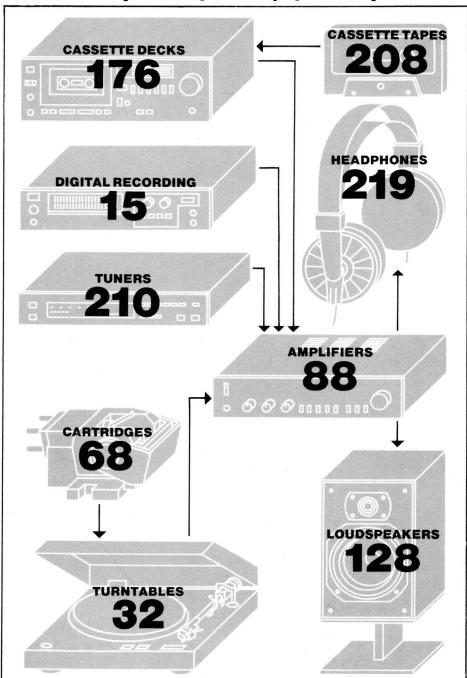


### HI-FI CHOICE

The most comprehensive guide to buying hi-fi ever published



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Series Editor Steve Harris; Editor David G Prakel; Contributing Authors Martin Colloms, Angus McKenzie MBE; Additional Laboratory Tests CamTech Ltd (amplifiers and tuners); Product Photography Trevor Attewell, Karin Craddock, David Prakel; Layout Ken Smith; Advertisement Manager Rob Mackintosh; Assistant Advertisement Manager Norman Setra; Group Art Director Perry Neville; Typesetting Beverley Douglas, Maggie Kayley, Velma Miller; Production Manager Sonia Hunt; Distribution Manager Colin James; Publishers Sportscene Publishers Ltd, 14 Rathbone Place, London W1P 1DE. Telephone 01-631 1433. Distributors Seymour Press Ltd, 334 Brixton Road, London SW9 7AG. Telephone 01-733 4444; Printers H.E. Warne Ltd, London and St Austell. Any enquiries regarding the content of this book should be made in writing to Hi-Fi Choice Editorial, 14 Rathbone Place, London W1P 1DE. Enquiries cannot be dealt with by telephone. While every care has been taken in the preparation of this book, the publishers cannot be held responsible for the accuracy of the information contained herein, or any consequence arising therefrom. Readers should note that judgements have been made in the context of the products available to Hi-FiChoice at the time of review, and that 'value for money' comments are based on UK market prices current at the time of review. While prices have been checked and where necessary updated as far as possible for this issue, they are subject to fluctuation and are only applicable to the UK market. This edition ® 1984, Felden Productions. Cover Photography Ian McKinnell, Cover Picked for their good looks are the Aiwa AD-F660 cassette deck, Onkyo A-22 amplifier and Akai GX-R6 cassette deck. In the background are Linn LP12 and Lux PD 370 turntables, Tannoy Mercury, KEF Coda and Celestion SL6 speakers, plus Sennheiser HD-410 headphones, TDK and Maxell tapes. The Sony Walkman Professional (see page 202) belongs to photographer Ian McKinnell who likes it so much he insisted on putting it in. Diagrams Mark Watkinson.



# Castle Acoustics Loudspeakers of Quality

Shortbank Road, Skipton, North Yorkshire. BD23 2TT Telephone: Skipton (0756) 5333/4

# HOW TOUSE THIS BOOK

Welcome to the third Best Buy Guide in which we present a more comprehensive collection of equipment reviews than ever before. Each regular issue in the Hi-Fi Choice series relies on a sophisticated lab measurement programme coupled with extensive listening tests, which together help produce the most consistent and reliable assessments of hi-fi performance. It is only after testing a large number of competing products under controlled and consistent conditions that we add our 'recommended' or 'best buy' rating to the conclusion.

So by bringing together all the recommended and 'best buy' products in a single book, we are able to offer a unique guide to hi-fi equipment, which will help those assembling a complete system as well as those in search of one particularitem. In addition to the reviews, the book contains as much helpful information as we could cram in, covering every aspect of selection and setting-up.

The chapter Choosing and Setting Up a System covers the basics of component matching or 'compatibility', how to shortlist products for audition, how to get the best out of a dealer demonstration, plus installation, setting-up and maintenance. Here we have tried to answer the most often-asked hi-fi questions.

Each review section, starting with *Turntables and Tonearms*, has its own introduction, explaining the design and operation of the equipment in more detail. In each case we have added a 'what to look for' visual guide to choosing and matching any component. Reviews themselves are presented in alphabetical order as originally published, but of course have been revised and updated for reprinting here.

Reel-to-reel tape recorders are now technically challenged not only by the ever-improving cassette deck, but also by the expensive but entirely practicable digital audio adaptor (using the transport of a domestic video recorder for recording audio signals in digital form). Apart from the ease of editing, which makes it first choice for many amateur recording

enthusiasts, reel-to reel now has few advantages, and so we have decided not to reprint any reel-to-reel recorder or tape reviews this time round. Instead, some digital recording adaptors are covered in the opening chapter Compact Disc and Digital Recording System.

Recommendations for Cassette Tapes can be found at the end of the Cassette Decks reprint section. This information on over 60 tapes is taken from Angus McKenzie's most recent comprehensive computer testing on tape, originally published as part of Issue 32 Cassette Decks and Tapes. There is an additional introduction to tapes which explains basic differences and stresses the importance of choosing the right tape for your cassette player.

Hi-Fi Choice has still to cover in depth the emerging Compact Disc technology and there are no product reviews we can reprint in this field. However we have devoted a chapter to 'things Digital', reprinting Martin Colloms' findings from a special group review of CD players.

Naturally in collating reviews produced over a period of longer than a year and reprinting reassessments of older product, some information contained in the original reviews needed updating. Every effort has been made to contact manufacturers and to publish details of even small design changes to Best Buyand Recommended product. This information is included in Update paragraphs or revisions to the reprinted reviews in this edition. Where prices have gone up or down this has been noted. We have deliberately left in the old price as well, to enable readers to get a better grip on the value judgments used at the time of reviewing.

For those readers having the original *Hi-Fi Choice* issues which contain reviews reprinted here, it is best to point out that we have left out those *Best Buy* and *Recommended* models which have since been discontinued. Old favourites that have been dropped may still be in the shops and may be found listed along with the *Other models worth considering* in the chapter introduction.

In choosing the reprint material, the decision was taken to include reprints of those products of which UK distributors still have some stocks even though the product may no longer be in production. Some extra special bargains are to be had at the moment from the end of line sales. The Worth Considering sections include all current product which only just missed recommendation in the original issues.

There were no Best Buy ratings made in the original issue of Turntables and Tonearms — we felt that it would be unjustly simplistic to award Best Buys in this category as turntables and arms need to be carefully matched to best results. The emphasis must be on finding compatible combinations.

Readers who want further information, particularly in-depth technical explanation of product design or test procedures, should refer back to the original issues of Hi-Fi Choice from which the review material has been taken. Issues 28, 30, 31, 32 and 33 are the relevant editions. These contain both consumer and technical introductions which explain the tests and product background in full. The Overall Comparison charts and Conclusions sections in the original issues make straightforward comparisons and discuss the findings of the project in general. Each issue contains a special Glossary from which we've pulled a shortened and simplified Glossary for this edition.

The Best Buy Guide is packed with vital information, and you will find it invaluable in shortlisting hi-fi products. But the danger of relying solely on the inclusion of a product in this book for a purchase decision cannot be stressed too strongly. Readers are advised to read back into the reviews rather than rely on the summaries. The review proper may contain important exceptions or points on the applicability, suitability or compatibility of a model. The *Hi-Fi Choice* Best Buy Guide should be your first step, to which must be added the help and advice of a good dealer and the all-important listening facilities which he can put at your disposal.



### If you can't tell whether it's a Bechsto



When a famous concert pianist insists on a Bechstein rather than a Steinway (or vice versa), we think you should hear why.

So it's not enough for our speakers to get a piano to sound like a piano.

We've removed all traces of distortion that would blur the differences between one famous piano make and another.

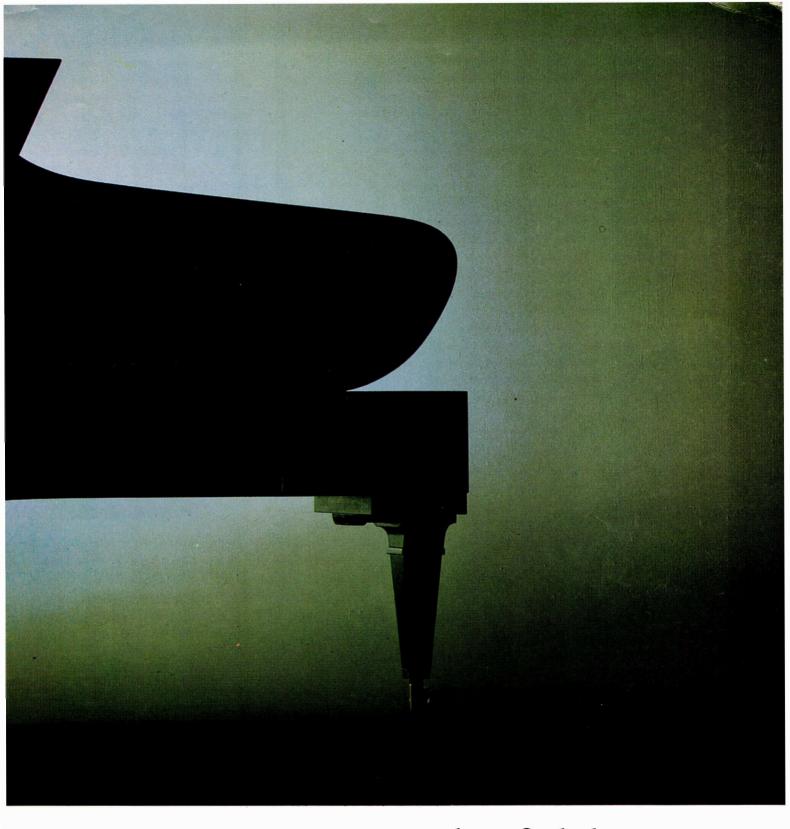
Such attention to accuracy has made us

the leaders in modern loudspeaker design.

By using a laser beam to produce holograms of a cone in action.

By using cumulative resonance spectra to provide a three dimensional plotting of the sounds a speaker shouldn't make.

And by evolving these two techniques into something even more sophisticated, namely a scanned laser plot.



### n or a Steinway, it isn't a Wharfedale.

Not surprisingly, our research calls for new ways of making speaker components. So we make most of them ourselves.

The result of our efforts is not only better sounding speakers, but also better value than you'll find elsewhere.

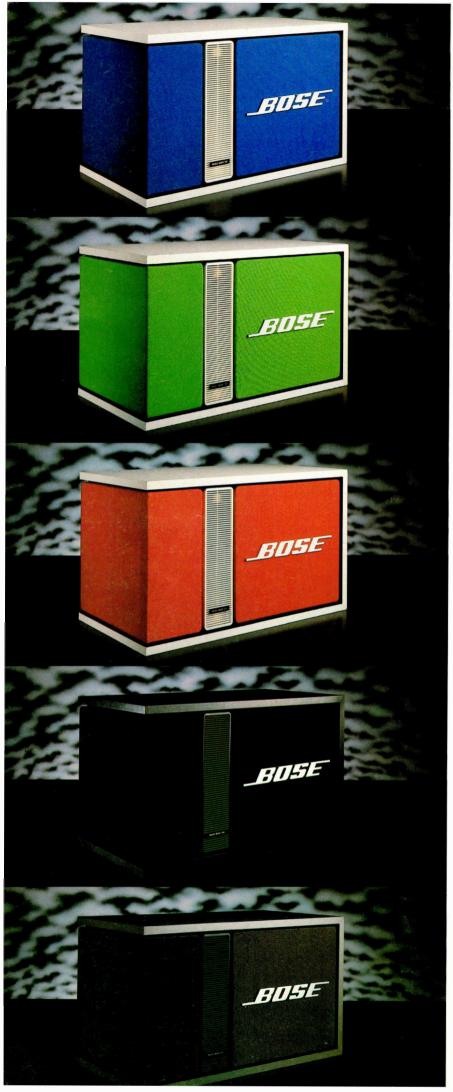
The best example is our new Laser range. Four speakers that share the same handsome design shown here.

But even the least expensive of them will play back the differences between concert grands costing thousands.

That's why you will hear the world's most famous instruments, when you listen to Britain's most famous speakers.

Wharfedale Loudspeakers. Highfield Road, Idle, Bradford, Yorkshire. Telephone (0274) 611131.





# IT'S THE ONLY COLOURATION YOU'LL GET WITH THE NEW BOSE 301 RANGE.

Bose announce the 301 Series II bookshelf speaker.

As you can see, it comes in five eyecatching colour combinations, as well as the more sober walnut and beige illustrated below.

More importantly perhaps, the new 301 boasts a crossover network specifically designed to avoid the irregularities in frequency response that can cause colouration.

We call it Dual Frequency crossover.

By precisely balancing the phase and amplitude of the signal passing to each driver, it allows both HF and bass drivers to operate together over nearly a full octave. Producing remarkable uniformity of response.

Like all Bose Direct/Reflecting Sound speakers, the 301 Series II recreates the clear spacious sound of

a live performance.

It's done by a unique configuration of three high-performance drivers that reproduces true balanced stereo in every corner of the listening room.

Ánd pumps a healthy 75 watts rms out of each  $17 \times 10\%$  inch cabinet.

At a retail price of £225 a pair, the Bose 301 Series II may not be exactly cheap.

But there again it's one of the most economical ways of buying a genuine Direct/Reflecting

Sound speaker.

WALL TO WALL SOUND

BOSE 301

Series II

BOSE (UK) Ltd., Trinity Trading Estate, Unit G2, Sittingbourne, Kent ME10 2PD

# CHOOSING AND SETTING UP A SYSTEM

For the new hi-fi buyer the first necessities are to match products carefully and to choose only after a suitable demonstration. To get the best from anything you need to have an ideal, a target performance at which toaim. In short you need to know what you want from a hi-fi system. Analyse your own expectations and desires before buying; if you don't, you too could be drawn into the unpleasant spiral of ever more expensive and ever less satisfying equipment upgrades.

For the hi-fi user who is dissatisfied with his current equipment the best approach is to come up with some concrete criticisms of the equipment's present performance — you need a strong idea of where and how your system could be improved.

The next move is to go to the dealer; choose him as carefully as you will your hi-fi. A good dealer can let you hear systems, changes of equipment, comparisons, everything you need to be able to make a sound decision. When you go to see a dealer, don't take with you any fixed ideas about how to spend your money — just have a fixed idea of how much you are going to spend! Rather than spend money on items for a system by formula, one third here, one third there, use the money to buy a system which satisfies the criteria you have worked out. Again this is where the dealer's time and facilities come in as he can demonstrate to you the budgeting options for direct comparison; he can play for instance two systems one with an expensive front end and the other with expensive speakers.

### Getting the best out of a dealer demonstration

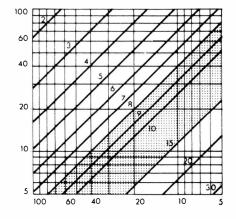
You will get out of a dem only what you put into it. Make an appointment with the dealer first if possible to enable him to assemble and set up the equipment which you wish to hear. Talktothe dealer on the phone beforehand and whittle down your options, for instance don't expect to hear every amplifier in stock demonstrated to you. Approach the dem with some degree of rigour and look for specific answers to specific questions. Change

one item at a time so you know what caused the sound to improve or get worse.

Many dealers welcome your own selection of records but take a sensible cross-section from your collection, maybe even a disc which has disappointed you in performance or sound quality — you may be surprised by what you hear from this record on a really good hi-fi system. Always use the source appropriate to your own use, for instance don't audition speakers using a taped programme if you only use disc at home. If the dealer is not prepared to lay on, within reason, the right ancillary equipment then your should be prepared to take you business elsewhere.

### Getting the best from disc

You've bought your turntable and want to get the best out of it. This is primarily a matter of placement. The turntable performs the essential job of isolating the stylus/disc interface



### MASS / COMPLIANCE/RESONANCE RELATIONSHIPS

Arm and cartridge resonance matching: the low-frequency resonance of an arm/cartridge combination can be calculated from the arm effective mass, cartridge mass and cartridge compliance. Add together the arm and cartridge masses, and draw in the corresponding vertical line. The draw in a horizontal line corresponding to cartridge compliance. Where the two lines intersect, the resonant frequency can be read from the diagonal scale. The shaded area is the optimum area within which the lines should intersect.

from the surroundings. If you play music loudly then you will need to have a turntable that can live happily in a high sound-pressure-level environment without feeding back. You can always improve the effects of the turntable suspension by choosing an appropriate situation for the turntable. Lightweight rigid tables firmly in contact with the floor do not have the energy storage problem associated with big heavy pieces of furniture.

For many suspended sub-chassis turntables, then, a lightweight coffee tableresting on screws driven through the carpet into the floor will perform a far better job of isolating the turntable than a sideboard position. Wall mounting is an excellent option but an open-work frame is recommended rather than a solid shelf. If you have a long shelf for your turntable, put it towards one end rather than at the point of maximum flexure in the middle.

The chapter introductions on *Turntables and Tonearms* and *Cartridges* give plenty of advice of matching the best components but you need to align the chosen components for best performance.

### Geometry

Setting the overhang of the cartridge is essential to achieve minimum distortion particularly at the end of LP record sides. To do this you will need to use a correctly designed two point alignment protractor like the one printed on this page (The protractor published here has been designed for minimum distortion wth records having minimum groove radii of 58 mm which is a figure found from practical measurement of record collections; the IEC standard 60 mm minimum will give two slightly different zero points).

Alignment doesn't stop there. The cartridge must address the record at the correct angle in each of three planes. It is probably best to imagine that you are trying to align the axes of the stereo generator assembly with the groove walls to maximise the efficiency of conversion of mechanical energy into electrical. The car-

# THE ARM THAT WON'T STRETCH YOU YET GROWS WITH YOUR HI-FI.



Introducing the superb new Datum tonearm from Logic. Probably the most versatile budget-priced arm now available — and certainly the best value for money.

For those stepping up to true hi-fi for the first time, the Datum is ideal. Despite its modest price of around £80, high quality engineering and its flexibility of design make it compatible with many different cartridges, even the finest moving coils.

So as you progress to more sophisticated equipment, your Datum will grow with you, giving high levels of performance that you could only rightly expect from an arm costing several times as much.

While the new Datum looks almost identical to its predecessor, its innovative design incorporates many significant improvements.

New, high quality bearings give extremely low friction levels and enable a very high standard of tracking ability to be achieved.

A revised bias mechanism means that tracking forces of 0 to 4gm can now be accommodated whilst the addition of an integral clip-in armrest combines with an adjustable height cueing device to make sure that the new Datum is easy to fit and use with almost any turntable.

Like its predecessor the new Datum provides for superior bass performance by using a coupled counterweight but you now have the option of a heavier counterweight to help you get the best out of cartridges weighing over 9gm.

So listen to Logic. See your nearest Logic dealer for a new Datum tonearm demonstration. You'll find his name and address simply by completing and mailing the coupon.



### LISTEN TO LOGIC AND YOU WON'T THINK ANY OTHER WAY.

Please send me details of my nearest Logic dealer and information on the Logic DM101 and Datum.

NAME

ADDRESS

### POST CODE

Clip this coupon and post it to

Logic Limited, 19 Hurlbutt Road, Heathcote Industrial Estate, Warwick CV34 6TD tridge must 'sit up straight' as seen from the front.

The angle at which the stylus tracks the groove must be correct when seen from the side of the cartridge. With normal tracking force applied, the top of the cartridge body should be parallel to the surface of the disc. Misalignment can be corrected by raising or lowering the arm pillar, if this is adjustable.

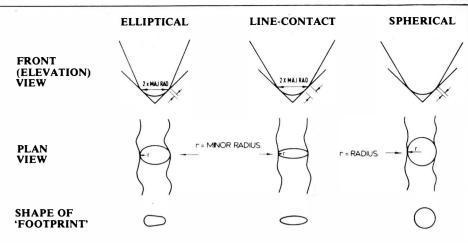
Once the cartridge is correctly mounted, you will need to set the tracking force (often referred to as tracking weight or downforce), either simply by following the maker's instructions, or (preferably) by using a test record to check tracking ability. Additionally, you will need to set the bias compensator, a device which exerts an adjustable outwards pull on the tonearm. This counteracts the natural tendency of the arm to move inwards because of the offset and overhang embodied in the arm geometry. Bias adjustment can be carried out on high-compliance cartridges by looking at the cartridge from the front and applying bias until the cantilever assembly is seen to be central. For for less compliant designs, set bias for best tracking (mistracking on the right channel means the arm is pulling in too much and bias needs adding; mistracking on the left means that the bias force is pulling the arm away from the left groove wall and bias force needs reducing).

The stylus needs regular cleaning always brush from back to front. Cleaning liquids are not always a good idea as they can introduce solvents into the rubber suspension by capilliary action. A stiff short bristle pad moistened rather than wetted with a proprietary cleaning fluid is to be recommended as is regular stylus

cleaning and inspection.

Amplifiers and speakers

These items are handled together here, because matching amps and speakers seems to one of the most common problems encountered in putting together a system. It's most important to point out that the wat-



Different stylus types: The three sets of diagrams above attempt to show the difference between the main types of stylus profile, although these two-dimensional views cannot show the 3-D forms accurately. The 'footprint' shows the shape of the tip's contact area on the angled groove wall, and is not drawn to scale.

tage ratings alone will not tell you how loud the speakers or amp will sound. There are three influences on the perceived loudness of a system once a clean and feedback-free signal from the turntable is assured. These are the amplifier power, the speakers' efficiency and room size, layout and furnishings. As explained again later in the book our reviews give a range of amplifier powers for each speaker giving the minimum requirement (which would suffice for average levels in smaller-than-average, sparsely furnished rooms) to the maximum power handling which would represent the kind of amplifier power required for high levels in a larger than average room with heavy curtains of furnishings (An 'average room' here means one of 80 cubic metres).

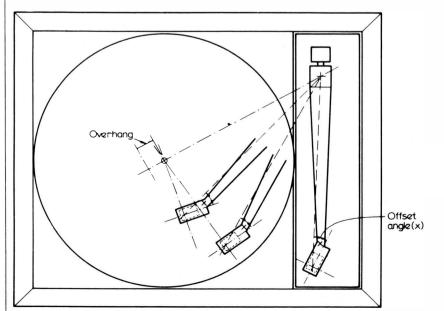
Big amplifiers hardly ever damage loudspeakers. It is small amplifiers running into distortion that do the damage. This is explained in more detail in the chapter introductions to Amplifiers and Loudspeakers.

**Electrical matching** 

The ability to drive difficult loads is often behind an amplifier's superior performance in auditioning tests. An amp's ability to drive real world loads is shown by an exact doubling of '80hm' power into a halved impedance and a further good attempt to double that figure into 20hms. The amplifier reviews give this information, which should be matched with the quoted impedance (look for the minima on the impedance curve) and the 'ease of drive' comments in the summary sections of the speaker reviews.

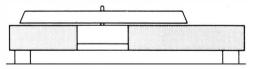
The cable you choose to put be-tween the amp and speakers can have a serious effect on sound quality. Don't use odd bits of thin wire but use as a minimum 5 amp multi-strand cable for short runs, and 13amp cable for runs over 10 metres. Specialist cables with high-quality multi-stranded constructions can be recommended. No one cable offers a 'magic' solution, often it's a matter of system tuning. Remembers to wrap the wires neatly at the terminals so as not to cause electrical short circuits.

Speaker placement and the provision of strong stands firmly coupled to the floor is also of importance in getting the best performance out of a hi-fi system. Details of stands and

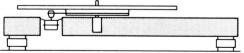


Lateral tracking angle alignment, showing offset angle and overhang.

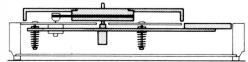
### THREE TYPICAL TURNTABLE DESIGNS



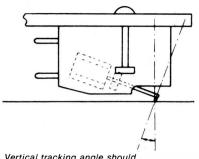
A direct drive motor integral with the platter bearing is usually mounted on a solid plinth with any decoupling in the feet.



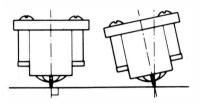
2. A solid plinth/belt drive type is often used in cheaper systems.



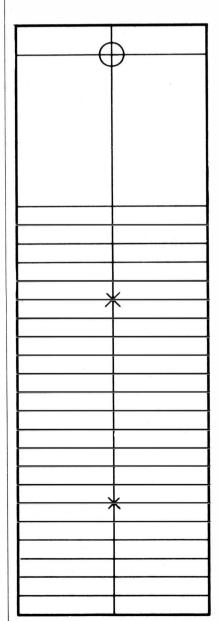
A decoupled sub-chassis/belt drive system offers good environmental and motor isolation. The entire suspended section is shaded.



Vertical tracking angle should be 20 deg. It can in effect be controlled by arm height adjustment.



Viewed from the front, the 'tilt' angle should be zero.



Alignment protractor

position requirement are given in the section on Loudspeakers.

Getting the best from a tuner

Aerials will be discussed under the section introduction to *Tuners* but is important to stress the point that an aerial must be suitable for local reception conditions. There are two things which increase with increasing complexity of aerial design, namely gain (more signal) and directionality. If you want good stereo from BBC national FM networks and from BBC and ILR local stations then you will in all probability need only a simple roof or loft mounted dipole.

If you want to enjoy stereo reception from the more distant stations, a more complex aerial will need to be installed. But more elements means more directivity which may mean compromising reception from one station for another. This is where the aerial rotator comes in — those who are really serious about FM radio will certainly want an aerial rotator to offer perfect compass alignment of the aerial by remote control.

Once you've bought a good aerial, don't spoil the job by using cheap and 'lossy' down lead. At best, it will weaken the signal you paid money to get; at worst it may channel rain down from the roof into the back of your tuner. Aerial amplifiers can be used to boost signals over very long cable runs but professional advice and installation is recommended in these circumstances to avoid any disappointment.

Finally, if you are bothered by interference check first it is not a poor connector or badly aligned aerial before bringing in the Post Office interference people. Log the times of the problem and make a tape recording of the interference to enable them to at least hear the severity and nature of your problem.

### Getting the best from a cassette deck

There are three important areas to get right if you want the best performance from your particular cassette deck. First of all the machine should be accurately electronically adjusted so there are no errors of equalisation or Dolby tracking problems. This alignment should have been carried out by the manufacturer with reference to a particular brand and type of tape. However all too often this alignment needs to be redone by a competent independent test engineer. Alignment accuracy depends on the level of quality control, and not a few decks failed on these grounds in our reviews

To check this for yourself always ask to use the actual cassette deck you intend to buy in the shop; make a quick A/B recording from disc, play back the tape and disc together listening for gross response irregularities. Try playing back the same pre-recorded tape and LP copy of comparison.

Incorrect physical alignment of the heads with respect to the tape (azimuth adjustment) can seriously impair pre-recorded cassette replay. You should be prepared to pay for alignment service, though many shops which do not offer discount will pro-

vide alignment free of charge — don't expect, though, to get free alignment and a discount!

Returning to electrical adjustments, the deck should be aligned to record and replay correctly with one brand of tape or with a small group of similarly performing tapes. Fortunately, more and more tape types now conform to the IEC recommendations which standardise bias requirements and should help make tape-to-machine matching problems a thing of the past. Alignment differences are often bigger than the difference between different makes or models of cassette deck.

Cassette deck maintenance is important. Perhaps the most important point here is to avoid using cheap tapes from anonymous manufacturers — often they will chew up or deposit oxide heavily on the heads. In any case, regular cleaning to keep the heads and tape path free from fluff and oxide particles shed from tape is essential. A head covered with oxide will have little or no treble output. Cleaning should be done after every 20 hours running, using cotton wool buds moistened with isopropyl alcohol. Decks with heads which are difficult to access are best cleaned with a proprietary cleaning cassette; though all too frequently these cassettes fail to clean the erase heads.

Additionally, you should be prepared to remove the magnetisation in the heads which builds up over a period of use. Devices for de-magnetising (or 'de-gaussing') tape heads are readily available, in either handheld or cassette shell form. Follow the manufacturer's instructions to the letter and regularly de-magnetise your cassette heads, say one every couple of months.

Upgrading

Whatever you choose and use you'd be wise to think ahead to the time you either want to expand the facilities, replace some part of your system or improve its overall performance. If you intend to upgrade in steps then each step must offer a worthwhile and audible improvement.

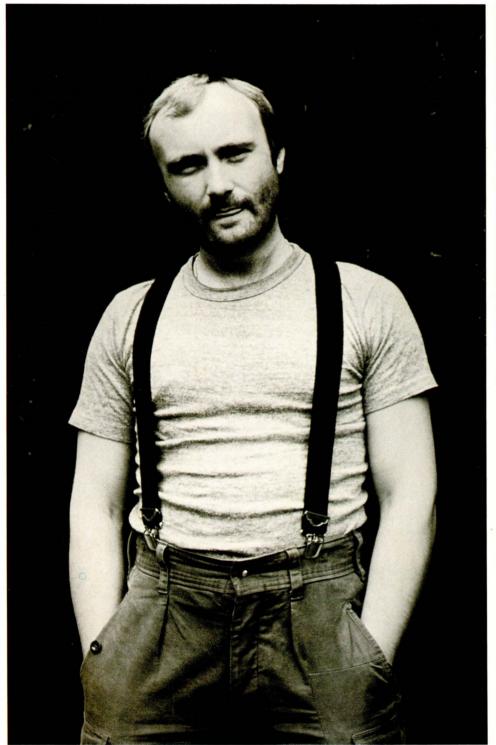
Bigger speakers and more powerful amplifiers may not mean better speakers and amplifiers – rely on reviews and personal auditioning preferably at home to ascertain just what you're buying.

A popular and inexpensive way of upgrading a system's performance is to fit a new stylus to an existing cartridge body. This can often be done for around half the cost of an equivalent cartridge. Buying a better stylus with a more sophisticated profile and improve cantilever can give a more detailed sound but beware, as the arm you are using may need upgrading as well to get the best from the new stylus

Do rememberthere is no substitute for personal audition and that our recommendations should merely be the starting point for your own assessment of any piece of hi-fi equipment for your system needs and expectations. Whatever changes you make remember to look at upgrading always in the context of the system performance and not in terms of the excellence of individual items.

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Name and Europe. Our sales staff know the equipment and will help you decide.  UNILET
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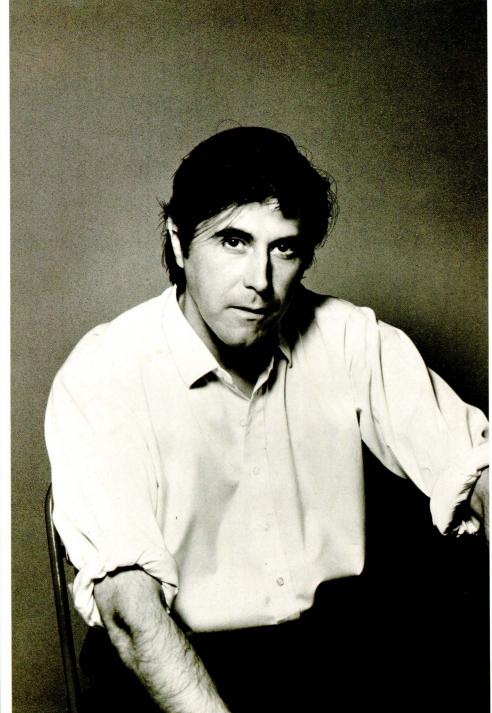
CDP-501ES

### pact disc players.



From the CDP-101 with its sophisticated music search and random track selection, to the state-of-the-art CDP-701ES with features like separate channel, digital/analogue converters.

All of course with infra-red remote control.



And though it would be nice to be as talented as the gentlemen pictured



CDP-701ES

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The Yamaha is a real gem" wrote Popular Hi-Fi in March 1983 about the K-300 cassette deck. Backed up by superior Yamaha technology, it offers Dolby B and C noise reduction. The Yamaha K-300 costs just £159.00.





Send for full literature on Yamaha Hi-Fi to Natural Sound Systems Ltd Unit 7 Greycaine Road Watford WD2 4SB Tel: 0923 36740

# COMPACT DISC AND DIGITAL RECORDING

Controversy still rages over digital audio, specifically Compact Disc. So it may come as a surprise to learn that when CD was launched, the BBC had already been using digital technology for some years in relaying radio programmes. Almost unsung, the BBC pioneered the use of PCM (Pulse Code Modulation) techniques to transmit radio, to link studios and transmitters and to record material for broadcasts.

Analogue systems deal with analogies of the musical waveform, be they stored as a physical analogy in the case of the LP record groove or as a magnetic analogy in the orientated magnetic fields in a piece of recordingtape. The problem with such systems is that they are prone to degradation and noise, furthermore they can become 'nasty' when pushed

near their limits.

Digital recording systems promise to overcome these problems by storing information about the music waveform in a robust mathematical code form. The code is created by a technique known as sampling. The ditial encoder looks at, or 'samples' the music waveform very frequently, 44,100 times a second. At each sample point it looks at the level of the signal and ascribes a code to the level. This code is built up from binary digits ('on's and 'off's - or 'ones' and 'noughts') but to encode sufficient levels to capture the full dynamic range of music, codes built up out of 16 bit (binary digit) words are used. All the possible permutations and combinations of a string of 16 'one's or 'noughts' gives you 65,536 levels which in effect corresponds to a dynamic range of around 100dB.

The binary code is robust because the only thing that needs storing is a difference between an 'on' stage and an'off' state — unlike analogue systems which need to store a continously changing voltage level.

Because, in a digital system, the music is stored mathematically, any lost pieces of information can be mathematically recreated, or 'interpolated' by error correcting systems which act like very fast acting adding machines. This means that even gross defects in the storage medium, which in analogue systems would produce unacceptable noises such as pops,

can be compensated for and made inaudible.

**Digital tape recording** 

Due to the high frequency sampling rate and the need to store 16 bits for the left channel, 16 bits for the right channel and a further 16 for error correction codes etc, the tape recorder needs to be able to handle roughly 2 million bits of digital information every second — in other words it must have a bandwidth of greater than 2 MegaHertz. The video tape recorder is the only domestically available tape recorder with this kind of specification and it has been press-ganged into audio use by a number of manufacturers. There are two types of digital audio unit, those which have dedicated 'video' type recorders usable only recording audio signals (like the Technics SV-P100) and those which use conventional VCRs (like Sony's PCM-F1 digital audio adaptor which can be used with any video recorder operating at the right video standard — PAL for UK and European use, NTSC for the rest of the world including the US and Japan).

It does now seem that it is only the digital audio adaptors, for use with existing domestic video machines, that are being actively marketed in the UK. These are the only models now included in this review section.

**Compact Disc** 

In contrast to the digital systems which allow the user to both record and replay digital material, the Compact Disc (CD) system is a play-only system for pre-recorded discs. The CD system has been developed in Europe by Philips with a large R&D input from Sony over the error-correction techniques and circuitry. Sony and Philips of course lead the marketing drive for the new medium but almost every hi-fi manufacturer of size has shown their own or a 'badge-engineered' CD player since the offical launch on March 1, 1983.

The Compact Disc itself measures little more than 4 inches across and carries its digital information in a spiral track of non-reflective pits pressed into an encapsulated and protected metal foil layer. This spiral is wound between 40 and 60 times

more 'tightly' than the groove on a conventional LP. The benefit of this sandwich construction is that the laser can focus past surface imperfections onto the information layer and so be immune to small marks and scratches. The redundancy built into the coding of the information can be applied if the disc is damaged. The Compact Disc is read by a

The Compact Disc is read by a solid-state laser which tracks the disc from the centre to the edge; the disc spins at an ever changing velocity to keep the flow of information constant.

At the UK launch a handful of players were presented to the public with roughly 195 software titles. Writting almost a year, later the available software has expanded perhaps fourfold; on the hardware front, most of the Japanese majors are now making some attempt to sell a CD player in the UK. Sonyare still probably market leaders with their CDP-101 while Philips, Marantz and Hitachi, who between them took the rest of the launch market, are now joined by Toshiba, Sansui, NAD, Yamaha, Technics, Akai, JVC and others. Some of the launch players have already gone off the market to be replaced by secondgeneration players many of which have been restyled and repackaged to offer the looks and operating method of the Sony player.

The Hi-Fi Choice measurement programme includes Compact Disc players in the Turntable and Tonearm issue currently in preparation. As our previous test material (conducted well before the offical CD launch) is obviously out of date now and because we cannot pre-empt the publication of Martin Colloms' CD tests we have decided to refer readers to that new issue when it is published in the early summer of 1984. However we reprint some of Colloms' excellent background material to the new technology.

Compact Disc: User Report
— by Martin Colloms

In tests, spectrum measurements show CD material to have more peak treble energy, but often the subjective results indicate a 'brighter' more open soundfrom the conventional LP— so this is not a function of its frequency response but simply the effect of the extra surface noise.

full understanding of the mechanics of LP record replay would lead one to anticipate a deterioration in sound quality as the arm traverses the playing radius, due to the progressively reducing groove velocity gradually compacting the music modulation. This makes it harder for the stylus tip to trace accurately. In practice however this deterioration passes relatively unnoticed, as with continued listening to a given record, one tends to assimilate changes in clarity, treble energy, separation and distortion with the changing programme — unless a particularly trying end-of-side finale or massed choral section appears, where the record player's failure to cope is only too obvious.

With CD replay, the sound is consistently accurate from end to end. which makes comparison with LPs rather difficult. It becomes quickly apparent that the LP sound really is constantly changing, and that even with one of the finest analogue player combinations only the outer part of a mint LP is of much use. By the time that the last track has been reached, the difference is too obvious for any useful comparisons of fidelity to be made. Other problems also arise. Peak programme measurements suggest that even with wellcut records and top-flight cartridges, peak compression and distortion occurs on an analogue player, and even when the noisy low level sections have been avoided, and the sound balanced for a fair comparison on middle sounds, analogue, is, brighter on transients.

If levels are not carefully judged it is all to easy to clip the monitoring amplifier and wrongly attribute the resulting hardness to the so-called 'digital sound'. This terms is virtually meaningless, since good digital can be so transparent a recording medium as to be almost inaudible; a fundamental of performance sadly lacking in the current analogue systems whether tape or disc.

**Subjective qualities** 

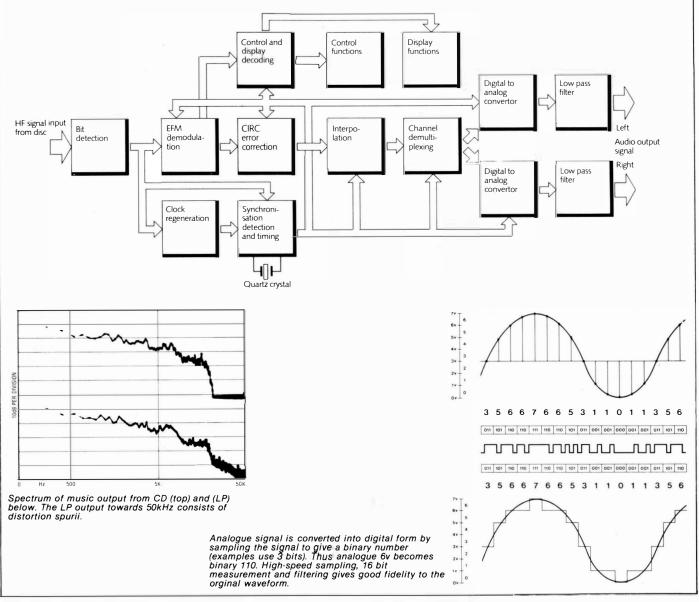
Some pundits, without actual experience of good digital equipment have nonetheless speculated on digital's subjective faults, such as 'grainy treble', 'hard midrange', curtailed stereo depth and ambience, plus audible lowlevel distortion. We however have experienced none of these with our machines; on the contrary we have discovered some unexpected virtues which I feel will assume increasing importance in the future. The most obvious the perhaps the least expected is the bass quality.

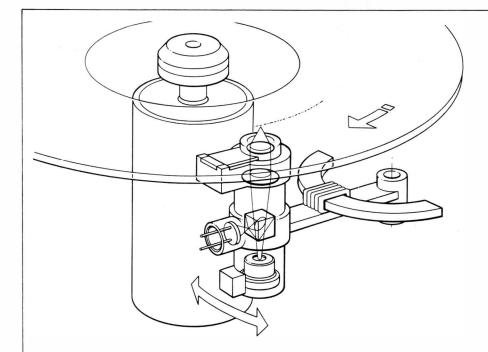
With CD replay of digitally mastered sources, the particularly good quaity of the bass is immediately noticeable, the effect best described as an 'opening up' of that frequency range. The bass seems less obvious, less forward or boomy, and takes on a more natural perspective, showing greater depth, attack, damping and extension. The midrange also seems more clearly defined, the reduced bass confusion appearing to be a contributing factor here.

The potential of CD, yet to be realised in future recording productions of the right quality, will come as a revelation to the audio consumer. It will expose analogue LP weaknesses and will provide a stimulus to amplifier and speaker manufacturers alike to improve their product to

match.

In absolute terms, the analogue LP chain has a tendency to soften, mask and compress the original programme in addition to applying a degree of audible frequency response filtering at both extremes. Strangely enough, on a considerable quantity of current programme this failure is actually an advantage. It would appear that much of the programme is doctored, hyped-up, equalised, or otherwise produced in such a manner as to give an enhanced 'larger' and 'closer





Laser light is focused on the disc's bright reflective layer, reading the microscopic pits as either high reflected light level or very low light level when light is scattered by the pits. A photodiode converts this light signal electrical impulses. The tracking arm moves from inside to outside of the disc, disc speed decreasing progressively from 500 to 200 rpm.

than life' effect. Moderated by the analogue chain, the end result is more or less satisfactory, but the same programme replaying in all its exaggerated glory via CD can sound dire in many cases — a travesty of the musician's and composer's intentions.

### **Paradox**

We therefore have an interesting paradox here — the LP can actually beat the CD player on modern programme material of typical communical quality, when judged from a musical standpoint. Once again, there is scope for the pessimist to condemn digital replay. Conversely, given 'musically' produced and balanced programme free of emphases, CD affords the domestic user a very close approximation to a highly transparent, if delayed, link to the studio mixing desk at the moment of programme production.

The results we have attained so far suggest that with accurate programme the CD system performs extremely well by analogue standards and ruthlessly reveals recording eccentricities.

### **Features and facilities**

From the players tried, a fair idea of CD operation and the general facilities that will be offered was gained. All were automatic in the sense of a conventional turntable; tracks may be selected by pushbuttons on any order and the sequence stored for subsequent play.

When a CD player starts up, the first thing it does is to seek the start point (discs are played from the inside outwards) and reads the disc index. It then has all the necessary information to read out the number of tracks present and their individual as well as their total duration. If 'play' alone is pressed, the tracks are reproduced in their normal sequence without interruption, and some of the machines have fine forward and reverse controls for track seeking.

The 'pickup' position on the record can be 'seen' in some machines by observing a timer calibrated in minutes and seconds for each track; in others the pickup will jump complete tracks without the benefit of a fine access capability within each track.

Differences in the speed of operation when reading the discs and selecting tracks became apparent during out first appraisal of early CD players. Several machines seemed quite slow. However, the Toshiba XR-Z90 gave a hint as to what is actually possible. A pre-production prototype, it demonstrated a very desirable turn of speed as regards transport operation. Not only was it easy and logical to use, but it also appeared to respond with great agility.

A further facility we found convenient was the presence of a head-phone socket in the front panel, for example on the Hitachi and Sony players. This was found to be very useful.

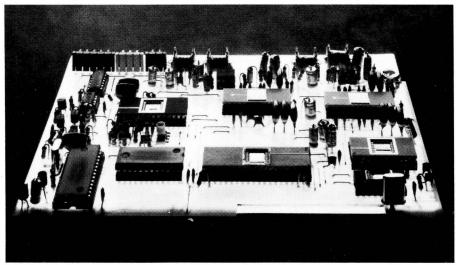
CD players have the potential to be very small indeed, since the disc is under five inches in diameter, and the horizontal types (both top and drawer loaders) hold out the greatest potential for compactness. In physical terms the basic Philips/Marantz design is still the smallest so far, this a top loading design.

Note that the CD player produces a line or auxiliary signal level, with a flat-response audio signal, like a tuner or cassette recorder.

### **Conclusions**

The conclusions arising from this preliminary investigation into CD players and digital sound replay in general are pretty obvious. Already extremely good, digital is clearly here to stay. Limited measurement showed that the similarities between particular CD players seem much greater than their differences.

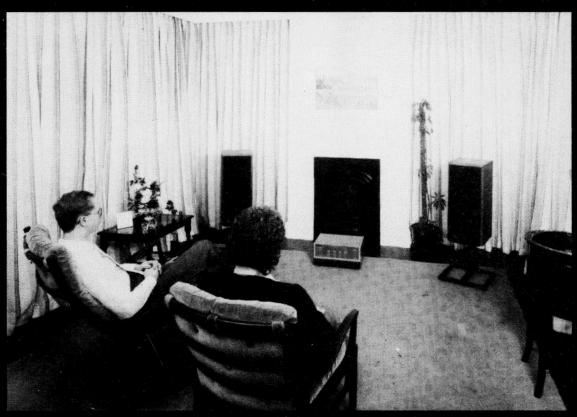
It will be some time before CD presents a serious alternative to analogue, though, because of the finite rate of expansion of the CD record catalogue. At first, only a few hundred titles will be available, and no-one with an established library of LPs is gong to scrap these and their associated analogue equipment. Initially a secondary music source, CD is however expected to expand in the next few years to make serious inroads into the analogue and LP market, to an ultimate stage where the analogue equipment and source material will be rendered obsolete except for archive purposes.



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# Home truths about speaker performance

It's true: some loudspeakers sound superb under scientifically designed test chamber conditions.

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For the past few years our most important area of research has been the interplay between room surfaces and speaker performance. Through the use of a complex computer programme connected to a sophisticated robot head, we have been able to analyse speaker sound reproduction as perceived by the human ear.

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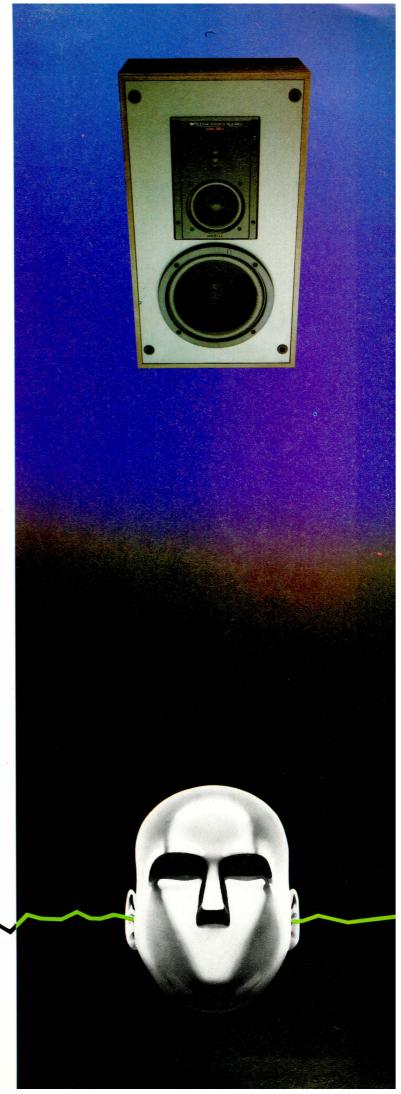
And it's why every AR speaker is guaranteed to perform up to factory specification for a full five years; with a warranty that covers parts, labour and even carriage to and from your nearest authorised AR

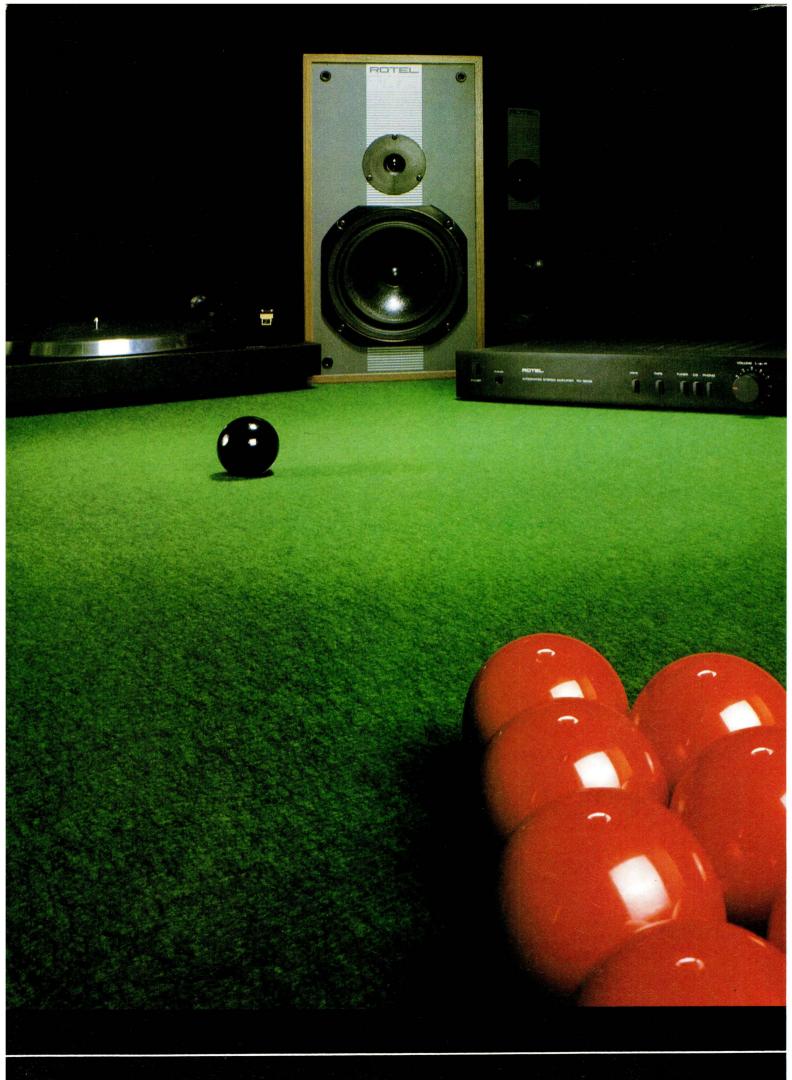
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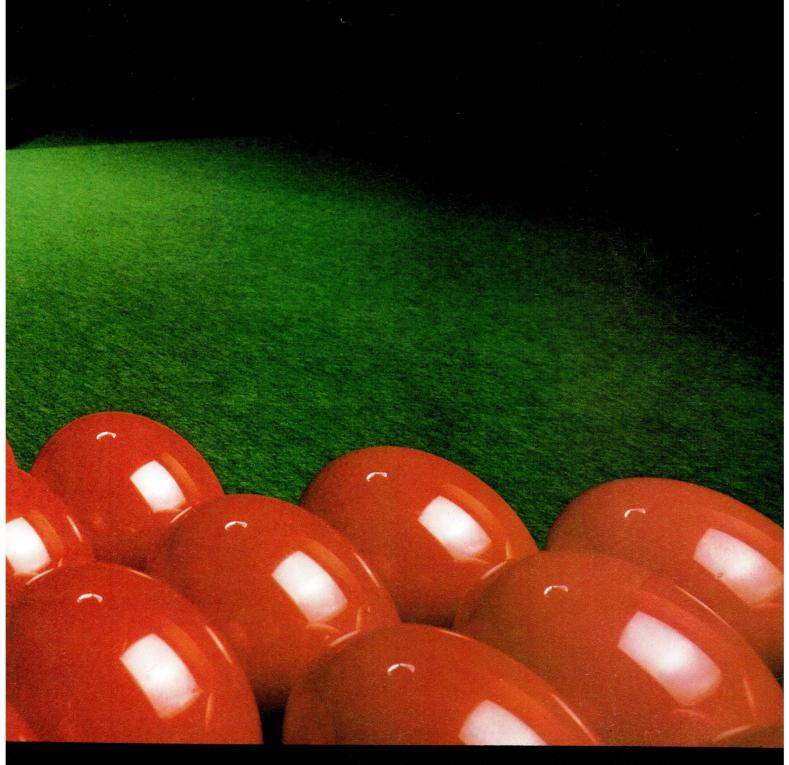
Listening to reality





# Go for the black

Top points on the table go to Rotel's Black system.
Turntable RP830, is your cue to real sound quality.
Amplifier RA820B makes a clean break from convention and the speaker system puts the rest under the table.
This is Rotel's winning combination and the price, you will find, is easy on the pocket.





