

*With numerous facilities
and memories, operating in
the digital domain, the
Meridian 601 is much more
than a pre-amplifier*

by MARTIN COLLOMS

MERIDIAN 601

The 601 represents so many products and product combinations that it was impossible to find a safe viewpoint from which to judge relative performance and values. Meridian describes it as a 'digital signal processing pre-amplifier'



The Meridian 601 is a pre-amp with a digital heart, offering a unique combination of functions and facilities.

Meridian has taken the bold step of relying on the high performance of its A/D system (seen already in the fine 607 encoder) to interface the 601 with the analogue world. Once the signals are digitized by this A/D, highly versatile signal processing may be organized. Thus the 601 can take on tasks at a high quality level which are extremely difficult to do in the analogue domain, and which would require a rack of equipment.

Analogue inputs are 'conditioned', which means that they are converted to digital form, and then join the other inputs derived from digital sources. Once in the digital domain, any input signal may be subjected to a fantastic variety of equalizations, these falling into two main categories: those corresponding to necessary specifications and standards; and those which may be designed and controlled by the user. In the former class are the RIAA equalisations for vinyl disc replay together with a host of alternatives for older records including a range of 78rpm standards. Other filter facilities may also be exploited to recover the optimum sound quality from archive material.

With its high degree of intelligence, the 601 is also capable of storing a number of user preferences. The most obvious of these is the matching of loudness for a variety of sources, allowing best use of the volume control range. While this is an undoubted convenience, it is also a factor in obtaining the best from the 601, because the internal 16-bit system needs to be exercised over a decent proportion of its dynamic range to give optimum noise levels. In addition, the input choices may be assigned to a range of selected inputs, analogue or digital. Specific choice of signal processing may also be assigned, for example to adjust for the particular tonal balance of a given pickup cartridge.

For the serious amateur and professional recording engineer, the 601 may be seen as an encoder of truly professional quality combined with a digital signal processor which has the ability to perform clean EQ filtering. The distortionless level control allows up to 6dB of digital gain. In this application the 'replay' D/A units fitted to the 601 are also useful for on-line monitoring.

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Starting at the fundamental level, the 601 will comfortably carry the

responsibilities of a normal analogue pre-amplifier. It offers moving-coil and moving-magnet disc inputs, with adjustable sensitivities for both. Line level inputs include several for tape, video tuner and so on, also with controllable sensitivity. Digitized and processed these signals ultimately reappear at two stereo analogue outputs which may be variously used for tape dubbing or to feed the power amplifiers. On the main output both balanced and unbalanced working is possible. Full digital signal processing (DSP) is available for the 'analogue' pre-amp aspect. This 'pre-amp' is fully remote controlled and carries the Meridian 'COMMS' interface allowing for intelligent control of other Meridian designs, and also for sophisticated multi-room arrangements. You might well think that the price justifies this aspect alone. A headphone monitor output is also fitted.

Next let us consider the 'digital pre-amp' aspect of the 601. Here it offers a range of digital inputs under remote control, four coaxial and two optical, operative over 32, 44.1 and 48kHz input sampling frequencies. Digital outputs include two cable and two optical. Full DSP is available in the digital path, including digital volume control with up to 6dB of forward gain. Thus level matching and professional dithered fades may be made in the digital domain. A key point for Meridian is the direct interfacing of the 601 with its digital input loudspeakers, while the relevance to CD-R, RDAT and other digital recorders such as DCC is self-evident.

The 601 returns signals to the analogue domain when required via two separate stereo digital-to-analogue converters. Independent or linked signal handling allows for amazing flexibility on these two outputs. One cannot really regard the 601 as a digital decoder, since its analogue outputs are always provided via the volume control and output buffer; in other words, with a pre-amp permanently on board. Thus the 601 decode quality should be compared with, say, a 606 coupled to an appropriately priced pre-amplifier, perhaps one at around £750.

