



# Net Working

**Reflecting the move away from storing music on physical media, Linn's brand new Klimax DS network music player is one of the company's most interesting products to date. In this world exclusive, Professor Malcolm Hawksford assesses the technical aspects of the design, and David Price does the listening...**

**T**argeted squarely at the audiophile, Linn's new network-enabled music player is quite unlike any other such device on the market. The Klimax DS, as it's called, is a statement product in every sense, and has been conceived as a bridge to link networked media devices with a conventional two-channel audio system - in crude terms, it's a hi-fi DAC that attaches to your computer.

When you first set eyes upon this new Linn product, it's hard not to be consumed by the striking solid aluminium enclosure. The Klimax DS shares common heritage with the (now legendary) CD12 by being carved from a solid aluminium ingot, while its understated but elegant lines are the new art deco.

The Klimax DS's job is to take a digital audio stream from your computer and convert it simultaneously to balanced and unbalanced signals suitable for direct connection to an analogue stereo system, using XLR and RCA connectors respectively. The idea is to store your music on a PC or networked hard drive (either in uncompressed .wav or lossless compressed FLAC formats), and then with the help of the Linn

PC software you can play it back in any number of ways. Your computer effectively becomes your music library, and the Klimax DS is what turns the digits into music.

Effectively then, it works as an intelligent DAC. It has no internal storage of its own (aside from a buffer to smooth the flow of music) and instead runs together with either a PC and/or what's known as a Network Attached Storage (NAS) device, which is a standalone hard drive, holding all your music.

It comes with a Linn Graphical User Interface (GUI) which runs on an Ultra Mobile PC (UMPC), and is the only computer kit required in the listening room. Such devices can be attached to your network by wireless, effectively making them compact and simple remote controls with their own touchscreens. Alternatively, a standard desktop or portable PC can be plugged in, or multiple users on a network could access and control Klimax DS. All this means the Klimax DS is a very flexible widget indeed!

A conventional remote control is provided, so that if a playlist has been pre-programmed then this music can be accessed without the need for a screen in the listening room. This

is another attractive feature, as the presence of an illuminated screen can distract, enticing one to skip tracks and become preoccupied with the electronics rather than the music.

So much for how it works, what about its audio capabilities? Well, as you'd expect the Klimax DS plays high quality LPCM audio files and accommodates standard sampling rates up to 192kHz at 24bit precision. It also has a Xilinx FPGA upsampling stage for conversion to either 384kHz or 352.8kHz and new Wolfson multibit sigma-delta modulators provide conversion, with output transformers used for isolation. The sample clock is free running and controls the flow of audio data from Ethernet; as you'd expect, it is optimised for extremely low jitter. This holistic design philosophy adopted for Klimax DS, including EMC screening and mechanical isolation derived from the solid casework, bodes extremely well for a low-noise low-jitter converter. MH

## SOUND QUALITY

The Klimax DS is a dealer installed product, so would be professionally supplied and fitted in your home, and connected up to your computer via

Ethernet with the supplied Linn 'GUI' and Twonky media server software. In my case, I set the Linn up via a Linn-supplied Toshiba PC, and plugged its balanced outputs into my reference MF Audio Silver Passive Preamplifier, driving a World Audio K5881 tube amplifier and Yamaha NS1000M loudspeakers.

The results were deeply impressive and, spookily, I couldn't stop thinking about my year spent with a Sondek CD12 some time back. Although the Klimax DS and CD12 share little (beautiful aluminium billet case excepted), Linn's high end digital products are so meticulously voiced that – despite the very different chipsets inside – the two have the same silky but ultra high resolution sound that gets into the groove with the best of them.