If you've ever danced the night away at the Hong Kong Hilton, The Heliopolis Sheraton Cairo, Cinderella Rockerfellers in Chicago, the Singapore Hilton . . .

Alright, so you haven't!

However, you may still have experienced a little of the atmosphere of these exotic nightspots right at home in your own front room.

For they are just a handful of top international clubs and discotheques who use the budget-priced KEF Coda III speakers.

Bookshelf hi-fi speakers in a discotheque? The idea sounds absurd. But not according to the company whose brainchild it is - The Juliana's Group.

Anyone in the club or hotel business will know that Juliana's are the world's biggest and most experienced discotheque company

They supply a custom designed complete discotheque package, calculating the exact sound requirements, then designing and supplying a complete system of sound, lighting and video, much of it built themselves by their manufacturing company, Beam Electronics.

Beam were called in to overcome some of the problems in lighting Peter Stringfellow's extravaganza - the Hippodrome, London, designing and building a wiring loom that took some five miles of cable.

In an entertainment world that is becoming more and more hi-tech, innovative and spectacular, custom designing a complete sound system becomes increasingly complex.

So how do KEF Codas help?

Alex Munro, Technical Director of Juliana's London Division and Tony Hamza, Managing Director of Beam Electronics, explained:

"In the kind of international discotheque we're talking about, there are two distinct sound requirements.

One is the high energy sound we get from the big speakers on the dance floor itself. In hi-fi terms it is not a particularly accurate or a high quality sound. But it's there for dancing to, not listening to. If this sound was directed at the whole area, it would become very irritating, because the volume would be too loud to talk over and because the high frequencies would get soaked up by the soft furnishing of the surrounding areas where you end up with a low-grade sound.

So we contain this high energy sound within the hard reflective surfaces of the dance floor itself

Then we use a further sound system for the surrounding areas. This is where the KEF Codas come in. The sound here is of hi-fi quality. It still contains all the excitement of the dance floor sound, but at a less obtrusive level that you can talk over.

The art is not to have an obvious change-over point, so that the sound appears consistent throughout, although in reality it is quite different."

But can the small KEF domestic speakers really supply the volume, even at listening levels, in such large areas which are usually crowded with people?

"Certainly. We do, of course, use as many as we have to. In the Hong Kong Hilton, for example, we used seventy.

Also, we use them with a line transformer. This makes use of a big amplifier with a very high voltage output and a transformer close to each speaker. So we can totally control the power to each speaker, giving more volume or less wherever we need it.

By having more small speakers with individual control, we can achieve great flexibility. This is important because every sound system we design is a 'one-off, custom built for its particular location. And the smaller speakers are ideal because we can hide them and interfere as little as possible with the design and decor."

Juliana's have pioneered another entertainment concept which they call the Music Room. This is a multi-function lounge, bar, tea room and night club which runs from late morning until the early hours. A series of DJs provide music to suit the hour of the day, ranging from classical through to jazz to the late night disco music.

Again, KEF Codas and Chorales are used extensively.

"The quality of sound is particularly important here, especially in the quieter day-time hours. The music is an important feature. It is 'live' in the sense that it is being presented by a DJ. The ambience is crucial. It must have presence, but again without preventing or intruding on conversation."

Juliana's started using KEFs about a year ago. They now have hundreds in use and are ordering more all the time.

"We haven't had a single one back, which is quite a remarkable record. We have clubs and discotheques from Australia to the Arctic Circle and we have to service every one of them, so the reliability is a bonus. But really, the quality of sound is what we look for, and in a small speaker at this kind of price we haven't found anything to beat the KEF Codas."

### FOOTNOTE:

KEF Speakers have been manufactured for 22 years. KEF have the largest development and design team of any loudspeaker manufacturer and have been in the forefront of every important speaker development over the past two decades.

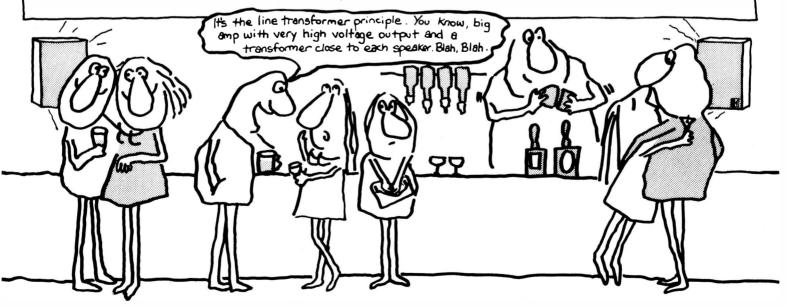
KEF speakers are internationally recognised as being the finest in the world and many of the leading hi-fi manufacturers have studied the KEF methods of testing and manufacturing at their Kent factory.

They range in price from £9,000 to less than £100 a pair, and KEF's continuous programme of advanced research and development benefits their budget speakers every bit as much as the professional studio models.

Any reader wishing to receive a complete information pack on KEF speakers should telephone, or write to the address below:

KEF

KEF Electronics Limited, Tovil, Maidstone, Kent ME15 6QP. Tel: 0622 672261.



Sansui PC-X1 digital adaptor

Sansui (UK) Ltd, Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Middlesex UB6 0AA. Tel 01-575 1133



Sansui's first digital adaptor, unusually, or playback and so it is not possible to code switch selecting appropriately. and de-code at the same time. The PCX1 will allow copying with error correction, but not down to analogue and back again. It only has 14-bit resolution, but good dither was provided. Sonvs.

In fact this processor is a 12V DC model also supplied. This interconnects with a frequently used on equipment. Two 1/4 in mono jacks are also impedance models. provided for left and right microphone inputs, whilst line inputs and outputs are on pairs of phono sockets on the right hand side panel. being provided. Two more phonos are fitted for and sockets are provided for a carrying strap if

interconnection with TV tuner or TV set inputs incorporates processors switchable to record and entitled 'monitor TV' and 'video tuner', a

On the front panel is quite a large splitconcentric level control, which was easy to adjust. Switches select copy on/off (when off, the copy socket can feed the encoded signal to and so 14-bits are better on this than on the a second video in parallel), meter function (level or tracking and battery level), muting off/auto, and mic/line input switching. A large incorporating a 'bug hutch' on the side which rocker switch selects record or playback accepts a re-chargeable nicad pack, but in mode. A 1/4 in stereo headphone jack is addition a separate mains power supply unit is provided with a small ganged level control for gain adjustment, and this gives adequate special plug and socket, of a conventional type volume into low impedance models, but clips Japanese at 310mV, and thus is unsuitable for higher

Record level metering also works on replay. and is of the bargraph type with fairly good discrimination, reading peaks accurately. Also on this panel are a mic attenuator switch. There is also an overload light to tell you that (20dB) and a microphone bass cut switch. you've just gone over the top! As you cannot Phono sockets are also used for monitor the return digits, you cannot of course interconnections to the video inputs/outputs de-code and hear clipping, so this overload of video recorders, an additional copy socket warning is important. There is a record mute.

you are using it for outdoor recordings whilst you are happily jogging.

Sansui claims this model has superb error correction built in, and indeed it must have since it coped very well indeed with the test digital recording that we had already played 250 times. It seemed to cope very well indeed with 14-bit correction, but our 16-bit tapes did have the odd error that could not be corrected on this adaptor.

When we recorded speech at -50dB and played it back appropriately, we regarded the quality as excellent, having very good dither and the sound was very clean, even at this remarkably low level. It may only be of academic interest, but with the replay level boosted up on this very under recorded speech, we did detect a slight tone, measuring 300Hz at - 96dB, and second harmonic at - 94dB. Under normal conditions, though, in quite extended listening tests, we never heard any whistles, and we did not hear any noise modulation from the speech, which is extremely good.

We played several cassettes made on a Sony PCM-F1, the first being a superb recording by Peter Baxendall of Renaissance Brass Music, recorded with two compensated STC 4038 ribbons, using transformers. This sounded really beautiful, as it had done on the Sony. There was just a slight suspicion of noise modulation, though, which vanished when we converted to 14-bit via the Sony 701. We then coded a compact disc through it and monitored with the 701, and results were superb. The only audible difference was perhaps a marginal spikiness on strings, and suspicion of a lack of body at lower HF, for which we could find no plausible explanation. other than a difference between 16- and 14-bit.

I must emphasise that we were judging by the highest standards, and that whilst differences were heard by all of us, they really were very marginal. You can see that distortion at peak bits is incredibly low for 14-bit, and that signal-to-noise ratios were very good, unweighted ratios also being excellent. Even distortion at low levels was very low when judged in perspective. Need I say that the responses were as flat as a pancake! Input sensitivity was just slightly lower than I would have liked it, but output level was ideal, again not variable.

At the time of writing a price had not been firmly established, and I feel the value-formoney is highly dependent on the price of this unit compared with the Sonys. One should bear in mind, on the debit side, that it is only 14-bit, and that it has to be switched to record or replay. On the credit side, the Sansui has an advantage over the Sony 701 in that it can be operated as a portable off batteries. A strongly recommended product then, with no bugs that we could find.

### **GENERAL DATA** Maximum output for peak record le

Input sensitivity for peak record level5	
Overall distortion at 1kHz, 0dB (2nd/3rd/4th)	
82dB/in noise/in noise (total 0.012% inc r	noise
Overall distortion at 1kHz, -20dB (2nd/3rd/4th)	
	76dE
Overall distortion at 1kHz, -40dB (2nd/3rd/4th)	
	noise
Overall distortion at 1kHz, -60dB (2nd/3rd/4th)	
– 40/ – 42dB/in	
Overall noise, unweighted	80dE
Overall noise CCIR/ARM weighted - 80	0.5dF

.310mV clipping, gain in hand Meters under-read .0dB on 8ms

Overall frequency responses

Headphone output level into 600ohms

Headphone output level into 8ohms

### Sony PCM-F1 portable digital adaptor

Sony (UK) Ltd, Sony House, South Street, Staines, Middx. TW18 4PF Tel 0784 61688



This utterly remarkable 16-bit adaptor has now been available since early Autumn 1982 and has set a standard of digital recording quality for home and semi-professional use which has actually been the envy of many professionals, several of whom have purchased these units for high-quality recording. The PCM-F1 is intended for interconnection to a PALcompatible video recorder, although an NTSC recording model is available. Modifications allowing the record side to be switchable between PAL and NTSC standards have been written up by Tony Faulkner in Studio Sound magazine (March 1983).

The PCM-F1 adaptor can be driven either from an internal nicad battery pack, or from an external mains charger. It is designed primarily to match the Sony portable video recorder type SL-F1 UB, and TT-F1 tuner/timer/charger. Other optional extras include various interconnection lead combinations; a separate charger power supply AC-F1 UB at around £70; car cigar lighter charger and so on. The PCM-F1 works ideally with the SL-F1 UB video recorder which allows a form of cueing and double-speed playback.

The PCM-F1 gives the choice of 16-bit or S 14-bit encoding, but for playback automatically decodes either without the need for switching. Also, the F1 will automatically decode either PAL or NTSC format, which is useful. This allows you to convert digital audio tapes (if they are EIAJ standard) from, say, NTSC to PAL if you have the right video decks.

This unit has quite sensitive microphone inputs, on 1/4 in mono jacks, and these have both low distortion and quite high sensitivity and yet a good clipping margin, allowing direct interconnection with capacitor microphones, but these will need their own power supplies. Line inputs, on phono sockets, have a reasonable sensitivity for obtaining peak recording level in most applications. They are about 6dB less sensitive than average cassette deck inputs, but will handle very high input levels for professional applications. Input signal level is controlled by separate left and right miniature rotaries, which were found slightly awkward to use. The signal can then be encoded either to 16-bit, or to 14-bit with extra correction (which we did not really find an advantage). Two machines can be fed, one from the video out socket, the other from a socket switchable to the record side or to an error corrected signal from the replay side, thus allowing copying with error correction,

which is excellent.

The record and replay converters may be used independently, which allows you to obtain analogue audio playback from one video deck, level control and equalise, then reencode to a second deck for mastering, and you just need an extra video deck for this. The metering is of the horizontal bargraph type with excellent discrimination, indicating from replay only unless 'record mute' is pressed. There is also a peak reading light the meters were found not quite bright enough for outdoor use. Audio outputs are on phono sockets, which give a maximum level at low and mid frequencies of 1.35V RMS, although of course high frequencies will be at a lower level because of the 50/15µS eq pre-de-emphasis which cannot be switched out on record, although non pre-emphasised tapes made on another adaptor will automatically be processed correctly. A mute on/off button below. allows audio to be heard during cueing etc. and stops the deck muting unless errors are incredibly bad. There is a battery check button 'average battery life from full charge is one hour), and meter select switch for level or tracking, auto/manual peak hold and release button, mic/line input switch, and finally, a headphone volume switch in approximately this unit with the SL-F1 and it has opened 6dB steps, headphones being interconnected with the usual 1/4 in stereo jack. Low and medium impedance models could go loud enough, but higher impedance ones could not go loud enough 'in the field' unless you endangered peaks by going very near peak. Thoroughly recommended as a 'best buy'. recording level (we certainly did when recording fireworks!).

We have been using this model now for one year, recording off batteries and mains anything from steam railway locos to symphony orchestras in the Royal Festival Hall, and have obtained recordings which we all consider to be of stunning clarity and accuracy, and which seem to have an openness and lack of modulation noise that could never come from even the finest analogue machine. We have absolutely no reservations about the sound quality, although we found it necessary to fit a voltagedependent resistor across the mains input to remove surge clicks, as most digital equipment is prone to being thrown by these. We have regularly also used a QED mains filter R which has worked very well.

When you are doing live mic recordings I most strongly advise you to use balanced mics L and cables, together with a balanced to unbalanced transformer of the highest possible quality as near the PCM-F1 as possible. This is extremely important in order to keep out interference, which may be caused Overall frequency responses

by anything from lurking thermostats to transmitters around the corner!

The SL-F1 video has a counter which reads in minutes and seconds, but this does not work on blank tape (it works by counting the number of video frames).

We recorded speech at a level of 50dB below peak and then amplified it right up on replay to a full level. No distortion was apparent on 16-bit, the dither being very effective, but 14-bit reproduction showed a rather crackly background, and clearly required more dither. We have carried out every test imaginable with spectrum analysers and distortion meters and can find nothing wrong. On 16-bit, levels well below the noise are easily reconstituted on playback because of the excellent dither characteristics permitting this (on 16-bit). In the laboratory, distortion was stunningly low throughout as you will see from the figures

The unit does get extremely hot and requires to be used in a well ventilated place. All audio and video interconnections are on phono sockets, the DC input socket being a special DIN one. (A car lighter socket lead can also be supplied).

We have all had such tremendous fun using many new doors to 'fun with audio'. If you want the flexibility of mains or battery operation then I urgently suggest that you consider this set-up rather than messing about any more with analogue tape (see also *PCM-701* review).

### **GENERAL DATA**

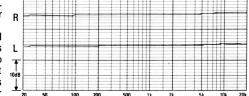
Meters under-read.

Maximum output for peak record level,. .1.35V Input sensitivity for peak record level,. Overall distortion at 1kHz, 0dB (2nd/3rd/4th) . – 88dB/in noise/in noise (total 0.0046% inc noise) Overall distortion at 1kHz, -20dB (2nd/3rd/4th) - 81/ - 79dB/in noise Overall distortion at 1kHz, -40dB (2nd/3rd/4th) ..in noise/ - 73dB/in noise Overall distortion at 1kHz, -60dB (2nd/3rd/4th) in noise/ - 50dB/in noise Overall noise, unweighted, 16 bit. 90.5dB Overall noise, unweighted, 14 bit..... Overall noise, CCIR/ARM weighted, 16 bit 88.5dB -91dB

.4.4V max.

290mV max

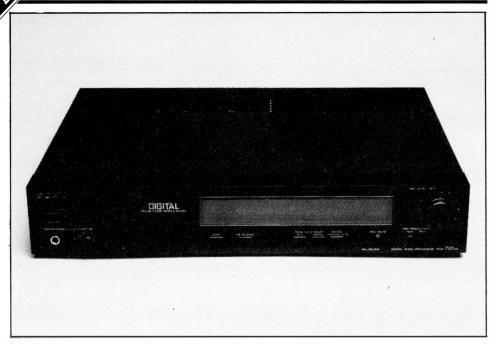
.0dB on 8ms



Headphone output level into 600ohms...

Headphone output level into 80hms

Sony PCM-701ES digital adaptor Sony (UK) Ltd, Sony House, South Street, Staines, Middx. TW18 4PF



PCM-701 is very similar but gives a marginally better performance. It omits microphone inputs and is only mains operated, having no 12V input. It does have, however, a video monitor feed which allows you to look at the dots and bars produced by a digital audio signal on the screen of a normal video monitor (that is not a normal telly, but one having a straight video input). The 14/16-bit switch for record is on the front rather than on the back, and there is an indicator which shows you whether you're decoding 14- or 16-bit, Record level controls are much better, being a friction locked concentric rotary. It is twice the width of the PCM-F1, but has about the same depth and height, and gets at least as hot, possibly even hotter! All other controls and interconnections are identical.

There are no audible differences that we could detect between the 701 and F1, although the measurements were marginally even better as will be seen. We again tried the very difficult grossly under-recorded speech test, which it passed with flying colours. Recordings made

Introduced a year after the PCM-F1, the interchangeable with this model. We have found that errors are not really of any concern. until you play back a tape more than a hundred times, if you are using decent video tape on a respectable video recorder. Copies were indistinguishable from the orginal, and so at the lab we all suggest that the use of either of the Sony PCM adaptors will open up a completely new world of glorious audio quality for you that you may never have experienced before - unless you have previously heard good digital, or one of the few superb compact discs on the best players.

Since its price will be around £200 cheaper, at £750 or less, than the PCM-F1, it is an exceptionally good buy and, of course, is a 'best buy'. This brand new unit is obviously going to be used by top professionals and I suspect is going to be responsible for closing down, unfortunately, quite a few production lines of semi-professional analogue reel-to-reel decks. Possibly it will also seriously harm the sales of the most expensive cassette decks. I emphasise that you will get the best error correction if you use a deck such as the SL-F1. with the PCM-F1 are all completely or the Sony C9, which both have special PCM

input and output capabilities which by-pass unnecessary video shaping circuits which are normally required for TV recording. Other video records not having this facility should still work well with these adaptors, but your tapes will show deterioration rather sooner.

On the speech test recorded at very low level there seemed to be almost no quantisation noise, but just gentle dither. Distortion was not really noticed even at this ridiculous low level on 16-bit. 14-bit was not so good, with 'frying' noise being audible; the speech seemed to modulate this noise, but only slightly. We suggest that within its frequency range, what goes in seems to come out again with no apparent loss of information, neither does it add anything. The error correction seemed superb, even coping with tapes acceptably well which had been played back perhaps 250 times. I feel that the Sony digital adaptors put the domestic and semi-professional recording enthusiasts into a world that they could never have believed possible only a few years ago. A very worthy 'best buy' indeed.

tter than — 88d h) in noise/in nois h) ' — 48dB/in nois — 91d — 85.5d in — 91.5d
h)
– 91d – 95.5d in – 91.5d
– 85.5d in – 91.5d
01.00
5.7V ma
280mV ma
1aB on 8ff

Overall frequency responses



### **'CHOICE' RECOMMENDED** AND BEST BUYS COM ITH FREE A 2-YEAR GUA FROM BARTLE

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### **TURNTABLES**

Ariston RD80SL	]
Beogram 8002	]
Dual CS505/1	]
Lux PD300	
STD 305S	
Technics SL7	]
Thorens TD166	]
Thorens TD160	
Walker CJ55	

### **PICK-UP ARMS**

Audio Technica AT1120	
Audio Technica AT1100	
Linn LVX	
SME SIIIS	

### **CARTRIDGES**

Audio Technica AT31E	
Coral MC88E	
Goldring G920 1GC	
Goldring G910 1GC	
Grado GT Super	
Mission 773HC	
Nagaoka MP30	
Ortofon VMS 20E 2	
Ortofon VMS 30 2	

### **AMPLIFIERS**

AR P 35												
Hafler DH110/DH	12	2	0									
Luxman L230												
Luxman L430												
Mission 778												
Mission 777BU												
NAD 3020A												
Nytech CA202												
Quantum IA 100.												
Rotel RA820												
Rotel RA870/RB8	7(	)										
Sansui AU-D101												

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Acoustic Research AR48LS
Celestion 100
Celestion 110
Celestion SL6
Keesonic KU6
KEF Coda 3
Marantz LD30/2□
Mission 70/2 □
Mission 700S
Monitor Audio R252 □
Monitor Audio R352 □
Mordaunt Short MS20 □
Mordaunt Short Carnival 3
QUAD ESL 63
Rogers LS7
Rogers Studio One
Tannoy Mercury
Wharfedale Laser 90
Wharfedale TSR 108/2 □

Yamaha NS1000.....

### **TUNERS**

Luxman T210L
Pioneer F90
OUAD FM4
Revox B261

### **CASSETTE DECKS**

Aiwa ADF 660
Aiwa ADF 770 □
Akai CSF14
Akai HX3
Akai GXR6
Beocord 8004
Beocord 9000 □
Dual C844
Hitachi DE44
Hitachi D220M
Marantz SD320 □
NAD 6050C □
Nakamichi ZX7
Nakamichi ZX9
Revox B710/3 □
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With the rapid proliferation of stations in this country and around Europe, conventional tuners not only have to pick up and hold thosen stations, they also have to fight off other signals muscling in from nearby frequencies.

On top of this, more and more stations are using digital equipment to dramatically improve the already high quality of their FM proadcasts.

Conventional tuner designs simply can't do justice to such high quality.

Obviously a new breed of tuner is needed. One with greater receiving capabilities and a previously unreached high in sound quality.

### THE ALL-DIGITAL TUNER

Conventional tuners are essentially twocircuit affairs.

One circuit demodulates the incoming FM signal into an audio signal.

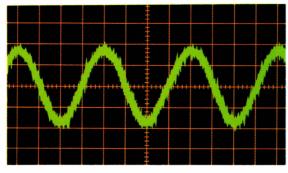
The second circuit turns that into stereo. It's all analogue technology. Unfortunately,

analogue signals are very easily affected by interference

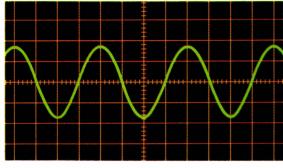
BY GIVING YOU NOTH

and noise. And very difficult to make clean.

The answer was clear.



**CONVENTIONAL SYSTEM** 



DIGITAL DIRECT DECODER SYSTEM

If you can't remove the symptoms, remove the cause.

Exit analogue. Enter digital. Pioneer's extraordinary new Direct Digital Decoder.

### THE DIRECT LINE TO STEREO

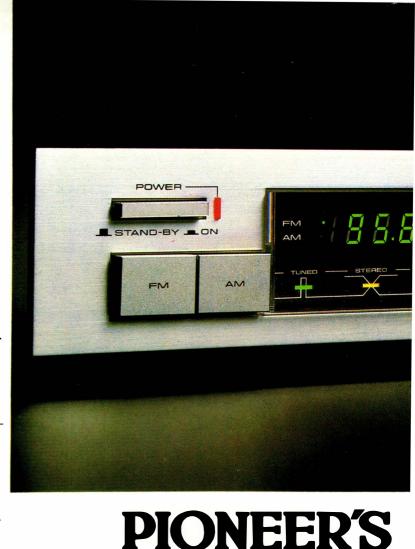
Instead of two circuits, there is now just one. No separate FM and MPX demodulators – left and right channels are produced directly from the FM wave.

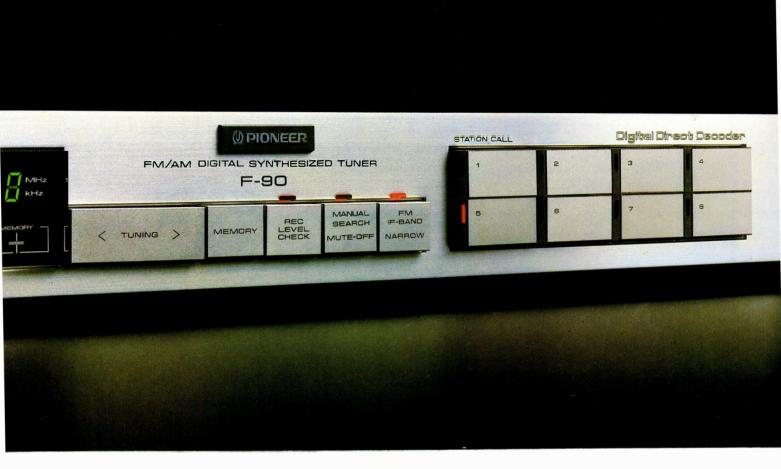
No distortion. No beat and noise. No interference.

Our system is more advanced than even the Pulse Count Demodulation system.

And the F-90 is our first tuner to incorporate Direct Digital Decoding.

Already, not unexpectedly, it has been received with acclaim, as the following quote from the American 1982 AES Convention shows.





## **NEW F-90 DIGITAL TUNER.** G, IT GIVES YOU EVERYTHING.

### REPRINT FROM 1982 AES CONVENTION.

In the conventional receiver, stereo signals are decoded by switching the composite signal with a subcarrier, having a square wave form, whereas in the new direct stereo decoder, stereo signals are decoded by switching the sinusoidal subcarrier with

Subcarrier generating circuit

the pulse train which has information from the composite signal. The beat noise caused by the harmonics of the switching signal is eliminated. and accordingly, no

anti-birdie noise filter is required. Moreover, the switching devices are operated at 1.26 MHz so their non linearity does not effect the decoded audio signal. Thus, in the new FM direct stereo decoder anti-interference and hi-fidelity reception are realised at the same time.

At Pioneer, we'd go even further. We believe the F-90 is the best tuner in the world. Its specifications will do the talking.

### ALL SOUND, NO NOISE

Total Harmonic Distortion of 0.0095% for 1kHz mono. 0.02% for 1kHz stereo.

So there's none of the usual blurring of

sounds at the extremes of the

dynamic range.

Low distortion 38kHz

Signal to Noise ratio of 93 dB mono. 86 dB stereo The distortion which can veil the sound just melts away.

Stereo separation of

65 dB at 1 kHz. Brings new life to FM for stereo radio as you've never heard it before.

Specifications so high, that today's best measuring instruments are pushed to register them. Such specifications will set up Pioneer's new F-90 Direct Digital Decoder as the goldstandard in tuners. This (A) PIONEER is FM like it's meant to be. Everything you hear is true.

Pioneer High Fidelity (GB) Ltd, Field Way, Greenford, Middx UB6 8UZ

# Inthe race for pe



# ction we lead by a head.

If you don't yet own an Akai GX-7 cassette deck, may we politely suggest that you need your head examined!

You see, although all manufacturers seem to claim that their latest developments are the greatest thing since Edison shouted Eureka, we at Akai honestly believe that the GX-7 with its Super GX head is one of the most significant steps forward in the history of Hi Fi to date.

We've always contended that if it's Beethoven you're playing, it shouldn't sound Brahms and Liszt. So we literally put our heads together and came up with a 3 head system using revolutionary Super GX heads.

To the initiated, it means we've combined a 4 micron recording gap with a 1 micron playback gap, guaranteeing ideal range and dynamics for each and every mode.

To the uninitiated, it means you hear exactly what you've just recorded.

And to everyone, it means perfect sound whether you're using normal chrome tape or the more recently fashionable metal tapes.

Add to that two capstans and pinch rollers which grip the tape more firmly than a Hi Fi freak holds onto his hertz and a \*Dolby C system which reduces noise a hundred times, and Wow, Flutter and Hiss become so unnoticeable you can practically forget them.

In fact, in the never-ending race for perfection, we at Akai do seem to have a decidedly unfair advantage.

Ahead start.

For full details of the Akai range phone 01-897 2487, any time, any day.



\*Trademark of Dolby Laboratories

# TURNTABLES AND **TONEARMS**

A definition of terms first. Though the word turntable strictly means the rotating platter, its bearing and motor only, it is generally used to describe the familiar turntable package also known as the record deck, integrated player or turntable system. This combines motor unit and pickup arm in a plinth system. This integration can offer automation of arm functions which cannot readily be provided on a manual model, furthermore the integration can offer size reduction down to the LP jacket sized player with radial tracking tone-arms integral with the player lid.

Hi-Fi Choice uses the description motor unit to describe a turntable without a pickup arm. A plinth and cover may come as extras to some

motor units.

### What should a turntable do?

The turntable must simply provide an isolated environment for the stylus to interact with the groove on the record to enable the cartridge to abstract the greatest amount of recorded musical information from the groove. The turntable should not introduce its own mechanical noise (rumble) or electrical noise (hum and hiss) and it should help 'isolate' the cartridge and minimise 'feedback' from both air and surface borne vibration. In other words, while it must keep the groove running steadily past the stylus by rotating at the correct speed, it should not permit or introduce any other relative movement between the two.

Hi-Fi Choice measures a turntable to assess how accurately it rotates, both in terms of how close to the absolute correct speed (33.3rpm) it gets and how it varies from that speed over time. The vibrations generated by the bearing, and electrical noise, are measured, as is the platter's effectiveness at damping vibrations in the LP record itself; again to minimise unwanted noise.

The turntable's ability to withstand unwanted vibrations in the air and in the surface on which it sits are shown in the 'break-through' graphs which indicate where energy gets through the turntable's 'defence system'.

Ideally then, the turntable should rotate at the absolutely correct speed without drift or cyclic variations. Medium term variations are heard as wow, particularly in recordings of piano music, shorter term variations

can be heard as flutter. The turntable shouldn't slow under the imposed load of a cartridge tracking a large modulation of the groove. Wow caused in these circumstances is known as transient wow and is heard as a blurring of the leading edges of musical notes. The turntable should not introduce its own noise into the system and should ideally be usable in a fairly high sound-level environment without causing blurring feedback or gross howl-round.

### **Tonearms**

The tonearm or pickup arm needs to be part of the suspension system of the turntable which enables the stylus to follow the groove independently of the cartridge body. Relative move-ment between stylus and cartridge generates the signal fed to the amp.

The conventional compromise in tracking a record (remembering that the master was cut by the cutting stylus moving along a radius of the disc) is to use a pivoted tonearm tracking an arc, designed to pass through the radius at two carefullychosen points. In combination with the geometric design of the arm, this will minimise the distortions due to tracking angle error. Parallel, straightline, tangential or radially tracking tonearms are all names for the same thing, an arm which attempts to get back to the original cutter path thereby reducing tracking error to zero. In practice few manufacturers have overcome the manufacturing problems to make such designs fully viable in a hifi context.

### Arm assessment

The basic geometry of the arm must minimise tracking error. The bearings used in the arm must be of suitably low friction so as not to impede progress of the arm across the record. The effective mass of the arm at the headshell should enable to be used with a suitable range of weights and compliances of cartridge. The arm's ability to cope with energy fed into it mechanically by the cartridge is measured in the graphs called 'structural arm reasonances'.

### Other models worth considering

At the bottom end of the turntable

market the Dual CS 505 will set itself back atop the budget pedestal with revisions which have been and are about to be introduced. The Sansui SR222 IV which failed to capture the imagination in the way the SR222 MkII had so successfully done in the UK is now discontinued and will be relaunched in an improved guise later in the year. Bang & Olufsen's recom-mended Beogram 1700 has been replaced by the 1800 model, yet to be tested in Choice.

Of the dozen integrated players which were rated 'worth considering' in the last issue of *Hi-Fi Choice* only two remain. These are the Aiwa LX 100 (£150 including cartridge) which sounded reasonably good for the price and was fitted with a compatible cartridge; and the Marantz TT120, now sold at £59 as the TT120CT with cartridge (not tested), which narrowly missed recommendation and offered true hi-fi performance with good sound at a low price.

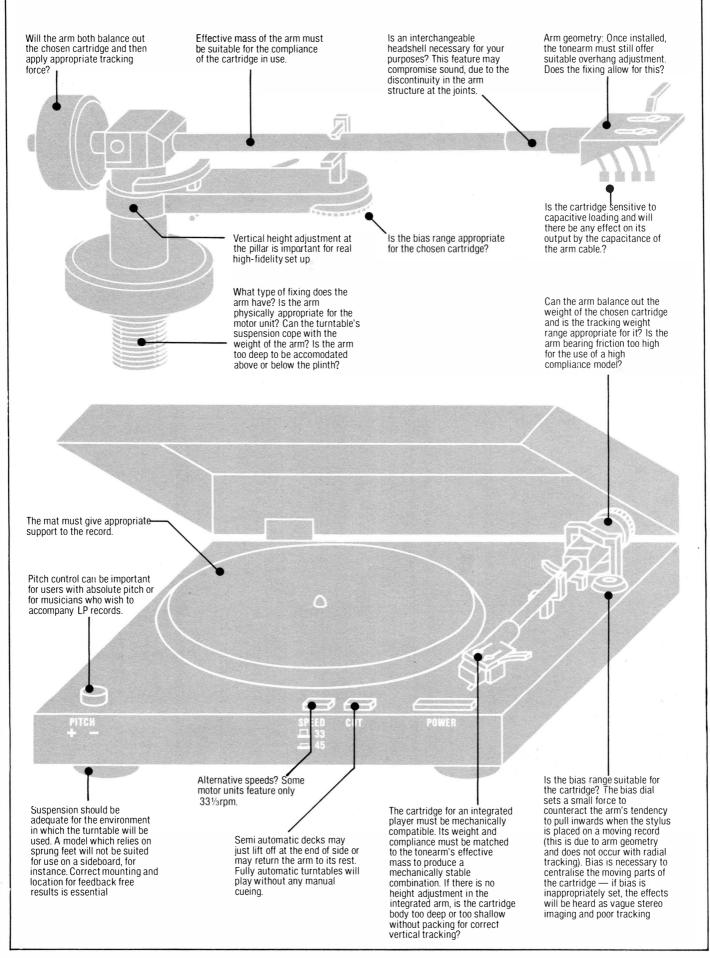
Motor units which just missed recommendation in the previous issue were the Ariston RD11 Superieur (now £380) which was thought not entirely convincing on sound quality but was of a high enough general standard to warrant inclusion here. The Dias 'Heavy' (£480) produced top ranking sound marred only by slight wow and motor breakthrough. The Marantz Esotec TT1000 (£999), the Oracle (now £792) and the Thorens TD126 IVC (now £440) were all rated as being well worthy of consideration.

Among the tonearms, casualties have been many since the last edi-tion. The budget 'supremo', the Linn Basik LVV is no longer sold, its place in the market effectively being taken by the Mission 774-LC (as yet to be reviewed). Mission's 774 and 77.4SM designs are no longer available (except in turntable packages) as the new Mission 'Mechanic' is due for release. 'The Arm' by Sumiko (now £898) continues to offer high sound quality but at a very high price and is one of the few models 'worth con-sidering' which has lasted into this issue.

The Audio Technica AT1100 and 1010 models have finally been dropped, though stocks do remain at £120 and £160 respectively; the same comment applies to the AT1503

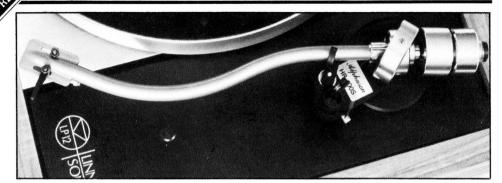
(also £160).

# TURNTABLE & TONEARM BUYER'S CHECKLIST



Alphason HR100S

Alphason, 31 Shawbrook Close, Euxton, near Chorley, Lancs PR7 6JY Tel (02572) 76626



Since I was first asked to report privately on an early prototype of this UK-designed arm over a year ago, production models have undergone significant further development.

A medium mass arm possessing high rigidity, the Alphason's main feature is the use of a substantial titanium beam tube with classic 'S' shape geometry. This has allowed a straight join to the headshell, itself ingeniously formed from the front end of the tube; a transition accomplished with minimal impairment to good interfacing of cartridge and arm. A considerable proportion of the beam upper surface continues down to the 'shell' or cartridge mounting platform.

The concentric gimbal bearings are built of hardened tool steel for maximum strength and the pivots are pre-loaded high precision ball races. During the course of the review the bearing surfaces were updated using ultrahard carbide inserts — pre-loading could then be dispensed with, offering much higher rigidity with reduced friction levels.

Considerable care has been taken to maximise rigidity as well as to minimise resonances in the design by suitable choice of materials and structure, the resulting performance reflecting the mechanical engineering expertise of the designer. Appearance and finish are undoubtedly to a good standard, but nonetheless this arm exhibits a 'craftsman' approach rather than the superlative feel and finish of the Japanese manufactured designs, for example.

At present the arm is supplied with a pillar base specified as Linn Ittok/Basik compatible, but we did not find this to actually be the case. 6mm rather than the required 4mm bolts are used, and the tracking geometry is optimised for a 58mm radius zero tracking-error point.

rather than the accepted 64-65mm. The arm is also slightly longer than the Ittok by about 2mm. However we understand that these discrepancies will soon be overcome in production to make the arm fully compatible. The long slotted headplate of the Alphason of course allows any desired overhand/offset angle to be obtained, and in this sense the geometry is already compatible.

The Alphason's fixed arm leads are reasonably compliant, aiding subchassis cable dressing, and are fitted with gold-plated plugs of good quality. Cable capacitance was low at 95pF. It is likley that two counterweights will be provided, these sliding on a hard nylon insert with a locking socket-head screw, while the weight carrier is stiffly engaged on a threaded section allowing fine adjustment of downforce — 0.4g per revolution for the heavier weight, which is suited to the Koetsu.

### Lab report

Effective mass was in the low to medium range at 10g inclusive of steel fixing bolts, and the structure was highly 'dead' as well as most rigid, with zero bearing play. The geometry (optimised) was excellent with very good finish and fine engineering. With the larger bias weight on the centre notch the compensation was fine for a 2g downforce as well as being in the right ratio, while friction was very low particularly on the 'carbide' version now standard. The cue worked well though the arm lock was rather stiff - I would prefer a separate pillar rest. Resonance graphs were plotted for the first sample which has steel bearings and a small counterweight, and also for the second sample with 'carbide' bearings and larger stiffened counterweight assembly. The latter showed improved rigidity, noticeable

in the 'sharper' nature of the resonances but in both cases behaviour was very good, indicative of a very low-coloration design. Below the 'carbide' graph, the excitation on the Linn arm board is shown as a dotted line, demonstrating the substantial pillar coupling and clear interactive relationship between arm and mounting.

### Sound quality

The  $H\dot{R}100$  impressed us strongly by its neutral and tonally balanced performance. Treble was detailed and precisely located and vet free of 'edge' or 'grain'. The mid-range gave excellent rendition of vocal lines while bass was firm, extended and detailed. Stereo was exceptional with precise positioning and fine depth and ambience, and despite an apparent 'smoothness', transients were nevertheless reproduced with fine 'attack'.

### Conclusion

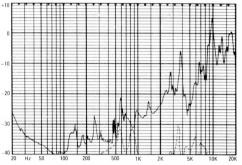
While the price is high and the overall finish not quite commensurate with the cost, the technical and more importantly the audible performances are both undoubtedly worth the money. The HR100S confidently joins the ranks of the 'super' arms, its moderate mass giving an extra margin of tracking stability for most cartridges. Finish is now black.

to NORMAN AUDIO

H-FI

ourse offer full credit
My well equipped
fying any faults and the
eme will let you rest
experience in the hi-fi

	nearm
Approximate effective mass, inc screws, excl cartridge.	10g
Type/mass of headshellnon-detact	chable
Geometric accuracy	
Adjustments providedoverhang/offset/	
Finish and engineeringgood/exc	
Ease of assembly/setting-up/usevery good/good	
Friction, typical lateral/vertical10mg	
Bias compensation methodthread, pulley and	
Bias force, rim/centre (set to 1.5g elliptical)180mg/	
Downforce calibration error, 1g/2g – 0.1g/	
Cue drift, 8mm ascent/descentnegligible, 0.5 sec/1	1.0 sec
Arm resonancesvery	y good
Subjective sound qualityver	y good
Lead capacitance/damping method 95pl	F/none
Estimated typical purchase price	£285



Structural arm resonances, audio band

# AUDIO PRES

# Om H F

T

ROM

3

Ariston RD80SL

Ariston Acoustics Ltd, Unit 176, Brieryside, Prestwick Airport, Ayrshire KA9 2RD Tel (0292) 76933



Favourably reviewed in the last issue, the Ariston *RD80* has undergone some changes over the intervening 18 months — hence the current designation RD80SL. As outlined by the manufacturer, changes comprise improvements to the electrical insulation to meet Semco-Demco standards, while the platter is now machined to a slightly concave upper surface. Using the screw-down record clamp, standard with the unit, this allows reduction of most record warps as well as improved recordto-mat contact. Fine adjustment of the motor/ pulley/belt angle is now possible by a tilt frame and a nut-runner is supplied for this purpose and for subchassis suspension levelling. Access is now provided underneath the tonearm without removing the base plate and in addition a new absorptive composition mat is included.

Of slightly plain finish and appearance, the '80SL employs a weighty 2.5kg platter. The subchassis has a well-balanced three-point spring suspension, and plinth and cover being substantial non-resonant items.

### Lab report

Though apparently undamaged externally our review sample suffered motor disintegration in transit, but fortunately survived a rebuild. The supplied LVX arm fared less well as the counterweight had been left in position; the result was 'notchy' bearings.

Lab performance of the version was much the same as for the earlier model, both being to in a respectable standard. Speed, wow and

flutter and rumble figures were all good, if marginally poorer than before on our sample, and some mains-related rumble was evident on the drive, though the bearing showed signs of improvement with continued use — Ariston do state that there is a 'running-in' period.

Platter damping was fine, with a clean initial transient but some subchassis/platter flutter in the 'after-shock' (see impulse plots). Vibration isolation proved very good, as did resistance to acoustic breakthrough, with tolerable shock resistance and very good feedback immunity. Some rotational whippiness around 9Hz was observed with the subchassis, the main resonance being at 6Hz — while belt loading with the ridged two-speed pulley could be troublesome if adequate talc dressing had not been previously applied.

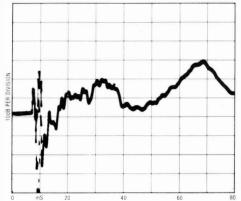
### Sound quality

Maintaining the standard set previously on sound quality grounds, the 80SL provided a substantial proportion of the required performance parameters on a number of basic counts. The stereo soundfield seemed well focused. stable and precise, while the overall balance was generally neutral and the sound fairly transparent. The bass showed good depth and evenness, and pitch stability was also pretty

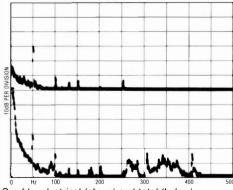
### Conclusion

While not a truly great turntable, the RD80SL is nonetheless a substantially good one at a realistic price. Its performance and sound quality, plus new additional features, have maintained its competitive quality, and accordingly the design continues to merit a Choice recommendation.

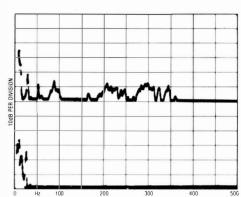
GENERAL DATA Motor Unit
Type manual belt drive, synchronous motor, subchassis
Platter mass/damping2.6kg/very good
Finish and engineeringgood/very good
Type of mains2-core
Speed options
Wow and flutter (DIN peak wtd, sigma 2)0.08%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)0.1%/0.07%
Absolute speed error+0.08%
Speed drift, 1 hour/load variationsynchronous/ - 0.25%
Start-up time to audible stabilisation
Rumble, DIN B wtd L/R average (see Spectrum) 75 dB
Size/clearance for lid rear
Ease of usegood
Typical acoustic breakthrough and resonancesvery good
Subjective sound quality of complete systemgood +
Hum level/acoustic feedbackvery good/very good
Vibration sensivity/shock resistancevery good/fairly good
Estimated typical purchase price£180



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



Breakthrough, acoustic (above) and vibration (below)

Charts above characterise general turntable behaviour. See text for commentary on these results.

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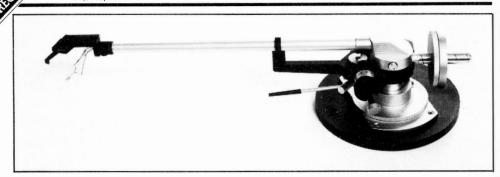
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quality

### Audio-Technica AT1120

Audio-Technica (UK) Ltd, Hunslet Trading Estate, Low Road, Leeds Tel (0532) 771441



In the last issue a group of related Audio-Technica arms were assessed, including the 1010, the 1100 low-mass and high-mass versions. This year they are joined by a new low mass version of the 1100 called the 1120.

The 1100 was characterised by its detachable arm carrier fitted with a rigid low mass fixed headshell, the counterweight an elaborate affair with a lead-screw drive. With the 1120 Audio Technica have in essence simplified the design and taken some steps to improve certain areas, notably the bearings. These changes are in fact sufficient to result in a new arm model and justify a full review here.

The 1120 is a genuine low mass model in the 5g effective mass range. This makes it compatible with high-compliance cartridges that are unsuited to the more massy arms which are increasingly becoming available. As it is supplied with a fluid damping unit which may be used if required, this versatility is further extended. Low mass does of course mean that some sacrifice in rigidity is necessary, and this can mean a reduction in compatibility with lower compliance moving coil cartridges not so much on grounds of subsonic resonance but more in the context of mutual resonances in the audible range.

The arm tube and shell of the arm are fixed in the 1120, and the alloy shell of the 1100 has been replaced by a lighter but frailer carbonfibre-loaded plastic moulding. The new arm is clearly designed for use with low mass cartridges and will correctly counterbalance units as light as 2g. The upper cartridge weight limit is 9a, even with the use of an extra counterweight, so high-mass cartridges are ruled out. The counterweight is one of the ubiquitous rotating types with a sliding scale and it has a rubber decoupling insert in its mounting. Audio-Technica's 'DTS' system is incorporated, whereby the vertical pivot plane is located below the stylus tip, thereby reducing the tendency for a stylus to lift out of the groove under heavy modulation. In fact stylus drag tends to increase the short-term downforce with this system, giving an increase in trackability.

### Lab report

With previous arms in this series the bearings have never seemed quite tight but in the case of the 1120, judged by our sample at least, the pivots are free of detectable play. Bearing play and any other indeterminate looseness or incipient rattle in an arm can seriously detract from the sound, generally resulting in a muddling of detail and a failure to reproduce transients with good clarity.

Despite this absence of play the bearings provided low levels of friction, giving an excellent 5mg lateral measurement, and a fine 20mg vertical reading. Finish and engineering were both to an enviable standard, and the geometry was sound. The effective mass figure of 5g includes mounting bolts. The usual AT weighted lever bias compensation is used. and on this example gave lower values than usual as well as being in the inverse ratio to that needed for accurate compensation from beginning to end of a record side. Pillar angle adjustment can ameliorate this somewhat and the dialled settings need to be increased by 20-30% to attain the correct values.