Last but by no means least, we come to the digital signal processing section. Facilities standard to all modes are Bypass or 'tone defeat', RIAA (LP) equalization, Volume, Balance, and Delay Balance (an augmented delay compensated balance function for off-axis listening). Equalization programmes available include the KEF KUBE for the KEF R107 speaker, KUBE 200 for a range of KEF 'R' series models, and a Universal speaker equalizer. This

includes adjustable correction for the rear wall, either for free-space speaker models used on the wall, or for a wall-mount speaker off the wall: this is a really subtle facility. The speaker equalizer also has a variable bass control set at very low frequencies, where it can be used to augment the final low frequency octave without unduly influencing tonal balance. The latter is the responsibility of the Tone Control; at moderate settings, this offers a broad tilt in response over a wide frequency range, useful for adjusting a bright room/speaker combination or over-bright recordings.

The 'Headphone Equalizer' is remarkably versatile and could be allocated a complete review to itself. For the specialist user, an auxiliary amplifier will give the best performance here. A complex menu structure is provided whose facilities include the tone control, four types of complex ear and delay compensation, and a user-optimized option. Headphone processing attempts to simulate a normal frontal soundfield rather than the usual, often coloured, in-the-head effect. Advanced filtering incorporates cross-feed equalization accounting for head shadowing, inter-aural delay, and complex equalization for the headphone-ear interface. Fine-tuning of these parameters can result in the perception of a more natural, speaker-derived stereo impression with headphones, notably with out-of-head localization.

Another major facility is Archive, which has 13 analogue equalizations compatible with different historic recording practices. The other facilities included in this mode comprise tonal balance, a variable notch at 4kHz, a treble scratch filter and a two-stage rumble filter. Next on the DSP mode list comes the Octave Equalizer, an implementation of a 10-frequency graphic equalizer, 31Hz to 16kHz, and the technical characteristics are selected to complement the acoustic phenomena to be controlled, such as physical resonances.

Finally we have 'Loudness', the familiar bass and treble compensation, based on the variation of hearing response at different levels. Meridian's version may be programmed by the user for a particular threshold which corresponds to a judgement of 'full volume' from your system. This gets the best subjective correction from the compensator at lower volumes, leaving the maximum user defined volume setting with a flat frequency response.

There is one crucial limitation, namely that the operator may only use one of the special-mode facilities at a time. For example, suppose one

Scratch filter

The scratch filter is a 2nd-order low-pass Bessel filter at 10kHz.

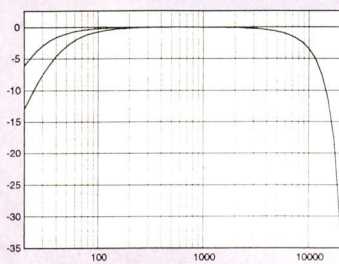


Fig a Frequency Hz

Notch filter

The notch filter is approximately an octave wide and centred on 4kHz. The notch depth can be adjusted between 0dB (off) and -12dB.

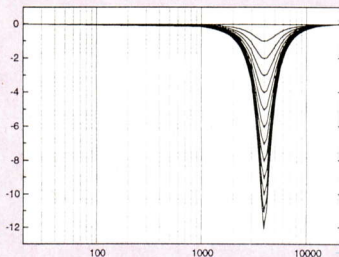


Fig b Frequency Hz

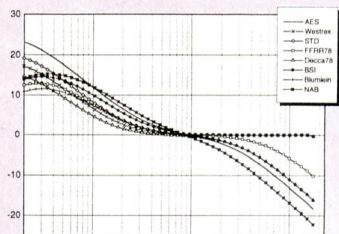
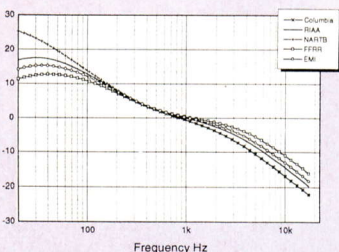
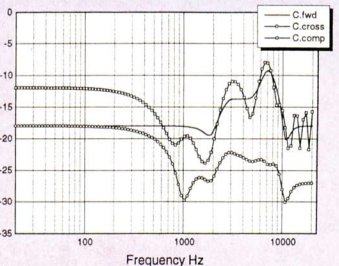


Fig c Frequency Hz

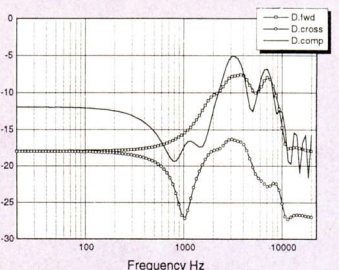
The graph above shows the frequency responses of the coarse-groove 78 rpm equalisations offered in Archive.