With all of my own reference recordings, committed to the Linn PC as .wav files (i.e. uncompressed 16/44 LPCM), I heard a consistently smooth and well finessed performance, with an extremely neutral yet vivid tonality. Bass was strong and expressive, but in no way warm or overblown. Midband was tremendously wide and deep, bristling with detail and yet never veering towards stridency, whilst treble was fine and subtle. The key to the

performance that simply makes me wish I was playing my vinyl version of this Blue Note classic, I heard a smooth, natural, spacious rendition of the disc, with that lovely ebbing and flowing rhythm that 'I Have a Dream' sets up. Once again, the textuality of the instruments was beautifully carried, with 'shouty' brass instruments such as the trumpet and fluegelhorn losing none of their feel but – unusually for digital – gaining no chromium plating either. Speaking of metal, the heavily compressed, noise-addled thrash of Ministry's 'Corrosion' was massively powerful yet surprisingly listenable – testament to the Klimax's characteristic 'iron fist in a velvet glove'. DP

## CONCLUSION

While many British hi-fi manufacturers have been unstinting in their condemnation of 'computer audio', Linn were an early adopter (the original Kivor is several years old already), and have once again done themselves proud with the Klimax DS. Obviously, it's not a product for everyone, but to those with large amounts of digital music stored on their computers and/or hard drives (and this number is bound to increase exponentially over the next few years as the iPod generation

grow up into real hi-fi), it's a landmark product.

Essentially, the first truly high end, high resolution network music player, it boasts the company's trademark superlative design and build, plus sonics which are the equal of pretty much any optical disc player on the market.

A beautifully engineered, flexible and superb sounding music playing device, its biggest problem is simply the fact that most people won't yet understand its reason for being. Although obvious to 'early adopting' digital music devotees, mainstream audiophiles may struggle to see how it works and even why it exists in the first place. Then of course, there's the price, which is prohibitively expensive for most people - here's hoping the technology will 'trickle down' into more affordable fare.

As the whole world slowly moves away from 'physical media', there will be more and more products like Linn's Klimax DS, but this one is special and will continue to be years later. Whether it's too far ahead of its time right now, remains to be seen. DP

[turn to p33 for MEASURED PERFORMANCE]



Klimax DS was the way it conveyed vast amounts of detail and strung it all together as a coherent and very emotive musical performance.

With 4hero's superbly recorded new album, 'Play With The Changes', I got a tremendously neutral vocal sound on 'Give In'. The Klimax DS captured the singer's voice with an eerie realism, and intimated his every subtle inflection. Behind this was a sumptuous keyboard backing which the Linn again carried with aplomb, proffering an extremely wide soundstage that hung back more than I'd heard with CD to date. The Klimax provided razor-sharp timing, as evinced by the giddy attack of hi-hat cymbals.

Herbie Hancock's 'The Prisoner' was also unrecognisably 'analogue' sounding, the Klimax DS giving no clues that it was [a] digital and [b] using a Toshiba PC's hard drive as a source! Instead of the usual stilted

## SECOND THOUGHTS

I installed the new Klimax DS as the front end of my reference system. Linn supplied me with a Dell PC (so I didn't need to set up my own), which came with a number of high resolution tracks pre-loaded (after all, the unit will sing all the way to 192kHz sampling) but I also installed some additional tracks including some high quality Chinese recordings which I had discovered on a recent trip to Singapore. (Believe me, some of these CDs put to shame many of the factory-studio discs we see in the West - the recordings are mastered in DSD, employ high-quality electronics and microphones and use simple techniques with little or no compression). Replay equipment included Audio Physic Tempo loudspeakers with two muRata supertweeters atop each one, LFD power amplification and a digitally controlled analogue gain stage. Normally my system incorporates an LFD DAC3 preceded by a dCS sampling-rate converter to filter source jitter. Audition commenced in a darkened room to reduce cross-sense contamination, first by sampling the hi-res Linn tracks and then moving to familiar CD recordings.

It was obvious that the Klimax DS occupied rarefied and esoteric sonic territory, as I don't think I've ever heard better from a digital source. The results were magical, and it was immediately evident that the performance had risen significantly above my in-house reference converter, itself capable of superb clarity. The stereo soundstage proved truly capacious, giving a wonderful sense of envelopment, and transients were fast and totally devoid of grain, edge or smear. Vocals had stunning presence and immediacy, and overall the sound texture was delicate, natural and beautifully reproduced. As the music faded at the end of a track, it seemed to reach out and touch infinity, such was the clarity and low level signal integrity of this machine. Although the supplied 24/192 recordings proved wonderfully realistic, fast and articulate with a lush, shimmering metallic quality to percussion, what really surprised me was how well the Klimax DS did with plain old 16/44.1. The sound was a revelation, but I just wish it hadn't taken over thirty years to get here – all those wasted hours! MH

## VERDICT

Impeccably engineered, built and voiced, this is a landmark high end digital product, but whether it's too far ahead of its time is too soon to say.