Downforce calibration was accurate, while the cueing and fluid damping systems worked well. Leadout cable capacitane was low at 85pF. However the arm resonance behaviour was none to promising, with the 100Hz mode (redrawn) probably deriving from the counterweight while that at 400Hz was a shell/tube mode. The slope is rather broken up and is severely dissected above 2kHz.

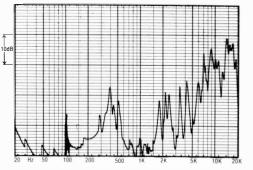
### Sound quality

Auditioned on a good quality sub-chassis turntable, the sound quality was better than the resonance graph might suggest. Tonal balance was quite pleasant with the central image reasonably well defined, with some worthwhile depth rendition. The treble was not so well defined, vet remained inoffensive, and while the bass definition was below that of the 'super' arms, demonstrating some 'lumpiness', again this was not too serious. With a moving magnet cartridge (Shure V15 V) all these problems seemed reduced by an order of magnitude.

### Conclusion

While less suited to the more intolerant moving coil models, the 1120 performed pretty well with others, such as the Dynavector 23R or the Denon 303 and 305. Moving magnet examples generally gave good results, and although in context the arm is rather expensive it is probably worthy of recommendation on the basis of its overall performance.

GENERAL DATA Tonearm
Approximate effective mass, inc screws, excl cartridge20g Type/mass of headshellspecial detachable/13.5g
Geometric accuracyvery good
Adjustments providedoverhang, height
Finish and engineeringexcellent/excellent
Ease of assembly/setting-up/usevery good/good/very good
Friction, typical lateral/vertical50mg/10mg
Bias compensation methodweighted lever
Bias force, rim/centre (set to 1.5g elliptical)150mg/150mg
Downforce calibration error, 1g/2g0.05g/ – 0.1g Cue drift, 8mm ascent/descentN/A
Arm resonancesgood
Subjective sound qualitygood +
Lead capacitance/damping method95pF/none
Estimated typical purchase price£110



Structural arm resonances, audio band



Beogram 8002

Bang and Olufsen (UK) Ltd, Eastbrook Road, Gloucester GL4 7DE Tel (0452) 21591



Replacing the previously-reviewed 8000, the 8002 incorporates a number of significant improvements. There is a 'remote control' terminal at the rear which, via a single cable. links both audio signals and control facilities to a matching B&O receiver, and a neat infra red remote control supplied with the receiver allows complete command of the turntable. The deck of course complements the elegant and unified Scandinavian styling of the other B&O components.

The 8002 is an automatic player with photoelectric sensing of record presence and size hence, on the remote, functions of start, stop and pause/cue lift, are all that is required. The central control interface in the receiver will also accept data from the turntable when operated manually. With the remote disconnected, the turntable may be operated in a conventional manner with a DIN to phono audio adaptor lead.

Other salient features include microprocessor control via B&O's versatile and ergonomically angled touch-button panel. Two speeds are available, with incremental pitch variation monitored by a large three digit LED display. Repeat playing may also be selected up to a maximum of nine times, while the arm  $\frac{\omega}{2}$  is serve controlled with touch-button cueing

and proportional arm traverse. Most important perhaps is the superbly executed sub-chassis system, based on a near-perfect pendulum suspension with adjustable leaf springs. A heavy steel sub-chassis plate provides the foundation for the drive and also the complex arm assemblies.

The direct-drive motor system applies power via magnetic eddy currents induced in an aluminium drum located beneath the platter, speed being under full servo control. The platter has been considerably revised by comparison with earlier models and the oftcriticised hard plastic ribs have been supplanted by a platter with thin film Nextel pads for support and photo electric detection. These are just 0.15mm high and provide a good non-scratch interface with the disc, resulting in much improved record contact and damping, B&O claim the platter is deliberately light (0.6kg) so that the record damps the platter, and vice-versa.

The tonearm is an ultra low mass design of integrated concept and matches B&O's new range of quality lightweight cartridges. The model fitted in fact weighs just 1.6g - it is a detachable cartridge, to be replaced entirely when the stylus is worn or damaged. Total effective mass with cartridge is a little under

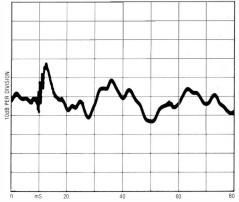
7g. This integration results in foolproof installation, correct geometry and proper stylus compliance-tonearm compatibility, with the subsonic resonance placed in the ideal 12-14Hz range providing excellent warp immunity. The tonearm is a linear or parallel tracking design, traverse provided by a nearsilent servo controlled leadscrew. Photoelectric detection of tracking angle holds errors to a miniscule  $\pm 0.04$  deg or less, and bias compensation is not required. The boxbeam arm tube is constructed of hard drawn brass which gives satisfactory rigidity despite is pencil-like thinness.

The cartridge must be assessed in the context of its inclusion in the integrated turntable package. The 8002 is fitted with the topline MMC2 (the MMC1 is only a selected version of this), a brand new B&O design with a hollow sapphire cantilever. It uses a semi-linecontact, grain-orientated naked stylus tip of very low tip mass, tracking confidently at just 1g downforce, 20Hz to 20kHz is specified within  $\pm 1.5$ dB, with a reduced sensitivity to load and temperature, by comparison with earlier versions. Separation is quoted as 25dB minimum at 1kHz and better than 20dB from 50Hz to 15kHz.

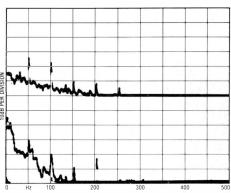
### Lab report

The 8002 proved to have an excellent motor section with textbook levels of wow and flutter. and unweighted wow. Speed was accurate and freedom from speed variation under load was fine. Start-up time was, inconsequentially, average at 2.5 seconds. DIN B rumble was low at -77dB, with no motor harmonics visible and just a trace of 200Hz mains supply breakthrough. As testified by the impulse photo. disc damping was effective, a result vastly better than previously attained. The arm collected a list of 'excellents' for geometric accuracy, finish, engineering, ease of assembly, setting up and use. Cue rate was safe and rapid, minimising record damage.

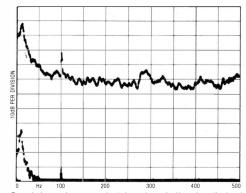
However, most arm parameters could not be measured due to the servo control although they could be inferred from the excellent tracking performance of the cartridge at a 1g downforce. An insensitive arm would not allow this high standard. Arm resonances were plotted with the supplied cartridges, the behaviour indicated being above average in view of the main energy continuity through the spectrum. It was not free of breakup, this beginning as low as 200Hz with further modes at 350Hz, 800Hz, 1kHz and 2.5kHz, and these were just sufficient to impose small blips on the steady state frequency response of the cartridge.



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



Breakthrough, acoustic (above) and vibration (below)

Charts above characterise general turntable behaviour. See text for commentary on these results.

Proving very good on acoustic breakthrough, and excellent as regards vibration resistance and feedback margin, the deck also demonstrated outstanding shock immunity. The cartridge delivered a good performance on this abbreviated evaluation (it will be reviewed fully in a future Hi-Fi Choice) with the response meeting  $\pm 1.5$ dB limits as specified from 35Hz to 20kHz, having an impressively uniform treble range. Mid-band separation reached 34dB but, on this test at least, was curtailed somewhat at high frequencies.

Sound quality

Auditioned complete with cartridge, the 8002 attained a substantially good standard even by comparison with audiophile exotica using costly moving-coil cartridges. First impressions were of a confident and firm presentation with good timing and pitch, plus a tuneful articulate bass line. Surfaces were quieter than usual, while the midrange was well projected with good detail and stable stereo focusing. Slight mid 'horniness' or hardness was noted, but the treble did not draw attention to itself, and was slightly depressed or 'laid back' - not a bad thing with some records! Stereo stages were well rendered with promising depth and ambience.

### Conclusion

After years of personal campaigning for B&O to refine their tangential player particularly with respect to the platter, I am pleased to say the 8002 has finally done the trick. A high quality, foolproof automatic player, it deserves serious attention. Viewed as a package the price is realistic, the sound quality good overall and particularly acceptable as regards pitch, timing and bass quality. B&O afficionados and indeed others can confidently consider this elegant creation, as the 8002 wins a recommendation this year.

Note: Our sample 8002 was supplied well ahead of first production in order to meet deadlines for this issue. We have since learned that the main resonance modes in the tonearm have responded to the application of damping. A very similar belt-drive version is soon to be released - the 6002 at £275. On the basis of our previous experience with B&O belt drives, this model should also be worthy of recommendation.

### GENERAL DATA Integrated turntable (inc. cartridge)

GENERAL DATA	integrated turntable (inc. cartinage)
Motor Section	
	automatic, linear-tracking, direct drive
Platter mass/damping.	0.6kg/good
	jexcellent/excellent
Type of mains/connect	ing leads2-core/5-pin DIN
	variable, 33/45 rpm
	eak wtd, sigma 2)0.05%
Wow and flutter (LIN p	eak wtd 0.2-6Hz/6-300Hz)
	less than 0.06%/0.05%
Absolute speed error	
Speed drift, 1 hour/load	variationless than 0.05%/ - 0.1%
Start-up time to audible	e stabilisation2.5 secs
Rumble, DIN B wtd L/R	average (see spectrum) – 77 dB

### Arm Section

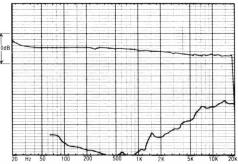
Approximate effective mass, inc screws, excl cartridge5.2g
Type/mass of headshell special, non-detachable
Geometric accuracyexcellent
Adjustments providednone
Finish and engineeringexcellent/excellent
Ease of assembly/setting-up/use

excellent/excellent/excellent

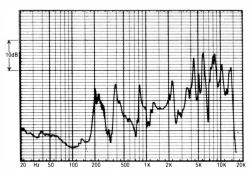
Friction, typical lateral/vertical N/A Bias compensation method. N/A Bias force, rim/centre (set to 1.5g elliptical). N/A Downforce calibration error, 1g/2g. N/A Cue drift, 4mm ascent/descent. none, 0.3 secs/0.8 secs
Arm resonances above average Subjective sound quality good Lead capacitance/damping method —/none

### System as a whole

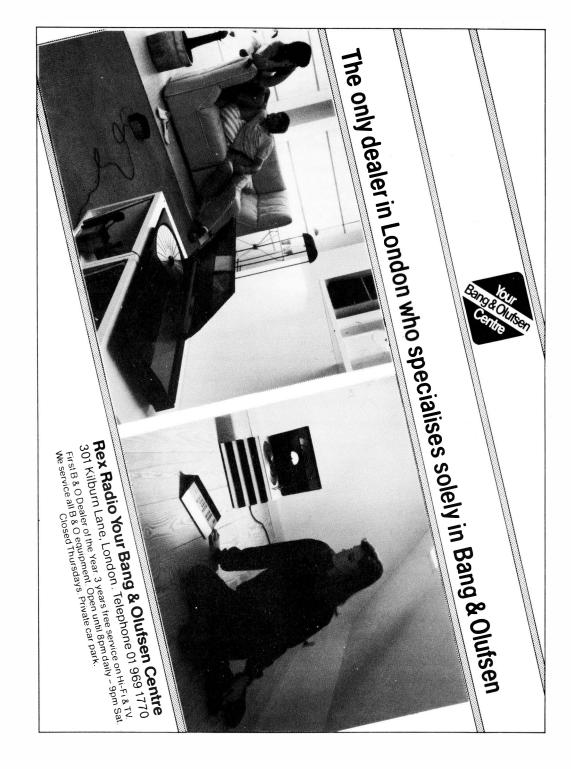
Size/clearance for lid rear49(w) x 38(d) x 8.5(h)/none
Ease of use
Typical acoustic breakthrough and resonancesvery good
Subjective sound quality of complete systemgood+
Hum level/acoustic feedbackvery good/excellent
Vibration sensivity/shock resistanceexcellent/very good
Typical purchase price £450 when reviewed, now £395



Frequency response and separation, cartridge



Structural arm resonances, audio band



Dual CS505-1AM

Hayden Laboratories Ltd. Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9HG Tel (0753) 888447



First impressions of this revised stalwart were none too promising and little hope was held out for its success in our competitive context. But as testing proceeded it gained ground, and after the listening sessions virtues were no longer in doubt.

A classic spring-suspended turntable using a flanged steel deckplate/chassis, the 505 is an inexpensive design which now comes fitted with a promising Ortofon LM10 cartridge. For the latest version the arm counterweight has been simplified to reduce spurious resonances, while the suspension spring compliance had also been lowered, and a superior flat type of mat fitted.

Belt-driven from a 16 pole synchronous motor the 505 is fitted with vari-pitch speed control. The motor pulley is multilobed and may be expanded or contracted by mild degrees to provide fine pitch variation.

Since it came fitted with a worthwhile cartridge, reaping the benefits of the low-mass integration of the cartridge and special arm fixing, the player was assessed as a complete unit. Used in this way, the arm effective mass is a low 5g, complementing the Concorde-style cartridge. Dual have always produced arms with higher than average sensitivity and they have not skimped on this one. Although of rather light construction, the design is rigid. with low friction and excellent bearing adjustment free of play, while both downforce and biasing are well executed.

### Lab report

Platter mass has been slightly reduced for this latest 505 but the improved mat has resulted in

better record damping and termination; all transients decay more quickly. Wow and flutter was fine on this sample, with balanced results for the separate components. Speed error was negligible and slowing under load small at 0.2%, with start-up average at 2.3 seconds.

Rumble was however just satisfactory and I feel it could and should have been improved the 505 has been borderline on rumble for some years now. The platter bearing alone measured - 78dB, the poorer result entirely the fault of the motor vibration breakthrough.

The arm's basic parameters measured very well, with low friction, sensible biasing and reasonably accurate downforce calibration. As noted previously the resonance graph illustrates a fairly wild behaviour, the plot taken this vear with the cartridge supplied. The 300Hz mode easily imposes itself on both the frequency response and the crosstalk curve of the attached cartridge, which is shown with two loading combinations, 200pF and the preferable 450pF. The Dual arm supplied 180pF of lead capacitance, to which the amplifier's contribution is added in practice.

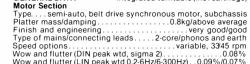
Ease of use was highly rated on grounds of its semi-automatic operation. Vibration isolation was certainly improved and attained a good standard, while acoustic breakthrough was fairly good, feedback low, and shock immunity good.

### Sound quality

Within moments of starting the listening tests it was clear that the 505 sound had improved despite the marginal rumble measurements. and the end result was well above average. The stereo image was stable and quite well focused with surprising depth for a deck at this price. The overall tonal balance was quite neutral and detail was present at both extremes of the musical spectrum without serious exaggeration. Some mild coloration was noted, associated with the arm, and by comparison with far more costly systems it would appear that the 505 is a trifle 'loud' and 'brash'.

### Conclusion

Selling at under £80 inclusive of cartridge, in its improved form the 505 is an impressive, easy to use and fuss-free turntable system with a number of useful facilities. With a slight reservation concerning motor breakthrough. the unit nonetheless scores a full recommendation.



Speed options	
Wow and flutter (DIN peak wtd, sigma 2).	0.08%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-3	00Hz)0.09%/0.07%
Absolute speed error	0.05%
Speed drift, 1 hour/load variation	0.05%/-0.2%
Start-up time to audible stabilisation	
Rumble, DIN B wtd L/R average (see spec	trum) – 67 dB

### Arm Section

GENERAL DATA

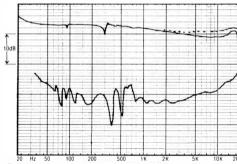
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180pF/decoupled counterweight

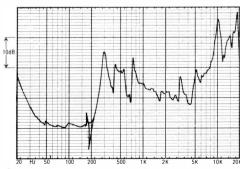
Integrated turntable (inc. cartridge)

### System as a whole

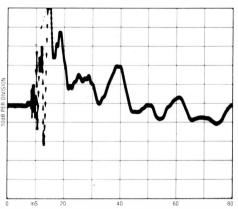
Size/clearance for lid rear . . . . 43.5(w) x 36.5(d) x 13.5(h)/7.5cm Subjective sound quality of complete system...average + + Hum level/acoustic feedback.......good/good 



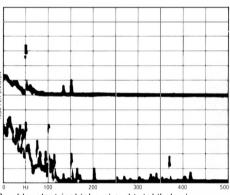
Frequency response and separation, cartridge



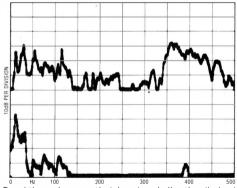
Structural arm resonances, audio band



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



Breakthrough, acoustic (above) and vibration (below)

Charts above characterise general turntable behaviour. See text for commentary on these results.

### Dunlop Systemdek II

Dunlop System Transcription Ltd. PO Box 9, Troon, Scotland Tel (0563) 29777



Dunlop have devoted considerable effort to the design of a low-cost true subchassis turntable. benefitting from the experience with their original Systemdek model. Built in an unusual cylindrical form and lacking a dustcover, it superficially resembles a small version of the Dais. The deck is belt driven by the usual synchronous motor, the two-part platter consisting of a reinforced plastic centre drum on which a plate glass platter is located. A felt mat is used, the disc clamped if so desired by the ingenious and secure spindle clamp provided. Two speeds are available, changeover on the double crown pulley being effected by hand with the platter removed.

A lightweight reinforced subchassis is employed, with the arm mounting arranged as an outrigger, providing easy access for cable dressing and mounting. The subchassis is suspended on three compliant springs and levelling may be done from above — more convenient than with those models requiring the removal of the base plate. Furthermore, three external plastic feet allow easy levelling of the whole unit, which is important in view of the soft suspension with its low resonant frequency — estimated at 2-3Hz in the dominant vertical mode. Rotational freedom is well controlled if the arm leads are well dressed, though the unit does take rather a long time to settle down after a shock impulse.

### Lab report

Despite the large size of the initial disc impulse transient with its secondary reflec- Estimated typical purchase price.....£115

tion, the pulse died down quickly after 30 milliseconds with little low frequency ringing thereafter. The platter has a reasonable mass of 2.1kg, and the general finish and engineering were considered very good. Wow and flutter. DIN peak weighted, was fine, though with the linear wow figure a touch on the high side. It also ran a little slow. - 0.43% (beware slower tempo on A/B comparisons!), although in use this will not matter a great deal. Torque was fine under load, and rumble was also good at -74dB, this mainly attributable to motorframe vibration breakthrough at 100Hz and 200Hz as shown on the spectrogram. Vibration resistance was excellent and acoustic breakthrough very good.

### Sound quality

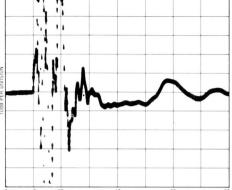
We were most impressed by the sound quality of this model. It was felt to offer a neutral and open sound with good transparency and stereo depth plus fine bass, good 'drive', attack and depth. In this respect it approached the performance of far more costly models, and the feedback immunity was also impressive. Only the slightest reservation was expressed concerning subjective pitch stability, possibly due to the very soft suspension.

### Conclusion

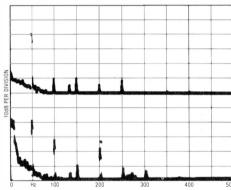
While devoid of a cover this turntable offers a remarkably high sound quality for the price and would do justice to a number of quality tonearms. We obtained good results using the Linn Basik LVX and Audio Technica AT11200 for example. If you like the look of the Systemdek II. we can back your preference with a strong recommendation.

(Note: Dunlop have indicated that they intend to revise the suspension stiffness to give a higher resonant frequency.)

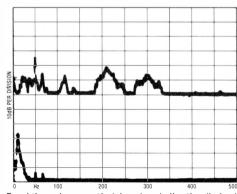
GENERAL DATA Motor unit
Typemanual, belt-drive, synchronous motor, subchassis
Platter mass/damping2.15kg/good
Finish and engineeringvery good/very good
Type of mains/connecting leads3-core
Speed options
Wow and flutter (DIN peak wtd, sigma 2)0.08%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz) 0.15%/0.06%
Absolute speed error
Speed drift, 1 hour/load variationsynchronous - 0.18%
Start-up time to audible stabilisation3.5 secs
Rumble, DIN B wtd L/R average (see spectrum) 74 dB
Size/clearance for lid rear43(w) x 31(d) x 13.5(h)/none
Ease of usefairly good
Typical acoustic breakthrough and resonances very good
Subjective sound quality of complete systemvery good
Hum level/acoustic feedbackvery good/excellent
Vibration sensivity/shock resistanceexcellent/good
Estimated typical purchase price £115



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



Breakthrough, acoustic (above) and vibration (below)

Charts above characterise general turntable behaviour. See text for commentary on these results.



HUDDERSFIELD

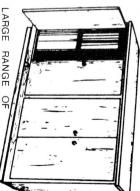
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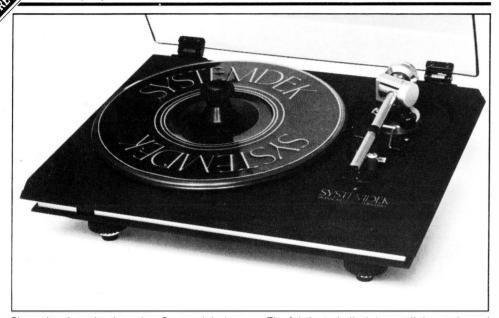
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### Dunlop Systemdek III

Dunlop System Transcription Ltd. PO Box 9, Troon, Scotland Tel (0563) 29777



Since its introduction the Systemdek has begun to establish itself firmly in the quality category. The early minor teething problems have long ago been sorted out, and a number of detail refinements have been made to improve the performance and the ease of alignment/setting up

Founded on a steel plate, the Systemdek subchassis has an aluminium extrusion reinforcement which runs beneath the main bearing through to the arm base. The original models were very softly sprung indeed, with an estimated 3.8Hz vertical and 3Hz lateral subchassis resonance, and gave rise to alignment problems. With the high 4.8 kg platter mass, this gave the unit a tendency to rock or sway from side to side, resulting in slightly high pure wow readings and some handling sensitivity.

In the later version, this situation has been improved – by the substitution of even more compliant springs! At first sight this might be expected to worsen matters, but in fact when properly adjusted the springs lie in a state of greater compression and are physically shorter. This considerably improved lateral stability, confirmed by the low wow figures in the last HFC. Alignment is made easier by the use of surface mounted crosshead screws. Located beneath the top platter.

The fabricated plinth is a well damped wood composite steel structure, with open access for arm lead dressing beneath a detachable arm board, which is secured by two socket head bolts. Improved feet have been fitted and can be adjusted for levelling, while the low resonance lid is retained. The plinth is finished in a Nextel suede type coating.

The outer platter has benefited from the addition of a so called 'wave termination' ring: a high density absorbent rubber insert fitted into the rim. The dense lambswool felt mat bonded into position has been retained, but in practice it is easily enough removed if alternative mat types are desired. Two speeds are provided, using a simple manual belt change, which requires the (annoying) removal of the outer platter.

With the III designation, the Systemdek acquires a concave platter which in conjunction with the clamp supplied gives some reduction in record warps and also improves disc/platter contact.

### Lab results

The drive exhibited good torque, with only 0.1% slowing under load, and a fair start up time in view of the heavy platter. Wow and flutter was very satisfactory and better than

for earlier samples: likewise the rumble level. which is now at the threshold of measurement. A 100Hz component was noted on the spectrogram at -70 dB, but this proved to be inaudible as a specific effect when auditioned.

The results for vibration isolation and acoustic breakthrough, reprinted here from the last issues, were both very good, the slight lumpiness on the acoustic trace attributable to the disc and its supports. Two disc impulse responses were taken. First on X1 scaling and using the mat as supplied, the initial transient was large, but was quickly damped, and the longer term low frequency performance was fine. For comparative purposes the Audio Ref mat was also tried, and this reduced the impulse magnitude by almost a factor of 10, allowing X10 scaling for the superimposed (white) presentation - a very fine system response. Use of the record clamp on the new concave platter should equal or improve on these results.

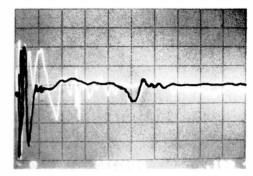
### Sound quality

When reviewed in previous issues, the Systemdek has been considered as setting a top class standard as a motor unit, with a firm and stable quality to the stereo image. The bass register was open, deep but slightly 'heavy' in balance, while coloration was very good, only showing a mild 'thickening' in the lower midrange (eg tenor), which also affected bass transients slightly. Though the Systemdek has always tolerant of arms, we nevertheless obtained the best results using the Ittok. The felt mat suited most moving coil cartridges (Asak, Supex and the like), but with 'flatter' models such as the Karat and the Technics EPC205, the Audio Ref mat gave a more relaxed perspective, with greater midband depth and ambience.

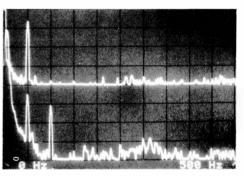
For this issue, the III was auditioned using an Ittok tonearm. The listening results were very good, and yet slightly disappointing in that the smaller Systemdek II was felt to be marginally 'clearer' with more musical 'attack'. The III set a high standard, but this time just failed to get the top rating by virtue of a shade of vagueness in the stereo presentation and stereo focus.

### Conclusion

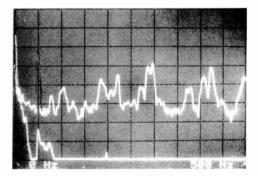
The Systemdek III remains a very fine turntable whose competitive pricing has been maintained, and consequently it continues to be recommended. It sets a high standard on all major parameters, is relatively easy to set up and possesses a well finished exterior, as well as proving largely uncritical of the choice of accompanying arm.



Disc impulse: black, felt X1: white, Audio Ref X10.



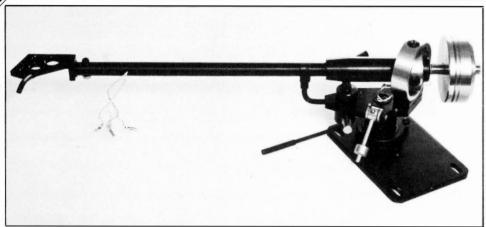
Rumble (0-500Hz lin): above, electrical only: below, total.



Breakthrough (0-500Hz lin): above, acoustic; below vibration

Typical purchase price. . . . . . . . . . . . . . £299

Helius Designs, The White House, Aldington, Eversham, Worcs WR11 5UB Tel (0386) 830083



Reviewed in its provisional form in the last issue, the Helius arm is now in full production. Two distinct versions are available, one with the established sliding/detachable headshell (no plug system however for the leads) and a second called the Aurum, where the shell is permanently bonded to the arm. We did not test the latter, but the Helius designer had indicated that it shows improved audio band resonance control and consequently a 'smoother' sound.

A medium mass design, the arm tries to avoid any injurious decoupling between the firm, large-area cartridge mounting platform. and the arm mounting base. The full-circle nested gimbal bearing is finely adjusted for moderate friction and zero detectable play, a condition critical to sound quality. The arm should therefore be carefully handled if this condition is to be maintained. An unusual ball race is employed with only three balls per race aligned to maintain mutual contact as well as firm contact with the bearing needle and of course the race itself.

The sliding headshell does confer certain practical benefits, allowing for easy adjustment of both overhang and vertical tilt. In practice the fixing is quite strong, a vertical bolt firmly clamping the splined main tube onto the headshell stub. The main tube is anodised alloy with cross section and thickness varying along its length, the intention being to break up symmetrical vibrational modes.

The rear section comprises a threaded brass rod on which the counterweights are screwed.

Two weights are used in various combinations and when the appropriate downforce has been set — a downforce gauge is required — the weights are contra-tightened to lock them firmly on the arm. A thread and weight lever bias compensator is fitted, this also uncalibrated.

While the overall finish and constructional standard was very good, the wiring around the bearings was exposed and somewhat untidy particularly the single strand third earth. Wires must be kept in a good state of adjustment if the arm sensitivity is not to be impaired.

### Lab report

At 12g effective mass including hardware the arm was well suited to cartridges in the 10-25cu compliance range. The bearings were well adjusted with a satisfactory 50mg lateral friction and fine vertical friction figures.

Set half way, the lever weight provided bias appropriate for a 1.5g-downforce elliptical stylus, measuring 160mg rim and 220mg centre. On our sample, cue descent was rather slow at 4.2 seconds.

The arm resonance graph illustrated some anomalies though the general trend put it in the 'good' category. The 100Hz mode was quite energetic, probably due to the rigid counterweight mounting, a point noted also in our earlier Helius review. Those clustered around 600Hz were likely to be main beam modes, their complexity relating to the distributed structure. Above 1kHz the unit remains well behaved.

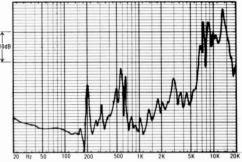
Sound quality

Loosely ranked in the 'good +' category, the Helius sound was found to be lively with good transient attack, while the bass lines were well portraved with substantial weight. A good first impression was gained, but prolonged listening suggested some mid colouration on vocal sections, and although the standard of stereo was high, with promising depth, the treble register did not perfectly integrate with the mid, the whole sounding a trifle uneven. These results were confirmed when moving onto the more costly and superior Orion.

### Conclusion

The second time around we were less enthusiastic about the Helius although it undoubtedly achieves a high technical and subjective standard. Possessing its own particular character it is recommended.

**GENERAL DATA** Approximate effective mass, inc screws, excl cartridge...12g Type/mass of headshell.....pecial detachable/7g Geometric accuracy.....excellent Adjustments provided . . . . . . . . overhang/height/lateral Finish and engineering ......very good/very good Ease of assembly/setting-up/use....good/difficult/very good Friction, typical lateral/vertical.....50mg/10mg Bias compensation method.....thread and lever Bias force, rim/centre (set to minimum).....N/A Downforce calibration error..... uncalibrated Cue drift, 8mm ascent/descent...moderate, 0.9 secs/4.2 secs Arm resonances.....fairly good Subjective sound quality.........good + Lead capacitance/damping method.......70pF/none Estimated typical purchase price.....£150



Structural arm resonances, audio band

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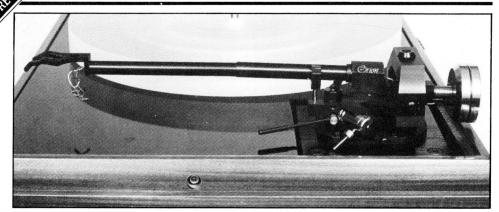
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# П U

### **Helius Orion**

Helius Designs, The White House, Aldington, Eversham, Worcs WR11 5UB Tel (0386) 830083



Since the introduction of their first arm, Helius have continued development of an advanced model, taking some of their concepts to a further level of refinement. The result is the Orion, supplied to us at short notice in an early form, and soon to be updated in some minor respects.

The most obvious feature of the *Orion* is the massive bearing assembly milled from substantial aluminium block, and as with Audio-Technica models, the pivot plane has been placed below the stylus tip to aid tracking stability. The bearing is an unusual design whereby the horizontal and vertical components are effectively concentrated on a single point, use being made of the Helius 'tri-ball' system, which when correctly set provides of offset angle and overhang. Although no zero play and no secondary rattles. Inertial masses may be designed to balance around this unified pivot (not to be confused with a 'unipivot' since this one is rigid except in the two desired planes), conferring benefits as regards the wider distribution of structural turntable to gain access to the socket head resonances.

A large section threaded rod provides the rear counterweight extension, the multiple weights screwed on and contra-locked for final setting. Synthetic inserts in the counterweights damp the interface between the rod and counterweight mass.

The main arm beam, in alloy tube, has an extended larger diameter first section to distribute vibrational modes. At the front the standard Helius right-angled alloy cartridge platform is fitted, here rigidly bonded in place. A revision to the shell, which is in hand at the time of writing, includes a curved section to reinforce the right angle and marginally

increase the mass — probably by 2-3 grams

Both the arm base, which has an improved pillar lock, and the cue device are made of solid metal, possessing minimum self-resonance. Thread-and-weight level bias compensation is fitted and, as with downforce, this is uncalibrated.

### Lab report

Approximate effective mass was 11g, increasing to 13-14g with the production headshell revision, and the arm is therefore classed as medium.

Geometric accuracy was excellent, the slotted headshell providing ready adjustment slack whatsoever was detectable in the bearings, the friction levels in both planes were exemplary. The arm was however not so easy to set up, and for final clamping of vertical height it needed to be removed from the bolts below the baseplate — this arrangement may be improved.

Set to 'minimum' the bias was found to be appropriate for a 1.5g downforce, and little extra will be required for the usual 1.8-2.0g downforce moving coil cartridge. Cue descent was however too slow at 8 seconds, this encouraging groove damage as the stylus slides slowly into record contact. Overall engineering and finish was very good, but the gold plating on the counterweights was suspect and not adhering well on the review samples.

The resonance graph portrayed well ordered behaviour, showing a highly-favourable energy trend. It did however demonstrate some resonances, with that at 200Hz probably a bearing/counter counterweight mode, and that at 800Hz the main tube — a worthwhile high value. The remainder were more difficult to pin down as to exact origins. Low in capacitance. the leads were usefully flexible and carried good quality plugs.

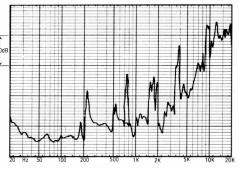
### Sound quality

On audition there was no doubt whatsoever concerning the high calibre of this tonearm. The bass was particularly good, showing depth, weight, eveness and good articulation. The midband was neutral as well as transparent, matching the unexaggerated musical treble register. Stereo effect was very good and the overall sound sweet and well-balanced tonally. Compared with certain other models however the Orion could sound less 'sharp', which could be interpreted as 'softness' on its

### Conclusion

Engineering and sound quality meet the reguired standard but considering the high price, the arm can hardly be described as good value for money in the accepted sense! But it can be strongly recommended on the basis of its overall performance.

**GENERAL DATA** Approximate effective mass, inc screws, excl cartridge. . . 11g Type/mass of headshell.....non-detachable Geometric accuracy.....excellent Adjustments provided . . . . . . . . overhang/offset/height Friction, typical lateral/vertical..less than 5mg/less than 5mg Downforce calibration error .....uncalibrated Cue drift, 8mm ascent/descent .....none, 1.0 secs/8 secs Arm resonances .......very good Subjective sound quality .....very good Lead capacitance/damping method......73pF/none Estimated typical price..... £395 when reviewed, now £425

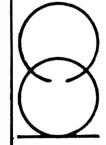


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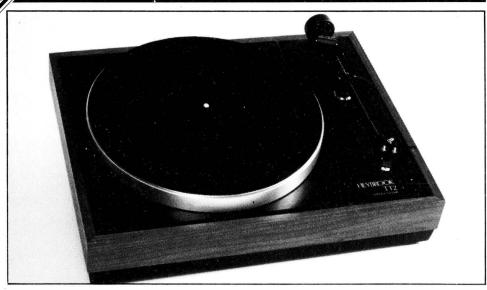
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Heybrook TT2

Mecom Acoustics, Knighton Hill, Wembury, Plymouth, Devon Tel (0752) 863188



Noted for their specialist speaker designs. Heybrook have made their first foray into the turntable field with the TT2. It is a comprehensively-designed full subchassis model in the UK audiophile tradition. The price is placed in the middle sector, substantially undercutting the audiophile decks, and vet hopefully solving important design problems.

Every manufacturer has his own approach, and in the case of the TT2 rigidity and solidity appear to be key factors. The subchassis is a heavy cruciform of thick guage welded steel, box section, a heavy nylon coating protecting the surface and adding some damping. By comparison the platter is of moderate mass at 2.6kg — a fine-quality cast component in the familiar two-piece form; it comes with the increasingly popular dense felt mat.

The arm board is made of a wood composition material secured to the chassis by a large concealed bolt. The whole thing is suspended at three points on three deep multi-turn (8-9 turns) coil springs, whose adjustment points are conveniently located on the top surface of the deck. Belt-driven by the usual synchronous slow-speed motor, the pulley has two diameters, speed being selected by hand after removal of the outer platter. The combination of heavy chassis and compliant springs resulted in a rather low suspension resonance of a little under 4Hz. Recovery was fairly slow

after excitation and evidence of a rather higher-frequency rotational mode was seen and estimated at 8-10Hz, possibly due to the proximity of two of the suspension centres to the arm board, an area of reduced mass compared with the platter centre.

The high constructional quality, generous use of materials and thought that has gone into such aspects as adjustment access and alignment was much appreciated, and in contrast to many other models, useful instructions were also included — a critical factor with this type of turntable. Our sample came with a Heybrook arm accessory called the AK-1 comprising a kit of steel sockethead cartridge bolts, a wrench and spanner plus a two-point cartridges alignment protractor.

### Lab report

The disc impulse response showed poor damping of the initial transient but thereafter the decay was rapid and clean, an above-average result overall. Weighted wow and flutter was fine at 0.08% with very low flutter while pure wow was also good at 0.09%. It ran close to absolute speed and slowing under load was well within the accepted subjective tolerence. Start up was slow, as is usual for this type of turntable.

Rumble was excellent at -79dB DIN weighted and with only the merest trace of mains related signal at 150Hz — this was insignificant. Despite the number of turns on the suspension springs, vibration rejection was truly excellent as was acoustic breakthrough. Hum was very low and the unit was also highly resistant to acoustic feedback, while shock was also quite well rejected.

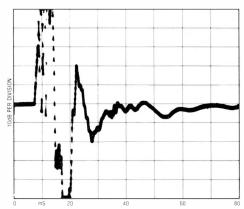
### Sound quality

With a top class lab performance and its fine constructional quality we had high hopes of a good subjective result. In the event the findings were encouraging, particularly on lab related parameters, but the TT2 failed to make the top grade. Before criticising, it is worth pointing out the model's merits; namely in terms of feedback, tonal balance, integration and pitch stability. It proved less rewarding in the more subtle areas of dynamics where. strangely, the sound seemed mildly compressed and as regards clarity where some 'veiling' and muddle were noted in the mid and lower mid/upper bass range. The sound was suggestive of a mild but continuing low-level hangover (acoustic not physiological!) and somehow the attack and momentum of the programme appeared diluted. I have no proof but only a suspicion that the heavy steel beam subchassis was acting as a longer term energy store — an unwanted reverberator — while the chassis rotational mode may also have been a factor.

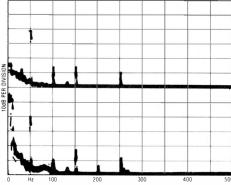
### Conclusion

If the subjective report seems tough, it should be viewed in the context of the competitive pricing of this model for what is, after all, a well made well finished turntable of excellent lab performance, durable construction and reliable, stable alignment. I suspect that with a lower mass arm and less resonance-inducing cartridge the sound quality would improve still further. Despite our criticisms, as it stands the subjective performance was sufficient to merit recommendation.

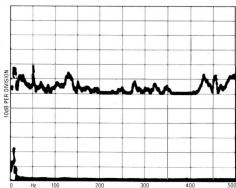
GENERAL DATA	Motor uni
Typebelt-driven, synchronous motor, s	
Platter mass/damping2.6kg	/average+
Finish and engineeringvery good	/very good
Type of mains/connecting leads	
Speed options	
Wow and flutter (DIN peak wtd, sigma 2)	0.08%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)0.0	
Absolute speed error	
Speed drift, 1 hour/load variation synchronou	is/ = 0.18%
Start-up time to audible stabilisation	
Rumble, DIN B wtd L/R average (see Spectrum)	
Size/clearance for lid rear44(w) x 37(d) x	
Ease of use	
Typical acoustic breakthrough and resonances	
Subjective sound quality of complete system	
Hum level/acoustic feedbackvery good	
Vibration sensivity/shock resistanceexce	
Estimated typical purchase price£2	35 (TT2/II



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



Breakthrough, acoustic (above) and vibration (below)

### Update

The TT2/II now features a revised, cast sub-chassis, new belt, pulley, springs, bearing and arm board. Retro fit for TT2 -£40 plus carriage.

### Linn Sondek LP12

Linn Products Ltd, 235 Drakemire Drive, Glasgow G45 9SZ Tel 041-634 0371



With a decade or so of production behind the *Sondek*, the 'Nirvana' modification covered by the review in the last *HFC* 'Turntables' edition has now been augmented by a further development called 'Valhalla' (as with the 'Nirvana', this is an easy retrofit). For years now, the popular slow-speed synchronous motors generally fitted to the sub-chassis belt drive turntables have been at the mercy of the mains supply. The latter's frequency, distortion, noise level, transient fluctuations and voltage all affect the motor's output and also the level of vibration emitted from the motor frame.

Ideally such motors should be run from a two phase supply, but the second phase-shifted line has generally been optimised in a less-than-ideal fashion by using a phase shifting capacitor. When a turntable is intended for UK and for US markets, a pulley change is also required to account for the 20% mains frequency difference, in addition to the 2:1 change in voltage.

'Valhalla' solves these problems by effectively isolating the motor electronically from the mains supply. Mains power is rectified and smoothed to feed a bi-phase 100V low distortion power amplifier acting as the motor

source. The exact 50Hz frequency is synthesised from a quartz oscillator. When fed clear, stable 50Hz, the motor generates less vibration and mains harmonic components, attaining a near perfect pulley speed stability over both the long and the short term. Power into the belt is more stable, with (in theory at least) a lower rumble and reduced subchassis vibration resulting from the power feed. For simplicity's sake the single 33 rpm speed has been retained.

General alignment has also been improved with the recent introduction of larger and more accurate suspension springs and deckplate bolts. However the deck is still at present subject to suspension settling with use, and thus requires occasional realignment though new low-fatigue springs are promised to solve this problem in the near future.

To return to basic features, the *LP12* comprises a straightforward full sub-chassis belt driven turntable unit capable of accepting a variety of high quality tonearms. Deceptively simple in design, long experience with the product has shown that it has been subjected to such a high level of detailed development and refinement that almost every component down to the humblest screw fixings can be

shown to have a significant effect on the performance of the whole.

A substantial main bearing is used, with a hardened spindle ground to a slightly radiused point bearing on a thrust plate. High density PTFE sleeves in the bearing provide sufficient rigidity and very low rotational noise levels. The two piece platter is of considerable mass, cast in Mazak and turned to close tolerances, with a special grade of black felt used for the platter mat. Even now, considerable care is needed in setting up an *LP12* in a final installation, and the help of an experienced dealer is virtually mandatory.

Other minor improvements concern the light touch on-off switch with LED indicator, as well as extra screws front and back to help keep the baseboard in position.

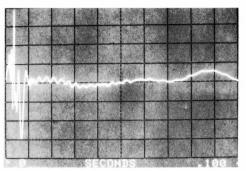
The well damped platter weighs some 4.1kg. Our assessment of disc damping was revised for this issue, and while the initial transient was certainly poorly damped by the felt mat, the impulse died away quickly thereafter, this a good result. A measurement taken last year showing the frequency transform of the felt mat versus an absorbent one has assumed greater significance this time round, inasmuch as it can be seen that while the 'composition' mat produced greater attenuation, its frequency response was uneven, while that of the felt was more uniform, suggesting lower overall coloration.

'Vallahalla' made its mark on the motor results with excellent wow and flutter, plus significantly lower linear wow. Absolute speed and accuracy was satisfactory, while loss under load was very good at 0.13%, another important result. DIN weighted rumble improved to a superb –80dB. In fact the spectrograms for residual measuring system noise and for the *Sondek* were very similar and to check this result the two were submitted to subtraction providing the second rumble photo – no mains related rumble components remain!

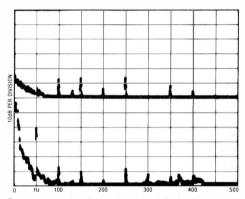
The LP12 was not the very best in the issue as regards vibration isolation or acoustic breakthrough but the curves did confirm a high standard for these parameters nonetheless. Shock resistance was also quite good, with both acoustic feedback and hum very good.

### Sound quality

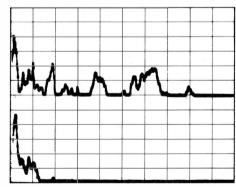
A few years ago it was considered heresy to suggest that turntables could make a 'sound' at all, but meanwhile the *Sondek* has been a leading exponent in demonstrating just how different the subjective performances can actually be. It scored an excellent rating on audition, notwithstanding some mild spectral



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



Breakthrough, acoustic (above) and vibration (below)

Charts above characterise general turntable behaviour. See text for commentary on these results.

### LINN SONDEK continued

imbalance and coloration; a consumer who feels that absolute tonal neutrality is paramount is entitled to reject the LP12 but should be made aware of the importance of certain other factors. For example the LP12 has long generated a feeling of 'involvement' with the music for reasons that are only partly becoming understood - some of these are becoming clearer now with the improvement afforded by 'Valhalla'.

After careful and prolonged listening the LP12 was found to excel in its ability to retain the timing, tempo, rhythm and pitch of complex percussive sections, failure here producing some loss of interest on the part of the listener. Additional qualities included rapid post-transient decay producing 'transparent silences' between successive notes and these were all too often obscured by hangover in other models. The felt mat also provided a level of tonal integration of bass and treble now considered optimum for the deck. However some anomalies were heard - a mild upper bass richness with marginally 'loud' and forward midband, although when the latter effect was identified, it was not felt to be important enough to affect the high subjective ranking. The Ittok arm still produces a spectacularly good sound with the Sondek.

matched it well, providing in some respects a sweeter and more neutral balance.

### Conclusion

The Valhalla Linn costs more than before but the increase is not far out of line with inflation over the last year or two. Now better than ever. the LP12 had no trouble in maintaining its virtually pre-eminent ranking for its price category; many can pick holes in its performance but few can actually do better.

### Update

New nuts fitted to suspension ease set-

ENERAL DATA	Motor un
lotor Section	

Motor Section	
Type manual, belt-drive, synchronous motor, su	
Platter mass/damping4	
Finish and engineeringexcellent	/excellent
Type of mains/connecting leads	2-core
Speed options	
Wow and flutter (DIN peak wtd, sigma 2)	
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz) 0.09	
Absolute speed error	
Speed drift, 1 hour/load variation quartz-locked	1/ – 0.13%
Start-up time to audible stabilisation	6 secs
Rumble, DIN B wtd L/R average (see spectrum)	80 dB
Size/clearance for lid rear 44.5(w) x 36(d) x 1	5(h)/5.5cm
Ease of use	good
Typical acoustic breakthrough and resonances	very good
Subjective sound quality of complete system	. excellent
Hum level/acoustic feedbackvery good/	very good
Vibration sensivity/shock resistancevery of	lood/good
Estimated typical purchase price	£374
**	

# and to my ears at least, the Alphason arm aise PPOINTED STOCKISTS OF

# sounds better than ever nicely controlled, and of course the LINN-SONDEK LP 12

On the mid priced suspending subchassis front the new AR the subject of turntables including the REGA 3 with the new R300 arm, in the past the Rega was very good — now it's amazing. turntable sounds smooth and

As usual composite by appointment us, book the time usual demonstrations time trations are just phone and

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Phone: 01-961316

superb, finally the A&R A60 goes from strength to strength. We could go on especially on

252, Meridian's component amp looks great and sounds hard to beat, not forgetting the superb NYTECH CA 202 and price bracket, at an even lower price the CREEK 4040 is On the amplifier front there's the highly acclaimed AUDIO LAB 8000A, the NAIM NAIT having already established

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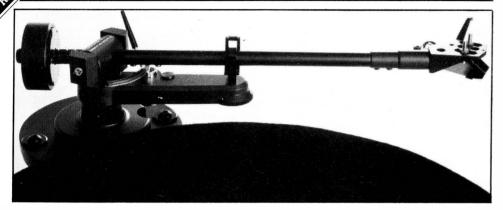
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### Linn Basik LVX

Linn Products Ltd, 235 Drakemire Drive, Glasgow G45 9SZ Tel 041-634 0371



Encouraged by the runaway success of their low-cost Basik LVV arm, Linn have now introduced a second, which is Scots-designed and Japanese manufactured. Costing rather less than one-third the Ittok price, the LVX nonetheless manages to return something of the former's features as well as adding some of its owm.

An all-black creation, it is distinguished by its moderate arm mass — estimated at 12.5g - and yet it still offers a cast headshell of near-Ittok quality, secured by a split-shaft lock. tensioned by a socket head bolt. This arm is an obvious choice for those wishing to undertake a comparative evaluation, be they reviewer or dealer demonstrator.

The LVX is fully calibrated, with a partially decoupled rotating counterweight providing the usual second slide scale. Closed loop bearing are used, these adjusted for zero play, an unusual characteristic where such an inexpensive arm is concerned. However there are bound to be repercussions — we examined a number of samples (several other manufacturers decks were fitted with a LVX) and we found variability with respect to pivot friction. The arm is also a little fragile, much more so than the Ittok. It should be handled with care and never subjected to shock — not that this isn't good advice where any quality product is concerned. Our Linn-supplied LVX delivered 150mg of lateral friction which I consider to be in the reject class; however the sample used for audition was satisfactory.

The LVX uses the new large arm pillar but the baseplate is still unique to the Basik series inasmuch as a cutout is required to accommodate the cue damper cylinder. The low capcitance output cable is to Ittok specification though the headshell tags and pins are not gold plated. However the 'giveaway' Linn Basic cartridge is included with the arm, and could be regarded as a no-cost 'starter' (see review).