The graph above shows the frequency responses of the fine-groove 33 rpm equalisations offered in Archive.



The graph above shows the frequency responses for the forward and cross-feed channels in the Type C standard setting. Also shown is the composite result to one output when the left and right input signals are identical. The 'ragged' look to the response at high frequencies is the result of comb-filtering due to the inter-aural delay.



The graph above shows the frequency responses for the forward and cross-feed channels in the Type D standard setting. Also shown is the composite result to one output when left and right signals are identical.

For the serious amateur and professional recording engineer, the 601 may be seen as an encoder of truly professional quality

DSP functions as illustrated in Meridian's instruction manual

MERIDIAN 601: (D/A)

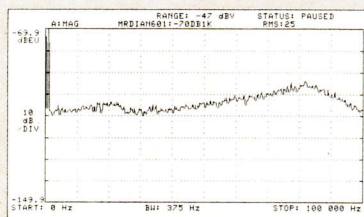


Fig 1. Meridian 601 (D/A): spurs up to 100kHz associated with 1kHz tone at -70dB

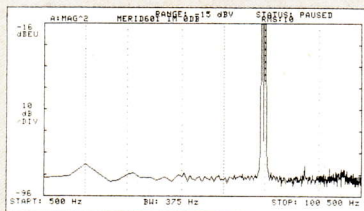


Fig 2. Meridian 601 (D/A): intermodulation spurs from 19kHz/20kHz tones at 0dB

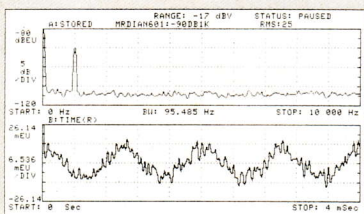


Fig 3. Meridian 601 (D/A): dithered 1kHz sine wave at -90dB, with distortion spectrum above

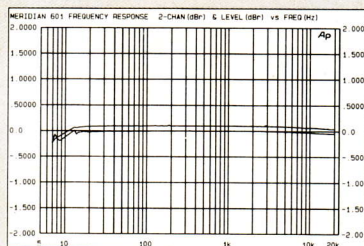


Fig 4. Meridian 601 (D/A): frequency response, DSP bypass

The 601's analogue line input sounded more open and more 'alive' than that of the 607, with an improved capture of ambience and a better-defined, more stable soundstage. Higher definition was also heard in the bass

has set a tone correction which balances the speakers well in a given room: it is then impossible to choose Archive. Selecting the 'KUBE 200' speaker equalizer means, for example, that you can't then use 'Loudness'. It is either one or the other.

With so much information to present, the carefully-written book which accompanies the unit is more of a technical treatise than an instruction manual, running to 80 pages of A4 with a four-page index. A keen user with an inquisitive approach can spend many happy hours exploring the many facilities until he or she has mastered the 601 – and can then allow the 601 to master the entire audio system. On the other hand, the 601 may be pre-set for an owner and need never be programmed again until the system is changed or more facilities brought into use.

TECHNOLOGY

The interior is well packed and could be said to begin at the power supply, arranged to provide necessary levels of galvanic-electrical and high-frequency isolation between critical stages. Two toroidal transformers help, each carrying three isolated secondary sections. Filtering is present at the mains inlet, while in this design chip regulators are distributed liberally around the relevant stages, almost too many to count.

More important, perhaps, is the advanced level of printed circuit technology employed. Many audio companies are just getting to grips with double-sided (two-layer) boards, but Meridian has used four-layer for some time now. In the 601 one critical board is a six-layer type. Used in conjunction with plated-through-hole techniques, these multiple layers endow the designer with additional freedom in track placement, screening and track impedance. A vital aspect here is the presence of a very low impedance ground plane and the potential for shaping the planes carrying the regulated power lines to steer currents, a technique called partitioning.

