AUDIO SYNTHESIS DAX

Britain's best decoder yet? The DAX is equipped to take on the world's finest...

by MARTIN COLLOMS

Audio Synthesis jumped head-first into the DAC market a couple of years ago, determined to offer, both in kits and ready-built models, a range of conversion technologies. BitStream was represented by a very competent exposition of the Philips DAC7 chipset, one of the best implementations available, while alternative examples of their DSM converter offered a choice between 20-bit Burr-Brown and the UltraAnalog hybrid circuit, also 20-bit [*HFN/RR*, March '92].

Customer preference proved in favour of multibit, with the difference between the Burr-Brown and UltraAnalog types felt to be quite small. Consequently, the Burr-Brown model offered the best value, proving a hard act to follow. The next Audio Synthesis development was a passive 'pre-amp' of unprecedented neutrality and transparency, the Passion [*HFN/RR*, April]. This has now become an all-Vishay attenuator design, resulting in another worthwhile lift in sound quality. (It is available with various balanced/unbalanced options.)

The original DSM DAC had a modular look, with accessory interface boxes, separate power supplies and the like. While these provided versatility, they also added to the cost. By contrast, the new £1995 DAX is a one-box self-powered unit (430x70x320mm, whd), fitted with standard IEC socket, on/off switch and a useful complement of other facilities. Casework is black anodised machined aluminium.

Of the two digital inputs, wired coaxial and Toslink optical, the coaxial is preferred for sound quality. Digital input selection is via a 6-position rotary switch on the front panel. The first is Coax 1/AES and an option adapts this for AES balanced connection using an XLR input. There is provision for two AT&T glass optical connections – one is fitted as standard – to a high-end transport without ground wire

linking the two. A second Toslink may be installed, while the last selection may be allocated to a further coaxial (phono socket) connection. The DAX also has a properly buffered re-clocked digital output for digital recording, and has coax and Toslink outputs as standard, with an option for AT&T.

It is remarkable that such a small company could take so exhaustive and dedicated an approach to the development of its new DAC. Much of the technology used has direct parallels with US high-end equipment. For example, the DAC itself is the UltraAnalog hybrid module with its upgraded I/V converter. This stereo 20-bit unit involves the summation of one 12-bit and two four-bit DACs, tuned and close-toleranced to guarantee tight conformity with the 20-bit specification. Providing an unbalanced audio output, this DAC may be optionally supplemented by a second unit, combined with phase inversion in the digital domain, to provide a balanced output for that particular version of the DAX.

The balanced option is also available for the Burr-Brown version, while both use a common 20-bit digital filter by NPC which has on-board digital de-emphasis. This allows streamlining of the analogue path, which has linear phase filtering incorporating polystyrene capacitors and Vishay resistors.

Astonishingly, the output sections are hard-wired with pure silver and no printed circuit track is used. This section is enclosed in copper screening cans. With fairly high oversampling, the output filter requirements are not arduous, and a tight specification can be achieved. The output has DC offset correction, and shunt relay muting guards against poor locking or power loss.

An eight-times oversampling rate with true 20-bit high performance DACs is one thing, but what about the precision of the recovered clock and its ability to acquire clean jitter-free data over the S/PDIF link?

Here, serious work has gone into three separate crystal oscillators for 32, 44 and 48kHz. These are of low distortion analogue quality, buffered from the noisy digital lines and contained in their own screened environments. The S/PDIF is acquired by the well regarded Crystal chip, improved in this implementation by the optimal choice of time constants. As standard, the DAX is configured for 44.1kHz only crystal locking.

The second phase-lock-loop is made by Audio Synethesis and is crystal controlled, with exceptionally low jitter. Absolute clock frequency is updated in the long term only at intervals of a second or two, and is not continuously cycled.

Graphs were supplied from a Rhode & Schwartz high resolution spectrum analyser, which clearly show the high performance attained. This test method could well be adopted on the basis of its unambiguous results. In Fig 1 the analyser is set for a 50kHz span, twice the audio range; it runs from the 11.284MHz clock frequency. The upper trace is the jitter for the CS8412 chip, the interference described in radio frequency terms as phase noise. The next trace is for the UltraAnalog AES20. Finally, there is the augmented, crystal-locked recovery of the clock signal from the CS8412 seen in the DAX, and this trace is below the analyser limit for these settings.

Moving to Fig 2, the analyser has been set to a narrower 2kHz span, horizontal magnification at 25-times. Now the upper trace is for the AES 20 showing that some music-related jitter is after all present to a significant degree, close to the carrier present in the range below 1kHz. Note that this balanced input device was fed unbalanced via a matching pad. The next trace down is similar with regard to general phase noise, but avoids the music-related effects and shows the standard Crystal implementation. The lowest trace is virtually off the bottom of the graph at –100dB, and is that of the DAX recovery of the same clock signal: an excellent performance.