**LINN KLIMAX DS** £9,600  
Linn Products Ltd.  
☎ +44 (0)500 888 909  
[www.linn.co.uk](http://www.linn.co.uk)

## FOR

- state of the art sonics
- superlative build and finish
- concept, flexibility

## AGAINST

- price



### MEASURED PERFORMANCE

Jitter is a barometer of the effectiveness of any digital audio system design - ideally there should only be a small amount of narrowband random jitter, as this is least damaging sonically. So to measure the Klimax DS's jitter, I used a high-amplitude, high-frequency input signal together with an analysis technique capable of fine spectral resolution, and noise averaging to expose any coherent jitter sidebands. My selected test signal was a maximum amplitude sine wave set at one quarter the sampling rate (i.e. 24kHz for a 96kHz sampling rate). This signal was computed over 221 samples and gives a spectral resolution of 0.046Hz, then loaded into a PC, streamed to Klimax DS and subsequently recaptured by a high-performance analogue to digital converter. The results proved very impressive - the spectrum in figure 1 is extremely clean, and consists mainly of noise extending about 10Hz either side of the excitation frequency. Although predominantly contained within a 1Hz bandwidth, there are some minor spectral lines just evident above the noise, which I should think are benign and just as likely to be related to the ADC clock - no measurement instrument is perfect!

The next measurement, again performed at 96kHz, used a 221 sample noise sequence equalised for a flat amplitude spectrum. The frequency response is shown in Figure 2, while Figure 3 shows the interchannel crosstalk. These show the new Linn has a well extended low frequency response, with the -3dB break frequency at about 1Hz. However, at high frequency there's an apparent 0.7dB peak in the response at about 35kHz - just before the high-frequency low-pass filters kick in. I was initially concerned, but it was found to be a function of ADC loading and the mildly inductive output impedance of the transformers. As you can see in Figure 4, where the error disappears, a preamplifier offers a kinder load.

When I did the jitter test, I found there were narrow band sidebands distributed around the test frequency. Now, when an equalised noise excitation is used, this actually consists of series of closely spaced sine waves having random phase, so if you imagine similar noise sidebands about each of these components. Because the lines are so close, the result is noise in the measured frequency response. Also, because there are now multiple tones, any non-linearity in the system will add intermodulation products to the output. By first smoothing the frequency response, distortion in the spectrum can be estimated, and in Figure 5a both frequency response (top) and spectral error function (bottom) are shown. The total error in each spectral line from sideband noise and intermodulation is around 80dB. Given the 0.046Hz line spacing, this is an excellent result - especially as both DAC and ADC errors contribute, so the Klimax DS must actually be a little better than this result suggests.

Increasing the line spacing to 100Hz, sideband noise due principally to jitter is reduced and the frequency response error then falls to below 100dB as shown in Figure 5b, while in Figure 5c the noise between the spectral lines can be seen to have fallen to

the noise floor. Obviously, any practical 24bit digital system is going to have a noise floor significantly above the theoretical level (see red traces where appropriate). The noise spectrum was measured both with Klimax DS switched on and off, and as there was only a tiny perceptible difference in the measurements, this shows the Linn has lower noise than the measuring analogue to digital converter!

In further tests, sparse low-level line spectra (around -140dB) were observed, which are very likely to be interference from a nearby PC and very difficult to eliminate in practice - again this is no reflection on the Klimax DS. These very low-level artefacts become visible when extending resolution to 24bit, which in practice is about 4 to 6bits greater than what's really needed for high quality audio. (Just because a system has 24bit resolution does not imply accuracy to 24bit, and this goes for both recording and reproduction systems.)