The 601 contains three main boards and two subsidiaries, the latter comprising the optical input and the switch and display unit. The main boards help classify the system architecture. Analogue signals are buffered, conditioned, and selected before arriving at the stereo ADC section, all these tasks performed at this four-layer A/D board. Input selection is accomplished by logic control of the professional-grade FET solid state signal switches specially designed for such applications by SSM.

Line level signals are buffered at a sensible 100k-ohms input impedance

while analogue disc signals go to an LT 1028 IC configurable for suitable gain and input loadings, and equipped with the bass component of the RIAA equalization characteristic. Selected FETs with very low 'on' resistance, 0.1 ohms, are used for 1028 mode control. High frequency equalization is accomplished in the digital signal processor which has many user options in the Archive modes.

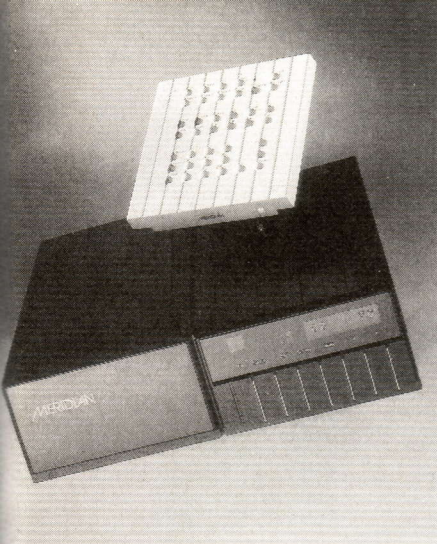
The analogue input signals are scaled for a best fit to the dynamic window of the A/D stage, a variant of the highly effective Crystal implementation first seen in the 607 recording encoder. This is a chip working on Delta Sigma 64-times oversampled principles and includes its own digital filtering. Meridian has taken care to use a high-precision, low-noise, low-jitter crystal oscillator at this point. This helps maximize encoding performance. A short path is achieved between the analogue inputs and the digital converter. To prevent hum and noise loops, Meridian has isolated the whole A/D board from the rest of the unit. Logic and signalling data is wholly opto-coupled, the power supplies float, and the digital data line is fed via an isolating transformer at 75 ohms over a wide band serial link. In fact the data output from the analogue input board is already S/PDIF serial coded.

COM stands for Computer and relates to the main six-layer board which is the processing heart of the 601. It begins with the logic-controlled digital input selector choosing from five coaxial inputs including the conditioned analogue inputs plus the several opticals. A powerful S/PDIF input design is used here, based on the Philips chip and seen in both the 606 and 6000 Meridian products. Three separate crystal oscillators are provided for the three sampling frequencies, providing very low jitter data acquisition.

A large, upgradable 1M-bit EPROM holds the operating codes, both DSP and controller software, and there is also provision for additional RAM to allow storage of up to 32k samples for processing. This will allow the implementation of more advanced facilities in future. As standard, the store is 100 samples long, all that is required for the main processor, and it is in fact built into the DSP chip. Software flexibility is the key to the long-term power of the 601, and it is capable of handling a wide range of future developments. For example, the complex acoustic processing in areas such as Dolby Pro Logic, reverberation, compression and room acoustic control.

The present EPROM, an upgradable plug-in device, holds all the

Test results	Meridian 601 (D/A)		
	20kHz	1kHz	20kHz
Channel balance (dB)	0.02	0.02	0.06
Stereo separation (dB)	127/117	104/93	76/67
Channel phase difference	0°	0°	0°
Distortion (dB):			
THD, 0dB	-90	-90	-90
THD, -10dB	—	-80	—
THD, -70dB	—	-41	—
Intermod, 19kHz/20kHz, 0dB	—	-83	—
Intermod, 19kHz/20kHz, -10dB	—	-90	—
Frequency response, L/R (dB)	-0.02/-0.01/-0.08/-0.1		
Signal-to-noise (dB)	90		
20Hz-20kHz unwt'd	86		
CCIR/ARM, 1kHz ref	90		
De-emphasis (error in dB)*	+0.03	+0.06	+0.07
Output level, 0dB	3V (+3.5dB), programmable		
Output impedance	95ohms		
Spurious to 100kHz (dB)	-94		
Linearity error at -90dB, L/R	0dB/0dB		
Dimensions (whd, mm)	380x100x325		
Typical price (inc VAT)	£2500		