The precision re-clocked signal is also used for the digital outputs, offering a potential improvement in quality when a digital source is sent through the DAX to a recorder, CD-R, RDAT or DCC, helping to offset the small losses which can occur in such transfers.

Certain aspects of the specification are interesting: in particular, the figures for the Burr-Brown and UltraAnalog versions, which are to all intents and purposes identical. Unbalanced, the output is set deliberately high at 3V giving a 3.7dB lift over the nominal 2V standard. This is not to give an unfair advantage in A/B listening comparisons but to provide enough level for the use of the matching Passion passive control unit, which can provide no signal gain en route to the power amplifier. D/A output impedance is a moderate 400 ohms, the usual power driving output stage being omitted in the interest of signal transparency.

The output is DC coupled, extending to 20kHz, –0.1dB. A figure is given for linearity which constitutes a remarkable claim: 0, +0.25dB from 0dB to –100dB. Residual jitter is at the pico-second level with a primary locking range of ±100ppm. Typically up to ±200ppm.

SOUND QUALITY

In the course of the listening tests, which included the use of reference-grade transports such as the Wadia 7, it was found that the make of glass optical fibre for the AT&T link was quite critical – nothing can be taken for granted even where high-speed, generously specified digital data links are concerned.

Right from the start there was no doubt about the very high attainment of the DAX and a considerable uplift in performance was obtained over Audio Synthesis' last and well respected 20-bit DSM. One fascinating aspect was the improved character of the UltraAnalog converter in this implementation. Always capable of a big soundstage with a full-bodied sound, it could also sound a touch darkened and distant. The fine dimensionality of the soundstage was fully apparent with the DAX, yet somehow the sound was more intimate and immediate, the darkening cleared away to a point where the DAX could be described as crisp, open and sparkling.

Very high levels of clarity were present over the whole frequency range, approaching those of the Wadia 9. Focus was first-rate, the unit portraying perspectives very well. On tonal balance it must be regarded as very neutral; it did not favour any specific recording technique, technology or type of music. The natural presentation of dynamics and rhythm with the DAX was clearly differentiated from the slower paced and 'softer' sounding low-bit, high-oversampling CD designs. DAX rated well for pace and rhythm although still not in the class of a Linn LP12 – but neither is anything else, for that matter!

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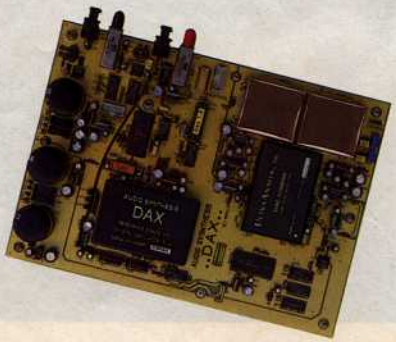

The bass was remarkable in that it comfortably matched the high-end references, although perhaps there was a slight shortfall in absolute weight and slam. Similar effects are sometimes an unavoidable by-product of a moderate output impedance plus the medium source impedance imposed by a passive volume control. The marginal lightness in the bass was well counterbalanced by the DAX's open, articulate nature – a 'free' sound where the speed of bass transients subjectively kept pace with the fine mid and treble.

The natural midrange has already been noted, but the treble also deserves comment. Here the DAX was in the top class, whether due to its low clock jitter, special output circuit or whatever. It did not sound dulled, compressed or mechanical, and was virtually grainless as well as highly informative. Fine, subtle detail was exceptionally well differentiated. Resolution was achieved with no long-term listening fatigue.

Scoring the DAX was easy: the lowest mark was 38, using an old budget Sony transport on Toslink; a Marantz CD60 with wired coaxial connection reached 42–43; using the best transports, with either coaxial or AT&T connection, 45 was achieved.

If the system grounding was well organised, I still marginally preferred the coaxial connection. For Passion users, the electrically isolated AT&T mode has its benefits in avoiding one possible ground loop.

CONCLUSION

Cries of 'not cricket' are bound to greet strong review approval of a design which has few sales outlets – in fact none on the high street – and mainly operates by mail order. However, set against this the two-year guarantee and money-back offer provided by Audio Synthesis. The company will provide a list of suppliers who demonstrate the DAX.

As regards the product, the DAX is well built and finished, meets all the relevant regulations and supply voltages in all countries and demonstrates remarkable versatility via its many options. For my purposes, the UA version, unbalanced, with AT&T input did all I could wish for, and the balanced version should be little different save for superior matching in balanced applications.