### Lab report

Estimated effective mass had been noted at 12.5g including hardware, this suitable for cartridges on the 10-20cu range. A special design with metal plug insert, the detachable headshell weighs 7g inclusive of screws, and a limited adjustment for vertical tilt is possible due to the takeup tolerance in the headshell lock overhang, height and lateral angle adjustments are standard. Both finish and engineering were very good, and the arm was easy to use. The usual internal spring system was used for bias, but levels were slightly on the low side, with no apparent differentation from rim to centre. Downforce was slightly low, while the cue worked well with sensible rates. On our 'good' sample lateral friction was around 50mg, while in the vertical plane it was excellent at less than 10mg. Rated good on arm resonance, the graph showed a well controlled behaviour up to the first major break at 750Hz, a commendably high frequency. A trifle disjointed thereafter (literally!), the remaining abberations were nonetheless very mild, and suggested a smooth treble, tidy bass and generally clean midband.

### Sound quality

Awarded a promising 'good' on the listening tests, the LVX did not compare too favourably with the LVII but was nonetheless a fine arm in its own right. Subjectively, it was not as

'involving' as the former model but at the same time there was very little obviously wrong with it.

The overall tonal balance was very satisfactory, and as a whole the stereo image was well defined with both depth and ambience. It sounded a little 'thin' in the midrange, and the bass lacked some tautness, tending to appear a little 'boppy'. Treble was sweet and musical but lost some detail and stereo precision.

### Conclusion

While Linn are unable to make a satisfactory 'cheaper' turntable, the LVX does make for a less expensive arm/deck combination. To my way of thinking the alternative LVV is not really acceptable unless viewed as a starter component only. The LVX represents a welcome medium-mass tonearm of fine quality with a detachable headshell, and both moving magnet and moving coil types work well in it. With our reservation concerning pivot friction variability noted, the LVX is nonetheless well recommended; indeed many consumers will never need to go beyond it.

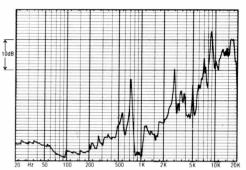
### Update

MOORE

New cartridge by Audio Technica now fitted.

**GENERAL DATA** Approximate effective mass, inc screws, excl cartridge. . 12.5g Type/mass of headshell.....special detachable/7g Geometric accuracy.....very good Adjustments provided.....overhang/offset/height Finish and engineering ......very good/good Ease of assembly/setting-up/use...very good/good/very good Friction, typical lateral/vertical. .approx 50mg/less than 10mg Downforce calibration error, 1g/2g......-0.1gm/0.1g Cue drift, 8mm ascent/descent...negligible, 1.0 secs/3.3 secs Lead capacitance/damping method

100pF/counterweight decoupling Estimated typical purchase price......£74 inc. cartridge



Structural arm resonances, audio band

10 THIRLMERE ROAD, PRESTON PR1 5TR FEL No. 0772-703745 more precise Stereo Image arrived at the mat bscure some requencies. requencies. nd the thickness I have chown is ideal for all spring sub-chassis turntables tjer an all ffers the same opportunit to improve your existing system This High quality suede mat, at only £17.95, offers value for money and Various mats I have tried have altered the sound, but did no will be amazed at the results. have tried various materia round It is far less expensive than a cartridge upgrade, and amnow fering. impro ment. After much you many happy listening hours It is made from High Quality Suede Whilst it is achieve il & a lij experimentation we ve higher and low-lifelike sound with

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Price, Teak & Black Oak £298 per pair + VAT; Walnut £299 per pair + VAT.

### Type ML Monitor

Size  $13\frac{1}{2}$ in high x  $8\frac{1}{2}$ in wide x  $7\frac{1}{2}$ in deep.

Axial Frequency Response 70 to 20KHz. Max Power input 40 watts programme peak. Sensitivity 85dB/watt @ 1 metre. Nominal Impedence 8 ohms. Units 5in polypropylene cone bass/mid range unit; 1in fabric dome HF unit.

Price, Teak & Walnut £173.00 per pair + VAT.

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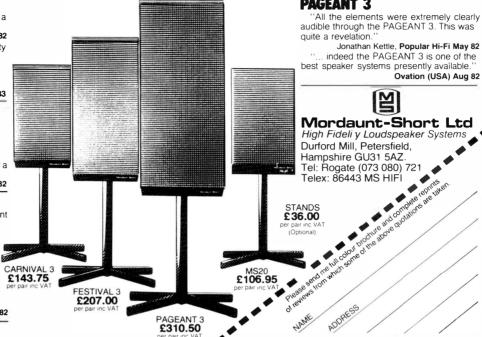
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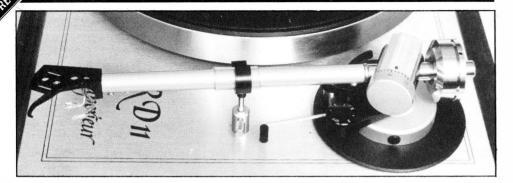


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Linn Ittok LVII

Linn Products Ltd, 235 Drakemire Drive, Glasgow G45 9SZ Tel 041-634 0371



When first released, the LVII immediately established an enviable reputation for excellent engineering, sound quality and technical performance. The current version still resembles the original arm, despite some minor constructional changes which have helped maintain a competitive state of 'tune', and the original is by no means rendered obsolete.

A rigid fixed head tonearm, it carries the relatively truthful label 'Direct Coupled' this referring to the ability of this arm to directly couple the cartridge mounting to the subchassis are board. Considering the requirements for high sensitivty in two planes of freedom at the bearings, this is no mean feat of engineering. While I would not encourage careless handling, my experience of a number of Ittoks suggests that not only are they consistently well adjusted but they are also fairly robust compared with many other models.

At close on a 14g effective mass including hardware, the design fits the upper end of the medium-mass group and is best suited to cartridges in the 8-16cu compliance range. Providing a strong foundation for cartridge mounting, the cast magnesium headshell carries a very well designed and non-resonant finger lift and the more recent counterweights exhibit a pretty tight fit on their slightly resilient synthetic bore liners; the importance of this particular aspect may be seen in the improved damping of the resonances at 400Hz, 900Hz and 1.6kHz, when a deliberately loose but non rattling counterweight was substituted.

This arm proved convenient to use, the effective cueing system controlled by a lengthened finger lever fitted with a roller at the top. This aids cueing on floppy subchassis turntables and reduces unwanted spurious shock effects post cueing. In marked contrast to the majority

of upmarket audiophile designs, the Ittok comes fitted with a well calibrated and respectably accurate dials for both downforce and bias, the latter adjustable during play. A precision low-torque flat coil spring is used for downforce, with a linear coil spring for bias correction. The small but worthwhile improvements noted with later models include an increase in diameter of the main pillar cylinder together with a larger socket head clamping bolt allowing an unrivalled strength three-point lock to be obtained between arm and base. The main tube is now hard anodised in a darker shade of grey with a lacquer coating and the bonding of various parts has also been uprated by the use of larger bolts with heads capable of accepting greater tightening torque.

### Lab report

Geometric accuracy was considered excellent. with a properly square headshell and adjustment provided for overhang, lateral angle and height. The alignment is in fact virtually optimised for our two point minimal subjective distortion criterion. Finish and engineering were both excellent and the arm proved easy to assemble, set up and use. Friction was superb at around 10mg or less in both planes, with no detectable slack. Biasing was in the correct ratio if marginally low in our estimation (based on a normal elliptical stylus), but downforce was well within the required tolerance. The cue worked well with a sensible rate and negligible drift. Arm resonances were classed as very good with the first main flexure deferred to a high 1kHz, this suggesting a remarkable rigidity.

As has been noted previously, the close nature of the coupling between arm and mounting board meant that the latter becomes

influential as regards final sound quality.

### Sound quality

The overall rating is a secure 'very good, but as with all acoustic components the final result obviously represents some sort of balanced Ease of assembly/setting-up/use compromise. In our view the Ittok's strengths lie in its subjective speed of response to transients, its fine transparency and its ability to reveal atmosphere, depth and fine detail. The bass was to a fine standard with good extension and drive, while the treble was also revealing of detail if very slightly brash and forward at times. A trace of upper-mid hardness was also noted, where the stereo focus suffers a mild dilution. The importance of this depends on the final combination of equipment chosen.

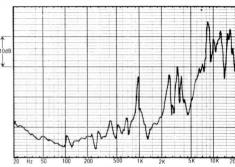
### Conclusion

In its price category the Ittok remains an outstanding design with a fine combination of technical performance, sound quality and finish, plus ease of adjustment and use. While this is a fine universal tonearm, working well with many decks, it excels on the Linn LP12. where its minor faults appear to be significantly ameliorated. Likewise it is well suited to the standard Linn Asak cartridge, these three components in combination providing a disc player of virtually unrivalled performance for the price.

GENERAL DATA	Tonearm
Approximate effective mass, inc screws, excl cartr	idge
	est. 13.5g
Type/mass of headshellnon-	detachable
Geometric accuracy	.excellent
Adjustments providedheight/overhang/la	teral angle
Finish and engineeringexceller	ıt/excellent

very good/very good/very good Friction, typical lateral/vertical

less than 10mg/less than 10mg
Bias compensation methodinternal spring
Bias force, rim/centre (set to 1.5g elliptical)175mg/195mg
Downforce calibration error, 1g/2gless than 0.03g/0.038g
Cue drift, 8mm ascent/descent, negligible, 0.8 secs/1.8 secs
Arm resonancesvery good
Subjective sound qualityvery good
Lead capacitance/damping method100 pF/none
Estimated typical purchase price£253



Structural arm resonances, audio band

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By virtue of a remarkably ingenious mechanism installed as a functional part of the platter and actuated only when required by a power drive built into the plinth. Lux have managed to bring a 'vacuum' platter to an integrated turntable costing less than £300.

The underside of the platter has a strong integral bellows which when actuated suck the disc onto the platter, the interface slightly cushioned by a thin liner 'mat'; (a thicker non vacuum mat is also provided.) By removing the need for an airtight airline main bearing, a standard direct drive motor can be used, and this is the key to the major price saving.

Superbly finished in the Lux tradition, the PD370 is fitted with an attractive fixed headshell tonearm. The headshell clamp allows rotation for vertical tilt angle adjustment. but the arm is not adjustable for height, this achieved instead by using cartridge packing spacers. The plinth design is of rigid form. lacking an isolating sub-chassis, although semi-compliant feet are fitted to help reduce vibration feedback. The above average quality lid is coupled directly to the plinth and thence the playing system. The motor is a two-speed quartz-locked type with a good quality bearing though the rigidity of the platter/plinth interface was not too high.

### Lab report

The substantial aluminium platter weighed 2.6kg and demonstrated very good impulse damping. However two components were superimposed on the photo, namely the slight one at 600Hz (a ringing internally) and the other at 20Hz — a platter rocking effect.

Wow and flutter were excellent, with good overshoot-free torque and excellent speed stability, while rumble was also very good. though with an unusual kind of low frequency 'noise' present below 150Hz. The arm was quite well adjusted showing little bearing play and good geometry, and effective mass was in the medium range at approximately 13g including hardware. Lateral friction was however slightly high and the bias compensation on the low side, set in the inverse ratio. Downforce calibration was fine, but some cue drift was observed. Arm resonances were classed as slightly better than average, their main flaw being the energy 'break' at 1.5kHz.

Reasonably good on acoustic breakthrough, the vibration isolation was just average, shock resistance only fair. Feedback immunity was fairly good.

### Sound quality

Just making the 'good' category, the 370

showed some 'life', with reasonable bass plus satisfactory stereo focus and staging. The midband was above average and the music showed good subjective timing and pitch. However the treble appeared somewhat harsh, brash and uneven, with poorer stereo precision here: changing the test moving coil cartridge helped matters in this respect.

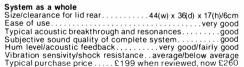
### Conclusion

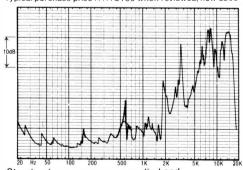
Recommended for use with moderate-compliance moving magnet cartridges with a 'sweet' upper range, the PD370 succeeds by virtue of its fine disc damping and motor, plus satisfactory arm. An uncritical, unfussy model possessing an excellent appearance, this unit is well worth considering.

GENERAL DATA	Integrated turntable
Motor Section	3
Typemanual, quartz-lock, o	direct-drive, vacuum platter
Platter mass/damping	
Finish and engineering	excellent/very good
Type of mains/connecting leads	3-core/phonos and earth
Speed options	
Wow and flutter (DIN peak wtd, sign	
Wow and flutter (LIN peak wtd 0.2-6)	
	0.06%/less than 0.04%
Absolute speed error	
Speed drift, 1 hour/load variation	none
Start-up time to audible stabilisation	
Rumble, DIN B wtd L/R average (see	e spectrum) 77/78 dB

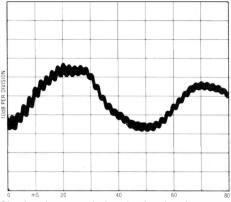
Arm Section
Approximate effective mass, inc screws, excl cartridge13g
Type/mass of headshellnon-detachable
Geometric accuracyvery good
Adjustments providedoverhang/offset/lateral
Finish and engineeringexcellent/very good
Ease of assembly/setting-up/usegood/very good/very good
Friction, typical lateral/vertical80mg/20mg
Bias compensation methodlever
Bias force, rim/centre (set to 1.5g elliptical)150mg/100mg
Downforce calibration error, 1g/2g+ 0.05g/none
Cue drift, 8mm ascent/descentnoticeable, 0.5 secs/1.3 secs
Arm resonancesaverage +
Subjective sound qualityaverage+
Lead capacitance/damping method
150 p T/securate suscisht desecuations

### 150pF/counterweight decoupling

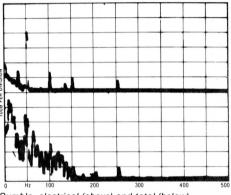




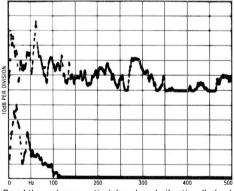
Structural arm resonances, audio band



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



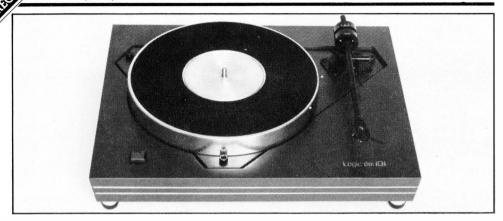
Breakthrough, acoustic (above) and vibration (below)

Charts above characterise general turntable behaviour. See text for commentary on these results.

REASSESSED

### Logic DM101

Logic Ltd., 19 Hurlbutt Road, Heathcote Ind. Est., Warwick CV34 6TD



First reviewed in the last HFC 'Turntables' edition, the Logic DM101 design has undergone considerable modifications since then and accordingly has been completely reassessed for this issue.

In several respects the performance in previous tests was very good indeed, but a weakness was present in the subchassis springing which was believed to have limited the ultimate performance attained.

The subchassis is open, fitting in a recess in the upper surface of the semi-solid plinth. Sawn from a thick, stress-free 8mm aluminium alloy plate, and asymmetrically shaped to reduce self resonances, the chassis is suspended at its three extremities on a total of six small diameter coil-springs acting as a sort of 'web'.

However, Logic have subsequently added a large central coil spring to the subchassis around the bearing housing, bringing the total number of springs used to seven.

A useful feature with the Logic design is the ability to lift the subchassis right out for arm fitting and lead dressing, while the levelling points are locking socket-head bolts, conveniently adjustable from above and clear of the platter. The precision machined two-part alloy platter of this belt drive model weighs 3kg. It is fitted with a bonded baize mat, and runs on an impressive-looking main bearing. This has a 12mm shaft and a single point (thrust ball), plus a rigid phosphor-bronze sleeve exhibiting excellent tolerances. Speed change is effected manually after removing the outer platter.

### Lab results

ण In previous tests, weighted wow and flutter

was an excellent 0.06%, following stabilisation after start-up. The time required for the chassis to settle down after starting was a rather long five seconds. Flutter and rumble were also very good when separately measured. The speed ran 0.05% slow — significant in A/B comparisons — and this had to be taken into account during auditioning. The slowing under load was a satisfactory 0.35%, and the DIN B weighted rumble was a first rate - 77/ - 78dB. From the spectrum analysis it can be seen that the suppression of mainsrelated rumble components was very good, with barely any visible difference between the static electrical breakthrough and the total rumble content.

We also obtained promising disc impulse responses, allowing X10 scaling; noteworthy is the scarcity of the low frequency long wavelength components which were often encountered with other models, confirming the considerable bearing/platter rigidity. The Logic's previously standard disc support gave guite good transient damping, but the alternative Audio Ref showed a superior control in the mid/treble range.

Both acoustic breakthrough and vibration isolation were excellent and proved to be a strong point with this model, endowing it with a very high feedback immunity.

On the latest version the original low-slung suspension has been restored, affecting the rotational mode stiffness and giving a very low resonance (too low perhaps in my view) has been attained of around 2.5Hz. The turntable now takes some time to stabilise after shock and pure wow has also doubled to 0.22%, a

significant result and believed due to this revised suspension.

A felt mat is fitted to current production models (see the new graphs for isolation and impulse) and this was thought to slightly worsen the performance, although the vibration isolation remained excellent.

### Sound quality

On the listening tests the original and promisingly high standard was still demonstrated. with the previously-noted slight stereo stage defocusing (believed attributable to the old suspension) now absent. However prolonged audition suggested another effect — a subtle instability of pitch which was believed to be associated with the measured slow wow, a contributory cause being the 0.3% of load variation. As before, the low frequency range was unusually clear, even, detailed and well extended, while feedback was held well at bay. and the general tonal balance with the standard mat was both neutral and vet at the same time sufficiently 'lively'. The Ittok worked well. though it demonstrated greater midrange 'hardness' than when partnering the Sondek: the Helius or Mission arms gave 'sweeter' results.

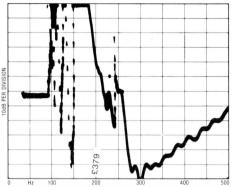
### Conclusion

When last tested, the Logic demonstrated many strong points in its technical and subjective performance, and can be recommended for its exceptional bass neutrality and good isolation. This time, the previous comments still hold true; generally pretty good and demonstrating a good potential, the Logic's development is, I feel, not yet complete. undeniably good sounds can be produced in its present state, but it still fails to meet the top grade in my view.

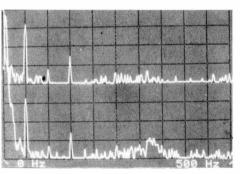
### Update

Production models from early 1983 onwards had electronic power supply with two speed switching. Cosmetic and suspension revisions have also been car-

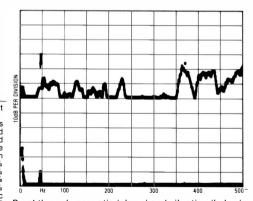
ried out.	
GENERAL DATA Motor Section	Motor uni
Type manual, belt-drive, synchro	nous motor, sub-chassis
Platter mass/damping	
Finish and engineering	
Type of mains/connecting leads	
Speed options	
Wow and flutter (DIN peak wtd, sigma	
Wow and flutter (LIN peak wtd 0.2-6Hz	
Absolute speed error	
Speed drift, 1 hour/load variation	
Start-up time to audible stabilisation	
Rumble, DIN B wtd L/R average (see S	
Size/clearance for lid rear48	
Ease of use	
Typical acoustic breakthrough and re	
Subjective sound quality of complete	
Hum level/acoustic feedback	
Vibration sensivity/shock resistance	
Estimated typical purchase price	



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



Breakthrough, acoustic (above) and vibration (below)

Charts above characterise general turntable behaviour. See text for commentary on these results, see Technical Introduction for explanation of test techniques

REASSESSED

Lux PD 300

HW International Ltd, 3/5 Eden Grove, London N7 8EQ. Tel 01-609 0293



Like the costly *PD555*, this Lux turntable also has an inbuilt suction pump quite conveniently operated by a front mounted hand lever. On this model Lux have taken the subchassis principle to heart, incorporating a superbly engineered die-cast example of unusually complex design. Much attention has been paid to such details as provision for a massive main bearing and its mounting, the symmetrical disposition of the three support components. and the webbed and reinforced arm mounting with its face-machined interchangeable alloy tonearm plates. The subchassis proved easy to level using knobs accessible on the plinth underside, but at some stage the designer(s) appeared to have had second thoughts, since the very good isolation afforded by the coil spring suspension has been compromised probably in the interests of improved shock resistance and handling stability — by the addition of plastic foam spring sleeves and silicone damping washers on the moving components. The potential performance of this deck was such that we auditioned and measured it first as supplied, and secondly with freed suspension and springs.

The 300 is a two-speed belt drive model, using an electronically controlled high quality DC motor. A quartz oscillator reflector type stroboscope is fitted for reference, since the drive is not quartz-locked, and fine variable speed control is via thumbwheels mounted underneath near the front edge. One complication in previous assessments arose with the solid flat platter, as the suction pump supplied an equivalent of 30kg pressure, and any dust or grit on the record underside or platter surface

will tend to impress itself onto the record surface when the vacuum is engaged. However, a very thin rubber platter mat is now available which does not impair the 300's excellent disc damping (see PD370 review) but effectively negates any worry over hard disc contact and damage. Furthermore the model now costs around two thirds of what it did.

### Lab report

With its substantial 3.4kg platter and high torque drive, the wow and flutter, torque and rumble results were all excellent. Speed drift was more than I would like at the price level, but start up was fine at 2.8 seconds, with no overshoot effects. Rated as good on shock prior to the modification, the acoustic and vibration isolation were also very good above 75Hz, while freeing the suspension produced 10-12dB acoustic improvement from 25 to 75Hz, and an even better 15 to 20dB improvement in vibration isolation; but shock resistance was somewhat impaired.

Lux have not made special provision for consistently dressing the arm leads, and an adhesive clip was added. X10 scaling was possible for the disc impulse tests, showing the transient was totally suppressed, leaving only minor low frequency ripples.

### Sound quality

Setting a high subjective standard at all times, the *PD300* showed much of the '555 midrange neutrality and transparency, particularly on percussive sounds and the ambience surrounding them. At times it was almost clinically clear, and in tonal balance seemed

slightly 'cold' and faintly 'glassy'. A trace of high frequency 'forwardness' and 'disembodiment' was encountered with several cartridges. The Asak/Ittok worked better than the Koetsu/Ittok, and a 'softer' sounding arm would suit best — for example, the Sumiko.

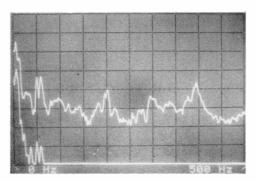
The chassis was slightly nervous in stability terms once 'free', but conversely as supplied the bass range lost some of the precise and open sound with good depth extension

### Conclusions

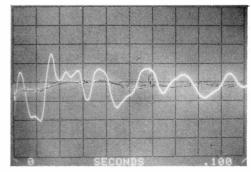
One of the best engineered and certainly one of the best finished turntables covered in this issue, the *PD300* offers many valuable facilities and continues to be strongly recommended.

Careful matching of system components is necessary for the best performance, and it is capable of accepting a wide range of tonearms; genuine alternatives to the *lttok* are slowly emerging, and their tonal characteristics may suit the *300* better — for example, Alphason, Mission, Orion and Zeta.

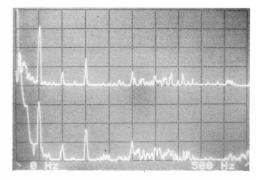
Its good alignment stability remains an important feature — it should not need resetting after installation.



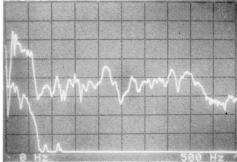
Breakthrough as modified (see text): above, acoustic; below, vibration.



Disc impulse transmission, magnified X10.



Rumble (0-500Hz lin): above, electrical only; below, total.



Breakthrough (0–500Hz lin) as supplied: above, acoustic; below, vibration.

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REVISED AND REPRINTED

### Michell Focus Motor

J. A. Michell Engineering Ltd., 2 Theobald Street, Borehamwood, Herts. Tel 01-953 0771



### Features and design

Now in its third year of production, the price of the *Focus* has remained competitive over this period, and the deck has undergone several refinements. The main improvements include an enlarged main bearing with a strengthened fixing to the deck plate, plus a revised drive assembly and motor decoupling to give reduced rumble and improved wow and flutter. Our lab measurements verified the value of all these changes.

The unit comprises a two-speed rubber cord drive design powered by a synchronous motor, and the flat 2.0 kg platter is fitted with an effective 'suede' mat bonded into position. The high quality acrylic lid is hinged directly to the wood/ plastic laminated chassis, which is not an ideal situation, but the whole is suspended on quite effective steel springs with absorbent rubber cushions, giving an overall low resonant frequency around 5 Hz.

### Lab results

As the figures show, this model now provided exemplary results for wow and flutter, both separately assessed and weighted. Torque and speed accuracy were both good, and although the weighted rumble figures were also fine at near -75dB (several dB better than before), spectrum analysis did reveal a 100 Hz component

at -73dB, which is poorer than average. The disc impulse response was quite good allowing X10 scaling and demonstrating good high frequency damping. Acoustic breakthrough was above average and vibration isolation fine, but shock immunity was not spectacular.

### Sound quality

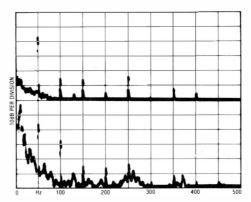
For some reason the deck never seemed quite at home with the *Focus* arm, but it provided pleasantly balanced and relaxed results in partnership with the Linn *Basik*. Above average with the lid installed, the bass was reasonably clean, the midrange quite transparent and detailed, and the stereo presentation above average. The sound was distinctly cleaner however with the lid removed, and for critical listening this is worth doing.

### Conclusion

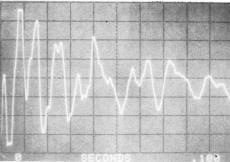
Possessing a fine handcrafted finish and distinctive styling, the *Focus* has improved significantly in mechanical terms since its introduction. It is now available at an attractive package price (£170), factory fitted with the Linn *Basik* arm/cartridge. This package gains a comfortable recommendation, and indeed the motor unit alone is worth considering at around £130.

(Note: On the latest version of the Focus, retested for this edition, Michell have revised the motor mounting as well as the plinth/chassis material. Lab figures are very similar this time except for a slight worsening in mains rumble component, but overall conclusions remain unaltered.)

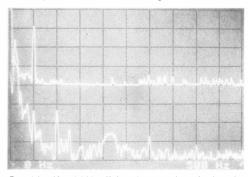
GENERAL DATA Motor unit
Type manual, belt-drive, synchronous motor
Platter mass/damping2.1kg/good
Finish and engineeringvery good/very good
Type of mains/connecting leads3-core
Speed options
Wow and flutter (DIN peak wtd, sigma 2)0.08%
Wow and flutter (LIN peak wtd, sigma 2)
0.06%/less than 0.04%
Absolute speed error+ 0.25%
Speed drift, 1 hour/load variationsynchronous/ – 0%
Start-up time to audible stabilisation
Rumble, DIN B wtd L/R average (see Spectrum)75 dB
Size/clearance for lid rear
Ease of usegood
Typical acoustic breakthrough and resonancesaverage +
Subjective sound quality of complete systemgood
Hum level/acoustic feedback very good/above average
Vibration sensivity/shock resistancegood/fairly good
Estimated typical purchase price£135
Latimated typical pulchase price



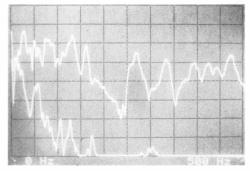
Rumble, electrical (above) and total (below) on latest sample — compare previous result.



Disc impulse transmission, magnified X10.



Rumble (0-500Hz lin): above, electrical only; below, total.



Breakthrough (0-500Hz lin): above, acoustic; below, vibration.

### **Update**

The Linn LVV tonearm is no longer available. Though stocks of the Focus/LVV package may well still be with dealers the slightmore more expensive Focus/Mission 774LC package can be recommended. An improved 'S' version of the turntable is also now available at £189 without arm.

Pink Triangle

Pink Triangle Products Ltd. Unit 3, 122 Maidstone Road, Foots Cray, Sidcup, Kent Tel 01-300 1918



From the outside, the name and distinctive well — a good feature. logo may seem all that is remarkable about this turntable, which has been designed in the UK along classic lines, using a sprung subchassis and belt drive. More detailed examination however reveals many unique features; for example, the platter is solid matt finished acrylic, supplying the record support and termination itself. A semi-glass black finish is used for the top deck, replacing the earlier tinted glass mirrors, and while the latter were removable the newer alloy plates are fixed. Fine speed control adjustment is available by the use of a screwdriver inserted in the small holes in the deck plate adjacent to the speed change switch, the drive being electronic via a small DC motor.

The subchassis is very light, but is an exceedingly rigid and well damped plate — an asymmetric section of honeycomb-cored aircraft flooring material.

The main bearing has been inverted and comprises an inherently self stabilising single point design. The inverted cup now has a ruby bearing surface as standard. An ingenious system of three small-diameter, but fairly long, coil-springs allows the chassis to hang freely in near isolation, with the vertical mode effect was lower than in competing models. controlled by spring stiffness, and the lateral and torsional modes assisted by gravity as

The expanded X10 scaling proved possible for the disc impulse measurement, and the

Arm mounting is by means of a 'U' shaped section alloy extrusion, which is firmly bolted to four study set in the subchassis. Adequate provision for lead dressing has been made, and the unit came fitted with an Ittok, which suited it well.

One point to bear in mind here is that the relatively low total suspended mass and high spring compliance results in slightly altered states of level with different record weights. The Ittok is little affected by this, but if using a Syrinx, for example, which is sensitive to absolute levelling, it could prove disastrous. However, the deck is easily levelled via concealed external nuts in the plinth sides.

### Lab results

State of the art rumble figures were achieved, the spectrum analysis revealing nothing of significance. The drive was remarkably stable with very low wow, very good flutter and fine weighted wow and flutter. As no dynamic wow overshoot occurred, this helped to mitigate the fairly low torque which resulted in a significant 0.5% slowing under standard loading. With a moderate 1.7kg platter mass, the flywheel

result was very good, with balanced impulse decay control over a wide frequency range. This performance carried through to the vibration and acoustic isolation results, which were exemplary, and aural testing with a live cartridge showed that this platform was singularly inert overall in terms of resonances, vet the subchassis freedom also resulted in quite good 'footfall' shock resistance.

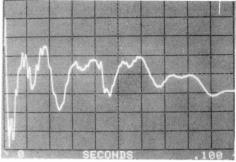
### Sound quality

For this issue the Triangle was tried with both the Ittok and Orion tonearms and qualities of low coloration tonal neutrality as well as a pleasing musical balance were immediately apparent. The bass register was well above average showing an open and articulate quality - tuneful and with good weight and solidity. The sound was alive yet somehow unforced. Disc/platter contact seemed particularly good, with a well focused treble, the whole delivering stable, clear stereo images. With rock-orientated material we heard a mild lack of pitch stability which slightly detracted from the timing and tempo of the music. although this negative effect depended on the listener's sensitivity as well as on the programme type.

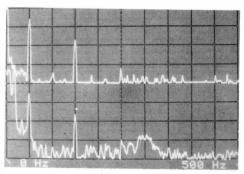
### Conclusion

Completely retested for this issue, the performance was virtually identical to that obtained previously and accordingly the original test results still stand. Notably, the pitch slowing under load is unaltered, a factor we were now aware of under audition, and a second sample showed no significant improvement. To conclude, this unit has been improved as regards some physical details, and maintains a high performance with respect to stereo depth, tonal balance and coloration levels. Only the individual purchaser can judge the importance of the pitch stability by personal audition, and with this mild reservation, the recommendation is continued.

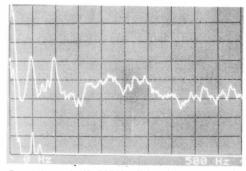
GENERAL DATA	Motor Unit
Type	
Platter mass/damping1.7k	g/very good
Finish and engineeringvery goo	d/very good
Type of mains lead/connecting leads	3 core/-
Speed options	ally variable)
Wow and flutter (DIN peak wtd sigma 2)	0.06%
Wowandflutter(LIN peakwtd0.2-6Hz/6-300Hz) <0	0.06%/0.07%
Absolute speed error adju	stable, +1%
Speed drift 1 hour/load variation+	
Start up time to audible stabilisation	3secs
Rumble: DIN B wtd L/R av (see spectrum)	77/78dB
Size/clearance for lid rear 45.5(w) x 38.5(d) x	15.2(h)/6cm
Ease of use	
Typical acoustic breakthrough and resonances	
Subjective sound quality of complete system	very good+
Hum level/acoustic feedback very god	
Vibration sensitivity/shock resistance exc	cellent/good
Estimated typical purchase price	£398



Disc impulse transmission, magnified X10.



Rumble (0-500Hz lin): above, electrical only: below, total,



Breakthrough (0-500Hz lin): above, acoustic; below, vibration.

Rega Planar 3
Rega Research Ltd, Swaines In

Rega Research Ltd, Swaines Industrial Estate, Ashington Road, Rochford, Essex Tel (0702) 333071



For several issues now, the Rega has been omitted at the maker's request on the grounds of a manufacturing shortfall in comparison with demand. However as Rega now dominate the lower priced audiophile end of the market in the UK, it was thought politic to purchase a deck and review it on our readers' behalf.

A simple design, it comprises a solid chipboard plinth covered in tough matt black laminate. Three fairly stiff stepped rubber feet provide a stable tripod foundation while the high quality lid is directly hinged to the chassis plinth with neither springs nor isolation. A plain main bearing with a thrust ball is used. and tolerances were close here, with no detectable play. Belt-driven via a rubber cord, the inner platter hub is a reinforced plastic moulding, the uppermost projection forming the tapered centre spindle and the outer platter boss. The platter is made of thick plate glass (reduced in thickness for the Planar 21), and surmounted by a thick felt mat. In a simple and ingenious gravity suspension, a second drive belt is looped to support the slow speed synchronous drive motor and surpress vibration coupling to the platter.

The arm is the traditional Rega unit made to their specification by Lustre in Japan, with improved bearings, a side entry cable fixing, and a stainless steel arm tube. Fitted with a universal detachable headshell, the arm has magnetically actuated bias compensation plus a rotating-scale calibrated counterweight, with some controlled decoupling from the arm tube. The lateral balance outrigger also has a damped stem. Effective mass is estimated at 16g, suited to lower compliance cartridges,

and in our (brand new) sample, some play was evident in the arm bearings.

Rega recommend that the deck should be placed on a light shelf, wall mounted, rather than a 'coffee table' or floor cabinet; this we found to be good advice.

### Lab report

The platter was clearly well founded as the minimal low frequency ringing on the disc impulse response shows. The initial transient was poorly damped, however, a characteristic of thick felt mats.

Almost no metal work was present in the unit and this meant very little humfield screening was provided. In fact, hum levels were poorer than average and the choice of cartridge will need some care. Weighted wow and flutter was satisfactory but linear wow was on the high side at 0.21%, this measured without the mat as the felt is of slightly variable thickness. Speed was fairly accurate, but slowed a significant 0.4% under load with some overshoot after recovery due to motor suspension tension rocking. Start-up was average for a belt drive at 4.5 seconds.

Rumble levels were just satisfactory for the price averaging – 71dB DIN. Spectrum analysis showed a considerable content of mains-related vibrations such as 100 and 200Hz, with 'pole harmonic' components around 200-300Hz. The bearing alone measured better than – 78dB with the motor off, however. Acoustic breakthrough was about average and the lid was found to be influential here, and results were better when was entirely removed. The plot is shown expanded by 10dB for lid up and down, the latter being preferred. Vibration isolation was also poorer than average.

The arm was well finished with very good geometry. It was easy to set up and use and demonstrated low bearing friction. Bias compensation was set to sensible levels and the cue worked well. Downforce calibration proved satisfactory. Charted for arm resonances, the design demonstrated surprisingly good control of the first headshell socket flexure at 230Hz; comparatively clean in the 300 to 3kHz range, the energy trend was rather broken up thereafter.

### Sound quality

Belying traditional assumed relationships between a number of technical parameters and sound quality, the Rega proves that a welldeveloped, subjectively-assessed balance of performance counts for more than technical excellence with regards to any one parameter. On the debit side the Rega did suffer from a modicum of programme wow, particularly on rock programme, but this was not considered serious at this price level; a mild loss of stereo depth was also noted, together with an accompanying impairment of low bass definition and evenness. Conversely it sounded 'musical' in a balanced and coherent manner. Upper bass definition was actually quite good, the midrange slightly 'warm' but well focused and the treble lively as well as transparent without the 'smear' and 'splash' evident with some cheaper turntables. Presentation of detail was considered well above average, little inferior to super-fi models in this respect.

### Conclusions

I have mild reservations concerning certain aspects of this model's lab performance but in truth the results are reasonable enough at the price, and I suspect that the cheaper *Planar 2* is equally good value. If you are very pitch-sensitive the Rega might pose problems — if not, the overall sound quality is such that it gains a warm recommendation. A good audition should confirm your decision either way.

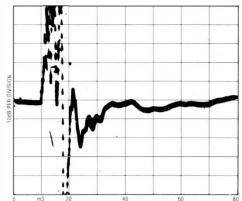
GENERAL DATA Motor Section	Integrated turntable
TypePlatter mass/damping	
Finish and engineering	very good/very good
Type of mains/connecting leads Speed options	
Wow and flutter (DIN peak wtd, sigma Wow and flutter (LIN peak wtd 0.2-6Hz	2/6-300Hz) . *0.21 % /0.45 %
Absolute speed error	synchronous/ - 0.4%
Start-up time to audible stabilisation Rumble, DIN B wtd L/R average (see s	
Arm Section	

Arm Section
Approximate effective mass, inc screws, excl cartridge16
Type/mass of headshelluniversal detachable/8.0
Geometric accuracyvery goo
Adjustments provided overhang/lateral angl
Finish and engineering excellent/very goo
Ease of assembly/setting-up/use

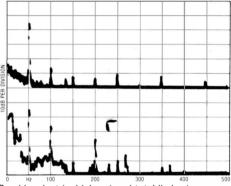
very good/very good/very good
Friction, typical lateral/verticalless than 25mg/15mg
Bias compensation methodinternal magnet
Bias force, rim/centre (set to 1.5g elliptical) 200mg/210mg
Downforce calibration error, 1g/2g 0.1g/ - 0.07g
Cue drift, 8mm ascent/descent negligible 0.5 secs/1.5 secs
Arm resonancesaverage +
Subjective sound qualityaverage+
Lead capacitance/damping method
70pF/counterweight decoupling

System as a whole

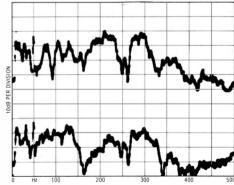
Size/clearance for lid rear4	
Ease of use	
Typical acoustic breakthrough and re	
Subjective sound quality of complete	
Hum level/acoustic feedback	
Vibration sensivity/shock resistance.	average – /good
Estimated typical purchase price	
*worsened by unevenness in thick fel	lt mat



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)

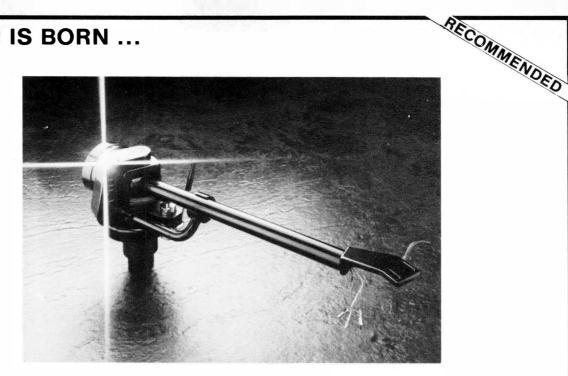


Breakthrough, lid up (above) and down (below)

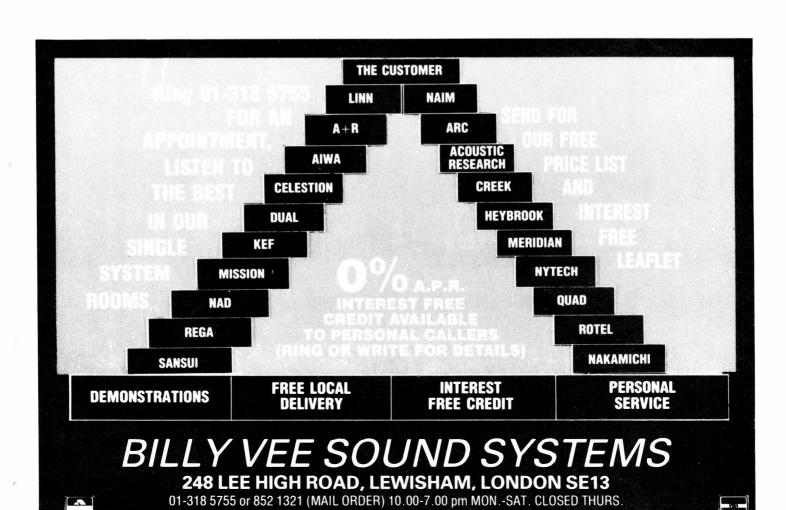
### Update

The *Planar 3* is now fitted with the Rega RB300 and costs £188. The *Planar 2* (£115) is still fitted with the Lustre-type arm as reviewed here.

A STAR IS BORN ...

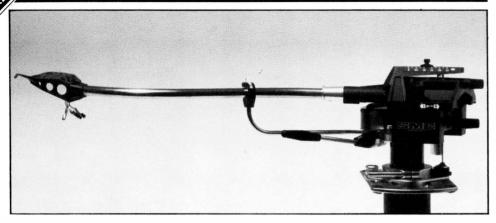


**ESOTERIC MARKETING** 23 BERRYDALE, NORTHAMPTON TEL: 411721



SME 3009 Series III(S)

SME Ltd., Stevning, Sussex BN4 3GY. Tel (0903) 814321



Features and design

This review covers the two models in the SME Series III range, with the cheaper S sharing many of the fundamental components of its more expensive brother, includa virtually indistinguishable performance. In addition to all the basic adjustments, the top price version has a rack and pinion adjustment for geometric overhand, and fine screw adjustment for both bias and downforce; the silicone fluid damper assembly, an optional extra on the S. is fitted as standard.

The main parts are constructed of carbon fibre reinforced mouldings, the arm using the traditional SME bearing combination of a horizontal plane ball race and knife edges in the vertical plane; the vertical bearing axis runs through the stylus tip to maximise downforce stability and reduce warp wow.

Although a friction-fit interchangeable arm carrier has been incorporated, the design objective was undoubtedly that of low mass. Viscous damping has been included (Soptional) to help control the high Q subsonic resonances of certain moving magnet cartridges which possess excessive compliances. A low 5.0g effective mass has been achieved by using a damped thin wall nitride-surface-hardened titanium arm tube, with a vestigial reinforced plastic cartridge platform/shell. Unfortunately this headshell is so small that some of the longer bodied cartridges produce a very tight fit. In addition, very little support is provided ahead of the fixing screws. These are made of plastic to reduce mass, but consequently cannot be done up tightly - the reverse of the thinking behind the Mission. Syrinx and Linn etc. designs, which stress tight cartridge fixing. SME do however provide some bituminous mastic to help couple the cartridge to the headshell.

Improvements have been made to the cartridge wiring tags, which were previously rather too stiff and easily broken off the wires during fitting. An increased mass option has recently been made available to give better matching with lower compliance cartridges, comprising accessory mass loading plates for the headshell which can be added as required: two are in fact supplied, weighing 4.4 and 2.2g. The augmented effective mass including steel fixing screws works out at 12g, and the combination is suitable for cartridges down to 8cu. At the other extreme, and in conjunction with mild damping (we believe that SME's damping recommendations excessive), models up to 60cu can be accommodated without the ballast weights.

The new black finished (B) versions of the arm also incorporated revised geometry. SME have increased the versatility and geometric performance by the simple expedient of adding some accessories to a new version of the carrier arm CA1. These include the established mastic mounting compound. to be placed between cartridge back and arm; a properly fitting type '3818' ballast weight which approximately doubles the

effective mass to 10g inclusive of screws. plus a return to aluminium mounting hardware. Carbon fibre reinforced nylon screws are also provided as standard, the final accessory being a revised two point alignment protractor to go with the new geometry, the latter a small revision to offset angle. This is necessary since the SME carrier has single hole fixings, and only overhang can be adjusted, this via the pillar base slide. The headshell has been slightly enlarged and strengthened to give more space for the deeper cartridges and a broader base for mounting.

### Lab results

Demonstrating excellent geometric accuracy, a full range of adjustments was provided, including tilt, which is awkwardly set by a friction lock on the headshell and requires much trial and error. Bearing friction was excellently low, and on our sample measured below 10mg in both planes. As in previous issues we found the bias settings were excessive by about 50%, but this can easily be compensated, while downforce also tended to be several percent on the low side. The cue descent was too slow at 4 seconds for a 8mm drop; one second is ample and minimises record damage when cueing on music tracks.

We found that when damping was applied was recommended, stereo image stability suffered due to excess forces being applied to the stylus on mild low frequency record warps in the 0.5 to 4Hz range; minimum damping thinned by 30% of dilulent stabilised the most severe resonance combinations successfully. In fact many cartridges worked well without damping.

The resonance characteristics in the audio range were fairly well damped but very complex. The arm was retested with the ballast weight, this condition suitable for low to medium compliance cartridges, particularly moving coil types. On most mechanical and measured parameters the performance was very good. Bias compensation appears to have been reduced to more realistic levels compared with previous samples, but the cue descent rate remains a trifle slow.

The complexity of the arm resonance plot reflects the pivot design and the large number of attached mechanical components.

**Sound quality** 

This arm was characterised by a 'soft' balance. with a subjectively subdued treble. Coloration was comparatively low and the

overall sound pleasantly relaxed. Stereo imaging was to a good standard and the bass register reasonably detailed and extended. Low compliance moving coils gave guite good results with the ballast. although some loss of transient precision and focus was evident when compared with the top class higher mass competition. The arm was at its best when used with more compliant cartridges that made less demands in terms of rigidity.

Placed the in 'good' category, the latest Series III was felt to offer an improved performance with moving coil cartridges as the bass felt more extended, with better detail and articulation. The heaviest possible counterweight helps matters here. The mid had the usual, slightly bland, 'rich' characteristic of the III, and the treble did not sound as clear or well localised as some more recent tonearms, although admittedly the latter are usually much more expensive. A mild loss of stereo depth and immediacy was also observed.

### Conclusion

Despite the higher effective mass option. this finely made and exceedingly versatile arm is not really suited to top moving-coil cartridges possessing lowish compliances. However it remains one of the best low mass tonearms at its price, and may be aligned to a high state of precision; the optional capacitance loading is a further advantage, though the lead-out cables are still rather stiff for subchassis turntables, but can easily be changed.

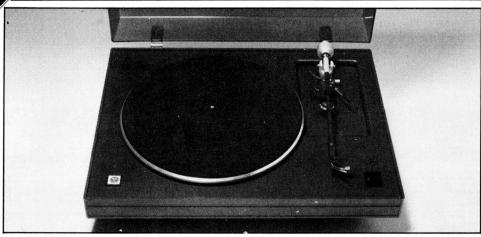
On ground of its respectable sound quality and high versatility with excellent finished and construction, not to mention the fine written instructions, the III continues to qualify for recommendation in its latest form.

### **GENERAL DATA**

Tonearm Approximate effective mass, inc screws, excl cartridge..... Type/mass of headshell ..... detachable carrier Geometric accuracy ..... Adjustments provided.,,,,,,, tilt/overhang/height Finished and engineering ..... excellent/very good Ease of assembly/setting-up/use..... good/good/good Friction, typical lateral/vertical . . . . . . . 5 mg/less than 5 mg Bias compensation method . . . . . . thread and weight Bias force, rim/centre(setto 1.5g ellliptical)... 150mg/150mg Downforce calibration error, 1g/2g....-0.05g/none Cue drift, 8mm ascent/descent....none, 0.9 secs/3.9 secs Arm resonances....good Subjective sound quality....good Lead capacitance/damping method......280(\*75)pF/none Estimated typical purchase price . . . . . £120(III) £90(IIIS) ★See text

305S(M)

Strathclyde Transcription Developments, Midton Road, Howwood, Renfrewshire PA9 1AQ. Tel (05057) 5151



### Features and design

The 305 M was the first and more costly version of this motor unit to be released some years ago now, comprising a two-speed belt drive with a four-spring subchassis. It exhibited a high standard of plinth construction and finish commensurate with its price range, but STD also found it possible to produce a less expensive version by economising on externals yet retaining the essential mechanics. This is designated the 305S, and uses a heavy, moulded black plinth.

Rather light in construction, the subchassis is Conclusion heavily damped by bituminous cladding. Levelling and adjustment requires the removal of the bottom cover as well as the setting of the four spring tensions to produce a clean, 'free' movement. The lid is of heavy gauge and non-resonant plastic, mounted on friction hinges.

### Lab results

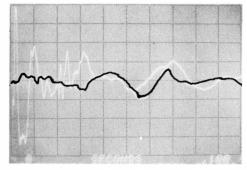
Weighing 2.0kg, the flat alloy platter is fitted with a felt mat that provides reasonable disc support. Two disc impulse responses were tried and are presented for comparative purposes, one with the mat as supplied and the other with the Audio Ref mat substituted; note that the latter did not affect the low frequencies, the disturbance here being due to platter rocking. At 0.07%, combined wow and flutter was very good, as were the rumble results although the spectrum analysis did reveal some spurious components around -80dB. Speed error and torque were both good, and both acoustic and vibration isolation were fine: in this instance the acoustic results were taken with the lid shut, using an Audio Ref mat.

### Sound quality

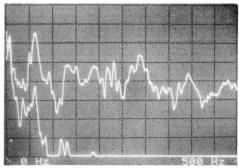
In its price class the S was undoubtedly capable of a high sound quality. The benefits of negligible motor imperfections, good resistance to feedback, and the isolated nature of the disc platform were reflected in the precision of the stereo staging, good detail and depth rendition, an extended and fairly even bass, and a general lack of 'muddle' which is an unfortunate feature of the majority of plinth plus feet turntables.