specified instructions and facilities, and also services the high grade system controller – a version of the Z80 series called 'Super 8'. Signal processing is accomplished in the Motorola DSP 56001, a massive computer system in its own right, running at 32MHz. It computes audio data at the 24-bit level to provide sufficient computational headroom while the more difficult filtering aspects are allocated 48-bit or double precision working. A key aspect is that all digital signal processing, delay, equalization and level control, are done with the optimum level of linearizing dither added in the form of a triangular probability spectral density function. This means that the dither signal has a good technical and psychoacoustic foundation and that quantization noise will not be audible. The DSP output is rounded to 16-bit with dither, for conversion to S/PDIF. The normal serial digital outputs drive the other digital components in the audio chain, Meridian's D600 or 6000 or indeed other forthcoming digital loudspeakers. These are also the feeds to digital recorders. Four channels of digital outputs are available, ie stereo front and stereo rear, allowing for surround sound combinations upwards from the simple Hafler arrangements included in the software package.

The digital signal may now return to the analogue domain for use with traditional systems. Here the replay DACs, two stereo units by Crystal, are hard-wired to the digital lines. Use of two stereo DACs gives the user four channels of audio output, 1 and 2, or front and rear, independently adjustable. The CS4328 DACs are Delta-Sigma types, effectively one-bit ('bitstream'), and effectively oversampled at a 64-times with 2.8MHz data rate. These one-chip implementations include digital filtering, the two DACs and advanced charge-coupled CMOS filters giving good rejection of unwanted ultrasonic frequencies. The incorporated digital filter is a high order 8-times oversampling device with a low amplitude ripple.

Digital output may be at fixed

level, or processed for dithered gain and attenuation over a 100dB range. The analogue outputs also have full volume control, this derived from the D6000 configuration and designed to maximize the effective dynamic range at the output. Thus the bottom 70dB of control is all digital while the louder, upper region has a combination of analogue switched scaling, 2-, 4-, 8- and 16-times, and 32-times with fine interpolation of level accomplished digitally. De-emphasis is incorporated in the gain-ranging buffer stage.

EMC precautions have been taken in the development of this high-speed processor, with special screenings and filtering features incorporated in the otherwise traditional Meridian casework. The construction is high-quality and the modular build is serviceable. Future compatibility is assured by that massive, upgradable EPROM programme store.

Fundamental categories for assessment included: (1) analogue signal acquisition, equalization and control, assessed into digital domain; (2) use as a wholly 'analogue' pre-amplifier without direct reference to its digital heart; (3) assessment of the quality of its digital signal acquisition, computation and control in a wholly digital environment; (4) assessment of its analogue 'monitor' outputs driven as digital decoders from purely digital sources; and (5) assessment of the multiplicity of filter and processing functions, their fidelity and effectiveness.

SOUND QUALITY: A/D

For category (1), using auxiliary monitoring of known quality the 601 was found to be a highly effective A/D converter and delivered digital audio data of a higher reference standard than that found with the excellent 607 [HFN/RR, June '91]. In fact for this test both items were used in their 'buffered' mode, and the 601 was felt to improve on the 607 even via its hard-to-drive 'direct' input mode. This fully validated the 601 as a digital recording tool at the 16-bit level. With the CD-R unit and neglecting operating system limitations, the combination sets an unusually high standard for digital mastering at a most reasonable price.

The 601's analogue line input sounded more open and more 'alive' than that of the 607, and the crisper, more transparent sound was rated at 21.5, with an improved capture of ambience and a better-defined, more stable soundstage. Higher definition was also heard in the bass. The analogue disc input was very hard to assess as a discrete entity, but I would estimate an effective score of 17. This places it close to the audio-