Overall, these measurements show that Linn's new Klimax DS is doing a fine job in terms of signal conversion - there's very little to criticise, which is just how it should be. Given the clean jitter waveform and low distortion, I'd expect a neutral and accurate sonic performance. Low distortion and jitter bode well for what I euphemistically call the 'signal-to-grunge ratio', which often pervades lesser equipment and is the principal reason why perceived dynamic range and clarity are often less than might be expected from basic frequency response and noise measurements - engineering this out is what master-class level electronic design is all about. Klimax DS ticks all the right boxes and I have little to criticise in terms of design ethos, its execution and electronic performance. MH

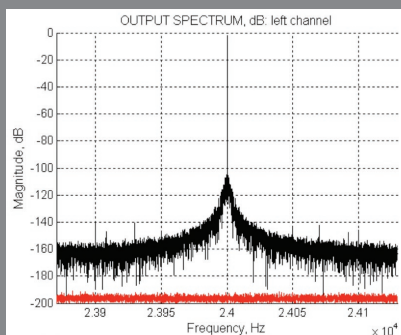


Figure 1 Jitter spectrum zoomed in to 24 kHz excitation signal.

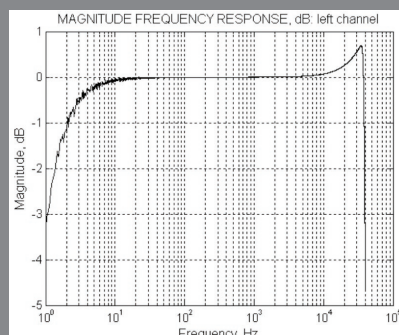


Figure 2 Frequency response, output loaded by ADC.

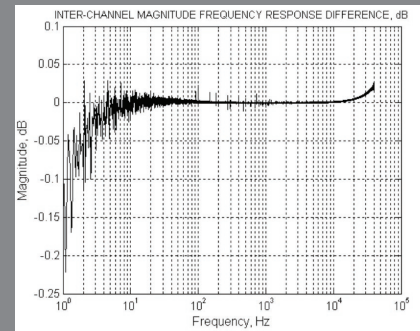


Figure 3 Inter-channel (crosstalk) frequency response difference.

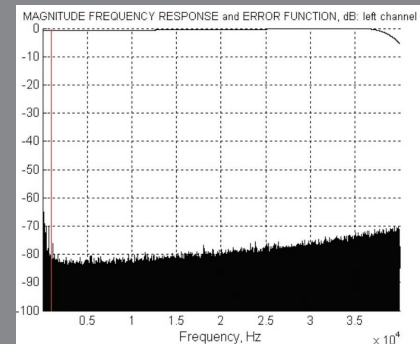


Figure 4 Frequency response with minimal output loading.

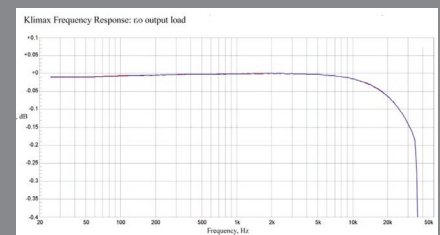


Figure 5a Frequency response and error function, 0.046 Hz line spacing.

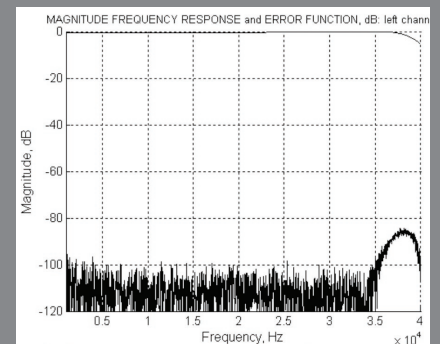


Figure 5b Frequency response and error function, 100 Hz guard bands.

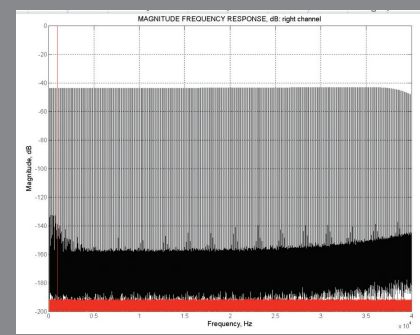


Figure 5c Output spectrum, 100 Hz guard bands (observe noise floor between lines).