While the M remains worth considering, the S can be confidently recommended as providing good value for money. The shock resistance achieved by some foam damping in the springs. is a little better than for other competing subchassis models, and this might be a particular factor in its favour under certain circumstances.

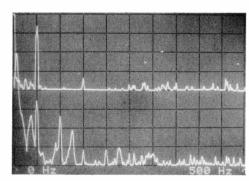
GENERAL DATA Motor Unit
Typebelt drive
Platter mass/damping2kg/good
Finish and engineeringgood/good
Type of mains lead/connecting leads
Speed options
Wow and flutter (DIN peak wtd sigma 2)0.07%
Wow and flutter (LIN peak wtd0.2-6 Hz/6-300 Hz)0.11%/<0.06%
Absolute speed error +0.25%
Speed drift 1 hour/load variation synchronous/ -0.35%
Start up time to audible stabilisation
Rumble: DIN B wtd L/R av (see spectrum)75/-76dB
Size/clearance for lid rear 47.5(w) x 36.5(d) x 15.5(h)/5.5cm
Ease of usefairly good
Typical acoustic breakthrough and resonances very good
Subjective sound quality of complete system very good
Hum level/acoustic feedback very good/very good
Vibration sensitivity/shock resistance very good/fairly good
Estimated typical purchase price£170



Disc impulse: black Audio Ref mat: white. STD felt mat (X10).



Rumble (0-500Hz lin): above, electrical only; below, total.



Breakthrough (0-500Hz lin): above, acoustic: below, vibration.

Demonstration

Available

### Technics SL7, SL10, SLDL1, SLQL1,

National Panasonic (UK) Ltd, 300-318 Bath Road, Slough, Berks SL1 6JB Tel Slough 34522



This range of Technics turntables has so many common factors in engineering and in component elements that it is logical to assess them as a group. The first model was the SL10, an extraordinarily compact and ingenious integrated player of superb external appearance. However, it proved hard to manufacture, and furthermore Technics underestimated demand for the product. Accordingly a year or so ago they introduced a companion model of virtually the same dimensions with an essentially comparable performance called the SL7. An improved microprocessor plus rationalised motor and control circuitry allowed a massive reduction in components as well as easier construction, resulting in a 30% price saving. Since then the SL7 design has been widened and stretched physically to match normal component and rack dimensions. producing the SLQL1 and the cheaper SLDL1. At the top end of the range, the SL10 has been supplemented by the SL15, which has additional track selection facilities, allowing the choice of any track in any order via a numbered array of pushbuttons. The successful incorporation of this complex additional feature within the limited space of the SL10 frame is something of an achievement.

The major component that all these models have in common is the basic tonearm from the *SL10*, a parallel tracking device built into a heavy set of precision castings. On the '10 and '15 the casting is continued to form the entire lid, while the other models have transparent front lid

sections, comprising plastics mouldings of a far heavier grade than usually fitted to turntables. A lid-mounted tonearm is admittedly sensitively located, but the exceptional rigidity and weight of the lids has proved to be beneficial for acoustic isolation and feedback immunity.

Cartridges of above average quality are fitted. and use a special fixing which gives a low effective mass total of 9g, ensuring good mechanical compatibility for the arm/cartridge subsonic resonance (10-12 Hz). Physically completely symmetrical, the tonearm is based on a precision optical angle sensor which detects errors from the tangent in the arm as it tracks, holding any error to +0.1 of a degree, which is many times better than for an offset fixed pivot arm. The arm has a reasonably rigid rectangular metal tube beam, with quite strong bearings and miniature four-point gimbal ball races. A variable rate micro-motor energises the leadscrew drive, and manual cue traverse at two speeds are provided according to the pressure exerted on the pushbuttons. Spring loading for downforce gives good dynamic balance, and with the lack of bias requirement endows the arm with a higher shock resistance than conventional models.

All the turntables are fully automatic and fitted with protection devices, for example to cue up the arm instantly when the lid is moved or lifted. Small slots in the mat/platter allow the lidmounted LED lamps to activate sensors underneath, detecting record size and setting speed/cueing-position. Manual override is however

possible, for example for a 45rpm 12 inch disc, and a repeat play function is also provided.

All the models are powered by Technics direct drive motors – quartz-locked with two fixed speeds except in the case of the cheaper *SLDL1*, which has a mains stroboscope plus fine speed control *via* a thumbwheel on the front section of the plinth, instead of the quartz reference. The basic controls of all models may be operated with the lid shut, and no additional clearance need be provided at the rear to accomodate lid elevation. A common constructional feature is the heavy/inert baseplates of either mineral-loaded plastics mouldings or of cast metal, and the units are supported on four steel coil spring feet with rubber damping inserts.

### The cartridges

The cartridges fitted range from a special version of the 305MC moving-coil model in the SL10 (which has an integral and switchable movingcoil pre-amp and can thus accept moving magnet alternatives), to the good quality moving magnet fitted to the 'DL1. A top quality moving magnet model is fitted to the SL15, being a version of the Choice recommended EPC205 IIIL, while the SL7 uses a P202, which also has many similarities to the '205, including the hollow boron cantilever, the low inductance generator giving wide electrical bandwidth and good tolerance of loading, plus a top quality naked elliptical diamond stylus. A slightly different version is fitted to the SLQL1, the cantilever carrying a shank-mounted elliptical tip (EPS22ES), which can be replaced by the EPS-22ED (EPS 202ED) stylus of the SL7 if so desired at a later date.

A *P23E* model is used for the *SLDL1*, still employing the broad electrical bandwidth generator, and tracking at a 1.25 kg downforce as all the models do quite comfortably. But here the output is a little higher than before, and the cantilever uses an aluminium micro-tube fitted with a shank-mounted elliptical tip.

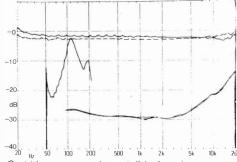
All the cartridge masses are identical, and hence are interchangeable without any necessary readjustment. In addition Ortofon have now built a compatible version of one of their own 30 series, though appropriate electrical loading should be applied here to give the best results.

### Lab results

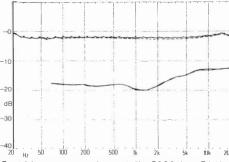
Not every unit in the range has been tested, but key models have been evaluated which are generally representative of the group as a whole.

### SLDL1

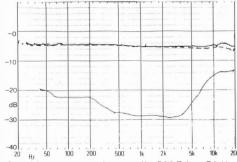
The *SLDL1* delivered an excellent mechanical performance with high torque, overshoot-free, with low drift and negligible wow or rumble. The arm performed well, judged largely by the fine stability and tracking performance of the supplied



Cartridge response/crosstalk/subsonic resonance raised (X decade): P202ED (on SL7).



Cartridge response/crosstalk: P202 (on QL1).



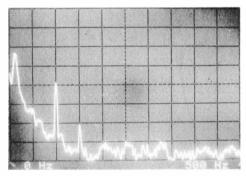
Cartridge response/crosstalk: P23E (on DL1).

cartridge at a 1.25g downforce. (See *SL10* trace for the arm audio band resonance behaviour). The subsonic resonance was near ideal at +8dB, 10Hz, while acoustic and vibration isolation were both very good above 100Hz, though the latter showed some deterioration at lower frequencies. The disc impulse transmission photos could not be taken, but platter damping was quite good, and all the models were fitted with a sensibly flat rubber mat possessing satisfactory absorbtion properties.

continued overleaf

Integrated Turntable

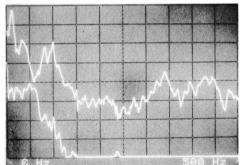
Motor Section
Type direct drive, parallel tracking, automatic Platter mass/damping. 1.4kg/good Finish and engineering very good/very good Type of mains lead/connecting leads. 2 core/phonos + earth Speed options. 33/45rpm Wow and flutter (DIN peak wtd sigma 2) <0.05%. Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz) 0.1%/<0.06% Absolute speed error . 0.1% Speed drift 1 hour/load variation. 40.1%/<0.1% Start up time to audible stabilisation approx 1.6secs Rumble DIN B wtd L/R av (see spectrum)77dB
Arm Section
Approximate effective mass. excl cartridge approx 3g Type/mass of headshell. plug in cartridge, special type /N/A Geometric accuracy. excellent Adjustments provided downforce Finish and engineering both very good Ease of assembly/setting up/use excellent/excellent/excellent Friction: typical lateral/vertical. N/A Bias compensation method. not required Bias force: rim/centre (set to 1.5¶ elliptical). N/A Downforce calibration error 1g/2g. N/A Cue drift/8mm ascent/descent. negligible/0.5sec/1.0sec Arm resonances. N/A (see \$L10) Subjective sound quality (complete unit). good Lead capacitance/damping method. N/A/none System as a whole
Size/clearance for lid rear 43.0(w) x 35.0(d) x 8.8(h)/0cm
Ease of use
Typical acoustic breakthrough and resonances very good
Subjective sound quality of complete system good
Hum level/acoustic feedbackvery good/very good



Vibration sensitivity/shock resistance..... average +/very good

Estimated typical purchase price.....

Total rumble via lacquer, SLDL1/SLQL1.



Breakthrough SLDL1/SLQL1: above, acoustic; below, vibration.

The good tracking properties of the cartridge have already been mentioned, and to this must be added an above average distortion performance as well as the good frequency response/separation characteristics printed here. The channel balance was very good, the response ±1dB 20Hz-16kHz, and the separation, typically -28dB in the midband, still measured well at 10kHz.

### SLOL<sub>1</sub>

Very similar to the 'DL1, the QL1 showed the benefit of its quartz lock in higher speed accuracy. The sample of P202 cartridge supplied produced a very well balanced and uniform response, but gave disappointing midband separation of under 20dB. The results with a second sample as fitted to an SL7 can be seen from the appropriate curve, where a rather better result was obtained, but on this occasion the cartidge demonstrated poorer channel balance. It should be noted that the cartridges do appear to have an element of sample variability, though this is by no means confined to Technics' models.

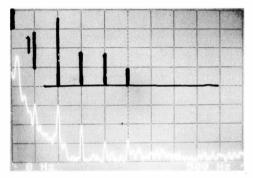
### SL7

All these turntables had to be measured for rumble using a lacquer acetate test disc, rather than the more sensitive rumble bridge employed where possible elsewhere. Nevertheless the indications were of a DIN B weighted figure better than -76dB, and I have no reason to doubt the spec of -78dB given for all models and applicable to the *SL*-7. The rumble spectrogram compares pure electrical breakthrough with the total rumble including disc charted below, and no pole switching harmonics can be seen – a tribute to the slotless full-wave current-controlled motor.

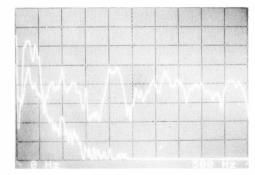
GENERAL DATA	Integrated Turntable
Motor Section	
Type direct drive, paral	lel tracking, automatic
Platter mass/damping	
Finish and engineering	very good/very good
Type of mains lead/connecting leads2	
Speed options	<0.06%
Wow and flutter (DIN peak wtd signia 2): Wow and flutter (LIN peak wtd0.2–6 Hz/6–300	
Absolute speed error	
Speed drift 1 hour/load variation	<0.01%/<0.01%
Start up time to audible stabilisation	approx 1 3secs
Rumble: DIN B wtd L/R av (see spectrum	better than -76dB
Arm Section	
Approximate effective mass inc screws, excl Type/mass of headshell	cartridge approx3g
Geometric accuracy	
Adjustments provided	
Finish and engineering	very good/very good
Ease of assembly/setting up/use	
Cue drift/8mm ascent/descentne	
Arm resonances	
Subjective sound quality	
Damping method	none
Size/clearance for lid rear31.5(w)	x 31 5(d) x 6 5(h)/0cm
Ease of use	
Typical acoustic breakthrough and resona	inces very good
Subjective sound quality of complete syst	em good
Hum level/acoustic feedback	very good/very good

Vibration sensitivity/shock resistance....average +/very good Estimated typical purchase price......£200

A +10dB resonance at an ideal 11 Hz was recorded for the arm/P202 cartridge combination, but channel balance was slightly erratic: 1dB out at low frequencies, it was matched at 7kHz and then diverged above 10kHz to a maximum of 1dB, 15kHz, so the frequency balance of the two channels will be slightly different. Fine stereo separation was recorded – still 22 dB, 10kHz, and approaching 30dB in the midband. The cartridge proving to be an excellent tracker with low distortion evident throughout the tests.



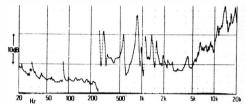
Rumble via lacquer disc (0-500Hz lin).



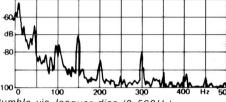
Breakthrough (0-500Hz lin): above, acoustic; below, vibration.

### **SL10**

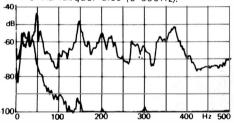
Overall the performance of the *SL10* can be seen to be similar to the other models in the group, though one detail difference was noted, in that the power level and speed of the arm tracking servo-motor was higher than for the later turntables in the series. Very critical listening involving relatively quiet, clean programme such as solo piano showed a trace of arm-drive rumble, which proved undetectable with the *SL7* arm and those of its companions, due to their slower and hence quieter arm motors.



Structural arm resonances, audio band.



Rumble via lacquer disc (0-500Hz).



Breakthrough (0-500Hz lin): above, acoustic; below, vibration.

## GENERAL DATA Integrated Turntable Motor Section Type. direct drive. quartz, parallel tracking Platter mass/damping N/A/good Finish and engineering both excellent Type of mains lead connecting leads. 2 core/phonos + earth Speed options. 331, 45rpm Wow and flutter (DIN peak wtd sigma 2). < 0.045% Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)

<0.16%/<0.048%
Absolute speed error
Speed drift 1 hour/load variation quartz lock/none
Start up time to audible stabilisation approx 1.2secs
Rumble: DIN B wtd L/R av (see spectrum)
Arm Section
Approximate effective mass inc screws excl cartridge 4g

Approximate effective mass inc screws, excl cartridge 4g
Type/mass of headshellnone/N/A
Geometric accuracy excellent
Adjustments provided downforce
Finish and engineering both excellent
Ease of assembly/setting up/use excellent/excellent
Friction: typical lateral/vertical
Bias compensation method not required
Bias force: rim/centre (set to 1.5g elliptical) N'A / N/A
Downforce calibration error: 1 g/2 g N/A/ N/A
Cue drift/8mm ascent/descentgood/1.0sec/1.2secs
Arm resonances
Subjective sound quality good
Lead capacitance/damping method N/A/none

System as a whole
Size/clearance for lid rear 31.5(w) x 31.5(d) x 8.8(h)/none required
Ease of useexcellent
Typical acoustic breakthrough and resonances very good
Subjective sound quality of complete system good
Hum level/acoustic feedbackvery good/very good
Vibration sensitivity/shock resistance above average/very good

continued overleaf

Similar results for acoustic and vibration isolation were achieved, and the 305MC cartridge proved to be a good performer, providing a ±0.3dB response from 40Hz to 11kHz, with 30dB separation between 100Hz and 10kHz. Trackability and distortion performances were both very good, though towards the frequency response extremes (20Hz and 20kHz), a 3dB lift occurred, and in this area the moving magnet alternatives are rather smoother.

### Sound quality

A 'generic' sound quality was exhibited by all these turntables, but there were differences between the models which are worth discussing.

As a group feedback levels were low and shock immunity good, while the bass registers were above average, though not quite as clear, firm or even as the manual subchassis models in similar price ranges. Stereo presentation, image stability and detail were all well above average, but on coloration grounds the models appeared



a trifle 'hard' and 'forward' in the midband, if not unduly so. The frequency balance gave an 'open' and 'lively' effect, with good clarity in the treble, and the overall impression was of a 'light' and 'lively' balance.

Of the less expensive models, the *SLDL1* was preferred, giving a more pleasant and relaxed performance than the *SLQL1*, which seemed a trifle 'edgy'. The *SL7* was better still, giving improved detail, and it was also found to sound better than the original *SL10*. Trial fitting of the 'luxury' cartridge option '205*III* produced further depth, refinement and detail in the *SL7*.

### Conclusions

All models set high standards in terms of complete integrated players. The *SLDL1* offers fine value for money and may be confidently recommended. Little advantage would appear to be gained from the more costly *SLQL1*, which was still good but is less competitive.

Bar the remarkable SL10 styling (in which respect I feel the SL7 is inferior), the latter supercedes the '10 in all other respects, and is excellent value at nearly £100 less than the '10. The latter still remains a fine 'buy' in its own right, and if the styling is paramount and the auto track programming important, then the more costly SL15 provides both, as well as the updated features of the '7 and Technics' best possible cartridge option. However, in strict hi-fi terms it cannot be said to offer such good value at around £400.

### **Update**

The SL10 and related SL15 model are now discontinued. Because the measurement programme relied heavily on data from these units to give a fully rounded view of the still current SL7, SLDL1 and SLQL1 models it was decided to include all information relating to these now discontinued models.





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### Thorens TD166 II

Cambrasound Ltd. Britannia Road. Waltham Cross. Middlesex EN8 7EF Tel Waltham Cross 716666



Originally popular a number of years ago the 166 has been revised and reintroduced after a long absence. On the face of it, this would appear to be quite a competitive product: for under £120 a good quality, well adjusted tonearm is provided, fitted to a true subchassis belt-drive deck.

The arm uses the Thorens detachable wand system offering a low effective mass in the region of 5-6g, and suited to medium to high compliance cartridges. Calibrated adjustment is provided for downforce and bias compensation while plinth mounted, shock-free cueing is built-in. Only manual operation is provided. and the plinth and hinged lid are rather resonant; in practice this is immaterial since the player components are isolated on the springsuspended internal sub-chassis. A generous cast machined platter is fitted with a main bearing of satisfactory quality. Power is supplied by a slow-speed synchronous motor via a compliant belt. The old-style Thorens mat is used for this economy model, but it could easily be updated by a felt or other type.

### Lab report

While a promising 2.5kg platter is fitted, the disc impulse response was uninspiring with considerable post impulse ringing; a good mat Used as supplied, the sound quality was rather would help matters here considerably. Finish and engineering were generally guite good and two speeds are provided with a good mechanα ical changeover. Weighted wow and flutter was

very good, though some mild pure wow was noted. The 166 ran 1.4% fast, which might just be noticed by a someone with absolute pitch acuity, but showing under load was negligible. Rumble was above average at -72dB, DIN weighted, and nothing untoward was evident from the spectrum analysis. As it should, the 166 rated as good on both acoustic and vibration isolation, while hum levels were moderate, feedback resistance well above average, and shock resistance fairly good.

The arm showed good geometry and was adjustable in all planes, which is unusual at this price level. As in the past, I found the Thorens system for cartridge fixing awkward but otherwise the arm was easy to set up and use. The bearings provided very low friction levels and bias compensation was in the right ratio if slightly low, while the cue operation was fine. Experiments with the arm resonances revealed a significant improvement in sound with the finger lift cropped to about one third its original length, or even removed altogether. Curtailing the lift meant that the 400Hz resonance then disappeared, and that at 500Hz was moderated.

### Sound quality

special for the price. It portrayed dynamics well and demonstrated worthwhile stereo depth and space, proving to be quite detailed and articulate throughout the frequency range.

The bass was quite good with a surprisingly stable tempo and drive. Substitution of a better mat and altering the finger lift gave greater clarity and smoothness.

### Conclusion

The 166 is unhesitatingly recommended. For the price it offers a good arm, a stable motor drive, good environmental isolation and a well balanced performance. The sound quality is well above the general competition, and furthermore the arm's low mass and high sensitivity allow the use if quite delicate higher compliance cartridges while still working well with medium compliance types.

GENERAL DATA	integrated turntable
Motor Section	-
Type manual, belt-drive, synch	ronous motor, subchassis
Platter mass/damping	2.5kg/poor
Finish and engineering	good/good
Type of mains/connecting leads	2-core/phonos and earth
Speed options	33/45 rpm
Wow and flutter (DIN peak wtd, sigm	a 2)0.08%
Wow and flutter (LIN peak with 0.2.6)	17/6300Hz) 0.15%/0.06%

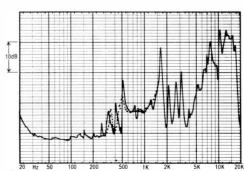
Absolute speed error....+ 1.4% Speed drift, 1 hour/load variation.....synchronous/ - 0.18% Rumble, DIN B wtd L/R average (see spectrum)..... - 72dB

### Arm Section

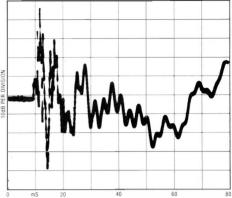
Approximate effective mass, inc screws, excl cartridge...6.0g Type/mass of headshell......detachable carrier Geometric accuracy . . . . . . . . . . . . . . . . . . very good Adjustments provided ..... overhang/offset/height Adjustineits protection from a good/good Ease of assembly/setting-up/use. good/fair/very good Friction, typical lateral/vertical.....less than 5mg/10mg Bias compensation method.....pulley
Bias force, rim/centre (set to 1.5q elliptical)....150mg/150mg Downforce calibration error, 1g/2g..... .. - 0.2g/none Cue drift, 8mm ascent/descent.....none, 0.8 secs/3.1 secs Subjective sound quality.....average + Lead capacitance/damping method 240pF/counterweight decoupling

### System as a whole

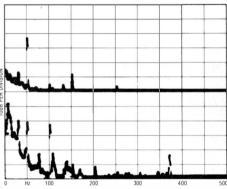
Ease of use ......very good Typical acoustic breakthrough and resonances ...... good Subjective sound quality of complete system . . . . . . . good + Hum level/acoustic feedback.....very good/good Vibration sensivity/shock resistance.....good + /fairly good Estimated typical purchase price.....£115 \*with fingerlift as supplied - see text



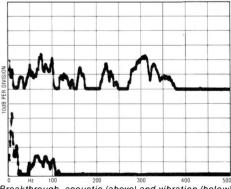
Structural arm resonances, audio band



Disc impulse transmission showing damping



Rumble, electrical (above) and total (below)



Breakthrough, acoustic (above) and vibration (below)

Charts above characterise general turntable behaviour. See text for commentary on these results.

Thorens TD147

Cambrasound Ltd. Britannia Road, Waltham Cross, Middlesex EN8 7EF Tel Waltham Cross 716666



In essence the TD147 comprises a development of the upmarket 160S, with a fitted Thorens tonearm based on the TP16 detachinclusion of some semi-automatic facilities.

A substantial thick chipboard plinth is provided for the 147, the review sample being mahogany veneered. A lever control is fitted for speed change, with another for remote arm cueing. Thorens have used a new motor for this model, a low voltage (16V) 16-pole synchronous type, and the accompanying miniature transformer is fitted into the supply cable to reduce cartridge hum induction.

inner chassis a reinforced light steel pressing suspended on three adjustable coil springs. The large zinc alloy platter is belt-driven at two fixed speeds and is fitted with a pulley clutch to improve start-up. The low mass arm has precision bearings with spring downforce and frictionless magnetic bias compensation.

### Lab report

Weighing 3.5kg, the accurately-machined platter came fitted with a reasonably flat mat affording fairly good disc damping. The unit Sound quality was well engineered and finished, with a substantial and well-toleranced main bearing. All readings for wow and flutter were to a good standard, the speed accuracy being satisfactory and the slowing under load of moderate

- 80dB with the spectral analysis revealing very little spurious effects.

Acoustic isolation edged into the very good able-carrier wand system, and allowing the class while vibration energy was also well rejected. Shock resistance was satisfactory but feedback margins were up with the best. Hum levels were low and the unit was easy to use, unlike many sub-chassis types.

Arm bearings were commendably free of play yet provided low friction levels. The bias compensation worked well though the readings were somewhat on the low side. Downforce calibration was accurate at the higher settings, while the cue operated at a decent The 147 is a full sub-chassis design, the rate with no drift. The arm geometry was very good overall, though height adjustment was by means of clumsy spacers; Thorens could well improve on this. Arm lead capacitance was also rather high at 240pF, and would be unsuitable for certain cartridges when added to amplifier input capacitance.

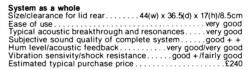
The arm resonance graph suggested quite a good behaviour with the energy trend quite well maintained, the minor modification of the springy finger lift giving a further improvement.

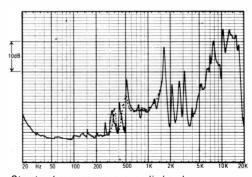
The sound was felt to present an improvement over the favourable level already established by the 166, though not anything like as great an improvment as the 2:1 price increase might suggest. Characterised by a 'tuneful stability', proportion. Rumble was quite excellent at the 147 gave good rendition of bass information with considerable detail throughout the range. The arm could sound a trifle hard and brash at times, with fair depth but slightly vague stereo focus but the addition of a felt mat, deletion of the lift and packing the cartridge to an accurately set vertical tracking angle helped considerably, and almost took the sound into the uppermost category.

### Conclusion

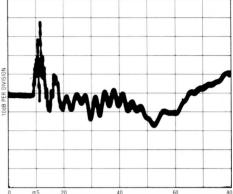
While clearly not as good value as the 166, the 147 is a fine-sounding integrated turntable of honest, well adjusted, conventional design, whose overall performance certainly warrants recommendation.

GENERAL DATA Motor Section	Integrated turntable
Type auto-stop, belt-drive, synchr Platter mass/damping	3.5kg/good
	la 2)

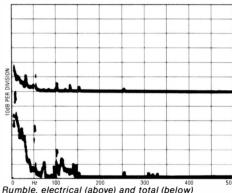


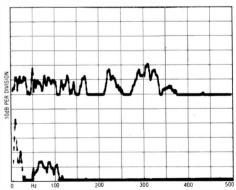


Structural arm resonances, audio band



Disc impulse transmission showing damping





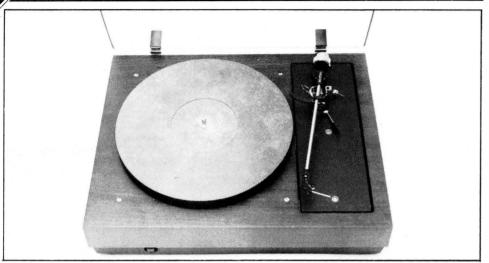
Breakthrough, acoustic (above) and vibration (below)

### Update

The TD160BC/II and TD160S models (£165 and £215) can still be recommended though our reviews of these models are not sufficiently recent to justify reprinting here.

Walker CI55

CW & J Walker Ltd., Brentwood, Red Lane, Frodsham, Warrington WA6 6RA. Tel (0928) 33326



For the last issue, a pre-production sample of the CJ55 arrived just in time to meet our deadline, but this year we were able to test a full production model. Designer Colin Walker is well known in the hi-fi industry, and with this turntable has at last brought the benefit of his two decades of product experience to bear on one of his own creations, rather than on behalf of others.

Stressing traditional design rather than pointless innovation, the unit uses an open hardwood frame for the subchassis, floating on four coil-springs whose setting is easily achieved from above. A full size rectangular arm board is incorporated. Belt driven from the usual synchronous motor, the double unit long established organic heavy engineering material called *Tufnol*, which provides an inert hard platform for the record; however additional mats can be used if so desired. The large 10mm/main bearing employs a hardened steel shaft in a plain, high strength bronze bearing, and runs on a central thrust ball. A nonresonant friction-hinged cover is fitted to the original promise. The sound quality is high traditional veneered plinth, and a full-sized arm commendable at the price — and all signifiboard is fitted. In fact as very little plastic or metal is used in its construction, in material content the '55 might be regarded as closer to a musical instrument than a piece of audio vantage of being kinder to disc undersides, but engineering!

### Lab results

The fine measured performance testified to the

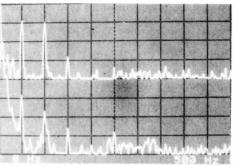
fact that no concessions have been made in important engineering aspects; even spectrum analysis of rumble failed to unearth any significant effects. Likewise the acoustic and vibration isoation were very good, although a low frequency platter rocking mode (not too serious) at about 50Hz prevented the use of X10 scaling for the disc impulse test, which otherwise gave a very good result.

### Sound quality

The new sample acquired for retest in this issue gave substantially the same good performance. Reauditioning with a Misssion 774 tonearm, this year we felt that subjectively the performance was further improved by the use platter is different in being machined from a of a felt mat which appeared to reinforce the stereo imaging and give a better-defined bass. The overall effect was still slightly 'rounded' in terms of tonal balance, and consistently musical, while pitch and tempo were well preserved.

### Conclusion

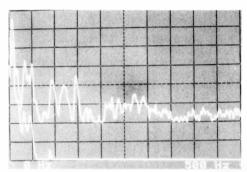
At around £150 this motor unit has fulfilled its cant aspects of its technical performance are to a respectable standard. It is worth trying it with a felt mat which has the additional adas it stands the CJ55 deserves a confident recommendation.



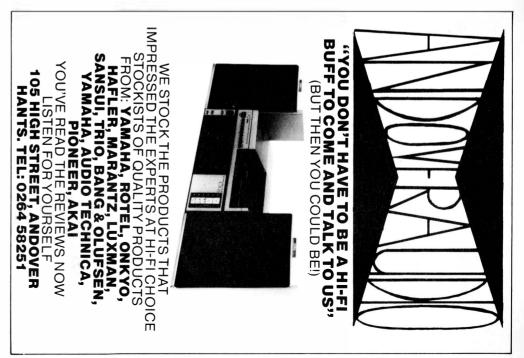
Rumble (0-500Hz lin): above, electrical only. below, total,

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Disc impulse transmission, standard X1.

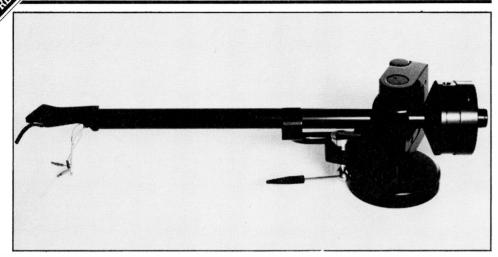


Breakthrough (0-500Hz lin): above, acoustic: below, vibration.



Zeta

Esoteric Marketing, 49 Levs Road, Pattishall, near Towcester, Northants Tel (0327) 830670



Firmly in the 'super-fi' class at close on £400. the Zeta arm is a UK-designed and manufactured product with a very business-like construction and exterior.

Finished in satin black throughout, the arm comes packed in a handmade, hinged plywood case. A fixed headshell design, rigidity is its byword, with the massive construction clearly amplifying this concept. The entire pillar/base and gimbal support is machined from a solid block and likewise the oversize beam tube is a continuous structure, running right through the bearing assembly. The headshell is free of perforations aside from the cartridge fixing slots, representing an excellent mounting platform. As in the Sumiko, those few parts which are joined are thermally bonded, thus avoiding the variability of the adhesives normally-used.

The large counterweight consists of an aluminium shell containing a series of steel weights, these being selected in combination for the required counterbalance force, then locked in position. The whole assembly may then be locked on the rear arm beam section using large socket head screws and downforce must be set using an auxiliary gauge. An internal hair-spring bias compensator is fitted, integral to the pillar housing and controlled via small knurled wheel. Uncalibrated, this needs to be set by trial and error, using a tracking test record and via listening tests.

Geometrically, the offset is at 23.75 deg in order to bring the stylus tip into alignment with

the arm beam centre line and to reduce torsional excitation. Heavily gold-plated professional connectors are used for the arm cable which has fine phono plugs at the other extremity, these also gold plated. The cable was judged to be reasonably compliant and offered a low 100pF lead capacitance.

The gimbal bearings are set virtually to tightness and employed a large number of race balls on superfinished hardened surfaces. Effective mass approaches the 'heavy' category specially suited to low compliance, high performance moving coil cartridges.

### Lab report

Estimated at 16g, the effective mass would ideally partner cartridges in the 7-14cu compliance range. The geometric accuracy was excellent, and the arm was superbly crafted and finished. Friction was satisfactorily low at 25mg in both planes, and when set to 'off', very little bias was developed. At the mid click position 200mg was noted, with 325mg at 'max' this is a very sensible control range. The cue worked well with sensibly chosen rates.

Charted for resonances, the start of the graph is low down due to the mass contribution; thereafter it is distinguished by a uniquely even energy trend. A few minor resonances are present, but do not significantly disturb the result. A trace of bearing play was noted with our sample but the designer indicated that this should be typical.

Sound quality

Immediately recognisable as a top-class product, the Zeta was most rewarding on audition. The bass was exceptionally good deep, powerful, tight and articulate. Tonal balance as slightly 'heavy' in a relaxed, unstrained fashion - full of depth, detail and sharp stereo focusing, while the treble was sweet and transparent with negligible blurring.

### Conclusion

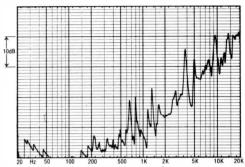
Here is another UK-built, front-rank audiophile product. Its constructional quality, finish and sound were all first rate and would satisfy the most discerning of purchasers, and while a high price must be paid for this, for many the results will justify the outlay.

### **GENERAL DATA**

Arm Section

Approximate effective mass, inc screws, excl cartridge . . 16.0g Type/mass of headshell.....non-detachable Geometric accuracy .....excellent
Adjustments provided .....height/overhang/offset Finish and engineering .....excellent/very good Ease of assembly/setting-up/use......good/good/good Friction, typical lateral/vertical......25mg/25mg Bias compensation method . . . . . internal spring Bias force, rim/centre (set to click-stop position

200ma/200ma Downforce calibration error, 1g/2g...... .uncalibrated Cue drift, 8mm ascent/descent.....slight, 0.7 secs/1.9 secs Arm resonances .....very good Subjective sound quality..... Lead capacitance/damping method......100pF/none Estimated typical purchase price.....£399



Structural arm resonances, audio band

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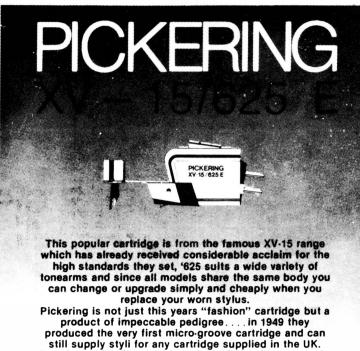
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## CARTRIDGES

The stereo cartridge or pick-up is a poorly understood and little appreciated hi-fi item. On the one hand it is difficult to grasp the tiny scale on which the cartridge operates; yet the influence it has on the system should is often taken out of all proportion.

Any cartridge works to convert physical energy into an electrical form. It should be understood that the cartridge is a passive device driven by the rotation of the turntable plater. It is that rotational energy which is modulated by the interaction between the record groove and the stylus which makes music. The linearity of the process defines cartridge quality. The cartridge is not an active part of the hi-fi system but a transducer of one form of energy into another.

### Scale

To understand the importance of stylus profile, polish and mechanical integrity, it's important to have an idea of the scale of the micro world in which the stylus operates. Imagine the V shape made by your hands when you put your wrists together. If that were the cross-section of the LP groove then the stylus which would track such a groove would be over a metre in diameter and over three metres high! The cantilever attached to such a stylus would be three metres in diameter and would have its pivot point in the cartridge body some 50 metres away!

Principle of operation

The cartridge is a form of electrical generator or dynamo; it generates electricity from movement. So the moving element may be a magnet near a fixed coil (magnetic), a coil moving near a fixed magnet (moving coil); or a piece of magnetic material moving near a fixed magnet near a fixed coil (induced magnet). The electrical properties of magnetic and induced magnet cartridges as opposed to the typically lower output moving coil type are covered on the facing page.

The sharp end

Stylus tip design must match as closely as possible the profile of the cutter which produced the record groove. Only by being able to track the path of the cutter closely can the stylus extract from the record groove what the cutter put in.

The last decade has seen a tremendous increase in the sophistication of stylus profiles in order to get more from record grooves over a wider

dynamic range without producing more surface noise.

The simplest stylus is the spherical or conical tip. This stylus looks like the tip of a ball-point pen and has the great advantage of being less critical about alignment than other profiles. Its high frequency tracking ability is however limited by the size of the

tip.
To overcome this limitation, stylus designers developed the *elliptical*, or more accurately *bi-radial* tip which reduces both the mass and scanning radius of the stylus. However, with the reduction in area of the stylus 'footprint' on the wall tracking weight has to be reduced in proportion, and this in turn has meant ever-higher compliances (and hence reduced arm compatibility) to maintain or improve

tracking ability. Discrete quadraphony (the now defunct CD-4 system) brought us the Shibata tip which was designed to track high frequency signals right up to 38kHz - well above the audible spectrum. With the demise of quad these tip grinds were redeployed for stereo use where their fine-line contact with the groove wall and reduced tip mass improved reproduction greatly, once the major profile had been redesigned to get the stylus point out of the groove bottom where it could otherwise track dust and produce noise. More and more manufacturers turned to 'fine line' or 'line-contact' tips which became available under a bewildering array of trade names, Aliptic (ADC), Fine Line (Ortofon), Hypereliptic (Shure), Vital (Supex). Computer modeling and high polish finish are the latest production techniques for better tips. The van den Hul tip, named after its Dutch designer, is now used successfully around the world in models by EMT, Goldring and Coral.

This last year has seen a move towards reducing the mass of diamond behind the tracking radii to produce what are beginning to be called *Micro Ridge* styli.

### Cantilever

The job of the stylus is to stay in the groove whatever the velocity or frequency of the signal being tracked. The movement of the stylus is transmitted through the cantilever, ideally made of a stiff, lightweight material, to the generator part of the cartridge. The suspension system or pivot, on which the cantilever is mounted, offers specific damping properties as well as a natural springiness. The degree of springiness is called compliance

and is what determines the compatibility of any arm and cartridge. If the mass of the tonearm as seen by the cartridge is too high for the springiness of the design, then the fundamental frequency at which the combination will want to resonate will be dangerously close to the frequencies produced by warps and ripples on the LP record. Too high a resonant frequency, and the low bass will be coloured. An ideal frequency is 12-14Hz.

### **Assessment**

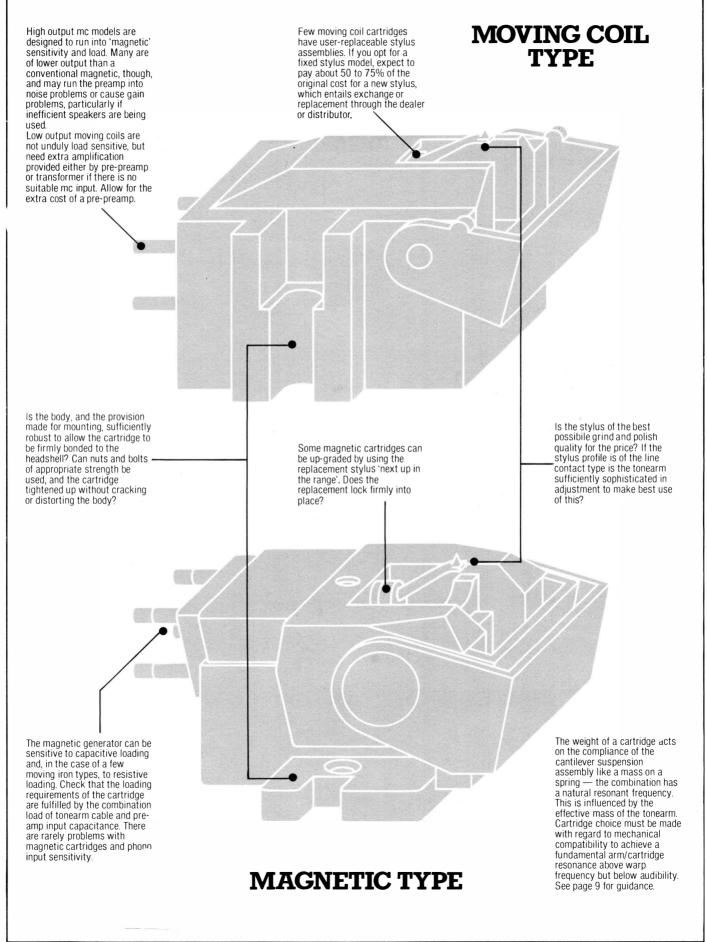
Our tests assess both electrical and mechanical aspects of cartridge. Electrically, the output is measured for a flat, or linear, frequency response; the level of output and the susceptibility of the cartridge to change its performance into different loads is also tested. In testing mechanical performance characteristics, the tracking ability, quality of stylus, compliance and any possible need for arm damping are also checked and listed in the test results with each cartridge review.

### **Maintenance**

It's worth stressing the point that once you've heard stylus wear distortion, it is too late to save the records you've just played from some damage. Microscope examination by your dealer or manufacturer is strongly recommended as is expert set-up of the tonearm and cartridge in the first instance. Use the tracking weight which secures the best possible tracking, as long as it is within the manufacturer's limits. For the hypercritical listener using a quality elliptical tip, a check every 400 hours is recommended. Line contact styli seem to last better. Moderate playing, say six albums a week, suggests an 18 month life for a fair quality stylus.

Other models worth considering It's surprising in view of the rapidly changing market for cartridges in previous years that the last year has been very quiet with only a few changes of distribution and almost no new model launches or discontinuations! Cartridges covered in the last issue in summary review form and which are certainly worthly of consideration are the Nagaoka MP20 (£37) and Nagaoka MP50 (£75) and the hyperelliptical version of the venerable Shure V15III now available at bargain prices in some stores. Sadly the Fidelity Research models are no longer available while the Best Buy Technics EPC205 IIIL (£70) becomes ever harder to track down.

### **CARTRIDGE BUYER'S CHECKLIST**



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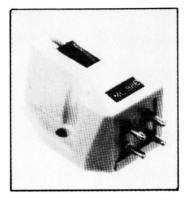
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MC88E A High Output Moving Coil for under £30.

Frequency Response: 20-60,000Hz • Output Voltage: 2.5mV 

• Channel Separation: 25dB 

• Channel Balance: 1.2dB • Tracking Force: 29g • Stylus Tip: Micro Diamond 

Load Resistance: 47kΩ

Weight: 5q ●

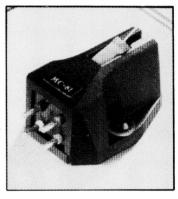
The MC88E is just what we've been waiting for. (HiFi Answers) 77

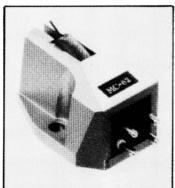
MC81 A Moving Coil Phono cartridge with "SHIBATA" stylus.

Frequency Response: 10-45,000 Hz ● Output Voltage: 0.25mV • Channel Separation: 30dB • Channel Balance: 1.0dB • Impedance: 6 Ohm, Weight: 5g • Tracking Force: 1.8 – 2.3g • Stylus Tip: Shibata •Load Impedance: 20-100 Ohms •

Bass was firm, the stereo presentation stable and to a good standard while much musical detail was in evidence. 77

(HiFi Choice review 1981)





MC82 A Moving Coil Phono cartridge with "Van Den Hul" Stylus.

Frequency response: 10-50.000 Hz • Output Voltage: 0.3mV • Channel Separation: 30dB • Channel Balance: 1.0db ●Impedance: 6 Ohms ●Tracking Force: 1.8-2.3g • Stylus Tip: Van Den Hul • Load Impedance: 20-100 Ohms • Weight: 5g •

Coral have produced a cartridge here which forces me to compare it to far more expensive units. I can only recommend that if you are looking for a cartridge in this price range – or higher – you give the MC-82 a try. (ETI March '83) "5"

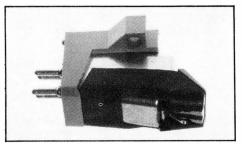
555SX and 555E MOVING **MAGNET CARTRIDGES** ALSO AVAILABLE.

CORAL



# ADC Phase I

Harman Audio UK Ltd, Mill Street, Slough, Berks. SL2 5DD Tel (0753) 76911



An inexpensive moving magnet cartridge, the Phase II is a sort of marriage of the *QLM 34* and '36 models, suited to higher tracking forces and moderate quality arms. Its lowish compliance endowed it with good arm compatibility and damping was not strictly necessary. A cheap pseudo-elliptical stylus was fitted, possessing just adequate polish — in fact, in our view ADC would have done better to fit a good quality spherical tip here.

With a smooth characteristic, the frequency response tilted gently downhill — giving a 'rounded' effect in the treble. Separation was just satisfactory, but the vertical tracking angle was close on 28° which is rather high. Distortion was quite good except at the highest frequencies, where even at a 2g downforce both the 10kHz pulsed and 20kHz noise tracks gave trouble. Otherwise trackability was fine at mid and low frequencies.

Scoring a little above average on sound quality, which is fine in view of its low price, the II showed a lack of treble precision in its splashy slurring of sibilants and cymbal transients. Tonally, it was quite well balanced and seemed pretty secure in the grooves and fine detail was presented although stereo depth was flatter than usual. These criticisms aside, the general performance and sound were sufficient at the price for Best Buy status.

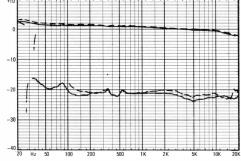
Cartridge type and weight ......induced magnet, 5.75g Estimated dynamic compliance at 10Hz 14cu(×10-6 cm/dyne) Specified downforce: 1.5 to 2.5g .....tested at 2.0g

LF resonance in test arm
(Mission 774, 5.5g me + cart) + 11.5dB at 12Hz
Sensitivity at 1kHz
Relative output (0dB = $1mV/cm/sec$ )
Subjective sound quality average plus
Recommended loading: 47kohms plus 275pF tested at 250pF
Recommended arm mass
Recommended arm dampingmarginal
Cartridge coil resistance/inductance 820 ohms/580mH
Induced hum levelvery good
Stylus type detachable, elliptical, shank mount,
spec 10 x 18 m

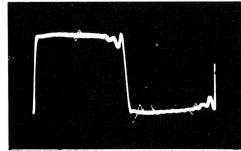
Finish and alignment . . . just adequate polish, good alignment,

50° cone angle
Tip geometry
HF resonance (tip mass/vinvl)estimated at 24kHz
Frequency response, wideband (30Hz-20kHz) + 1dB 2.5dB
Frequency response, midband (100Hz-5kHz) . + 0.5dB, - 1.2dB
Stereo separation, 100Hz, 1kHz, 10kHz 19dB, 21dB, 21dB
Channel difference, 1kHz, 10kHz 0.2dB, 0.2dB
Trackability, 300Hz vertical + 12dB
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack') 2.0g
Distortion, 300Hz vertical + 6dB
Distortion, 300Hz lateral + 9dB
High frequency waveform quality fairly good
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 3.0%

r	HF intermodulation (pulsed 10kHz, 24cm/sec peak) 1.5%
	Pink noise intermodulation,
,	12kHz, 16kHz, 20kHz
,	Typical price (inc. VAT)£20 when reviewed, now £25
1	Replacement stylus cost inc. VAT dealer will quote



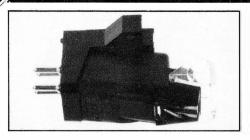
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# ADC Phase IV

Harman Audio UK Ltd, Mill Street, Slough, Berks, SL2 5DD Tel (0753) 76911



Stepping into the *XLM's* shoes, the *Phase IV* is a medium-priced model from ADC's new range, which externally at least do not appear markedly different from the old. The stylus fitted was a naked elliptical diamond specified, and measured by us, at  $8\times18\mu m$  which is larger than optimum in the minor radius. Finish and alignment were reasonably good, though the shape would have benefited from more care taken with the elliptical 'blending' process. Possessing moderate compliance, it suited low-to-medium mass arms and the need for arm damping was marginal.

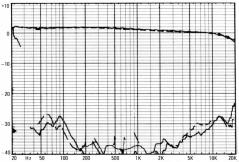
Measured with 250pF loading the response met very tight limits in the central frequency range but overall it showed a droopy treble falling by 5dB at 20kHz, referenced to 200Hz. Stereo separation was exceptionally good, as was trackability, while distortions over all the tests were within bounds. The design was well-behaved as regards all the major technical aspects.

On audition the loss of treble was noted, the output in this region also on occasion a trifle forward and grainy, but definition was promising in the bass-mid with quite good representation of stereo depth. The midrange showed a trace of veiling which detracted from the detail and immediacy present on some programme excerpts, but overall a 'good' rating was achieved, just sufficient for Best Buy status at the price.