DIGITAL PRE-AMPLIFIER

MERIDIAN 601: A/D AND D/A

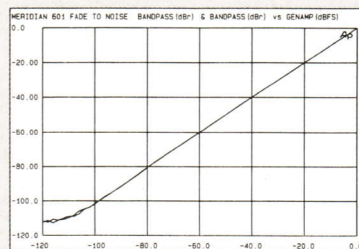


Fig 5. Meridian 601 (A/D, D/A): linearity plot, from 0dB (full level) to -60dB

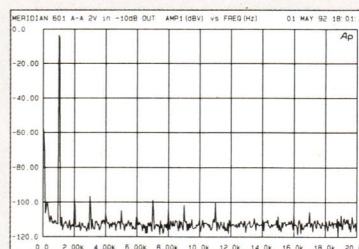


Fig 6. Meridian 601 (A/D, D/A): distortion, 1kHz tone at -10dB. Low-order harmonics are seen, all below -95dB

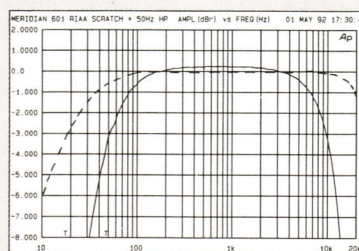


Fig 7. Meridian 601 (A/D, D/A): moving-coil analogue disc input. Dotted trace is RIAA equalization accuracy, solid trace shows effect of 'scratch' and 'rumble' filter (50Hz setting)

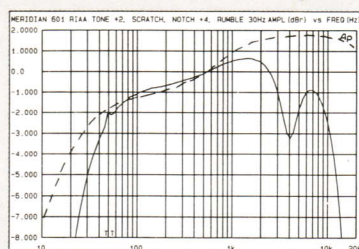


Fig 8. Meridian 601 (A/D, D/A): Moving-coil analogue disc input. Dotted trace is tone control at '+3', solid trace is tone at '+2', 'scratch' filter in, notch filter set at '4' and 'rumble' filter in (30Hz setting)

Test results Meridian 601 (pre-amp)

Test results	20Hz	1kHz	20kHz
Distortion (dB)			
Total harmonic distortion	-	>-85*	-
At 0.5V o/p, aux i/p			
Intermod, 19/20kHz, at 0.5V o/p			
Aux input		>-85†	
Disc (mm)		-85†	
Disc (mc)		-75	
Noise (dB)*			
Disc (mm) input (IHF, CCIR wtd)		70	
Disc (mc) input (IHF, CCIR wtd)		60	
Aux/CD i/p (IHF, CCIR wtd)		>86	
Residual, unweighted (vol control at min)		>90	
DC o/p offset			
DC o/p offset, tape			
Input overload (dB)			
Disc (mm) input (IHF)	27	24	12
Disc (mc) input (IHF) 600µV	27	24	12
Aux/CD input (IHF)	-	-	-
Stereo separation, (dB)			
Aux input (mc)	96*	85*	85*
Aux input	>90	>90	>90
Channel balance, disc at 1kHz (dB)		0.12	
Volume/balance tracking			
Aux i/p (error in dB)	0dB	-20dB	-60dB
	>0.1	>0.1	>0.1
Output			
Input data			
Disc (mm)	2.84mV* 47k-ohms	100pF	
Disc (mc) 600µV	0.284mV* 0.22k-ohms	10,00pF	
Aux	500mV* 100k-ohms	-	pF
Frequency Response (dB)			
Disc input (RIAA ref 1kHz, 30Hz to 15kHz)		+0/-1.5	
Line		-0.5dB <10Hz -20kHz,	
		-3dB <5Hz -20kHz	

* see text and graphs. † noise floor

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37 ◀ phile group which is more than sufficient for archive work. All but the best disc replay systems will get good service from this input and fine digital transcription recordings may be made. Its coded noise levels were well below that of disc surfaces and the sound was judged to be neutral with good clarity and focus. Rhythm and dynamics were also good although the bass could have shown more tautness on more complex pedal drum patterns. Mild blurring was heard here. Vocal sibilants were handled well and the treble was free from obvious glare or grain.

Quite good ambience was noted, though on recordings where ambience and 'air' were less strong in the mix, the 601 gave a drier-sounding acoustic than heard with the specialist reference pre-amplifiers. Good matching and level compatibility was shown on the moving-coil input while the less demanding m-m input checked out well when using a step-up unit with the Koetsu cartridge.