In the lab, it met its exacting claims for technical performance placing it close to the state-of-the-art. On sound quality rounds it was comparable with the very best of the high end, while its own unique balance of qualities, honesty and neutrality at the forefront, deserves to win the DAX many friends. ✦

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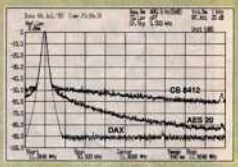

Fig 1. Audio Synthesis DAX: spectral analysis of phase noise, 50kHz span, revealing jitter levels. From top: jitter for the Crystal CS8412 chip used to acquire the S/PDIF signal; UltraAnalog AES20; and finally, the augmented, crystal-locked recovery of the clock signal from the CS8412 as seen in the DAX (manufacturer's data: see text)

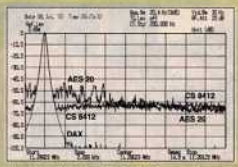

Fig 2. Audio Synthesis DAX: spectral analysis as Fig 1, but with a narrow 2kHz span, showing music-related jitter (see text). From top: UltraAnalog AES20; Crystal CS8412; and DAX implementation

Fig 3. Audio Synthesis DAX: spuriae up to 100kHz associated with 1kHz tone at –70dB

Fig 4. Audio Synthesis DAX: intermodulation spuriae from 19kHz/20kHz tones at 0dB

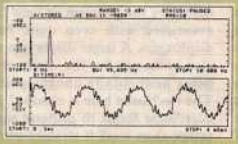

Fig 5. Audio Synthesis DAX: dithered 1kHz sinewave at –90dB, with distortion spectrum above

LAB REPORT

Look at the graph for low-level linearity [Fig 6]: allowing for system noise, there was no detectable error down at –110dB nor any difference between channels – a testament to the very close tolerance achieved. 20-bit is claimed and I can believe it. Worst case amplitude error at –90dB was just 0.1dB. The other low-level data provided close agreement on this, for example, the –90dB sinewave representation (averaged, dithered) was very fine as was the matching spectrum [Fig 5]. Here the inherently low noise floor of wide dynamic range multi-bit technology was established, barely rising above –120dB [for this filter setting], with no detectable distortions.

Signal-to-noise ratios were excellent, well over 100dB weighted or unweighted, with zero hum content and very low spuriae in the range up to 100kHz. Output impedance was moderate at 410 ohms: higher than usual but not unduly so.

De-emphasis was accurate, while the frequency response was wide and flat extending to almost DC at low frequencies, and with a fractional 0.1dB droop above 10kHz. Channel balance was superb, with corresponding results for separation, at typically better than 120dB to a few kHz, and averaging 106dB by 20kHz.

Distortion at full level was textbook perfect, with the unit carrying the full 16-bit resolution with a very high effective dynamic range of 110dB.

Very good results for full-level high frequency intermodulation were achieved. At –70dB 1kHz, dithered tone, distortion was absent, better than the –50dB at the system noise floor: a perfect result. The corresponding 100kHz spectrum showed one advantage of multi-bit technology, namely that the noise floor did not rise in the ultrasonic range above 20kHz, potentially aiding the performance of the amplifiers down the chain.

DC offset was negligible, while the unit in general locked within 10 seconds of a digital input being selected. No clipping or asymmetry was observed with the peak white-noise signal. What RF there was present was a trace of breakthrough in typically the 100MHz range at –58dBm, of little nuisance value.

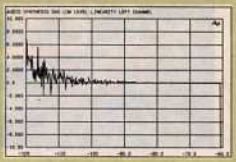

Fig 6. Audio Synthesis DAX: linearity plot below –60dB

Test results	Audio Synthesis DAX		
	20Hz	1kHz	20kHz
Channel balance (dB)	0	0	0
Stereo separation (dB)	137/123	126/122	110/97
Frequency response			
Distortion (dB)	–0.01°	0°	–0.11
THD at 0dB	95	95	<90
THD at –10dB		87	
THD at –70dB		<50	
Intermod 19kHz/20kHz, 0dB		96/99	
Intermod 19kHz/20kHz, –0dB		102	
Frequency response (dB)	–0.01	0	–0.11
Signal-to-noise (dB):			
20Hz–20kHz, unweighted		110	
CCIR/ARM, 1kHz ref			105

	1kHz	5kHz	16kHz
De-emphasis (error in dB)	0	0	–0.09
Output level 0dB	3.06V (3.71dB)		
Output impedance	410 ohms		
Linearity error at –90dB, L/R	0.1dB/0dB		
Dimensions (whd, mm)	430x70x320		
Typical retail price (inc VAT)	£1950		

Supplier:
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