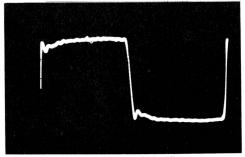
Cartridge type and weight induced manget, 5.75g Estimated dynamic compliance at 10Hz 24cu( x 10 - °cm/dyne) Specified downforce: 1.0 to 1.4g tested at 1.3g
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 11.5dB at 9.5Hz
Sensitivity at 1kHz0.85mV/cm/sec
Relative output (0dB = 1mV/cm/sec)
Subjective sound quality
Recommended loading: 47k ohms plus 275pF . tested at 250pF
Recommended arm mass
Recommended arm damping marginal
Cartridge coil resistance/inductance820 ohms/580 mH
Induced hum levelvery good
Stylus type detachable, naked, oriented, elliptical, 5 x 18 m
Finish and alignment fairly good finish and alignment,
50° cone angle
Tip geometry
The geometry is a second of the second of th

TIP geometry
elliptical, lacks 'blending'
HF resonance (tip mass/vinyl)estimated at 35kHz
Frequency response, wideband (30Hz-20kHz) + 1dB, -4dB
Frequency response, midband (100Hz-5kHz) . + 0.8dB, -0.8dB
Stereo separation, 100Hz, 1kHz, 10kHz31dB, 39dB, 29dB
Channel difference, 1kHz, 10kHz 0.2dB, 0.2dB
Trackability, 300Hz vertical + 12dB 0.05g
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack') 1.4g
Distortion, 300Hz vertical + 6dB
Distortion, 300Hz lateral + 9dB
High frequency waveform qualitygood
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 3.6%
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 1.0%
Pink noise intermodulation,
12kHz 16kHz 20kHz 18% 3.9% 5.5%

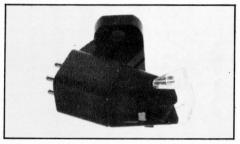
12kHz, 16kHz, 20kHz. 1.8%, 3.9%, 5.5% Typicalprice (inc. VAT) ......£43 when reviewed, now £45 Replacement stylus costinc. VAT ........................ dealer will quote



Frequency response, rel output and separation ref OdE (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)



Built in Japan to ADC's exclusive specification, the MC1.5 is a low-output moving-coil cartridge possessing a higher than average coil inductance and resistance. Active step up units are thus best suited - for example, a 470 ohms plus 10nF input. By moving-coil standards it is compliant, suiting low mass arms without extra damping as its internal damping was already rather high. A top-quality naked elliptical stone is fitted to the titanium tube cantilever.

Minor deviations were shown in the response, which demonstrated an excellent channel balance. A slight sag of 1.5dB was measured in the 2-4kHz 'presence' range, while fine stereo separation was evident throughout the range. A slight increase in downforce to 1.8g was required to negotiate the 'Supertrack' cut, but in general the trackability and distortion results were to a high standard and were well balanced. Vertical generator linearity was particularly good despite a slightly high vertical angle estimated at 28°.

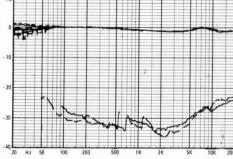
A very low tip mass was shown, with a tip mass resonance estimated at 53kHz, and the fast squarewave risetime confirmed this, as did the clear but unexaggerated portrayal of the record ringing abberation.

On the listening tests the MC1.5 achieved a respectable score, sufficient for recommendation regardless of price, and was marked well ahead of the Astrion, thereby joining the small and select group of top-ranked performers. The panel noted mild response uneveness and a trace of mid-hardness or coarseness, with some treble 'steeliness', plus a bass register lacking in ultimate control. But conversely the stereo was stable and deep. while the resolution of musical detail was most encouraging.

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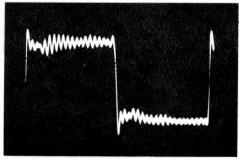
7. In-line 2000hm phono loading plugs are now provided.

Cartridge type and weight low output moving coil, 5.0g Estimated dynamic compliance at 10Hz 33cu( $\times$ 10 $^{-6}$ cm/dyne)
Specified downforce: 1.2 to 1.8gtested at 1.6g
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 6dB at 9.0Hz
Sensitivity at 1kHz
Subjective sound qualityvery good
Recommended loading: 200-1K ohms plus 100-1000 pF
tested at 250 pF
Recommended arm mass
Recommended arm damping none required
Cartridge coil resistance/inductance 90 ohms/1 mH
Induced hum levelfairly good
Stylus type fixed, oriented, naked, elliptical, spec 5 x 18 µm
Finish and alignment both very good, 55° cone angle
Tip geometry
Frequency response, wideband (30Hz-20kHz) + 2dB, -0.3dB
Frequency response, midband (100Hz-5kHz) + 1dB, -0.3dB
Stereo separation, 100Hz, 1kHz, 10kHz 28dB, 32dB, 27dB
Channel difference, 1kHz, 10kHz 0.1dB, 0.3dB
Trackability, 300Hz vertical + 12dB0.6g
Trackability, 300Hz lateral + 15dB 1. 1g
Trackability, 300Hz lateral + 18dB ('Supertrack') 1.8g
Distortion, 300Hz vertical + 6dB
Distortion, 300Hz lateral + 9dB
High frequency waveform quality fairly good Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 2.0%
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 1.0%
Pink noise intermodulation.
12kHz. 16kHz. 20kHz
Delegant styles cost in VAT dealer will sucte



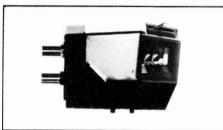
Replacement stylus cost inc. VAT.

Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewaye (ignore ultrasonic cutter ringing)

A&R Cambridge Ltd., Denny End Industrial Centre, Waterbeach, Cambridge CB5 9PB Tel (0223) 861550



This Japanese made cartridge is one of three models specified and commissioned by A&R of Cambridge. The modest mass and equally modest compliance of 23cu, together with a marginal need for damping, should provide compatibility with a useful range of effective arm masses ranging from 3 to 12g. An unusually good, UK-sourced stylus was fitted comprising a square shanked, low mas line contact 'Profiled' tip.

The frequency response was commendably flat, showing a mild droop at higher frequencies; 300-400pF loading was found to give a good result. Although uniform over the frequency range, the channel separation was nonetheless disquieting, measuring only 21dB in the midband. However A&R state that recent production is improved in this area. Distortions were well controlled, except for the mild intermodulation section where mistracking was beginning. The Supertrack itself required a 2.8g downforce, and one could expect that the '77 would occasionally be caught out on programmes at the usual setting of 1.8g. The squarewave response was quite clean, with only a mild overshoot and rounding.

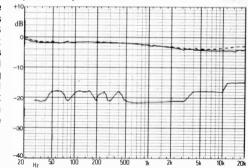
Ranked as good on overall sound quality, the '77 was described as possessing a slightly dull and smooth character. Surface noise and disc distortions were kindly handled, and the reproduction was quite detailed, but the stereo presentation was noticeably two dimensional. with depth comparatively restricted.

In conclusion this model represented quite good value, with a pleasant overall character, A well-balanced lab and subjective performance and very fine stylus tip as well as a sensible compliance and electrical matching requirement should enable it to be matched to a wide range of amplifier/turntable combinations. This design can thus be recommended. Closed mounting lugs are now provided while there have been improvements in the generator which it is claimed will improve crosstalk figures from those shown here.

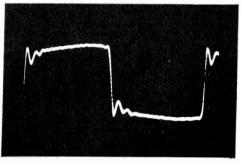
Cartridge type and mass	moving magnet, 6g
Estimated dynamic compliance at 10Hz	$23cu(\times 10^{-6} cm/dyne)$
Specified downforce: range 1.5g to 2.0g	tested at 1.8g
LF resonance in test arm	
(SME 111, 6g me + cart)	+ 10dB at 10Hz
Sensitivity at 1kHz	0.75mV/cm/sec

Delisitivity at 1812
Relative output (0dB = $1mV/cm/sec$ )
Subjective sound quality
Recommended loading 47Kohms plus 300-400pF
Recommended arm mass
Decommended arm demains
Recommended arm dampingoptional
induced num levelvery good
Induced hum levelvery good Stylus type and spec detachable naked oriented 'Profiled',
spec 6-8 × 50µm
Finish and alignment both excellent
Tip geometry essentially of stereohedron form, 8 x line µm
TIP geometry essentially of stereorieuron form, o x line µm
HF resonance (tip mass/vinyl) above 30kHz
Frequency response 30Hz-20kHz + 1, - 1.5dB
Frequency response 100Hz-5kHz±1.0dB
Stereo separation, 100Hz, 1kHz, 10kHz 18dB, 21dB, 18dB
Channel difference at 1kHz, 10kHz0dB, 0.7dB
Trackability 300Hz lateral ± 15dB,
Trackability 300Hz vertical ± 13dB,
Trackability 300m2 vertical ± 120b
Trackability 300Hz lateral + 18dB ('Supertrack')2.8g
Distortion 300Hz lateral + 9dB
Distortion 300Hz vertical +6dB
High frequency waveform quality good
Mid band intermodulation (1kHz + 1.5kHz 24cm/sec) 3.2%
Wild Daild Intermodulation (IKI 2 + 1.5KH 2 24CH/Sec) 5.276

HF intermodulation, pulsed 10kHz, 24cm/sec peak . . . . . 0.3% Pink Noise intermodulation, Replacement stylus cost inc VAT ..... £32.50



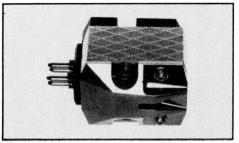
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Audio-Technica AT33E

Audio-Technica UK Ltd, Hunslet Trading Estate, Low Road, Leeds Tel (0532) 771441



The earlier AT32E was not received with particular favour but this new model, with gold-vaporised tapered beryllium cantilever, offers a great improvement, albeit at a higher cost. A moderate-compliance, low-output moving coil, it was fitted with a superb naked elliptical stylus of fine minor or scanning radius, with a low tip-mass.

Two samples were tried, the second significantly improving on the first's moderate stereo values. The frequency response showed slight anomalies, namely a slight presence suckout plus a treble bump at 11kHz, but in the midband ±1dB limits were met, while channel balance and stereo separation were both good. Tested at a 1.6g downforce, the trackability was exemplary and the AT33E sailed through all tests without fuss. Distortion was particularly good with close conformity to the ideal 20° vertical tracking angle.

Scoring an impressive 'very good' in audition, the AT33E added a slight 'bite' or 'glare' to the treble emphasising the upper harmonics of a saxophone, for example. Bass was clear and well differentiated, surface noise pretty good and stable, with precise stereo exhibiting good depth. The midrange was transparent as well as clean, and comments were in fact made by the panel concerning the low subjective distortion, in agreement with the lab findings.

Arguably the best Audio-Technica cartridge so far to appear in *Hi-Fi Choice*, the *AT33E* is well worth auditioning and is confidently recommended.

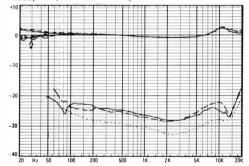
Cartridge type and weight	low output moving coil, 6.8g
Estimated dynamic compliance	at 10Hz 19cu( x 10 - cm/dyne)
Specified downforce: 1.2 to 1.8g	tested at 1.6g
LF resonance in test arm	

(Mission 774, 5.5g me + cart) + 15dB at 10Hz
Sensitivity at 1kHz
Relative output (0dB = 1mV/cm/sec) 18.8dB
Subjective sound quality very good
Recommended loading . ,
Recommended arm mass
Recommended arm dampingwould be helpful
Cartridge coil resistance/inductance 17 ohms/70µH
Stylus type fixed, oriented, naked elliptical, spec, 5 x 18µm
Finish and alignment both very good, 50° cone angle
Tip geometry
excellent finish

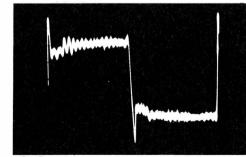
HF resonance (tip mass/vinyl)	
Frequency response, wideband (30Hz-20kHz) + 3dB,	_ 1dE
Frequency response, midband (100Hz-5kHz) + 1dB,	— 1dE
Stereo separation, 100Hz, 1kHz, 10kHz 23dB, 26dB,	24dB*
Channel difference, 1kHz, 10kHz	IB, 0dE
Trackability, 300Hz vertical + 12dB	0.9g
Trackability, 300Hz lateral + 15dB	
Trackability, 300Hz lateral + 18dB ('Supertrack')	1.5g
Distortion, 300Hz vertical + 6dB	
Distortion, 300Hz lateral + 9dB	0.14%
High frequency waveform quality	. good
Midband intermodulation (1kHz + 1.5kHz 24cm/sec)	. 3. 0%
HF intermodulation (pulsed 10kHz, 24cm/sec peak)	0.95%
Pink noise intermodulation,	

12kHz, 16kHz. 20kHz	, 4.2%
Typicalprice (inc VAT)£140 when reviewed, no	w £120
Replacement stylus cost inc VAT	:୧ସର

\*25dB, 30dB, 30dB second sample



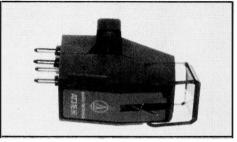
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Audio-Technica AT31E

Audio-Technica UK Ltd, Hunslet Trading Estate, Low Road, Leeds Tel (0532) 771441



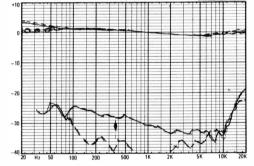
This neat and low-mass moving-coil cartridge has a detachable stylus assembly. The tapered aluminium cantilever carries a fine-quality naked orientated elliptical stone  $6.5 \times 20 \mu m$ , with a 55° cone angle and good alignment.

With some channel imbalance, the channel separation was nonetheless very good, averaging 33dB even at 10kHz. Smooth at high frequencies, the output fell gently from 50Hz to 5kHz, giving a slightly 'rich' balance, while the tip-mass resonance was a high 48kHz — this is clearly shown by the exaggerated cutter ringing in the squarewave response, although the overshoot itself was well controlled. The AT31E provided low distortion throughout with typical good vertical linearity and an accurate 20° vertical tracking angle. Trackability was itself very good, the 'Supertrack' passed at just 0.1g above the test 1.6g downforce.

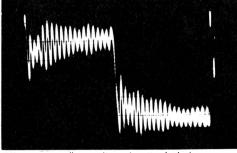
Auditioning placed this cartridge in the 'very good' category — a great result for the price. Sounding slightly rich, with a tonally rounded mid balance, the stereo image demonstrated fine detail, good depth and instrumental perspective, with definition maintained throughout the frequency range. Compared with the finest examples, a slight blurring and loss of transparency was evident but the overall effect was notably relaxed and well balanced. Audio-Technica clearly have a winner in the medium price bracket with the '31E, which is immeasurably better than its predecessor the AT30E.

Cartridge type and weightlow output moving coil 5g
Estimated dynamic compliance at 10Hz 22cu( x 10 - 6cm/dyne)
Specified downforce: 1.2 to 1.8gtested at 1.6g
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 13dB at 10.5Hz
Sensitivity at 1kHz0.07mV/cm/sec
Relative output (0dB = 1mV/cm/sec) 23dB
Subjective sound quality very good
Recommended loading
Recommended arm mass
Recommended arm dampinghelpful
October 20 commended and damping
Cartridge coil resistance/inductance10 ohms/30 µH
Induced humlevelgood
Stylus typedetachable, oriented, naked, elliptical,
spec 8 × 18μm
Finish and alignment both very good,
Tip geometry 6.5 µm x 8 µm, elliptical, good shape, 55° cone
HFresonance(tip mass/vinyl)48kHz
Frequency response, wideband (30Hz-20kHz) + 1.2dB, - 1.2dB
Frequency response, midband (100Hz-5kHz) . + 1.2dB, - 1.2dB
Stereo separation, 100Hz, 1kHz, 10kHz27dB, 35dB, 33dB
Channel difference, 1kHz, 10kHz0dB, 0.4dB
Trackability, 300Hz vertical + 12dB
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack') 1.7g
Distortion, 300Hz vertical + 6dB2.7%
Distortion, 300Hzlateral + 9dB
Distortion, Good Izlateral + Gub

High frequency waveform quality . . . . . . fair Midband intermodulation (1kHz + 1.5kHz 24cm/sec) . . . . 3.0%



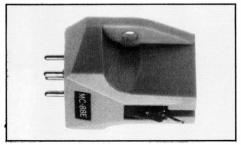
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Coral MC88E

Videotone, 55 North Street, Thame, Oxon. OX9 3BH



This budget high-output moving coil cartridge is a direct sale item, available primarily by post from the distributors, but also stocked by a limited number of dealers. Care must be taken when removing it from the awkward packaging so as not to bend the cantilever (as we did!).

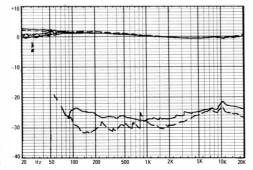
The stylus was of the shank mounted variety but was surprisingly good at the price, and contributed substantially to the performance. Compliance was fairly high, indicating the use of low-mass arms for the best results. For what it's worth, the response extended smoothly to 50kHz, reflected in the fast squarewave with the cutter ringing clearly exposed.

Frequency response in the audio band was commendably flat with fine channel balance and quite good channel separation. Lateral distortion was a trifle high but distortions were kept within reasonable bounds on other tests, and the trackability was sufficient for the vast majority of modern records. Vertical linearity was above average, with the vertical tracking angle only a couple of degrees above target.

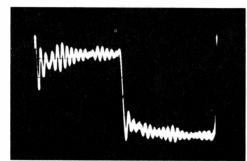
Ranked a little above average on audition — which is good for the price — the bass and midrange were presentable with stable imaging and moderate depth. The treble however represented an area of weakness, occasionally sounding strident, grainy and insecure, but surface noise was reasonably quiet. This cartridge has a lot going for it at the price, and carries our recommendation.

Cartridge type and weighthigh out	put moving coil 5g
Estimated dynamic compliance at 10Hz 29c	$u( \times 10 - cm/dyne)$
Specified downforce: 1.8 to 2.2g	tested at 2.0g
LF resonance in test arm	

Specified downlorce. 1.6 to 2.2gtested at 2.0g
LF resonance in test arm
(Missic ¬ 774, 5.5g me + cart) + 9dB at 9Hz
Sensitiv' at 1kHz
Relative output (0dB = 1mV/cm/sec)
Subjective sound quality average plus
Recommended loading47k ohms
Recommended arm mass, 4-8g
Recommended arm damping none required
Cartridge coil resistance
Induced hum level
Stylus type fixed shank-mount elliptical, spec 8 x 18µm
Finish and alignmentboth good, particularly at the price
Tip geometry 8 x 18 µm, good shape, properly blended elliptica
HF resonance (tip mass/vinyl) 48kHz ( + 3dB)
Frequency response, wideband (30Hz-20kHz) + 1dB, - 0.6dE
Frequency response, midband (100Hz-5kHz) + 1dB, -0.6dE
Stereo separation, 100Hz, 1kHz, 10kHz26dB, 28dB, 23dE
Channel difference, 1kHz, 10kHz0.1dB, 0dE
Trackability, 300Hz vertical + 12dB
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack') 2.10
Distortion, 300Hz vertical +6dB2.2%
Distortion, 300Hz lateral + 9dB
High frequency waveform qualityfair
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 3.0%
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 1.2%
Pink noise intermodulation.
i ilik ilolac iliterilloddiation,



Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Denon 303

Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG Tel (0753) 888447

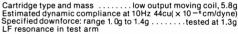


The 303 is a notable member of a new and costly group of moving-coil cartridges. A relatively low mass model at 5.8g, it has unnecessarily high compliance of 44cu, resulting in a recommendation for use with low mass damped arms only.

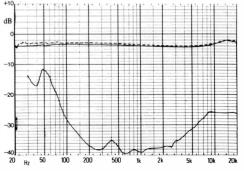
However it did produce a healthy output for a moving-coil, though still requiring a step-up device, while hum rejection was not particularly good. Tested at the recommended downforce - rather low for a m-c design - it provided exceptional trackability and distortion results on all tests, while the frequency response was virtually flat with excellent channel balance and fine geometric symmetry. The HF resonance was well out of band at 40kHz, allowing harmless display of the recorded cutter ringing on the good squarewave response. The special stylus turned out to be an excellently finished and well-mounted ½-chip oriented stone with well-swept radii of line contact form.

On sound quality it just achieved the 'very good, category, and was liked for its exceptional stereo imaging and tracking ability, while both surface noise and distortion were kindly handled. Most panelists agreed on its virtues, but for reasons not entirely understood and possibly to do with the high compliance in combination with our test arm, they did express mild reservations concerning a touch of 'vagueness' and occasional lack of firmness and definition, coupled with a tonal balance which seemed a trifle recessed in the lower treble, but slightly forward higher up.

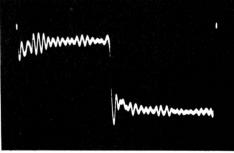
This good but costly cartridge was fussy about the choice of arm, needs a higher than average step-up impedance, and when all is said and done cannot be regarded as very good value. It will however be kind to your record collection, and does set a generally high performance standard.







Frequency response, rel. output, and separation ref 0dB (1mv/cm/sec)

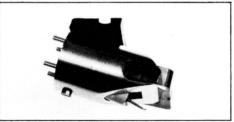


1kHz squarewave, (ignore ultrasonic cutter ringing)

# Dynavector 20A II

Logic Ltd., 19 Hurlbutt Road, Heathcote Ind. Est., Warwick CV34 6TD Tel (0926) 20302

0-4-4--



Replacement for the famous 20A, this mark two version sports a lower mass reinforced plastic body with an elliptical rather than Shibata tip. Output has been increased to a remarkable (for a moving-coil) 0.9mV, and no matching problems should occur with any preamplifier. Compliance is however high, and although damping is not required, low to medium mass arms are, 10g being the ideal maximum. The naked diamond stylus was well polished and aligned, possessing a pseudoelliptical grind but with over-polishing to provide blended elliptical radii of 8 x 29µm.

The well-damped overshoot and flat-topped squarewave confirmed the good transient behaviour and essentially flat frequency response (ignore the cutter ringing). Separation was fairly good and channel balance fine, while at close to the test 1.8g downforce it tracked almost everything bar the mid intermodulation section, which was significantly broken up. The distortion results were also good, with the exception of the lateral value which was high at 1%.

A commendable 'good plus' was achieved by this cartridge after all the panel's listening test data had been analysed. Sounding almost as flat as it had measured, the reproduction was well integrated. Generally quite stable, the stereo presentation was precise with reasonable depth, and the sound was generally transparent with a good presentation of detail. Occasionally a slight sharpness was evident — on strings for example — but it proved quite kind to surface noise and disc distortion, much more so than its predecessor.

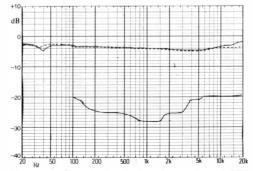
The 20AII is sufficiently advanced over the original 20A to maintain its market position, despite the higher standards dictated by the improved level of performance of the new generation of cartridges. A versatile moving-coil design, it merits recommendation and should work well with many systems, without the added complication of a high gain input or nead amplifier. Incidentally the 20BII is similar

but with a berylium cantilever, and in listening tests ranked a little below the 20AII.

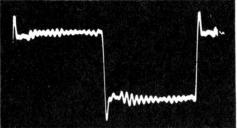
Makillana and For

Cartridge type and masshigh output moving coil, 5.3g
Estimated dynamic compliance at 10Hz 27cu(× 10 - cm/dyne)
Specified downforce: range 1.6g to 2.3g tested at 1.8g
LF resonance in test arm
(SME 111, 6g me + cart) + 7dB at 9.5Hz
Sensitivity at 1kHz0.9mV/cm/sec
Relative output (0dB = 1mV/cm/sec) 1dB
Subjective sound quality
Recommended loading 47Kohms plus uncritical pF
Recommended arm mass4-10g
Recommended arm damping not needed
Cartridge coil resistance/inductance 510 ohms, 1mH
Induced hum level very good
Stylus type and spec fixed, naked, oriented, elliptical,
spec 8x 18µm
Finish and alignmentboth very good
Tip geometry blended pseudo-elliptical,
effective contact 8 x 20µm
HF resonance (tip mass/vinyl)approx + 3dB at 28kHz
Frequency response 30Hz-20kHz±1.0dB
Frequency response sortz-zokriz
Frequency response 100Hz-5kHz ±0.6dB
Stereo separation, 100Hz, 1kHz, 10kHz 20dB, 26d 3, 20dB
Channel difference at 1kHz, 10kHz 0.3db, 0.2dB
Trackability 300Hz lateral ±15dB
Trackability 300Hz vertical ±12dB
Trackability 300Hz lateral + 18dB ('Supertrack')2.0g
Distortion 300 Hz lateral + 9dB
5: 1 00011

High frequency waveform quality . . . . fairly good



Frequency response, rel. output, and separation ref 0dB (1mv/cm/sec).



1kHz squarewave, (ignore ultrasonic cutter ringing)

# Dynavector DV23R 'Ruby'

Logic Ltd, 19 Hurlbutt Road, Heathcote Ind. Est., Warwick CV34 6TD Tel (0926) 20302



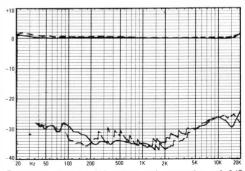
Quality control problems with early 'Rubies' gave rise to some cause for concern in the previous issue, but these are now happily resolved. The 23R employs a short 2.3mm long sapphire (ruby) cantilever (now of round cross-section though previously square) with a line contact stylus, though our consultant's report described a form nearer to the elliptical, possessing excellent shape and finish, and measuring 6.4 x 20 m. Alignment was however disappointing on our first sample, with a serious 5 error, although this is not typical of Dynavector's generally high standards.

As usual the cartridge returned a highly linear response with excellent balance and very good separation maintained over the whole frequency range. Compliance was moderate at 19cu, offering wide arm compatibility. strictly speaking damping was not necessary. Tip mass was clearly low, being estimated from 1005 disc at 45kHz, while the squarewave trace confirmed the wide bandwidth and uniform audible response. Trackability was undoubtedly good with only slight trouble on the most taxing of bands, and distortion was also well controlled throughout. The high level vertical linearity was fine — vastly better than the much more costly 17D — and a better stylus alignment would provide a further improvement as regards noise and distortion results.

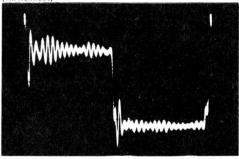
Auditioning the first sample gave a 'very good' ranking, and checking a second and correctly-aligned model gave a marginal improvement as regards treble sweetness. The stereo stage possessed good depth with stable imaging and good musical detail, while tonally the sound was open, neutral and generally very clean. Just a hint of treble slurring was present, where the high frequencies then appeared a trifle forward. The 23R is now clearly a very fine cartridge and, setting aside the alignment problems on our sample, is well worth a recommendation.

Cartridge type and weight	low output moving coil, 5.3g
Estimated dynamic compliance	e at 10Hz 19cu( x 10 - cm/dyne)
Specified downforce: 1.2 to 1.8	gtested at 1.6g
LE resonance in test arm	

opocinica do winoroc. ILE to 1.09 11	
LF resonance in test arm	
(Mission 774, 5.5g me + cart)	+ 11dB at 11Hz
Sensitivity at 1kHz	
Relative output (0dB = 1mV/cm/sec)	25.6dB
Subjective sound quality	very good
Recommended loading	
Recommended arm mass	4-14g
Recommended arm damping	marginal
Cartridge coil resistance/inductance	35 ohms/100µH
Induced hum level	boop
Stylus typefixed, oriented,	naked. line contact
Finish and alignment very good fin	ish, poor alignment,
	EE9 cone conto



Frequency response, rel output and separation ref 0dB (1mV/cm/sec)

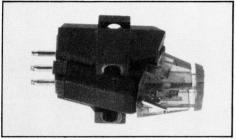


1kHz squarewave (ignore ultrasonic cutter ringing)

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# Empire 200E

Harman Audio UK Ltd, Mill Street, Slough, Berks. SL2 5DD Tel (0753) 76911



Specified for 2-4g tracking, this robust looking model was used at 2.5g for our tests. A 8 x 18 m shank-mounted elliptical stylus was specified in Empire's literature, but we found the stylus to be of poor quality - in common with previous Empires we have tried in this price category. The shape was irregular and nearer spherical than anything else, with the state of polish potentially damaging to the first few records played. Tip-mass was high, as judged from the poor 15kHz noted for resonance, while the compliance was very low - suiting high mass arms, but imposing rather a severe penalty on trackability. For example the second-level lateral 300Hz tracking-test band required a 2.4g downforce.

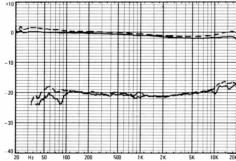
Frequency response was smooth, but stereo separation was below average although demonstrating good uniformity and channel balance. Distortions were also poorer than average, particularly on the high frequency tests.

Auditioning rated the 200E as average which is good for the price. While not sounding particularly secure, with what is best described as increased vinyl 'roar', the 200E gave a presentably neutral and accurate sound with good lateral stereo. Barring the occasional mistracking the level of detail rendition was good though with some treble stridency and roughness. On the basis of its overall sound-quality-versus-price this model is accorded a recommendation but with some strong reservations, notably concerning the quality of the stylus tip.

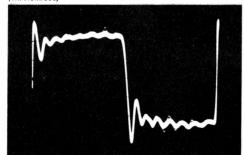
Cartridge type and weight	
Estimated dynamic compliance at 10H	z $10cu( \times 10^{-6} cm/dyne)$
Specified downforce: 2 to 4g	tested at 2.50
LF resonance in test arm	_
(Mission 774, 5.50 me + cart)	± 12dR at 15Hz

LF resonance in test arm	_
(Mission 774, 5.5g me + cart) + 12dB at 15H	17
Sensitivity at 1kHz	c
Relative output (0dB = 1mV/cm/sec) + 0.7d	Řι
Subjective sound quality average	ρ.
Subjective sound qualityaverag Recommended loading: 47kohms plus 250pF tested at 250p	Ĕ
Recommended arm mass	_
Recommended arm dampingmargina	
Induced hum levelvery good	
Stylus type detachable, shank-mount, elliptical spec, 8 x 18µr	n
Finish and alignmentboth poor, 60° cone angle	_
Tip geometryapprox 8 x 18µm, very poor shape, low grade	_
HF resonance (tip mass/vinyl)	7
Frequency response, wideband (30Hz-20kHz) + 1dB, -1dB	_
Frequency response, midband (100Hz-5kHz) + 0.8dB, - 1dB	2
Stereo separation, 100Hz, 1kHz, 10kHz20dB, 21dB, 19dB	ຊ
Channel difference, 1kHz, 10kHz	
Trackability, 300Hz vertical + 12dB	
Trackability, 300Hz lateral + 15dB	d d
Trackability, 300Hz lateral + 18dB ('Supertrack') >3.56	9
Distortion, 300Hz vertical + 6dB	
Distortion, 300Hz lateral + 9dB	
High frequency waveform qualityfair only	
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 2.5%	y
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 2.5%	
Pink noise intermodulation.	,
12kHz, 16kHz, 20kHz	
Typical selling price inc VAT	2
Replacement stylus cost inc VATapply to deale	,
mepiacement stylus cost inc VATapply to deale	1

\* Significant mistracking



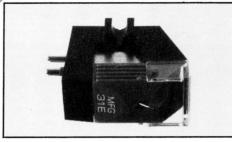
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



TKHz squarewave (ignore ultrasonic cutter ringing)

## Glanz MFG31E

Audiophile Products, 5 Crown Terrace, Hyndland, Glasgow G12 9HA Tel 041-221 5079

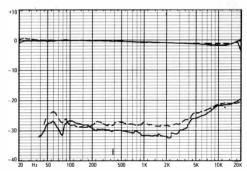


Moderately priced, the Glanz '31E proved to be fitted with a high-quality true elliptical stylus, very close to specification, and commendable at the price. Possessing moderate body mass and compliance, it is suited to low-to-medium mass arms (4-10g) and damping was not strictly necessary. The cartridge proved uncritical of electrical loading and was tested using 47K/250pF at a 1.5g downforce.

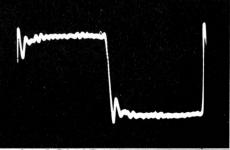
Ignoring the slight graph synchronisation slip, the '31E showed a very uniform and well-balanced frequency response. Good levels of stereo separation were established and were maintained to high frequencies. Tip mass was low, as the 30kHz resonance indicated — the reduced output beyond this frequency accounts for the cleaned-up squarewave response, which shows a good performance. The 31E exhibited good trackability and low distortion at mid-frequencies, though the 20kHz noise intermodulation distortion was a little higher than average. Technically at least, this model was vice-free.

Scoring a little above average on audition, the '31E sounded somewhat bland and occasionally produced a little more surface noise than usual, with some treble uncertainty. Tonally however it was quite neutral and stereo depth, detail and definition were all average or marginally above. Its character is pleasant enough and this model offers sufficiently good value for recommendation.





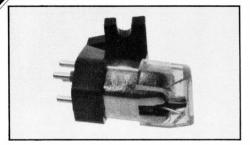
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

Goldring G920 IGC

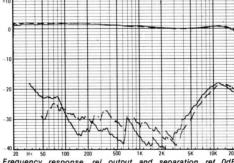
Goldring Products Ltd, Unit 8 Greyfriars Road, Bury St Edmunds IP32 7DX Tel (0284) 64011



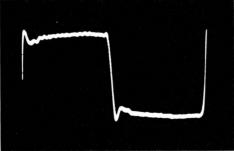
Goldring have at last realised that high trackability achieved by the use of excessive compliance can be an overall disadvantage. Compared with the original G900 IGC model, their new 920 IGC has a more moderate compliance value of 24cu, tracking competently at a suitable downforce, and suitable for 5-13g effective mass arms, with damping not strictly necessary. The stylus we measured was nearer elliptical than line contact in form and although well shaped it had rather a fine minor radius considering the state of alignment and downforce range specified.

Meeting tight response limits with 47kohm/250pF loading, the 920 exhibited very good separation up to 8kHz, and was still good beyond that. Channel balance was excellent, and with minimal overshoot plus a restricted supersonic bandwidth, the slight squarewave curvature reflected the essentially mild amplitude response variations. A sensible balance of distortion and trackability was obtained except for the noise intermodulation test, where the stylus geometry was believed to have had a disturbing influence. With exotic tips such as the Van den Hul, the designer's specification must be adhered to for consistent results.

On the listening tests the rating was good, which qualified this model for 'Best Buy' status at the price. It impressed many panelists, demonstrating decent stereo depth with a stable and decisive sound. Bass was presentable, with good midband clarity and detail plus above-average treble. The treble band did occasionally show a hint of sibilance and wiriness, but string tone was good, and surface noise well controlled. It is interesting to reflect that with tighter quality control on the stylus, the results could be better still!



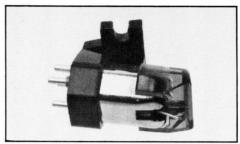
Frequency response, rel output and separation rel 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Goldring G910 IGO

Goldring Products Ltd, Unit 8 Greyfriars Road, Bury St Edmunds IP32 7DX Tel (0284) 64011



We had reservations concerning the samples of the *G900 IGC* reviewed in the last edition, due to their excessive compliance. The *G910* is a different version, specifically designed with a compliance value reduced from the original 42 to a far lower 23cu. Tested at a 1.8g downforce, it happily coped with all the test trackability sections throughout the frequency range, showing it to be a balanced design. The stylus was of reasonable quality but was not to the Van den Hul specification, and it could also have had a better polish as well as alignment – both critical areas with this tip.

Suited to low-medium mass arms, the need for damping is questionable with this cartridge, and it worked well with 47Kohms plus 250pF loading. Frequency response was smooth, meeting good +1.2, -0.5dB limits overall, and fine mid-frequency channel separation was recorded although this deteriorated rather quickly at high frequencies above 10kHz. Tip-mass resonance was well controlled at about 28kHz, this and the limited bandwidth beyond being responsible for the clean-looking squarewave. Distortion was also well controlled throughout the test bands.

Rated highly on audition the '910 sounded slightly sibilant on occasions, but in the main it sounded clear and clean over the whole frequency range, with quiet disc surfaces and a generally neutral tonal balance. Detail, depth and acoustic space were well portrayed and the panel agreed on its open yet confident character. Taking a critical stance, a slight loss of transient detail and transparency was noted as compared with first-rank (and far more costly) designs, but for the money the '910 is certainly good value and achieves Best Buy status.

Estimated dynamic compliance at 10H2 23Cu( x 10 = *Cm/dyne)
Specified downforce: 1 to 2.5g tested at 1.8g
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 11dB at 10.5Hz
Sensitivity at 1kHz
Relative output (0dB = 1mV/cm/sec) + 1.2dB
Subjective sound quality very good
Recommended loading: 47kohms plus 150-200pF tested
at 250pF
Recommended arm mass
Recommended arm damping marginal
Cartridge coil inductance570mH
Induced hum levelvery good
Stylus type detachable, naked, oriented, line contact
Finish and alignment both just 'good', 65° cone angle
Tip geometry
true extension to line
HF resonance (tip mass/vinyl)28kHz estimated
Frequency response, wideband (30Hz-20kHz) + 1.2dB, -0.5dB
Frequency response, midband (100Hz-5kHz) . + 0.8dB, -0.5dB

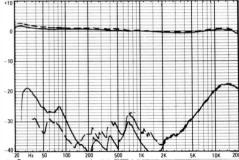
Cartridge type and weight .....moving magnet, 4.25g

Frequency response, midband (100Hz-5kHz) . + 0.8dB, - 0.5dB
Stereo separation, 100Hz, 1kHz, 10kHz 33dB, 35dB, 20dB
Channel difference, 1kHz, 10kHz 0.1dB, 0.2dB
Trackability, 300Hz vertical + 12dB
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack')>1.8g
Distortion, 300Hz vertical + 6dB
Distortion, 300Hz lateral + 9dB
High frequency waveform quality good
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 2.8%
HF intermodulation (pulsed 10kHz, 24cm/sec peak)0.7%
Pink noise intermodulation,
12kHz, 16kHz, 20kHz

 12kHz, 16kHz, 20kHz.
 1.4%, 4%, 6%

 Typical selling price inc VAT
 £59

 Replacement stylus cost inc VAT
 £39.50



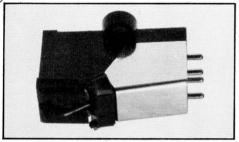
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Grado GT Super

Grado Products UK Ltd, 42 Cowgate, Peterborough Tel (0733) 51007

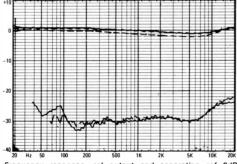


The GT Super is a new, inexpensive model from Grado, comprising a medium compliance design specified with an elliptical stylus and suited to medium-to-low mass arms. The arm should preferably be damped, though unfortunately damped arms are a luxury here considering the price of the cartridge. However, low generator impedance of Grado cartridges makes these models insensitive to electrical load variations, and their temperature stability is also good.

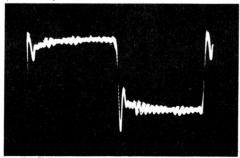
Stylus examination revealed a low-grade shank-mounted pseudo-elliptical (virtually conical) stone of inadequate polish. Such stones are neither kind to records nor do they promote low noise levels. Typical of Grado models in the past, the frequency response was quite uniform with only a small 1dB presence droop recovering to + 1dB at 20kHz. Good separation and quite good channel balance were measured.

Both trackability and low frequency distortion were good for the price, though the results were less favourable at high frequencies namely on the 10kHz pulsed and 16/20kHz noise intermodulations. We tried two samples and both were similar except that the second possessed rather poorer channel separation. On the 300Hz lateral tests the 0.4% distortion result was dominated by third-harmonic content, rather than the usual second-harmonic distortion, which might be responsible for the subjective brightness and 'sharpness' of this model. In fact it did quite well in the listening tests, providing a firm and well defined bass plus good detail and pleasing stereo. But the treble range was emphasised and steely, with increased surface noise and clicks, and it also showed some groove contact instability. However despite these subjective criticisms, and reservations concerning stylus quality, the GT Super did well enough at its modest price level to merit recommendation.

Cartridge type and weightinduced ring magnet, 5. 3g
Estimated dynamic compliance at 10Hz 20cu(x 10 - cm/dyne
Specified downforce: 1.5 to 2g tested at 1.8g
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 14dB at 10.5Hz
Sensitivity at 1kHz
Relative output (0dB = 1mV/cm/sec)
Subjective sound quality above average
Recommended loading: 10k-100k ohmstested at 250pF
Recommended arm mass
Recommended arm damping
Cartridge coil resistance/inductance 700 ohms/44mH
Induced hum level fairly good
Stylus type detachable, shank mount 'elliptical'
Finish and alignment poor finish, fairly good alignment,
48° cone angle
Tipgeometry 8 x 15μm pseudo-elliptical, rough grind
HF resonance (tip mass/vinvl)
Frequency response, wideband (30Hz-20kHz) + 1dB, - 1dB
Frequency response, midband (100Hz-5kHz) . + 0.5dB, - 0.8dB
Stereo separation, 100Hz, 1kHz, 10kHz 28dB, 29dB, 25dB
Channel difference, 1kHz, 10kHz 1.2dB, 0.8dB
Trackability, 300Hz vertical + 12dB 0.9g
Trackability, 300Hz lateral + 15dB 1.2g
Trackability, 300Hz lateral + 18dB ('Supertrack') 1.8g
Distortion, 300Hz vertical + 6dB
Distortion, 300Hz lateral + 9dB
High frequency waveform qualityfair
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 2.8%
HF intermodulation (pulsed 10kHz, 24cm/sec peak)1.6%
Pink noise intermodulation,
12kHz, 16kHz, 20kHz
Typical selling price inc VAT£18
Replacement stylus cost inc VAT £14.62



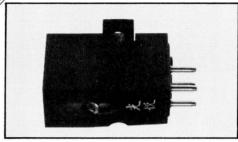
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Koetsu 'Black'

Absolute Sounds, 42 Parkside, London SW19 Tel 01-947 5047



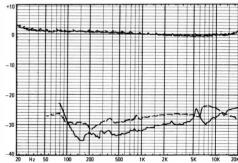
This low output moving coil is a less expensive version of the rosewood-bodied Koetsu, which is covered in the revised review printed opposite. The Koetsu is also available in an onyx-bodied form. The *Black* has an all-metal body with a stepped boron cantilever and a super-elliptical stylus, the latter of fine quality with a narrow 5µm scanning radius. Compliance is higher, which promises improved trackability although the resonance rise at low frequencies suggested that damping would prove helpful. Hum levels were low and the cartridge was uncritical of loading.

The frequency response was very uniform and more 'open' than the *Rosewood*, with minimal treble lift, plus consistently good stereo separation and superb channel balance. The squarewave confirmed the wide bandwidth and excellent control, the output within ±2dB right up to 50kHz. Distortions were well balanced and while the 'Supertrack' required 2.7g, the level just 3dB lower was happily passed at a modest 1.5g. It should be difficult to catch this model out on music programme.

Auditioning placed the *Black* in the 'excellent' class. Very slightly rich, with a detailed and unexaggerated treble, the bass was firm and well focused with great apparent extension while the midrange was startling clear, coherent and finely detailed. It sailed through complex choral passages without hardening or muddle, and was exceptional on piano transients. Stereo depth and stability were also very good.

The price is undoubtedly high, but the level of music refinement offered by this craftsmenbuilt design renders a recommendation mandatory — a purchase that those with deep pockets will find easy to justify.

Cartridge type and weight ... medium output moving coil, 9.5g Estimated dynamic compliance at 10Hz 14cu(x 10<sup>---</sup> cm/dynz) Specified downforce: ... tested at 2.0g LF resonance in test arm (Mission 774 5 5 me + cart) + 15dB at 11Hz

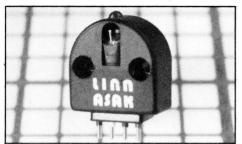


Frequency response, rel output and separation ref 0dB (1mV/cm/sec)

1kHz squarewave (ignore ultrasonic cutter ringing)

# Linn Asal

Linn Products Ltd, 235 Drakemire Drive, Castlemilk, Glasgow G45 9SZ Tel 041-634 0371



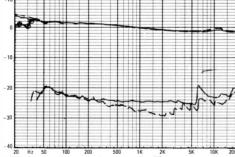
Now well-established, the *Asak* has been fully retested for this issue. It was perhaps inevitable that we should encounter sample variations, as the better a product is the more often it is tested and the more obvious any variations appear! We tried three samples; one exhibited excessively low compliance (a faulty batch) and none of them attained the exemplary separation levels of earlier examples we have tried. Nonetheless, the fine sound quality of our three when properly set up was never in doubt, and in our view the *Asak* remains the only serious competition to the Koetsus, when optimally mounted.

Of moderate compliance, the Asak is suited to medium-high mass arms, and tends to excite unwanted audio resonances in infereior arms. An excellent 'Vital' elliptical stylus was fitted possessing a low tip mass. Frequency response exhibited a mild but consistent downtilt falling almost 1.4dB from 30Hz-5kHz. with a smooth treble thereafter lending a weighty, slightly 'distant' tonal balance. Separation (usually better than the graph reproduced here) was typically 35dB midband. Our first Asak was an adequate tracker in view of its very low compliance, while the later samples were even less compliant than the 14cu recorded in our previous issue. The nominal squarewave overshoot and shape confirmed the wide smooth response of this design, while distortion levels were low except where mistracking was evident.

In good working order, the Asak despite its slight tonai 'richness', is a top class performer. Its bass was clear and clean with good dynamics, the mid detailed, neutral and transparent, and the treble generally well integrated and of good quality. Sample variation showed some trackability limitation and a slight loss of stereo depth, but with a watchful eye on quality variations, the *Asak* still remains a highly recommended design.

1
Cartridge type and weight low output moving coil 6.0g Estimated dynamic compliance
at 10Hz
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 13dB at 16Hz Sensitivity at 1kHz
Relative output (0dB = 1mV/cm/sec) – 27.8dB
Subjective sound quality excellent Recommended loading 30-500 ohms
Recommended arm mass
Cartridge coil resistance
Induced hum levelvery good Stylus typefixed, oriented, naked elliptical, spec 5 x 18µm
Finish and alignment both very good, 55° cone angle
Tip geometry6 x 18µm, well shaped 'Vital' true elliptical HF resonance (tip mass/vinyl)>50kHz (+2dB AT 50K)
Frequency response, wideband (30Hz-20kHz) + 3dB, -1.5dB Frequency response, midband (100Hz-5kHz) . + 1.6dB, -1.2dB
Stereo separation, 100Hz, 1kHz, 10kHz 24dB, 26dB, 24dB
Channel difference, 1kHz, 10kHz 0.1dB, 0.4dB Trackability, 300Hz vertical + 12dB 1.5g
Trackability, 300Hz lateral + 15dB
Distortion, 300Hz vertical + 6dB2.2%
Distortion, 300Hz lateral + 9dB
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 6.0% *
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 0.6% Pink noise intermodulation,
12kHz, 16kHz, 20kHz
Replacement stylus cost inc VAT £155.25

- \* Sample variation
- \*\* Mistracked, trackability was better with third sample, serial no. 6666 (uses for response graph)



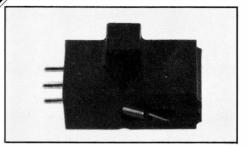
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Mission 773HC

Mission Electronics Ltd, Stonehill, Huntingdon, Cambs PE18 5ED Tel (0480) 57477



The original 773 was fitted with a boron rod cantilever and a Paroc line contact stylus. tending to a slightly 'glassy' treble, but with an impeccable frequency response. The new HC version retains much of that neutral character. despite the switch to an alloy tube cantilever and a super-elliptical stylus. This high-output moving coil design does not require a step-up device, but a pre-amp of good sensitivity (2mV) is needed. Moderate mass and well-damped medium compliance indicate its suitability for low-to-medium undamped arms. The stylus proved to be a well-shaped and finished superelliptical of fine scanning radius with a slightly extended major radius, with a sensible 55° cone angle. Vertical tracking angle was trifle high at 27°.

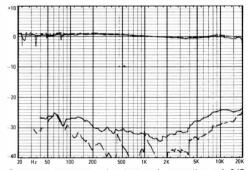
The frequency response showed a slight droop from 100Hz to 5kHz, but output remained uniform to beyond 50kHz, as the fast but well controlled squarewave response clearly demonstrated. Stereo separation and channel balance were very good throughout, and moderate signal levels were tracked well with low distortion figures. However the highest modulation gave some trouble, and trackability limits performance pretty quickly in this rarified high-modulation region. High-frequency tracing was nonetheless particularly good.

The new 773 attained a very good sound quality rating, marred only by very mild breakup and muddling on the highest level and most complex passages. The bass was to a good standard, the treble lucid and neutral with the mid open and clean, while stereo image was impressive in depth, clarity and stability.

This is now a subtle and refined cartridge of low apparent distortion, possessing great neutrality. Such a level of performance, coupled with its compatibility with standard preamps, earns it a warm recommendation.

Carringle type and weightligh output moving con, 6.0g
Estimated dynamic compliance at 10Hz 24cu(x 10 - cm/dyne)
Specified downforce: 1.8gtested at 1.8g
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 8dB at 9.5Hz
Sensitivity at 1kHz0.4mV/cm/sec
Relative output (0dB = $1 \text{mV/cm/sec}$ )
Subjective sound quality very good
Recommended loading: 47k ohms
plus 0-1000pFtested at 250pF
Recommended arm mass
Recommended arm dampingnot required
Cartridge coil resistance
Induced hum levelvery good
Stylustypeoriented, fixed, naked, elliptical
Finish and alignmentboth good, with a 55° cone angle
Tip geometry $5 \times 18 \mu m$ super elliptical, excellent shape
Frequency response, wideband (30Hz-20kHz) + 1dB, -0.8dB
Frequency response, midband (100Hz-5kHz) + 1dB, -0.6dB
Stereo separation, 100Hz, 1kHz, 10kHz 29dB, 35dB, 26dB
Channel difference, 1kHz, 10kHz 0.12dB, 0.3dB
Trackability, 300Hz vertical + 12dB 0.8g
Trackability, 300Hz lateral + 15dB 1.5g
Trackability, 300Hz lateral + 18dB ('Supertrack') 2.3g
Distortion, 300Hz vertical + 6dB
Distortion, 300Hz lateral + 9dB
High frequency waveform quality fairly good
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 4.2% *
HF intermodulation (pulsed 10kHz, 24cm/sec peak)0.6%
Pink noise intermodulation,
12kHz, 16kHz, 20kHz
Typical selling price inc VAT£149

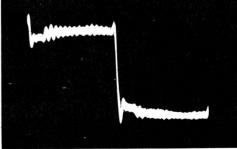
high output moving coil 6 0c



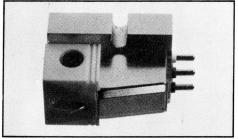
Replacement stylus cost inc VAT . . . . . . . . . . £78.50

\*Mistracked at 20cm/sec, 0.6% IM distortion

Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)



A medium-price cartridge, the *MP30* has a metal body of higher mass than the *MP11*, and interestingly, it also has a lower compliance of 20cu. As such, and in view of its 9g mass, 4-10g effective-mass arms are suitable and it should not require damping. A good quality elliptical stylus was fitted, although not quite up to the standard of some Japanese tips.