SOUND QUALITY: ANALOGUE PRE-AMP

Many of the comments in (1) are relevant to the 601's performance as a 'straight' analogue pre-amplifier. Broadly, the sound did not change too greatly when the on-board DACs were used, these broadly compatible with the performance of the analogue disc input. Scores in the 15–16 range were obtained for a sound which was essentially neutral, delivered with quiet backgrounds (once input and output levels had been properly scaled). Dynamics were good and the stereo images were reproduced with very good focus and high stability; good depth was apparent with no obvious loss of detail or subtlety despite the complex signal path. A mildly 'filtered' effect was noted in the high treble which sounded drier, possibly due to the steep band-limiting at 20kHz required of the digital chain. Likewise the bass was not as firm or as deep as the references. The 601 has mild infrasonic rumble filtering while my comparison pre-amplifiers do not, and this certainly had something to do with it. Rhythm and timing were judged as average or a little above. But ultimately, the 601's analogue performance will have to be judged on both its merits and facilities, rather than on detailed aspects of subjectivity.

SOUND QUALITY: DIGITAL IN/OUT

For (3), the digital in/out, necessarily involving S/PDIF interfacing, there is generally some small but unavoidable loss in sound quality due to residual ground noise and jitter. In my experience, only the digital loop of the Audiolab decoder has suc-

ceeded in improving the sound quality of connected digital systems which show moderate jitter suppression.

In the case of the 601, the digital path is further extended by the DSP and, as in all such devices, some loss was present. The effect was akin to the differences observed between different grades of digital connection, eg, various cables and optical lines. At the audiophile limit one might legitimately question the insertion of a 601 digital loop between a reference-class transport and digital decoder, as the loss is audible in this context. Conversely, if a given decoder is properly matched to the power amplifier in terms of output level, perhaps with a fixed, passive attenuator, it is feasible to couple it directly to the power amplifier and use the pure digital volume control in the 601; the sonic equation is then balanced by the deletion of the existing analogue pre-amplifier. One then has access to the filter and equalization software which is provided without further loss.

The digital volume control and filters perform as advertised, without noise, distortion 'grain' or clicks, and clearly a huge amount of effort has gone into digital system design and housekeeping. Only with ruthless and untypical analogue gain-riding, used artificially to explore the sound quality at very low digital volume settings, could some loss of detail and ambience be heard. In the Accuphase DP-70V review I commented that digital volume control was of somewhat limited use due to the likelihood of audible quantization distortion from its undithered action. With average sensitivity speakers and power amplifiers, this may well be evident in quiet surroundings at digital volume settings below -20dB. Not so for the wide-range Meridian implementation, which was essentially distortionless; neither were any spurious signals or idle tones present.

SOUND QUALITY: D/A ONLY

Functioning (4) purely as a digital-to-analogue decoder and noting that it effectively incorporates an analogue pre-amplifier at its output, the 601 was compared with related combinations and to the established Meridian 208. Interestingly, the 208 held its own and was marginally preferred. While it was undoubtedly true that the 601 was significantly cleaner in the treble and was also more neutral, in my view the 208 possessed the advantage in respect of rhythm and life, this making up for the noted 208 weaknesses and its softer, less well defined bass.

In general, the 601's 'controlled'

analogue output may be considered complementary to the 208 and not as an upgrade. The 601 replay has its points too: a precise well-focused sound free of audible distortion, presented with very good detail and a well-balanced character. The sound of the DAC used may well be an acquired taste and could suit some ears better than mine. As a DAC/pre-amp the 601 scores 16.5 to 17.5 on my listening-test scale, depending on the quality of the transport and the digital connections.

SOUND QUALITY: FILTERS AND EQ

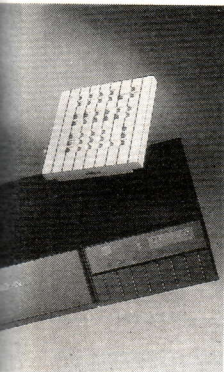
Finally (5) we come to the unique combination of filter and equalization facilities. Once one has arrived in the digital domain, a prerequisite of 601 operation, then use of these involves no further loss. The control ranges were useful both in scope and setting precision. The loudspeaker equalizer was found to be helpful in numerous instances both for optimizing a given model at a particular position in a room but also for the design analysis of a speaker: experimental low-frequency alignments could be modelled and tried without touching the loudspeaker. For voicing the overall tonal balance in a room, the tone control proved its worth.