We tried two samples, one of which gave just average stereo separation, with the second not representing a great significant improvement. Tested with 250pF of loading, the response was quite uniform, but using 100pF, the 20kHz point was better maintained, albeit at the expense of a less desirable dip around 9kHz. Separation was fairly good with excellent channel balance, while the upper (tip mass) resonance occurred at 27kHz, its mildness reflected by the minimal overshoot and ringing on the squarewave test. Trackability and distortion were good at moderate frequencies and levels, but deteriorated rapidly at peak levels - on the 300Hz 'Supertrack' test and on the high frequency sections the performance was poorer than average.

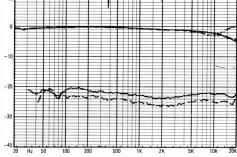
Rated a somewhat surprising 'good plus' on the listening tests — just enough for Best Buy status — the MP30 sounded confident and neutral, with stable stereo with good midband dynamics and detail. The treble register was suspect on occasion, with more noise and sibilant slurring than usual, but not unduly so.

Cartridge type and weight	
Estimated dynamic compliance at 10H	z = 20cu(x = 10 - 6cm/dyne)
Specified downforce: 1.3 to 1.8g , ,	tested at 1.6g
LF resonance in test arm	

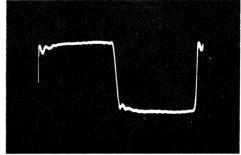
LF resonance in test arm	
(Mission 774, 5.5g me + cart)	+ 10dB at 9.5Hz
Sensitivity at 1kHz	0.62mV/cm/sec
Relative output (0dB = 1mV/cm/sec)	– 3.8dB
Subjective sound quality	good plus
Recommended loading: 47kohms plus 100pF 1	
Recommended arm mass	4-10g
Recommended arm damping	not required
Cartridge coil resistance/inductance	z = 4.3kohms
Induced hum level	very good
Stylus type detachable, oriented, naked, ellipt	
Finish and alignment both good,	55° cone angle
Tip geometry 7 x 18 m, well shaped ellipitica	
fro	om more blend

HF resonance (tip mass/vinyl)
Frequency response, wideband (30Hz-20kHz) + 0.5dB, - 3dB
Frequency response, midband (100Hz-5kHz) . + 0.5dB, -0.8dB
Stereo separation, 100Hz, 1kHz, 10kHz 22dB, 24dB, 23dB
Channel difference, 1kHz, 10kHz
Trackability, 300Hz vertical + 12dB,
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack') 2.6g
Distortion, 300Hz vertical +6dB2.2%
Distortion, 300Hz lateral + 9dB
High frequency waveform quality fairly good
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 3.5%
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 2.0%
Disk soins intermedulation

12kHz, 16kHz, 20kHz	2.2%. 6.5%. 10%
Typical selling price inc VAT,	£46
Replacement stylus cost inc VAT	£35



Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



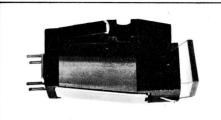
1kHz squarewave (ignore ultrasonic cutter ringing)

# Ortofon VMS20E II

Ortofon Ltd, Tavistock Ind. Est., Ruscombe, Twyford, Berks. RG10 9NJ Tel (0734) 343621

Cartridge type and mass

Replacementstylus cost inc VAT



REVISED AND REPRINTED

This model was also reviewed in Mark I version in the first issue, but did not achieve any particular distinction. The first '20E II tried here offered good but not especial separation, the generator axes showing a lack of mutual alignment, but a second sample (not selected) provided the improvement shown by the dotted trace on the graph; accordingly this sample was used for all subsequent testing. Two frequency responses were also charted to explore the criticality of loading, with the optimum dotted 400pF curve clearly the best. Without too great elaboration the VMS with a naked elliptical tip may be regarded as a improved version of the FF15E.

Measurement showed the VMS compliance to be a little higher than the '15, at 28cu, but trackability was significantly increased, the Supertrack needing just 1g. Most distortions were similarly good except for the 1/3-octave results which were much better than for the '15, while an excellent frequency response and channel balance were both charted, plus very good separation throughout.

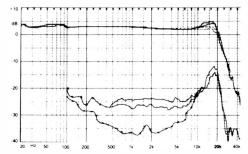
On audition the '20E II appeared in the upper group which is an excellent result for the price paralleling the achievement of the ADC XLM III in this respect. Considered very slightly nasal and dull in tonal colour it was nevertheless sufficiently neutral to achieve close tape copying. Stereo imaging was reproduced with precision and depth, and the treble range was clean and clear even on complex passages; a musical and accurate sound with quiet surfaces.

The stylus report showed a naked 220µm round stock elliptical diamond to specification, with a 50° cone angle and good shape. The alignment was fine but polish poor.

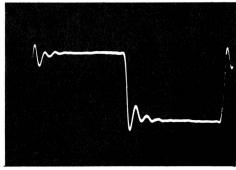
In conclusion, the 400pF loaded VMS 20E II can be strongly recommended on the assumption that the second sample rather than the first was typical, but is best suited to low mass arms. In addition, a cartridge of this calibre should really have better stylus polish, which would 'complete' the otherwise fine diamond.

Outlings type and mass
Estimated dynamic compliance at 10Hz 28cu( x 10 - cm/dyne)
Specified downforce: range 0.75g to 1.5g tested at 1.3g
LF resonance in test arm
(SME 111, 6g me + cart) + 11dB at 8.9Hz
Sensitivity at 1kHz1.2mV/cm/sec
Relative output (0dB = 1mV/cm/sec)+2dB
Subjective sound quality , , , very good

	monthfully at the Land to the control of the contro
Re	lative output (0dB = 1mV/cm/sec)+2dB
Su	bjective sound quality , , very good
	commended loading
	commended arm mass
	commended arm dampingmoderate
	rtridge coil resistance/inductance 800 ohms, 600mH
	duced hum levelgood
Stv	/lus type and spec detach, naked ellibtical, 8 x 18xm
	hish and alignment
	geometry8 × 18µm
HE	resonance (tip mass/vinyl) indicated at 18kHz
Erc	equency response 20Hz-20kHz
F16	equency response 100Hz-5kHz + 0, – 1dB
	ereo separation, 100Hz, 1kHz, 10kHz20dB, 35dB, 22dB
Çn:	annel difference at 1kHz, 10kHz
	ickability 300Hz lateral + 15dB, + 18dB
_ (	"Supertrack")0.8g, 1g
Tra	ckability 300Hz vertical + 12dB
	stortion 300Hz lateral + 9dB
	stortion 300Hz vertical + 6dB2.8%
Hig	gh frequency waveform qualitygood
Mic	d band intermodulation (1kHz + 1.5kHz)3.8%
HF	intermodulation, pulsed 10kHz, 24cm/sec peak 0.2%
Pin	k Noise intermodulation,
1	I2kHz, 16kHz, 20kHz
Tvp	pical price (inc VAT)£28 when reviewed, now £34
Dor	placementatylus cost inc VAT



Frequency response, rel output and separation ref 0dB (1mV/cm/sec) (dotted curve 400pF: separation see text).



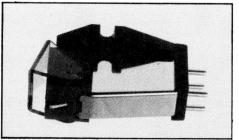
1kHz squarewave

# Ortofon VMS30

Ortofon Ltd, Tavistock Ind. Est., Ruscombe, Twyford, Berks. RG10 9NJ Tel (0734) 343621

Typical price (inc VAT) .

Replacement stylus cost inc VAT

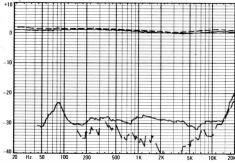


Latest in an established range of 'VMS' series cartridges is the medium priced '3011 incidentally, there never was a 'Mk I' VM\$30. The 'II' designation refers to the body type. It comes fitted with a high compliance stylus assembly suited to low-mass tonearms only. The tip when examined proved to be a topclass line or extended-contact type, with a usefully fine minor scanning radius and excellent polish.

Providing a highly uniform charted response on the specified 47kohms/400pF electrical loading the output met very close ±0.5dB limits, 30Hz-20kHz. Separation was very good and channel balance fine, and when tested at 1.5g the trackability was very good; clearing the 'Supertrack' 300Hz band at just 1.2g. However, tracking was less confident on the higher frequency intermodulation passages, and the vertical linearity on high-level tones was just average. Output peaked at 25kHz, just outside the audible range, and the squarewave result shows this bandwidth limit, the mild overshoot reflecting the rapid rolloff above tip mass resonance.

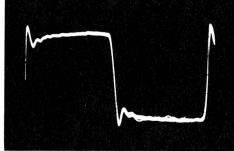
Attaining a 'good' rating on the listening tests, sufficient for Best Buy status at the price, the VMS30 II was felt to somewhat flatten stereo depth, and on some records it also gave increased groove noise. Tonally it was neutral if slightly dulled in impact and dynamics, but conversely it gave a decent level of instrumental detail in a civilised and relaxed manner.

Cartridge type and weightinduced magnet, 5g
Estimated dynamic compliance at 10Hz 34cu( x 10 - cm/dyne)
Specified downforce: 1.0 to 1.6g tested at 1.5g
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 10dB at 8.2Hz
Sensitivity at 1kHz
Relative output (0dB = 1mV/cm/sec)
Subjective sound quality
Subjective sound quality
Recommended loading: 47kohms plus 400pF tested at 400pF
Recommended arm mass
Recommended arm damping marginal
Cartridge coil resistance/inductance800ohms/600mH
Induced hum levelvery good
Stylus type detachable, naked, oriented, line contact
Finish and alignment both very good, 55° cone angle
Tip geometry 6μm x line, well shaped, symmetrical line contact
HF resonance (tip mass/vinyl)estimated 25kHz
Frequency response, wideband (30Hz-20kHz) + 0.5dB, - 0.5dB
Frequency response, midband (100Hz-5kHz) . + 0.5dB, - 0.5dB
Stereo separation, 100Hz, 1kHz, 10kHz 30dB, 32dB, 31dB
Channel difference, 1kHz, 10kHz 0.3dB, 0.6dB
Trackability, 300Hz vertical + 12dB 0.8g
Trackability, 300Hz lateral + 15dB 1.0g
Trackability, 300Hz lateral + 18dB ('Supertrack') 1.2g
Distortion, 300Hz vertical + 6dB
Distortion, 300Hzlateral + 9dB
High frequency waveform qualityfairly good
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 3.3%
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 1.4%
Pink noise intermodulation,
12kHz, 16kHz, 20kHz



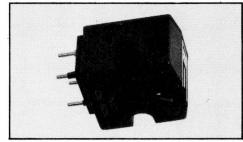
.. £38 when reviewed, now £47

Frequency response, rel output and separation ref 0dB



1kHz squarewave (ignore ultrasonic cutter ringing)

J Osawa & Co (UK) Ltd, 10 Forge Court, Reading Road, Yateley, Camberley, Surrey Tel (0252) 879121



Built by Supex to Osawa's specification, the internal component parts of the Mirage do not in fact parallel the Asak as he has been rumoured, although there are certain similarities - for example, the aluminium alloy cantilever and elliptical diamond. The diamond fitted to the '60L measured 8 x 18µm with the scanning radius a trifle large, but the shape, polish and alignment were all very fine. Not surprisingly in view of its lower cost, the quality of assembly was not quite to the Asak standard.

We tried two samples, one with a slightly offset cantilever and the other exhibiting poorer separation than that illustrated on the graph. In frequency response, the '60L drooped by 2dB from 100Hz to 2kHz, then recovered gently in the treble range. Channel separation was potentially very good, though with the anomaly at 7kHz which is characteristic of Supex cartridges. Measured trackability was also fairly good, with distortion moderate. The fast squarewave risetime and clean cutter ringing confirmed the response measurements, showing a smooth output extension to beyond 50kHz.

Possessing a medium-to-low compliance, the '60L suited a wide range of arm mass, and damping would be an advantage.

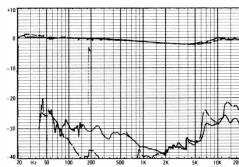
Rated as very good on audition, this cartridge did to some extent sound similar to the Asak. Slightly richer, the bass lost something in definition while the treble was a trifle coarser, with poorer integration. Midrange detail and stereo depth were similarly good - hallmarks of the best products from the Supex factory.

With a mild reservation concerning possible quality variations, the Mirage OS-60L is warmly recommended, and it should be borne in mind that the more expensive Mirages may not necessarily offer a significant improvement over the 'musical' balance of this model.

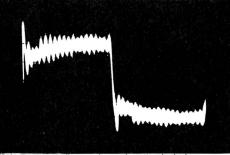
Cartridge type and weight low output moving coil 6.8g
stimated dynamic compliance at 10Hz 15cu( x 10 - cm/dyne)
pecified downforce: 1.5 to 2.1gtested at 2.0g
F resonance in test arm
(Mission 774, 5.5g me + cart) + 11.5dB at 11.3Hz
Sensitivity at 1kHz0.04mV/cm/sec

LF resonance in test arm
(Mission 774, 5.5g me + cart) + 11.5dB at 11.3Hz
Sensitivity at 1kHz
Relative output (0dB = 1mV/cm/sec) 27.2dB
Subjective sound quality very good
Recommended loading
Recommended arm mass
Recommended arm damping helpful
Cartridge coil resistance 2 ohms
Induced hum levelgood
Stylus typefixed, elliptical (naked), oriented
Finish and alignmentboth very good
Tip geometry8 x 18 µm, true elliptical stone of low mass
HF resonance (tip mass/vinyl) >50kHz ( + 4dB only at 50kHz)
Frequency response (30Hz-20kHz) + 2.3dB, - 1.1dB
Frequency response, midband (100Hz-5kHz) + 1.5dB, - 1dB
Stereo separation, 100Hz, 1kHz, 10kHz32dB, 37dB, 28dB
Channel difference, 1kHz, 10kHz0dB, 0.8dB
Trackability, 300Hz vertical + 12dB
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack') 2.7g
Distortion, 300Hz vertical + 6dB3.2%
Distortion, 300Hz lateral + 9dB
High frequency waveform quality fairly good
Midband intermodulation (1kHz + 1.5kHz 24cm/sec)3%*
HF intermodulation (pulsed 10kHz, 24cm/sec peak)0.37%
Pink noise intermodulation,
12kHz, 16kHz, 20kHz
Typical selling price inc VAT£99
Pople coment stylus cost inc VAT

Pink noise intermodulation,				
12kHz, 16kHz, 20kHz	. 1.1	١%,	2%	,3%
Typical selling price inc VAT			'	£99
Replacement stylus cost inc VAT				. £55
Some mistracking, 2% at 17cm/sec				
•				



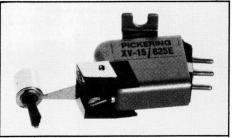
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

# Pickering XV15/625E

Pickering UK Distribution, 24 Gillygate, York Tel (0904) 642463

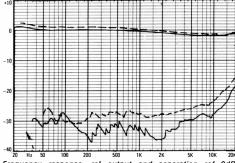


Highly rated in our first Cartridges issue over two years ago, this model is still popular and is fully retested here. An induced-magnet design of moderate compliance, it is fairly tolerant and robust, and will work with a wide range of arms. Strictly speaking some arm damping would improve the performance, but considering the price level involved this is something of a nicety. Tested at 1.4g, the results suggested a performance improvement if tracked at 1.6 to 1.8g, which is quite satisfactory in view of the 7.5 x 18 µm stylus. The tip is in fact a pseudo-elliptical form of good finish, but offering little advantage over a spherical tip - and although the cartridge design is worthy of a better stylus, conversely, fitting a good spherical would enable a price reduction to be made.

Slightly rich and 'dull', the frequency response was nonetheless very smooth and a good standard of channel spearation was achieved, still measuring 25dB at 10kHz. Distortion levels were very low except at the highest frequencies where tracing geometry limited the performance, while trackability was also good as was the 26kHz tip mass resonance (considering the price), the squarewave showing a slightly 'slow' but well balanced characteristic.

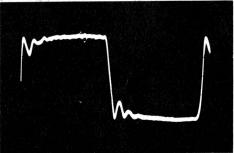
On audition the panel were somewhat unenthusiastic and yet compelled to award decent marks in the absence of significant flaws in the reproduction. Mild stereo depth and detail loss were noted, plus a bland, 'sleepy' character with only average bass definition. and yet the sound was relaxed and vice-free. Set against price, the performance was thus good enough to warrant recommendation.

Cartridge type and weight induced magnet, 6. 0g
Estimated dynamic compliance at 10Hz 15cu(x 10 - cm/dyne
Specified downforce: 0,75 to 1,5 tested at 1.4d
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 14dB at 12Hz
Sensitivity at 1kHz0.8mV/cm/sec
Relative output (0dB = 1mV/cm/sec)
Subjective sound quality
Recommended loading: 47K ohms plus 275 pF tested at 250 pF
Recommended arm mass6-18g
Recommended arm dampingwould be helpful
Induced hum levelvery good
Stylus type detachable, shank mount 'elliptical' spec.
8 x 18um
Finish and alignment
Tip geometry7.5 x 18µm, but of pseudo-elliptical form,
51° cone angle
HF resonance (tip mass/vinyl)
Frequency response, wideband (30Hz-20kHz) + 1.5dB, - 1.5dB
Frequency response, midband (100Hz-5kHz) + 0.5dB, - 1dB
Stereo separation, 100Hz, 1kHz, 10kHz 29dB, 30dB, 25dB
Channel difference, 1kHz, 10kHz 0.8dB, 0.6dB
Trackability, 300Hz vertical + 12dB1.0g
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack') 1.8g
Distortion, 300Hz vertical + 6dB
Distortion, 300Hz lateral + 9dB
High frequency waveform qualityfairly good
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 2.8%
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 1.5%
Pink noise intermodulation, 12kHz, 16kHz, 20kHz
Typical purchase price inc VAT £30 when reviewed, now
Typical pulchase price inc val 230 when reviewed, now



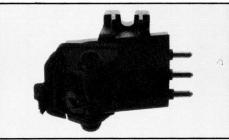
Replacement stylus cost inc vAI .....£25.44

Frequency response, rel output and separation ref 0dR (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

HW International Ltd, 3-5 Eden Grove, London N/ 8EQ Tel 01-609 0293



Supplied to Hi-Fi Choice just in time for the complete auditioning and an emergency lab test the brand new V represents a major effort on the part of Shure to recapture a larger share of the 'quality' market. With a tip resonance at 38kHz (our estimate), moving mass has been reduced compared with the V15 IV by the use of a special 'thinwall' beryllium cantilever and smaller stone, the latter hyperelliptical but with improved 'Masar' polish over the contact region. Measuring  $5 \times 18 \mu m$ , the tip rated as a good-quality true elliptical.

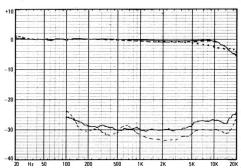
A medium-compliance design, the V15 V obviates need for a low mass arm or for arm damping by the inbuilt stabiliser, similar to that used on the IV. The cartridge is claimed to be free from electrical loading effects, but this was not wholly true as may be seen from the response graphs. The trend was very flat to 10kHz, above which a significant rolloff occurred with a capacitance of 450pF. Using 150pF, the fall was more gentle but commenced at 5kHz, this clearly in agreement with the rounded squarewave response. The very good separation was maintained right across the band, along with the channel balance. As might be expected from past masters of the craft, the trackability and the complementary

distortion results were very fine.

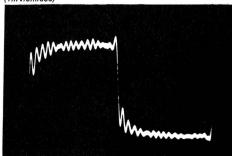
Auditioning using 300pF placed the V in the 'very good' category. Dynamics were well portrayed with a good sense of ambience and depth. It was highly controlled as well as secure, with consistently low surface noise, while instrumental detail and articulation were very good, with an absence of the traditional moving-magnet mid hardness. Slightly dulled in the treble, the V also lacked a touch of power and depth in the bass but neither aspect was considered serious. Its slight lack of precision and transparency was well countered by an easy, relaxed confidence, and it carries a firm recommendation.

Specified downforce: 0.75 to 1.25g .....tested at 1.1g LF resonance in test arm (Mission 774, 5.5g me + cart) . . . . . . . . . + 11dB at 9.0Hz Subjective sound quality .......very good Recommended loading: 47kohms plus 250pF .tested at 150pF Recommended arm damping .....not required Cartridge coil resistance/inductance . . . . . . 950ohms, 330mH Induced hum level ......very good Stylus typedetachable, naked, 'Hyper Elliptical' spec, 5 × 38µm Finish and alignment ..... both good, improved polish on Tip geometry ......5 × 18μm, very well shaped elliptical HF resonance (tip mass/vinyl) ... estimated 38.5kHz
Frequency response, wideband (30Hz-20kHz) ... + 0.2dB, - 3dB Frequency response, midband(100Hz-5kHz). + 0.2dB, -0.6dB Stereo separation, 100Hz, 1kHz, 10kHz.....28dB, 31dB, 28dB Channel difference, 1kHz, 10kHz . . . . . . . . . 0.2dB, 0.2dB Trackability, 300Hzvertical + 12dB . . . . . . . . . . . . . . . . . 0.6g Trackability, 300Hzlateral + 18dB ('Supertrack') . . . . . . . 1.0g Distortion, 300Hz vertical + 6dB ..... HF intermodulation (pulsed 10kHz, 24cm/sec peak) ....0.35% Pink noise intermodulation, 12kHz, 16kHz, 20kHz..... Typical price (inc VAT) ...... Replacement stylus cost inc VAT £125 when reviewed, now £160

Cartridge type and weight ......moving magnet, 6.5g Estimated dynamic compliance at 10Hz 27cu(×10 - cm/dyne)



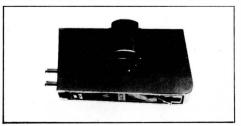
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

Supex SD901EV

Russ Andrews Turntable Accessories, Edge Bank House, Skelsmergh, Kendal LA8 9AS Tel (053 983) 247



The 901 is reviewed here in its latest form with the 'vital' stylus. Although in the past it has been regarded as the 'weaker brother' of the range, the results from the tests on our latest samples suggest that its performance now surpasses that of the 900. Representing the high output version of the 900, the expression 'high output' relates only to moving coil designs, and a fairly sensitive preamplifier (minimum 2mV sensitivity) will be required for full amplification.

The stylus achieved the same exemplary standard as the other Supexes, while the frequency response dip was held to just 1dB, and the treble lift to +2dB. A well-damped tip mass resonance is indicated by the minimal leading edge ringing on the squarewave, the clearly displayed cutter ringing merely demonstrating the cartridge's wide bandwidth. Stereo separation was outstanding and free of the 7kHz problem associated with low output Supexes, and at a recommended 2g downforce it almost managed the 'Supertrack', and held on throughout all the other tests, although the mid intermodulation was not far from failure.

Rated 'very good' on the listening tests, family similarities with the 900 were clear — the rich down-tilted balance lending a 'weighty' impression (see also Koetsu). Stereo imaging was notably transparent with fine depth and precision, and despite the 'laid back' balance, detail was well presented with surface noise and clicks subdued. A hint of coarseness was however apparent on difficult end-of-side passages, and the extreme treble could sound a little thin and wispy.

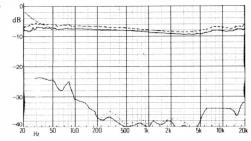
The first sample of the 901 received exhibited poor channel balance — not an uncommon fault with the high output moving-coil models — and was rejected accordingly. But its relatively high price, and on the assumption that good 901s achieve the standards set by the second sample tested above, the cartridge is clearly worthy of recommendation: its versatile electrical and

# physical compatibility represent strong points in its favour. Cartridge type and mass.....high output moving coil, 9.5g

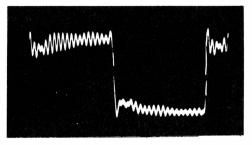
Estimated dynamic compliance at 10Hz 12cu( x 10 - cm/dyne)
Specified downforce: range 2.0g to 2.5g tested at 2.2g
LF resonance in test arm
(SME 111, 6g me + cart) + 11dB at 12.5Hz
Sensitivity at 1kHz0.33mV/cm/sec
Relative output (0dB = 1mV/cm/sec)
Subjective sound quality very good
Recommended loading47Kohms plus uncritical pF
Recommended arm mass
Recommended arm damping marginal
Cartridge coil resistance/inductance 80 ohms, negligible mH
Induced hum levelvery good
Stylus type and spec fixed, naked, oriented, 'super elliptical'.

spec 8 × 20μn
Finish and alignment both excellen
Tip geometry exemplary true swept elliptical, 7 × 20μη
HF resonance (tip mass/vinyl) above 40kH
Frequency response 30Hz-20kHz + 2, - 1dl
Frequency response 100Hz-5kHz ±1dl
Stereo separation, 100Hz, 1kHz, 10kHz31dB, 40dB, 34dI
Channel difference at 1kHz, 10kHz0.8dB, 0.95dl
Trackability 300Hz lateral ± 15dB,
Trackability 300Hz vertical ± 12dB
Frackab ility 300Hz lateral + 18dB ('Supertrack')2.5
Distorti on 300Hz lateral + 9dB
Distortion 300Hz vertical + 6dB
High frequency waveform quality fairly good
Mid band intermodulation (1kHz + 1.5kHz 24cm/sec) 1.4%
HF intermodulation, pulsed 10kHz, 24cm/sec peak 0.22%
Diel Neier interes deletin

12kHz, 16kHz. 20kHz	0.71% , 2.0% , 4.0%
Typicalprice (inc VAT)	£125 when reviewed, now£139
Replacement stylus cost inc VAT	£104



Frequency response, rel output and separation ref 0dB (1mV/cm/sec) (dotted — undamped arm)



1kHz squarewave (ignore ultrasonic cutter ringing)

Supex SD900EV Super

Russ Andrews Turntable Accessories, Edge Bank House, Skelsmergh, Kendal LA8 9AS Tel (053 983) 247



It now seems likely that the Supex designs may have gone through a 'sticky patch' some time a couple of years back, accounting for the problems Choice encountered in reviewing both the 900 and 901. Happily these difficulties appear to have been overcome, as the quality of the 900 models submitted this time was comparable with the superior performance of the original 'classic' sample of several years ago. A low compliance moving-coil design, the 900E is suited to medium-high mass arms, and slight damping could be beneficial. A superb naked oriented elliptical diamond was fitted, comprising a true swept-radius stone of effective contact 7 x 20 µm, the latter not unrealistic at a typical 2g downforce.

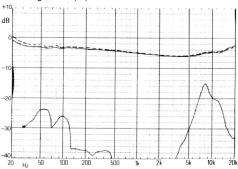
The very low effective tip mass was reflected by the HF resonance, which was estimated to lie above 45kHz. The midrange droop in frequency response was some 1.5dB, with the subjectively 'rich' balance corresponding to the gently rising response below 1kHz. The inevitable rise at 20kHz was held to +2.5dB, with fine channel balance, and with the exception of the 'glitch' at 7-8kHz (characteristic of low output Supex designs) the separation was very good. In common with many other cartridges, the 'Supertrack' and midband intermodulation sections both gave trouble.

On the revised rating system the SD900 scored 'very good' on sound quality (in relative terms this does represent a slight downgrading from the previous 'excellent'). While still showing its firm, stable character with very good stereo imaging and attendant depth, the balance tended to an 'overrich' quality which enhanced the bass at the expense of the mid/treble detail, and occasionally 'fizzy' effects were also noted in the extreme treble.

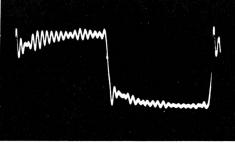
The costly 900, for so long a reference standard amongst moving-coils, continues to be a top flight cartridge, but is now somewhat eclipsed by its close relative the Asak.

Cartridge type and mass low output movin Estimated dynamic compliance at 10Hz $11cu(\times 10^{-6}$ Specified downforce: range $2g$ to $2.5g$ tes LF resonance in test arm	cm/dyne)
(SME 111, 6g me + cart)+ 12dl	Bat 13Hz
Sensitivity at 1kHz(0.96mV alone) 1.2mV	/cm/sec*
Relative output (0dB = 1mV/cm/sec) ( - 24.5 alone)	
Subjective sound quality	
Recommended loading 20-500 ohms plus unc	ritical pF
Recommended arm mass	
Recommended arm damping	
Cartridge coil resistance/inductance .3.5 ohms, negli	
Induced hum level	irly good
Stylus type and spec fixed, naked, oriented, or	
	8 x 20xm
Finish and alignment both	excellent
Tip geometry exemplary true elliptical,	$7 \times 20 \mu m$
HF resonance (tip mass/vinyl) + 12dB a	
Frequency response 30Hz-20kHz	, + 2.5dB
Frequency response 100Hz-5kHz	
Stereo separation 100Hz 1kHz 10kHz 26dB >40	

rrequency response rounz-skinz	u
Stereo separation, 100Hz, 1kHz, 10kHz 26dB, >40dB, 20	d
Channel difference at 1kHz, 10kHz 0.1dB, 0.1	d
Trackability 300Hz lateral ±15dB	8
Trackability 300Hzvertical ± 12dB	0
Trackability 300Hz lateral + 18dB ('Supertrack') 2.6	ŝς
Distortion 300Hz lateral + 9dB	9
Distortion 300Hz vertical + 6dB	1%
High frequency waveform qualityf	ai
Mid band intermodulation	
(1kHz + 1.5kHz 24cm/sec)	9



Frequency response, rel output and separation ref 0d (1mV/cm/sec)

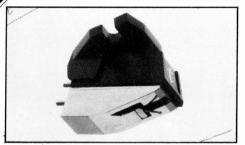


1kHz squarewave (ignore ultrasonic cutter ringing)

# Tenorel TMC10

Condor Electronics Ltd, Woodman Works, 204 Dunsford Road, London SW19 8DR Tel 01-947 9511

Cartridge type and weight



A modestly priced, Dutch-made moving coil from Tenorel, the '10 does not require a head amplifier. It has a moderate compliance, suited to many low-to-medium mass arms, for which damping is not required. The stylus was a well finished and shaped, shank-mounted elliptical, quite good for the price and possessing sensible geometry.

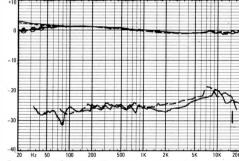
Overall the frequency response met tight ±1dB limits with excellent balance and quite good separation, especially at high frequencies. The overall frequency balance was however slightly 'rich', a common moving coil effect, but this cartridge's main area of weakness was its moderate trackability, the degree of internal overdamping necessitating 2.4g to negotiate the 'Supertrack' section. It must however be conceded that other taxing sections were handled pretty well at the 1.80 test downforce, although noise intermodulation distortion was a little high at 20kHz. The squarewave confirmed the response downtilt and also the essentially smooth, wideband characteristic.

Subjectively the TMC10 rated as 'good' which was encouraging. The presentation was a trifle flat in depth but at the same time it was open, and neutrally balanced with good detail and consistent from bass to mid. On occasion the treble was a little hard with some emphasis on strings but this was well controlled and in view of its price, this new Tenorel clearly justifies admission into the 'Best Buy' category.

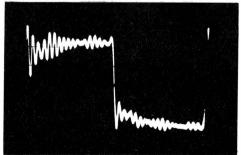
Cartridge type and weight high output moving con, 6.5g
Estimated dynamic compliance at 10Hz 20cu(x 10 - cm/dyne)
Specified downforce: 1.4 to 1.8gtested at 1.8g
LF resonance in test arm
(Mission 774, 5.5g me + cart) + 6dB at 10Hz
Sensitivity at 1kHz approx 0.6mV/cm/sec
Relative output (0dB = 1mV/cm/sec)4dB
Subjective sound quality
Recommended loading47kohms plus
Recommended arm mass
Recommended arm damping none required
Cartridge coil resistance120ohms
Induced hum levelgood
Stylus type fixed, shank mount, elliptical
Finish and alignment both good, 55° cone angle
Tip geometry6 x 18µm, well shaped, well finished elliptical
HF resonance (tip mass/vinyl) around 40kHz
Frequency response, wideband (30Hz-20kHz) + 1dB, - 1dB
Frequency response, midband (100Hz-5kHz) + 1dB, - 1dB
Stereo separation, 100Hz, 1kHz, 10kHz 27dB, 26dB, 22dB
Channel difference, 1kHz, 10kHz 0.2dB, 0.1dB
Trackability, 300Hz vertical + 12dB
Trackability, 300112 Vertical + 120b
Trackability, 300Hz lateral + 15dB
Trackability, 300Hz lateral + 18dB ('Supertrack') 2.4g
Distortion, 300Hz vertical + 6dB2.5%
D:-44: 000H-1-4I + 04D

high output moving coil 6.50

Distortion, 300Hz lateral + 9dB
High frequency waveform quality fair
Midband intermodulation (1kHz + 1.5kHz 24cm/sec) 2.8%
HF intermodulation (pulsed 10kHz, 24cm/sec peak) 0.6%
Pink noise intermodulation,
12kHz, 16kHz, 20kHz
Typical selling price inc VAT£40
Replacement stylus cost inc VAT£20



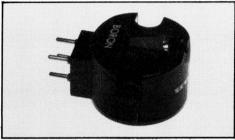
Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)

## Zenn MCZ7

Tapehand Ltd, Unit 3, 68 Windmill Road, Croydon, Surrey CR0 2XP Tel 01-684 0014

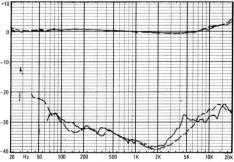


This black-bodied moving-coil resembles a slimmed-down Asak, but differs from that cartridge in its use of a solid boron cantilever and pure silver coil windings — although the latter feature has not been proved to beneficially affect sound quality. Of line specification, the oriented naked stone tended to an elliptical shape but was well shaped and polished with a largish scanning radius of 7.5µm. Compliance was sensible at 15cu, and the cartridge is thus suited to a number of good arms. Arm damping is not required.

No data was supplied with the review sample, but the design is clearly a low impedance type. A suitable test downforce was found to be 1.9g. The graph showed very good and consistent channel separation with a highly uniform response to 8kHz, beyond which the output rose to +4dB at 20kHz, which is more than I would like. Even so, the design was a good one, returning impressive results for distortion, while trackability was also good, only just failing the highest level Supertrack. With a tip mass resonance well controlled at about 38kHz, the squarewave overshoot simply reflected the rising treble response and was otherwise good.

Subjectively, the sound was affected by the treble lift though not as much as expected and a very good rating was achieved. Occasionally sibilant and brash, the bass was firm, with the stereo stable and deep, demonstrating fine clarity. A candidate for treble cut, the Zenn could nonetheless work well in many good systems.

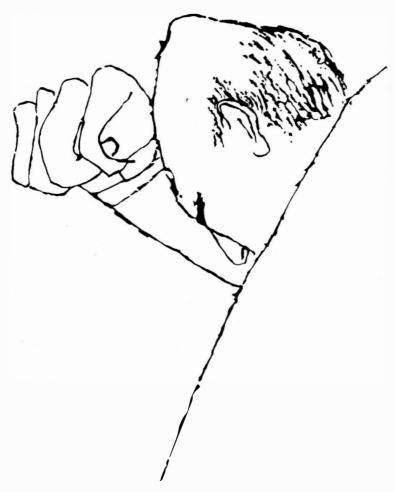
Pink noise intermodulation,
12kHz, 16kHz, 20kHz.
1.8%, 4%, 6%
Typical selling price inc VAT
Replacement stylus cost inc VAT
£136



Frequency response, rel output and separation ref 0dB (1mV/cm/sec)



1kHz squarewave (ignore ultrasonic cutter ringing)



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# **AMPLIFIERS**

It is now twenty years since the development of the transistor finally made mass production of amplifiers possible. Since then, year after year, amplifiers have offered lower and lower specified distortion with higher and higher power output. In relative terms amplifier power has never been cheaper. However the demands on power from digitally recorded material are making higher powered amps a necessity.

The amplifier can be looked on as the core of any hi-fi system. It deals with all sources of musical signals, reroutes, switches, modifies and amplifies these input signals for final output

to drive the loudspeakers.

Any hi-fi amplifier consists essentially of several stages. The principle division is between those parts of the integrated (or pre/main) amplifier concerned with signal handling and those parts of the amplifier concerned with driving the loudspeakers. When separately boxed, these two parts of the amp are called the preamp (or sometimes control amplifier) and the power amp (or sometimes main amplifier). Additional stabilised power supply boxes for pre-amps and some power amps can be seen among the more exotic equipment on test.

Pre-amp basics

The pre-amp is expected to accept electrical signals at low level from a range of signal sources, and to amplify them sufficiently to drive the

power amp stages.

The signals produced by cassette decks, tuners and Compact Disc players are all of roughly similar level (nominally 150mV, known as 'line' level), so generally 'tape', 'tuner' and 'anx/CD' inputs have similar characteristics. Separate, more sensitive inputs are needed to accept the much lower level signals produced by phono cartridges — typically 2.5mV (magnetic) or 0.25mV (moving coil). The line level inputs require no equalisation and in many of the best designs are merely fed straight to the volume control.

Cartridge equalisation

In order to cut bass frequencies on a record, without the sheer size of the bass modulations taking over half the disc and resulting in short playing times, the bass frequencies are reduced in level during cutting. The treble frequencies, on the other hand, are represented by very small groove modulations and could easily get

'lost' in the grain of the vinyl; so these are boosted during cutting to over-come surface noise. All records have this bass-weak/treble-rich signal cut onto them. The pickup cartridge faithfully translates this signal and the preamplifier's job is to restore it to a 'flat' neutral state by 'equalising' the signal, that is, introducing the inverse amount of cut and boost. The preamp boosts the bass and cuts the treble to restore a flat response. The international standard for this equalisation was laid down by a body known as the RIAA, which has become the name applied to phono stage equalisation. Our tests pay particular attention to the accuracy with which this is carried out.

Both line and phono level inputs are fed to the tone control section of the pre-amp. This may offer simple treble and bass controls or more sophisticated controls to 'tilt' the frequency response; or a graphic equaliser with five, maybe ten bands. In our experience very few tone controls offer anything of lasting high-fidelity worth and many so-called 'audiophile' designs omit them altogether. Some rare designs allow subtle control however (the Quad and Audiolab designs spring to mind

Tape recording

Tape decks need to 'talk' two ways with the pre-amp, to record signals from disc, radio or other source and to return recorded signals into the pre-amp for playback. Some amplifiers have record and playback sockets for only one tape deck, while others offer full connections for two decks. Some decks have switches to allow you to dubfrom 'Tape 2' to 'Tape 1' as well as the other way round. Some amplifiers have 'record out' sockets to allow the tape deck to record any input without that input necessarily having to be monitored; in other words, you can record discs while listening to the radio.

Confusion has been fostered in the past by the existence of two standards of connection, one to DIN specifications (European) and one conforming to Japanese and American market standards using RCA 'phono' sockets. The specifications involve different levels, headrooms and matching impedances as well as physically incompatible plugs. Further confusion is caused by UK manufacturers' use of DIN sockets carrying 'phono levels and impedan-

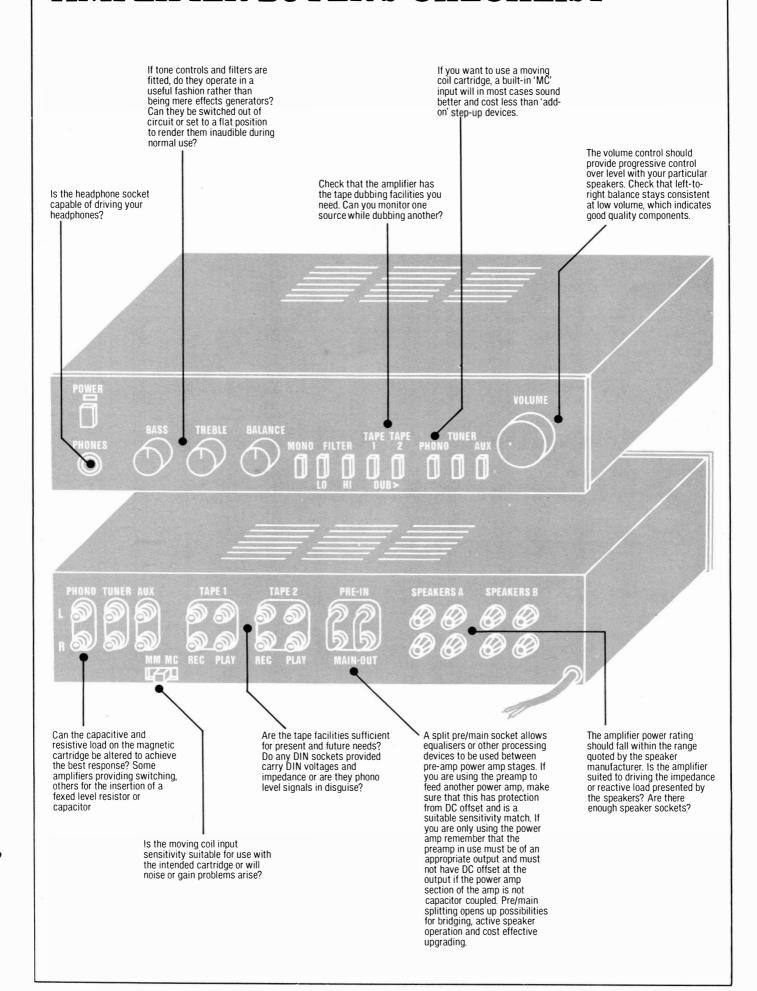
ces! Virtually all hi-fi cassette deck manufacturers have now given up fitting DIN sockets, which is just as well as these were often of poor performance and not to DIN specification either. The rule is that most tape machines work best through their phono sockets so use those if you can. Most current British amps, then, can be connected to tape decks via a DIN-to-four-phono-plugs lead, with no problems. On older equipment use phono-to-phono or DIN-to-DIN connections except where DIN is a disguised phono and then avoid connecting phono outputs to DIN inputs and DIN outputs to phono inputs. A tape deck with a level control can often solve any sensitivity problems at a stroke.

**Power amplifiers** 

The power amp's task is to handle the complex music signal from the preamp and to step up its voltage to a sufficient level to enable the attendant current to drive the loudspeakers. The problem is that the relationship between voltage and current is defined by the load presented by the louspeaker. No loudspeaker offers a simple resistive load of 80hms in actual use, and the interaction between amplifiers and speakers is very complicated once musical signals are involved. Our tests look at the power amplifier's capability of driving power into real loads (reactive and low impedance) rather than test bench loads.

Other models worth considering Models rated as worth considering were headed by the trusty A&R Cambridge A60 (£199), a well-equipped, versatile and established UK design. The Fisher CA275 (£180) was found to have a remarkably high output power and a generally satisfactory overall standards. The **Sony TA- AX500** provided similar versatility to the recommended Luxman L230 but achieved lower sonic attainment The Quad 34/405-2 (£500) proved to be a versatile pre/power combination (no headphone socket) of exceptionally fine build quality appearance with respectable sonics. The Tandberg 3012 (£530) proved itself a powerful high quality integrated design with comprehensive facilities and convenient operation. Low-priced product which on our tests rated worthy of consideration included the Akai AMU-3 (£109) and the Technics SU-V 303 (£129).

# **AMPLIFIER BUYER'S CHECKLIST**



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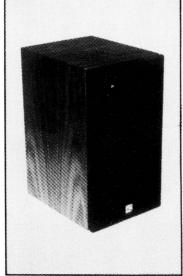
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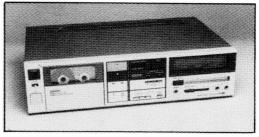
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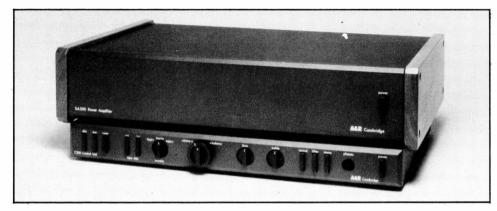






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Pre- and power amplifie



Tested mainly as an amplifier combination, the C200 pre-amplifier and SA200 power-amp were also assessed individually, with ratings given where appropriate. At over £600 the pair, the performance needs to be good, although it must be said that the price is fairly competitive for the power rating and facilities offered.

The C200 is internally constructed on modular principles, allowing the user considerable flexibility as regards the number and type of input facilities; for example, multiple moving-coil inputs if so desired. In its standard form it provides disc mm and mc, aux, tuner, and tape 1 and 2, with variable sensitivities and tape replay gain, plus a wide range of input loading possibilities. Most sockets are DIN, but the disc inputs are duplicated in phono. Bass and treble controls are also provided, and these circuits may be cancelled by the appropriate buttons. A treble filter, mono switch and headphone socket complete the facilities line up.

The SA200 uses a generous toroidal transformer with separate rectifier/reservoir supplies for each channel, these kept physically well apart within the strong steel chassis. The output is a direct-coupled quasicomplementary while the input is ac coupled with an ultra-sonic filter. Fast acting, the electronic protection has a generous operating area.

While the preamplifier circuitry is quite

plus some integrated devices, much work has been done of late on component sound quality. and both the C200 and SA200 show that great care had been taken in both design and build.

#### Sound quality

Via moving-coil input the sound quality was reasonable, with pleasing dynamics, good bass and quite good detail. The treble was a trifle uncontrolled but this improved when we tried the moving magnet input. Here depth effects and stereo focus were promising and both detail and vocal articulation were advanced in quality.

On digital programme the sound was on a large scale, with tuneful, musical quality, good tonal balance, decent bass plus an effective representation of depth and space. The SA200 could be driven hard, producing high sound levels: 104dB into the adverse load was a fine result.

These two units are now well matched in quality terms, and do not change their subjective ratings much if partnered by more costly models.

#### Lab results

While representing a matched combination, these two units are well designed and integrate quite satisfactorily with other equipment when required. Power output comfortably exceeded specification, with a good peak conventional, with a mixture of many discrete reading, this excellently maintained over the

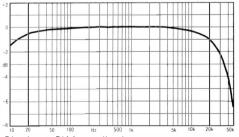
adverse load range despite measured peak. Test measurements current limits of ± 11A. The latter figures are To show how well the amplifier sustains its not representative of the unit's real power capacity, this confirmed in the listening tests.

Harmonic and intermodulation distortions were moderate, with decent noise levels recorded via the tested inputs. Measured dc output offset was satisfactory for both pre-and power amplifiers. Input overload margins were generous while channel separation was satisfactory, and channel balance was well maintained over the entire operating range. Sensitivities and input impedances were fine. though the auxiliary input value was lower than usual at 14kohms.

Disc equalisation was pretty accurate whilst the tone controls were usefully mild in action. The pre-amp is capable of driving long cables, and any other power amps, while the SA200 also works well with other models of preamplifier.

#### Conclusion

While I must say that in the past I have reserved judgement on the original C200, this current model has demonstrated much improved transparency and in now a worthy per former offering great versatility. The SA200 also commands respect as a powerful, neutral amplifier capable of satisfying dynamics and stereo depth at a realistic price. The technical performance is also good, with tolerance of awkward loads impressive, and the build quality is high. Value considerations cannot be as relevant here as at lower price levels, but these two products have delivered a performance which merits inclusion in the 'recommended' category.

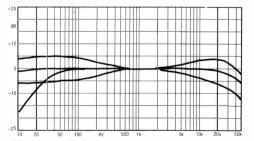


Disc input: RIAA equalisation accuracy

CENEDAL DATA

80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

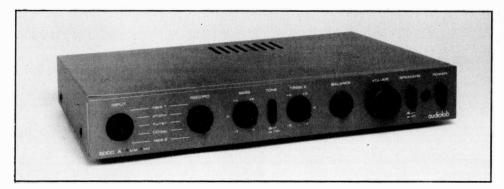
re- and power amplifier
100W( = 20dBW) z 1kHz 20kHz V 20.7dBW 20.1dBW V 19.9dBW 18.8dBW V 19.8dBW 19.0dBW . +11 A -11 A
z 1kHz 20kHz B - 81dB - 76dB ux input 76dB (mm) 77dB (mc) 70dB
- 76dB - 72dB - 78dB - 78dB nin). – 70dB - 22mV - 2mV
z 1kHz 20kHz B 35dB 35dB B 30dB 30dB B >20dB >20dB
3 - 62dB - 41dB 3 - 63dB - 41dB 0.04ohm 0.12ohm 0.12ohm 0.04db 0.12ohm 0.04dB 0.2d



Tone control/filter responses

# Audiolab 8000A

Cambridge Systems Technology Ltd, Roman Way Estate, Godmanchester, Huntingdon, Cambs PE18 9LN Tel (0480) 52521



A brand new amplifier, the 8000A is intended to be one of a new range of electronics designed by two UK engineers with an established track record in this field. It is conservatively rated at 50W per channel.

In contrast to much UK equipment today. which is of 'straight line' design, the Audiolab does have tone controls; these are however said to be specifically designed to produce a negligible subtraction of sound quality. Comprehensively equipped, the input facilities are all in DIN, and include disc (mm and mc), tape 1 and 2, plus tuner and CD/aux. A proper 'record out' selector matches the input selector. Two sets of speakers can be used, with one permanently connected, the other switched. and the second pair partners the headphone socket. A small dealer modification provides for pre-amp/power amp use if this is required (note that in this mode the circuitry which prevents switch-on thumps does not operate).