Using the various disc facilities, early records of varied vintage may be coaxed into some sort of balanced musical life; chosen settings may be stored for later use. Prospective purchasers need to spend time with an experienced operator to assess these facilities thoroughly.

I did not have time for more than a cursory check of the headphone compensator and its options, or the delay implemented balance or 'image steering' control. I found the loudness correction to be effective subjectively, though mild DSP clipping was experienced at low volume settings when using the Koetsu into the highest level moving-coil input. It was also to be expected that silly combinations of boost and equalization would eventually saturate the DSP and they did. But taken overall, the available headroom appears to be well judged.

LAB REPORT

With so much ground to cover, only a selection of the 601's operational modes were assessed. The test begins with the digital decoder/pre-amp, resulting in a CD results format. Channel balance was excellent, typically 0.02dB, while fine results were seen for separation, associated with negligible interchannel phase difference. At full level, total harmonic distortion was typically -90dB, and comparably good results were obtained over the frequency and



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dynamic ranges tested. The peak-level high-frequency IM result of -83dB has been bettered (Fig 2), but at -10dB modulation a good figure of -90dB was achieved. With a dithered code at -70dB , 1kHz , the THD result was -41dB (with a minor spurious signal at 4.2kHz , but nothing else), nor were any significant spurious present on the $0\text{--}100\text{kHz}$ spectrum (Fig 1). Down at -90dB modulation level the converter showed superb linearity with negligible error and unmeasurable distortion, better than 115dB below peak modulation and associated with good sine wave representation (Fig 3). The frequency response (Fig 4) was excellent: flat from 10Hz to 20kHz with no ripple.

De-emphasis was very accurate, while the signal-to-noise ratio figure was partially dependent on the output settings. The CCIR result was satisfactory and was the result of the properly dithered 16-bit DSP output. The output provided a source impedance of nearly 100 ohms with up to 9V available before clipping (17V balanced).

As regards RF strays, a sniff of 50MHz was present at a low level, the result dependent on cabling, etc. No clipping on peak white noise was seen until a total volume setting of 88

was reached, the threshold of significant digital gain.

The next phase of the testing mainly concerned the analogue in/out performance which by definition also encompassed the A/D section, which is of interest to the recording engineer. Perhaps the key graph is that for overall transfer linearity, knowing that the D/A is almost perfect. The result (Fig 5) was excellent, almost perfect to -114dB with distortion buried in the noise floor throughout.

A high-resolution spectrum analysis taken with the output set at 10dB down (Fig 6) gave harmonic levels better than 95dB down for the encode/decode chain and you cannot ask for much more. This is not a fluke graph: Fig 7 shows total harmonic distortion including noise over the whole bandpass and the result was 0.01% or better, meeting the specification.

In general, distortion was close to unmeasurable and much of the numeric data is for the noise floor. For example, the high frequency intermodulation result for the moving-coil input was a fine -75dB but was in fact a reading of harmless noise. RIAA equalization (m-c setting) was flat in the passband with a -3dB point at 19Hz and -1dB at

20kHz . The graph (Fig 8) also shows the 50Hz rumble filter and the scratch filter engaged and these closely followed the ideal models. As an example of the flexibility of the DSP section, Fig 9 shows the effect on the LP disc input for a simple $+3$ tone or lightening (dotted) with a set of four simultaneous corrections; $+2$ tone, 'notch' set at 4 , 'scratch' rumble (30Hz) filter in. Each had a distinct and unambiguous effect.

No unwanted DC offsets were present on the analogue outputs and the input characteristics were standard, with normal margins for noise and overload. Volume tracking was predictably excellent and very good channel separation figures were seen, despite the tight packing of the interior. No obvious limitations have resulted from the adoption of a DSP core to this pre-amp, even with the sensitive moving-coil input.

CONCLUSION

Meridian's design team, headed by Bob Stuart, is to be congratulated for producing such a powerful, sophisticated and well thought out digital processing pre-amplifier. That so much flexibility, versatility and sheer processing precision could be packed into a standard Meridian case at just £2,500 is amazing! ↵