As well engineered internally as it is finished externally, the amplifer uses a large 250VA toroidal transformer specially mounted to reduce mechanical hum. The output stages are high-current, direct-coupled complementary, with a dc servo to rolloff the extreme subsonic response without need for the usual decoupling capacitor in the feedback loop. Full electronic protection is fitted and designed to allow adverse load drive. All discrete circuitry is employed, the mc headamp a particularly careful design; in fact many of the design features are more commonly associated with more costly models.

#### Sound quality

This amplifier surprised all those who heard it. On moving-coil input the overall subjective rating was 'very good', which is miles ahead of the competition. Its character was highly neutral, if very slightly 'clinical', with an open, wide frequency range and very presentable bass, the latter offering power, precision and extension. The midband was well defined, articulate and well focused while the stereo image showed decent depth and ambience.

Via moving-magnet input a marginal improvement of depth was noticed, while the treble remained slightly imperfect; here a hint of fuzziness and grain was still noted. However, the effect was a little sweeter than on moving-coil, with some further advance in treble quality and a touch more clarity.

Via aux the sound remained very good, dominated by a fine transparency and with additional, admittedly minor, improvements in stereo staging, depth, bass power and detail. It could get pretty loud, and sounded very tolerable into clipping, with 103dBA possible into the normal loudspeaker. A fine load tolerance was also evidenced by the 102dBA produced into the severe load.

#### Lab results

Specified at 50W (17dBW) the amplifier demonstrated a fine power bandwidth at 19dBW into 8ohms. The 4ohm continuous delivery was also pretty good, while its ±15A peak current capability was more than sufficient for the rated power. Peak level approached 100W per

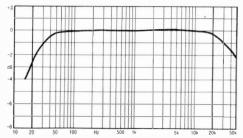
channel, at 19.8dBW, holding well into 4ohms at 18.6dB and still very strong at 18dBW, 2ohms.

Harmonic and particularly intermodulation distortions were at negligible levels, in a sense showing that high-linearity circuits are not in themselves a barriers to good sound quality. Noise levels were fine, and the dc output offsets negligible. Input overload levels were ample, and stereo separation up with the best in the issue, bar the special double-mono amplifier types. Output impedance was low and channel balance very accurate, except at the lowest volume settings. Input sensitivities were sufficient for all classes of source, and the input characteristics were well defined. The mm disc characteristic can be changed via optional loading plugs. RIAA equalisation followed the IEC rolloff, hence the subsonic fall shown here, while the tone controls were suitably mild in action. The pre-amp output also offered a decent output level at low impedance for other power amplifiers. Subjectively, no significant change in some quality could be heard with the tone controls engaged.

#### Conclusion

If sold just as a pre-amplifier the 8000A would get a good value for money rating, but as its power amplifier section is of comparably good quality, then the end result is a highly competitive unit.

It was accurate, powerful, load-tolerant, versatile and compatible and it also set an enviable standard for sound quality. In our view this modestly priced but excellently built amplifier sets a new reference standard and easily achieves 'Best Buy' status.



Disc input: RIAA equalisation accuracy

#### Test measurements

GENERAL DATA

Input data

Disc (mm) input.....

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA		integrated	amplifier
Power output Rated power into 8ohms, maker's s Power output One channel, 8ohm load Both channels, 4ohm load One channel, 2ohms, pulsed Instantaneous peak current.	20Hz 19. 4dBW 17.2dBW 17.8dBW	50W( 1kHz 19.5dBW 17.6dBW 18.0dBW + 15 A	20kHz 19.0dBW 17.0dBW 17.3dBW
Distortion Total harmonic distortion, at rated power, aux input Intermodulation, 19/20kHz, rated p Intermodulation, 19/20kHz, at 0dB Intermodulation, 19/20kHz, at 0dB	ower, aux W, disc (n	input nm)	– 85dB – 85dB
Noise Disc (mm) input (IHF, CCIR weight Disc (mc) input (IHF, CCIR weighte Aux/CD input (IHF, CCIR weightec Residual, unweighted (volume cont DC output offset	ed) l) trol at mir		– 73dB – 82dB – 78dB
Input overload Disc (mm) input (IHF) Disc (mc) input (IHF) Aux/CD input (IHF)		30dB 26dB	
Stereo separation Disc inputAux input	- 90dB - 78dB	– 72dB – 77dB	– 50dB – 56dB
Output impedance (damping) Channel balance, disc, at 1kHz Volume/balance tracking Aux input	0dB	– 20dB	0.12ohm 0.04dB - 60dB 3.6dB

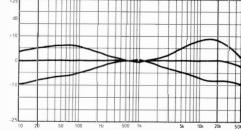


socket type sensitivity

0.3mV

loading

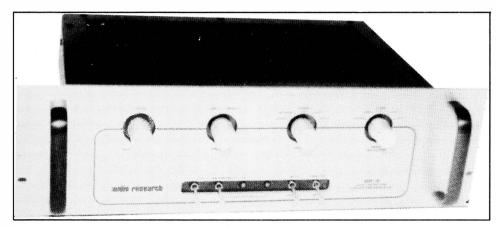
47kohms, 35pF



Tone control/filter responses

# Audio Research SP8 pre-amplifier Absolute Sounds Ltd, 42 Parkside, London SW19

Tel 01-947 5047



Something of an audiophile legend, this USmade pre-amplifier is a valve (tube) design offering superb build quality. The design follows the purist school, and no tone controls or filters are provided, nor is there provision for a moving-coil input. The highest output moving-coils may however prove suitable for moderate listening levels, but if decently low input noise levels are required, then an external high quality pre-amp is essential.

A large and imposing unit, the SP-8 is finished in silver aluminium, with large black handles. Input selection is from disc, tape, tuner plus aux 1 and 2 with all inputs via phono type sockets.

Inside, the power supply is almost as complex as the amplifier section with dc regulated lines to both the HT lines and to the valve heaters. Selected triodes are used throughout. The disc equalisation and input section comprises a three-stage circuit with conventional series feedback RIAA. A similar circuits is adapted for line level use and feeds the output terminal. Very high quality coupling capacitors are used, and particular care has been taken over the power supply decoupling. Frequency responses are very wide and only top-class signal sources are suitable.

#### Sound quality

As 'reference' pre-amplifiers go, this was undoubtedly a very fine-sounding unit. Equally

good via aux or mm inputs, it was characterised by a fine spatial effect, the sound stage full of ambience and depth, with a natural perspective. Stereo focusing was very good. the mid tonal balance exceptionally pure and natural, while the frequency extremes sounded firm, detailed and well controlled. Even the bass was very rewarding when compared with lesser products. The auxiliary socket transmitted PCM digital material with very little alteration, giving a very truthful result.

A suspicion arose concerning a possible mild aberration, though; the ambience effect was a touch excessive and we believe this was actually a function of the mild microphony exhibited by this and several other tubed designs. Also, the audible level of mechanical transformer hum was a minor source of irritation, at least in my room, and a site well away from the listening position is therefore advised.

#### Lab results

The sensitivities are those obtained with the unit as supplied but they may be halved to achieve a lower value by a small board change which can be carried out by the supplier.

Harmonic distortions were very low, but the intermodulation result was poorer than expected, particularly via disc, though not enough to cause concern. Signal-to-noise ratios were above average but not outstanding, but input

overload margins were exemplary. Likewise, the output could exceed many tens of volts at a low distortion level: sufficient for any known power amplifier.

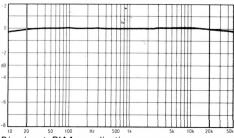
Stereo separation was satisfactory via disc but suprisingly weak via auxiliary, here tending to compromise the high separation available on PCM programme.

Channel balance was well-maintained across the volume control range, while the input characteristics were standard. Components may be fitted on a board to adjust the disc input loading if so desired, with the RIAA proving to be very wide in bandwidth (exceptionally so for a valve model), and giving an almost textbook accuracy. Turntable/arm/cartridge combinations giving excessive subsonic resonance output are to be avoided.

#### Conclusion

This is one of those products that demands to be auditioned at home as part of a good sys-

tem, and I believe that many of those who take this step will not return the SP-8 to their dealer. It does possess certain minor irritations and also lacks an mc input, but with this level of sound quality, price becomes a secondary consideration, and a recommendation is clearly indicated.



Disc input: RIAA equalisation accuracy

**GENERAL DATA** Pre-amplifier Distortion Total harmonic distortion, 20Hz at rated power, aux input. - 85dB - 85dB -85dBIntermodulation, 19/20kHz, rated power, aux input..... - 75dB Intermodulation, 19/20kHz, at 0dBW, disc (mm)..... - 65dB 
 Noise
 — 77dB

 Disc (mm) input (IHF, CCIR weighted).
 — 77dB

 Disc (mc) input (IHF, CCIR weighted).
 — dB

 Aux/CD input (IHF, CCIR weighted).
 — 81dB
 Residual, unweighted (volume control at min). DC offset, pre-amp.....left 0mV, right 0mV Input overload 20 Hz 1kHz 20kHz Disc (mm) input (IHF)..... 40dB 44dB 43dB Aux/CD input (IHF)....>20dB >20dB >20dB Stereo separation - 70dB -43dB Disc input.... Aux input..... - 56dB -37dB Channel balance, disc, at 1kHz.... .0.1dB 0dB -20dBVolume/balance tracking -60dB 0.05dB Aux input.... 0.1dB 0.3dB

Disc (mm) input..... Phono 0.2mV 50kohms, var pF Phono Aux input..... .....>20V max, 600ohms Output, pre-amp (tape)... Disc equalisation error, 30Hz-15kHz.....+0.1dB, -0.1dB Typical price inc VAT.....£1400

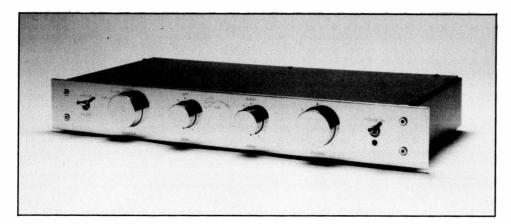
socket type sensitivity

loading

**AMPLIFIERS** Γel Dawlish (0626) 863604 Gulliford Kenton Exeter for House Devon TUNERS NYTECH

# Burmester 785 pre-amplifier Automation Sciences Co, 5B Eton Avenue, London NW3

Tel 01-435 8210



Though the name is not widely known in the UK, the Burmester audiophile pre-amplifiers have been in production for some five years now, and are built in West Berlin, Minor improvements have been made over the years to maintain standards, and the designer aims to provide a very long and trouble free life for these units. Built to very high standards, the pre-amplifier may be obtained in three panel colours, namely mirror-finish brass or chrome as well as a more sober satin black. A 'straightline' design, the 785 has no filters or other facilities: just moving-coil and moving-magnet disc, tuner and two tape inputs. Disc inputs are duplicated to allow the fitment of a variety of loading plugs to give many impedance and capacitance variations.

Two gain adjustments are also possible for disc, via a subsidiary switch marked 1 or 5mV, and also 'level' controls on the front panel which are secondary to the main volume control. All sockets are phono types, apparently silver plated and slightly oversized externally. making for a very tight grip on the plugs.

Internally, this unit, like the Musical Fidelity, is built using high quality integrated circuit amplifiers, carefully decoupled and employing first rate power supplies. Component quality is excellent, with the volume control handbuilt as a precision attenuator using discrete metal film resistors. The mains supply is filtered, and

used to obtain the lowest noise levels. This versatile pre-amp is self-contained and should prove to be compatible with a number of superior quality power amplifiers.

#### Sound quality

It proved hard to realistically separate the sonic achievement of the 785 from that of some of the finest pre-amps we tried. In fact, the tabulated 'excellent' rating is slightly generous, but only just.

A hallmark of the sound was its neutrality a general aura of accuracy and precision which inspired confidence. The bass was to a high standard being deep, articulate and well defined, while the treble was clear and open. and possessed a pleasant nature. The mid was evenly balanced, and free of hardness, with stereo images produced with good precision. Depth and ambience effects were also well reproduced.

Another strong feature was its consistency of sound quality with no evident shortcomings via the wide range of inputs that were tried.

#### Lab report

The unit could produce more than 7V output from a source resistance of typically 100ohms, and will drive most known power amplifiers. including the difficult Electrocompaniets.

Distortion levels were very low except via an earthed three core mains cable should be moving coil, and here the poorer figure is a function of the high gain setting used for test. Krell KSA50 and Mission 777BU power amps Likewise the disc overload margins were referred to a maximum gain setting and improved to decent levels when the pre-amp overall gain is adjusted to suit the cartridge.

Stereo separation was very high while channel balance was excellent. The output was dc £700-£1300, based on sections of the £3500 808 coupled but had no unwanted offset, while sensitivities were in accord with the specification: the moving coil sensitivity. though, remains possibly too low for the lowest output models.

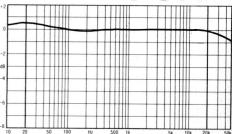
#### Conclusion

Demonstrably an audiophile product, the 785 left me with an impression of enduring consistency. Although it is not strictly comparable with exotic pre-amps in the £1500 range and higher it nonetheless offers a very high standard of sound quality and has the advantage of being fully-self-contained. Compared with its serious competition the 785 is fairly priced for its build quality, finish, and compatibility and we found it partnered the

**GENERAL DATA** Pre- amplifier Distortion Total harmonic distortion. at 1V, 10kohms load........... -87dB -98dB -85dB Intermodulation, 19/20kHz, rated power, aux input >-80dB Intermodulation, 19/20kHz, at 0dBW, disc (mm).....> – 80dB Intermodulation, 19/20kHz, at 0dBW, disc (mc).....-67dB Disc (mm) input (IHF, CCIR weighted)..... Disc (mc) input (IHF, CCIR weighted).... – 67dB Residual, unweighted (volume control at min)..... 96dB DC offset, pre-amp..... Input overload 0mV Disc (mm) input (IHF)..... 20dB 20dB 20dB Disc (mc) input (IHF)..... 3dB 3dB 3dB\* Aux/CD input (IHF)..... >20dB >20dB >20dB Stereo separation - 77dB Disc input..... - 75dB -76dB Aux input.....-84dB Channel balance, disc, at 1kHz..... - 74dB -49dB .0.1dB Volume/balance tracking -60dB Aux input..... 0dB 0dB 0dB socket type sensitivity loading Input data Disc (mm) input..... Phono 2.40mV 50kohms, 50pF 0.03mV Disc (mc) input . . . . . . Phono 500ohms, 0.3nF Aux input..... Phono 45.1mV 30kohms, 60pF Output, pre-amp...., 7.73V max, 100ohms typical Disc equalisation error, 30Hz-15kHz.....+ 0.35dB, -0.1dB Typical price inc VAT ..........£800

Note: all results ref 500mV output \*At max gain: improves to 26dB at min gain

well, although no doubt there are many other suitable combinations. Those interested in Burmester products should note the availability of a new modular design in the not too distant future, this costing in the region of model. In any case, the 785 is recommended.

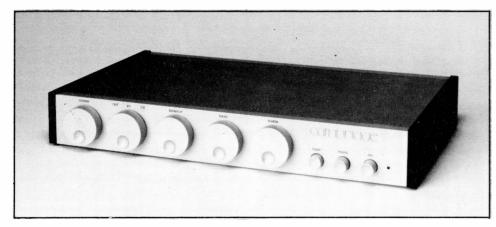


Disc input: RIAA equalisation accuracy

RADE RD ROAD, NOTTINGHAM ប្រភព

mão os s JANUA TINE

Cambridge Audio Research Ltd. Home Farm, Diddington, Huntingdon, Cambs PE18 1XU Tel (0480) 811811



In traditional Cambridge Audio livery of silver and grey with solid wood end caps, the P35 is nonetheless a completely new design. A moderately-priced 35W integrated amplifier, it provides disc, tuner and CD inputs, with moving-magnet and moving-coil disc options selected via a rear switch. Bass and treble controls are also included, plus a mono button, with the headphone socket at the rear - a trifle inconvenient. 4mm sockets connect the speakers, while inputs are DIN, with the exception of the disc input, which has phono sockets.

The review sample supplied by Cambridge initially was a prototype; the company did promise a production model to follow, but unfortunately were unable to deliver one before we went to press. Thus in fairness to all the 'official' products here included, a full approval, must be withheld, and the following findings are only provisional.

Internal construction was clearly to prototype level, using two main expoxy printed circuit boards. A decent-sized toroidal transformer supplies the shared reservoirs, with the output direct coupled complementary, and the system non-inverting. Following a variable gain mm/mc input buffer, the RIAA equalisation is performed in two stages; an input buffer feeds the passive tone controls leading to the power amplifier. The steel baseplate of the case itself forms the heatsink.

#### Sound quality

Slightly marred by some residual hum (which was better with a second sample we obtained), the design scored a commendable 'good' on the listening tests sessions.

Via the auxiliary input the sound was smooth, even bland, with reasonable midband stereo focus and some good depth effects. Musical detail was to a high standard in the mid register, but the amplifier sounded less on control at the frequency extremes.

Via disc some loss of detail and clarity were noted but the standard remained pretty good. Both bass and treble registers were above average and the midband particularly so, with the overall effect quite musical. The amp did not clip particularly well, and the adverse loading, while well-attempted in the sense of maintaining loudness, otherwise served to produce an effect of increasing 'thinness' and muddle. In fact, 100dBA was possible on the difficult load, this improving to a decent 102dB with 8ohms.

#### Lab results

Rated at 15.5dBW, the second sample gave a generous 18.8dBW, which is heading towards 80W per channel. Power bandwidth was fine at 80hms but more restricted at 40hms. Peak power into 80hms approached 100W (19.5dBW) and held well into 40hms, while at 20hms, a reasonable 4dB overall loss occurred. Peak

current capacity was a generous ± 19A. Distortion was satisfactory, with the IM and the 20kHz results only average, but at lower levels the high frequency results improved greatly.

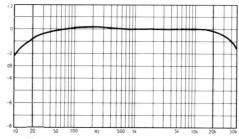
Signal-to-noise ratios were good (second sample) and dc offset satisfactory. All input overloads were ample while separation was fairly typical and could be improved via the aux/CD input. Output impedance was constant and moderate, while channel balance was good at higher levels but deteriorated at low volume settings.

Moving-magnet sensitivity was lower than usual, and the moving-coil gain will not suit the lowest output models such as certain Ortofon models. Note that the mm and mc resistances are the same at 47kohms/150pF, while the aux input impedance is lower than usual at 10kohms; however this should not cause problems except possibly with older sources.

#### Conclusion

This visually attractive amplifier, if well built and well quality-control tested in production could be 'Best Buy' material. It offers a clear, musical sound with a good performance standard, while the technical results were most promising. It was also generous as regards power and tolerant of adverse loading. However, as the P35 was available only in prototype form at the time of writing, I must give it only a reserved recommendation.

(Note: fortunately we were able to test a production sample just as we went to press. and this confirmed the 'Best Buy' rating for this model.)

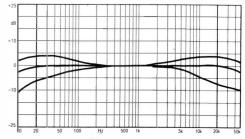


Disc input: RIAA equalisation accuracy

#### Update

Since this review was first published, the P35 design has been adopted by Acoustic Research, who intend to market it as 'The AR Amplifier'. The AR version will be presented in walnut and may feature other revisions.

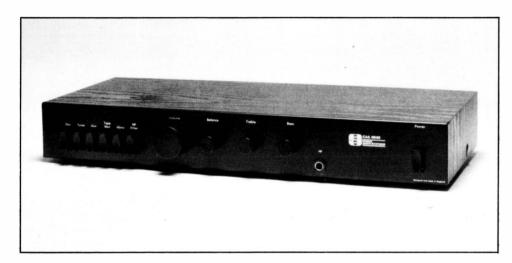
GENERAL DATA	Ir	tegrated	amplifier
Power output Rated power into 8ohms, maker's spe Power output One channel, 8ohm load	20Hz 3dBW 16 5dBW 16 *dBW 18	1kHz 8.9dBW 6.5dBW	20kHz 18.9dBW 14.4dBW 14.0dBW
Distortion Total harmonic distortion, at rated power, aux input Intermodulation, 19/20kHz, rated pow. Intermodulation, 19/20kHz, at 0dBW, Intermodulation, 19/20kHz, at 0dBW,	disc (mm	1)	>-80dB
Noise Disc (mm) input (IHF, CCIR weighted) Disc (mc) input (IHF, CCIR weighted). Aux/CD input (IHF, CCIR weighted). Residual, unweighted (volume control DC output offset.	at min).		– 75dB – 81dB – 77dB
Disc (mm) input (IHF)	20Hz 34dB 31dB 20dB	32dB	30dB
		– 62dB – 62dB	
Output impedance (damping) 0.0 Channel balance, disc, at 1kHz Olume/balance tracking	0dB	– 20dB	
nput data socket type s Disc (mm) input Phono Disc (mc) input Phono Aux input DIN	0.032mV	47kohm	ns, 150nF
Disc equalisation error, 30Hz-15kHz Size (width, height, depth)		43 x 7	x 28.5cm



Tone control/filter responses

# Creek 4040

Creek Audio Systems, 2 Bellevue Road, Friern Barnet, London N11 3ES Tel 01-368 4425



Creek's UK-built budget amplifier has been making good headway on the market in recent months. Priced at just over £100, it is specified at 35W (15.5dBW) per channel, and while features are fairly basic, it does provide tone controls as well as a headphone socket. Loudspeaker connection is via 4mm socket/binding posts, while all the input connectors are DIN sockets. These are chosen by many designers of budget equipment for their assembly convenience, low cost and good electrical performance.

The 4040's low-level stages use top quality integrated circuits, with the RIAA effected in two stages. The treble rolloff section is passive, with a separate switchable rumble filter to add the final low-frequency rolloff, this – 3dB at 45Hz.

The tone controls are incorporated in the feedback loop of the power amplifier section, this a high loop gain design. The strong negative feedback is necessary to reduce the otherwise high level of distortion that results from the use of an unbiased pure Class B output stage, with further assistance given by the Class A driver, which is run at higher than usual current. The review sample, we should point out, was obtained via retail channels and not direct from the manufacturer.

#### Sound quality

Performing fairly well on audition, the disc input showed a noticeable treble and presence lift, in other words more deviation from a flat tonal balance than is usually encountered. The bass was slightly softened with a lumpy effect but solo vocalists were quite well projected with a lively effect. Above average depth and ambience were noted, but a trace of muddle was apparent in the mid register, this increasing on loud passages.

Via the auxiliary input the clarity improved, and tonally it was more neutral showing only slight hardness. Fairly good stereo focus and depth were demonstrated, but the bass was probably the weakest point, sounding a touch lumpy and inarticulate. The treble was satisfactory.

The Creek could be driven hard, showing good clipping tolerance and it also coped with the adverse loading in an acceptable manner.

#### Lab results

Some weakness was exposed by the lab tests. The output specification was just met over the power bandwidth, 8ohms, one channel driven. The small power supply was reflected by the loss into 4ohms on continuous drive, but it made a good try at the 2ohm load on peaks, the

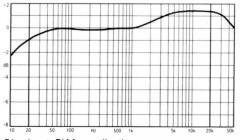
level here falling by a reasonable 4.5dB below the 8ohm peak level. The peak current capacity was satisfactory at +10, -9A

Harmonic distortion results were poor and the high frequency intermodulation also weak, with a figure of – 35dB, or 1.6%, noted here. The intermodulation result via disc was in fact so poor that the result is not shown, this due to the inadequate overload margin. In fact, at 20Hz and 1kHz, disc overload margins were barely adequate, particularly since the low sensitivity would suggest the use of higher output cartridges, while only 3dB of overload was permissible at 20kHz, a figure I regard as seriously inadequate. Noise levels were satisfactory and dc offset negligible.

Stereo separation was about average and channel balance good, except at very low volume settings where a 5dB error appeared. Input sensitivities were rather low, particularly auxiliary, this measuring 70mV as opposed to the usual 20mV or so. Disc equalisation had a significant error in the treble.

#### Conclusion

At moderate disc modulation levels one cannot deny that this amplifer sounded quite presentable — almost 'Best Buy' quality in view of its price. However it suffers from an overload problem which goes on to affect the sound on loud recorded sections. Distortion is also high for a hi-fi amplifier, and is believed to be responsible for the slight 'hardness' and 'muddle' we noted. Relying more on the sound than the test results, I can give the Creek a reserved recommendation, but I feel personally that more work could much improve this already promising design.



Disc input: RIAA equalisation accuracy

#### Note

CreekAudio Systems do not accept the validity of our disc input overload measurements, stating that the overload 'problem' we refer to does not exist in actual practice.

#### GENERAL DATA Integrated amplifier

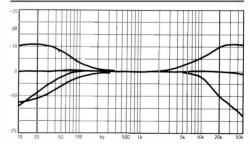
Power output			
Rated power into 8ohms, maker's	spec	35W( =	15.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	15.5dBW	16.1dBW	16.0dBW
Both channels, 40hm load	11.0dBW	13.9dBW	13.2dBW
One channel, 20hms, pulsed		12.0dBW	12.6dBW
Instantaneous peak current		+ 10 A	–9 A
Distortion			
Total harmonic distortion.	20Hz	1kHz	20kHz
at rated power, aux input	- 50dB	<ul><li>57dB</li></ul>	- 38dB
Intermodulation, 19/20kHz, rated p	ower, aux	input	35dB
Intermodulation, 19/20kHz, at 0dB\			
A1 1			

#### 

Stereo separation Disc input Aux input		– 67dB – 65dB	– 43dB – 40dB
Output impedance (damping)0 Channel balance, disc, at 1kHz			0.4dB
/olume/halance tracking	UAB	_ 20dB	_ 60dB

Aux Imput		0.000	U.LUD	O. IGE
Input data	socket type	sensitivity	loadir	ng
Disc (mm) input	. Phono	0.47mV	47kohms,	Ž20pF
Aux innut	DIN	70 4mV	54kohms	—nF

Disc equalisation error, 30Hz-15kHz	+ 1.4dB, -0.5dB
Size (width, height, depth)	42 x 6 x 18cm
Typical price inc VAT	£115



Tone control/filter responses



Electrocompaniet amplifier line has suffered an uneven history, mainly due to the lack of continuity in manufacturing and distribution. The original 25W power amplifier acquired a very good reputation some years ago and was joined by a less well developed pre-amplifier with moving-coil input. However for this review we chose the latest series, comprising a new pre-amp with an external mc head amplifier, and an updated stereo power amplifier. The style and finish are in the audiophile tradition coming in satin black aluminium with a minimum of spurious facilities, filters or tone controls. All the units are now self-powered, and thus may be used with other equipment or in isolation.

The amplifiers are now built to rather a better standard than before, though signs of late modifications and amendments were still evident. The pre-amp uses a toroidal mains transformer with a good reservoir capacity and sub regulators, while all-discrete circuitry is used, with matched and selected transistors.

Inside the power amplifier is a massive toroidal transfomer with separate reservoirs to feed each channel. Designed on low-TID guidelines for a good high frequency performance. the output stage uses a direct-coupled complementary configuration with a large number of small, fast output transistors connected in

Now generally known as Electro for short, the parallel. When factory-wired in bridge mode, the stereo power amplifier forms the basis of the 150W mono power amplifier also available and measured in the lab.

#### Sound quality

Pre- and power amplifiers were considered to be well matched, providing equivalent sound quality at an impressive 'very good' level. The power amplifier possessed a spacious, slightly 'sweet' character, with a touch of softness in the bass, while the pre-amp offered a closer stereo perspective with a mild tonal hardness evident in the mid register. Using the movingcoil headamp, a clear well defined sound was produced with good detail, focus and stereo depth, and via moving-magnet a slight sharpening of detail was observed, with the effect a mite more controlled. Finally, a really good sound was obtained via auxiliary, with fine ambience and depth, sharp image focusing and a clean detailed treble. A maximum sound level of 102dBA was obtained with good delivery into the adverse loading at 100dBA, but the amplifier was not thought to sound too good when clipped, so it should not be driven too hard.

#### Lab results

Rated at 50W (17dBW) per channel, this amplifier delivered 17.5dBW over its 8ohm power bandwidth with very little deterioration into 40hms. It exhibited a good load tolerance with the 40hm peak output at close to the 80hm peak level of 18.5dBW. Premature fuse blowing curtailed the 20hm and peak current tests on this model.

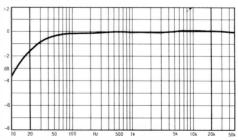
Both the total harmonic distortion and the intermodulation test results were fine, if a little poorer at higher frequencies. Good signal-tonoise ratios were demonstrated, while the dc output offset was quite satisfactory. Ample input overload margins were measured, while the stereo channel separation was well above average. Power amp output impedance was negligible while channel balance and tracking were held to a very good standard even at low volume control settings.

Good sensitivities were shown, with normal matching characteristics, except for the power amplifier, which has a rather low input resistance. The pre-amp provided a low source impedance to match, with a healthy output of up to 17V.

RIAA equalisation was very accurate with a welcome subsonic rolloff to the IEC recommendation. No filtering occurred in the measured range to 50kHz.

#### Conclusion

Left with the feeling that this design is still slightly pre-production, we nonetheless found that the Electro gave a good lab performance together with a fine transparent sound and very good stereo images. It was however rather an expensive model for its power rating and thus value for money is not very good, and it scores a recommendation on the basis of its sonic merit alone.

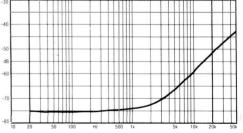


Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **GENERAL DATA** Pre- and power amplifier Power output\* Rated power into 80hms, maker's spec . . . . 150W( = 21.5dBW) Power output One channel, 80hm load......21.0dBW 22.2dBW 22.0dBW Both channels, 40hm load . . . . . . 20.8dBW 21.0dBW 20.8dBW One channel, 20hms, pulsed......fuses blow Instantaneous peak current.....fuses blow Distortion Total harmonic distortion. -76dB at rated power, aux input . . . . . . . 75dB Intermodulation, 19/20kHz, rated power, aux input..... – 79dB Intermodulation, 19/20kHz, at 0dBW, disc (mm)..... - 71dB Intermodulation, 19/20kHz, at 0dBW, disc (mc).....> - 80dB Disc (mm) input (IHF, CCIR weighted)..... – 81dB Aux/CD input (IHF, CCIR weighted). — 89dB Residual, unweighted (volume control at min). — 61dB DC offset, pre-amp. 20Hz 1 20kHz Disc (mm) input (IHF).... 36.5dB 36dB 35 5dB Stereo separation \_ 75dB \_:73dB Disc input..... Output impedance (damping)... Aux input. 75dB 75dB -51dB ...0.080hm 0.080hm 0.160hm Channel balance, disc, at 1kHz. 0.4dB Volume/balance tracking 0dB - 20dB -60dB Aux input...... 0.4dB 0.3dB sensitivity loading 0.22mV 47kohms, 220pF Input data socket type sensitivity Disc (mm) input..... Phono Disc (mc) input . . . . . . Phono cart ridge-dependant Aux input..... Phono 10.8mV 50kohms, 50pF Power amp..... Phono 82mV 13kohms, Output, pre-amp (tape). ..... 17.1V max. 510hms Disc equalisation error, 30Hz-15kHz.....+ 0.2dB. - 0.8dB Size (width, height, depth)......38 x 9 x 33cm, 38 x 9 x 33cm



Power measurements are for mono power amplifiers in bridge

mode. See text. Power amp price is for single mono unit

Typical price inc VAT.....

Disc input: stereo separation

0.10ohm

# Hafler DH110/DH220

HW International Ltd, 3-5 Eden Grove, London N7 8EQ Tel 01-609 0293



The recently-introduced *DH110* and *220* units complement the earlier 100/200 models and as before they can be obtained at a notable discount if purchased in kit form. Finish and styling is much improved however by comparison with the earlier models: this is especially true of the power amplifier with (thankfully!) bevelled heatsink fins. Lettering on the pre-amp does however remain a trifle coarse.

The DH110 is quite comprehensive in offering a headphone outlet in addition to bass and treble controls with tone defeat, a mono switch and filter. Inputs may be selected from disc 1 and 2 (mc optional), tuner, aux tape 1 and 2. The sockets are all phono, but cheap tinned types.

The power amplifier uses good 4mm socket/ binding posts for speaker connection, and has no controls bar on/off. It uses a large transformer and two 10000µF computer grade reservoir capacitors. This largely symmetrical amplifier has high-power MosFET output devices — some secondary components, soldered on their back pins, were nearly shorting on our sample. Inside the pre-amplifier, neat construction was evident, with ribbon cables references. linking the boards. A basic amplifier gain block is used for all stages, this of complementary

symmetry and employing six transistors per unit; in general good switches and controls have been used.

#### Sound quality

The pre-amplifier was not fitted with movingcoil input, but past experience with the 101 preamplifier would suggest that quite a good performance can be expected from this section when used. Commensurate with its track record, the Hafler system gave a good account of itself on audition.

On analogue disc the sound was clear, with a 'solid' midrange and an above-average bass quality, demonstrating weight, extension and definition. The high frequencies were less favourable, with some loss of definition here. Tonally it sounded a trifle 'clinical and cold' while the full depth effects of familiar programme were not wholly discernible.

Via. auxiliary, the sound was somewhat improved. The treble register was tidier now, almost equalling the fine bass, while depth was also improved; though neither in this respect nor as regards absolute transparency did it compare too well against the top class

Driven to high levels the sound held up well. bar a mild increase in mid 'hardness'. A high 106dBA sound level was produced which was very well maintained into the adverse loading.

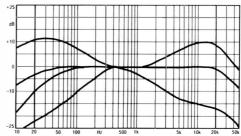
#### Lab results

Rated at 20dBW, the Hafler power amplifier comfortably exceeded this specification over the full bandwidth. A generous 23dBW into 80hms, the level barely fell with 40hms, and only showed signs of stress at 20hms, with a 4.2dB fall in level from the 80hm figure. In fact, the ±20 amp peak current rating is not quite sufficient to support full 20hms drive, but it nonetheless remains a lusty amplifier. Distortion levels were generally low, though the -67dB two tone intermodulation result (mm disc) was higher than expected. Noise levels were fine, and power amp dc offset satisfactory. Disc overload margins were very good, and while stereo separation was good via disc, it could have been better via aux. particularly in view of the superior performance of digital sources.

Channel balances were closely defined and the input impedances gave rise to no concern. Disc equalisation was respectably accurate and the pre-amp could supply a substantial output if so required for alternative power amplifier inputs.

#### Conclusion

This impressive product was capable of high levels with good power and authority. Good to listen to, it provided flexible input facilities and signal handling. While it is not a front rank design as regards the more subtle aspects of musical reproduction, such as rendition of depth and ambience, it nonetheless sets a standard that justifies recommendation.



Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

#### **GENERAL DATA** Pre- and power amplifier

Power output Rated power into 8ohms, maker's spec.... 20Hz .....115W( = 21dBW One channel, 8ohm load.......22.1dBW 22.4dBW 22.0dBW Both channels, 40hm load......20.0dBW 20.9dBW 20.3dBW One channel, 20hms, pulsed.....17.5dBW 18.8dBW 18.7dBW Instantaneous peak current.....

#### Total harmonic distortion, at rated power, aux input ...... – 87dB - 92dB 83d B Intermodulation, 19/20kHz, rated power, aux input..... Intermodulation, 19/20kHz, at 0dBW, disc (mm).....-69dB

Residual, unweighted (volume control at min)..... - 71dB DC offset, pre-amp.....

Input overload 20kHz Disc (mm) input (IHF).............. 36dB 36dB Aux/CD input (IHF).....>20dB >20dB Stereo separation \_ 43dB Disc input..... - 70dB -59dB Aux input..... - 70dB -59dB - 43dB

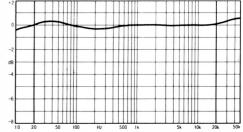
..0.4dB Volume/balance tracking -60dB 0.4dB 0.2dB 0.2dB Aux input..... socket type sensitivity Input data

Output impedance (damping)..... 0.04ohm 0.04ohm

0.27mV 47kohms, 190pF Disc (mm) input..... Phono Aux input..... Phono 14.3mV 34kohms, 100pF Power amp..... Phono 14.1mV 249kohms, 130pF 

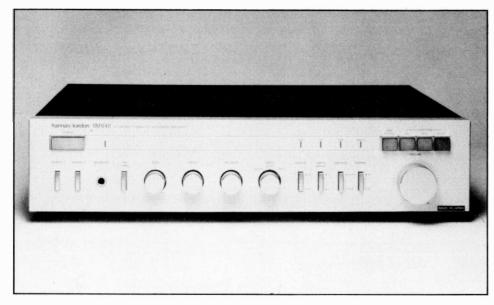
Disc equalisation error, 30Hz-15kHz.....+0.2dB, -0.2dB Size (width, height, depth). . . . . . 43 x 24.5 x 8cm, 40.5 x 26 x 12.5cm

Typical price Inc VAT. . . . . . £310, £360 (in kit form, £245, £295) when reviewed, now £360, £420 (in kit form £295, £355)



Tone control/filter responses

Harman (Audio) UK Ltd. Mill Street, Slough, Berks SL2 5DD Tel (0753) 76911



resulting in their producing a new line of amplifiers. As the 'starter' model in this range, the PM-640 is a fairly modest unit, selling for around £170 and rated at 30W per channel, vet treble controls with 'tone defeat', mono/stereo: complex sound textures. subsonic filter and, finally, a loudness control. spring clips.

Internally, this unit is carefully constructed. with properly-shrouded mains sections. The complementary direct-coupled output stages are designed to provide a high current and use small amplifier. substantial driver transistors, while heatsinking is ample.

#### Sound quality

confirmed that the 640 was a competitive per-

Harman-Kardon have been researching the former. Its basic qualities included an easy, peak current requirements of loudspeakers, clear character with an above average performance over the whole frequency range.

Via moving magnet input, the sound was described as pleasant, with a good midrange, fair stereo depth and satisfactory bass endowed with a high current capability. It is a definition, the latter with good extension. The slim design in the usual HK livery, offering treble was clear and unfatiguing, but slight switching for two pairs a speakers, bass and muddle and defocusing was evident on more

Via auxiliary input, a fine performance was Inputs are provided for disc, tuner and two obtained; the sound was considered to be tape decks, all connections being phono, while neutral, well integrated and of decent 'scale' speaker connections are via fairly light-acting and depth. Quite good sound levels were obtained, which belied the modest specification, and it also tackled the 'extreme' loudspeaker load with little hesitation. Even here, sound levels topped 100dBA, good for a

#### Lab results

Specified at 15dBW, the 640 typically measured at 17.5dBW with a fine power band-With scores well above average, listening tests width. The loss into 40hms on continuous loading suggested that the money has been

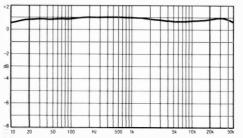
spent on good peak delivery rather than high continuous powers. The peak programme ratings confirmed this, with 18dBW available at 80hms, which was double the specification, and still held to a decent 15.5dBW into 20hms. Peak current capacity was very good at ±25A, which is sufficient for the most difficult of speakers.

Distortion levels were satisfactory, if poorer than average, but noise levels were particularly good. Power amp dc offset was a little high at 30mV. Input overload margins were fine and generally good separation results were recorded, though better 'aux' results would be an advantage for CD programme.

Amplifier output impedance was negligible, and channel balance more than satisfactory throughout the range. Input characteristics were typical though the sensitivities were a little lower than average, which is fine for CD, but the use of very low output moving magnet cartridges might be questionable. Disc equalisation showed a slight treble range depression of just 0.25dB, and the tone control responses were sensibly tailored. The subsonic filter provided -5dB of cut at 10Hz, which was a reasonable compromise.

#### Conclusion

The 640 is a more powerful amplifier than it looks and it delivered a generally good lab performance combined with a strong results on the auditioning test. Its provided a pleasing dynamic sound of wide response, good stereo presentation and substantial strength, even with severe speaker loads, and while we felt it was not best buy material, it still deserves a confident recommendation.



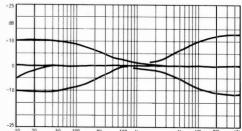
Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

#### **GENERAL DATA** Integrated amplifier Power output

Rated power into 8ohms, maker' Power output One channel, 8ohm load Bothchannels, 4ohm load One channel, 2ohms, pulsed Instantaneous peak current	20Hz 17.4dBW 14.7dBW 14.0dBW	1kHz 17.6dBW	20kHz 17.6dBW 15.5dBW 14.7dBW
Distortion Total harmonic distortion, at rated power, auxinput Intermodulation, 19/20kHz, ratec Intermodulation, 19/20kHz, at 0c	d power, aux	input	– 69dB
Noise Disc (mm) input (IHF, CCIR weigh Aux/CD input (IHF, CCIR weigh) Residual, unweighted (volume of DC output offset	ted) ont rol at mir		– 87dB – 74dB
Input overload Disc (mm) input (IHF) Aux/CD input (IHF)	30dB	1kHz 30dB >20dB	20kHz 30dB >20dB
Stereo separation Disc input			
Output impedance (damping) Channel balance, disc, at 1kHz. Volume/balance tracking Aux input	0dB	– 20dB	0.2dB -60dB
Input data socket Disc (mm) input Phon	type sensiti	vity loa	iding ims, 98pF



Phono

Disc equalisation error, 30Hz-15kHz.....+0dB, -0.2dB

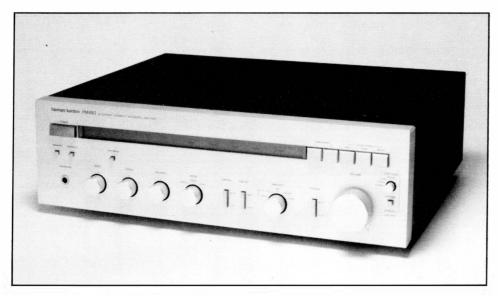
Size (width, height, depth)......44 x 36 x 10cm Typical price inc VAT.....£169

24mV 150kohms, 300pF

Tone control/filter responses

# Harman-Kardon PM-650

Harman (Audio) UK Ltd. Mill Street, Slough, Berks SL2 5DD Tel (0753) 76911



Although a larger 660 model is also available in practice, the amplifier output is direct-coupled the HK 'high peak current' range, it seemed to us that the already well-received 650 was the more natural choice for inclusion here. Basic heatsink. power rating is specified as 50W per channel (17dBW). It comes in a 'champagne silver' case with a neat front panel layout, and is well equipped: both mm and mc disc inputs are provided as are aux, tuner, tape 1 and 2, while two sets of speakers may be connected via substantial binding posts — which are necessary in view of the high current capacity. The moving magnet input capacitance may be adjusted in four steps via a front panel control, to give an additional 50, 100, 150 or 250pF; other facilities include a subsonic filter, bass and treble equalisation plus a 'loudness' contour.

The amplifier is constructed to a high standfor each channel. In accordance with modern mc cartridges it might even be worth consid-

complementary, using a generous Sanken output transistors mounted on a large internal

#### Sound quality

This model scored well in the listening tests. achieving an impressive 'good plus' via its auxiliary input. Here it was considered to be a powerful performer, well focused with firm. punchy bass substantial depth and ambience rendition with a generally neutral character. It clipped well, providing substantial sound levels and also took the adverse speaker load in its stride, attaining over 103dBA on this difficult test.

This generally good sound was maintained via the disc (mm) input, the main effect being ard using good supply wiring, this marred on that of promising attack and definition. Via the the sample by the inclusion of three unshut- mc input, a mild shortfall was however appartered US-type mains sockets on the rear, ent, for although the sound was more than Ideally, these should be blanked off to conform satisfactory, the treble register nonetheless to UK standards. A substantial mains trans- showed a mild 'featheriness', while the stereo former is fitted, using double secondaries images were mildly diffuse and the bass less which feed separate rectifiers and reservoirs well controlled. If the amp is to be used with

ering a competent ancilliary step-up or headamp unit since the good quality of the mm input would appear to justify this.

#### Lab results

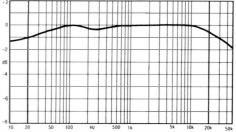
Rated at 17dBW, the 650 raised around 18.5dB under continuous-rated conditions, with a good power bandwidth. On peaks, 19.5dBW was available into 80hms, this falling by only 2.5dB into 2ohms (Of passing interest may be the fact that such a level is equivalent to 200W peak, 20hms!) Peak current was exemplary at ±39 amps which was in line with HK's design target.

Harmonic distortion was fine, although the intermodulation results were poorer than expected. Noise levels were fine except on moving coil, where the high sensitivity achieved has served to reduce this somewhat. The dc offset was satisfactory with ample input overload margins and stereo separation rather better than usual.

Good channel balancing was demonstrated, and all the input parameters were satisfactory. Disc equalisation showed some mild bass rolloff though it met close tolerances above 80Hz.

#### Conclusion

This well built and powerful amplifier has an outstanding peak current capability, and in consequence it is very load-tolerant. The sound was confident and firm, working particularly well with digital programme while movingmagnet disc source also gave fine results. A dependable product, then, offering good value for money, the 650 achieves certain recommendation.



Disc input: RIAA equalisation accuracy

#### Test measurements

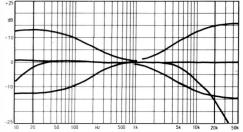
To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

GENERAL DATA	Integrated	d amplifie
Power output Rated power into 8ohms, maker's spec Power output One channel, 8ohm load 18.4dBW Both channels, 4ohm load 19.6dBW One channel, 2ohms, pulsed	1kHz 19.03dBW 20.7dBW 23.0dBW	20kHz 18.4dBW
Distortion Total harmonic distortion, 20Hz at rated power, aux input	– 79dB : input nm)	69dB 71dB

Disc (mm) input (IHF, CCIR weight Disc (mc) input (IHF, CCIR weighte Aux/CD input (IHF, CCIR weighted Residual, unweighted (volume cont DC output offset	– 68dB – 80dB – 78dB		
Input overload Disc (mm) input (IHF)	20Hz 33dB	1kHz 34dB	20kHz 34dB
Disc (mc) input (IHF)	23dB	23dB >20dB	23dB >20dB
	/200D	/200D	/200D
Stereo separation Disc input		– 74dB – 71dB	– 53dB – 49dB
Output impedance (damping)( Channel balance, disc, at 1kHz			0.15ohm

Aux input	0dB	0.1dB	1.2dE
Input data Disc (mm) input Disc (mc) input	sensitivity 0.28mV 0.008mV	loading 46kohm 112ohms	

Disc equalisation error, 30Hz-15 kHz	+0dB, -0.8dB
Size (width, height, depth)	. 44 x 40 x 14cm
Typical price inc VAT	£240



Tone control/filter responses



An American heavyweight built to the highest taxing of loads. Internally, no expense has standards of finish and construction, the KSA50 is a very expensive power amplifier modestly rated at 17dBW (50W). Versions at broadly similar in performance to the '50.

The amplifier runs in pure Class A into 80hm Sound quality loads up to its rated power, and employs a forced-air heat dissipator to provide steady thermal conditions as well as a rapid warm up (minutes rather than the usual hour or so for other Class A designs.) The fan is relatively quiet producing no more noise than the large toroidal transformers fitted, audible hum from the latter varying according to the quality of the mains supply, which depends on the time highly articulate bass to a neutral accurate of day! I would not recommend locating the amplifier too near the listening position if the room's ambient noise levels are low, however.

Below 8ohms, and at higher output levels, the amplifier momentarily departs into Class B operation, and here a large reserve current

been spared and the unit is arranged as a double mono design. Just a hint of its engineering quality may be gleaned from the use 100W and 200W are also available, and with in the power supply of two 1kVA toroids, and the exception of the power output, these are 4 × 40000 µF high-current reservoir capacitors!

This remarkable amplifier delivered an exceptionally good sound, and rarely has a product so consistently exposed the shortcomings of others. It lead the field by a substantial margin, providing stereo images of seemingly effortless depth, clarity and focus. Its stature was apparent throughout the frequency range, from its deep, powerful, and midrange, and a sparkling but delicately musical treble. It consistently provided more musical information in a more natural manner than other models we tried, including a number of references at rather higher prices. Its sound also continued to improve with the use of capability is provided to cope with the most better pre-amplifiers, these ranging from the Audio Research SP8 to the Burmester 808.

It sailed through the awkward load test, and the maximum sound levels obtained contradicted the conservatively-rated output specification. A considerable 102 to 103dBA volume was obtained in the listening room, which was not that much less than some of the most powerful designs tested in this issue.

#### Lab results

Rated at only 17dBW, the Krell typically produced on continuous ratings at 19.1dBW output level, and such was the extraordinary power bandwidth that no significant fall occurred from 20Hz to 20kHz, relative to 1kHz. Likewise the loss into 4 and 20hms was small. Peak output was approaching 100W, reading 19.3dBW, with 18dBW still provided into 20hms, the Krell proving to have one of the 'stiffest' output and power sections measured. Peak power into 20hms exceeded 240W. Peak current output was symmetrical at a substantial +29A, -30A, which was sufficient for the worst loads.

Harmonic and intermodulation distortion was negligible with noise levels also very low. One sample had a slight driver fault resulting in some moderate dc offset, this negligible once the problem was corrected. Stereo

**GENERAL DATA** Power amplifier Power output Rated power into 8ohms, maker's spec. .50W( = 17dBW)Power output 20Hz 20kHź One channel, 8ohm load. . . . .19.1dBW 19.1dBW 19.1dBW Both channels, 40hm load......18.4dBW 18.9dBW 18.3dBW One channel, 20hms, pulsed.....17.9dBW 17.9dBW 17.8dBW Instantaneous peak current..... + 29 A -30 A Distortion Total harmonic distortion, 20Hz 1kHz 20kHz at rated power, aux input, . . . . . . -90dB – 91dB -83dB Intermodulation, 19/20kHz, rated power.......>-80dB Channel balance, at 1kHz......0dB socket type sensitivity loading Input data Phono 110mV 22kohms, 176pF Power amp..... **Size** (width, height, depth)......48 x 43 x 21cm Typical price inc VAT.....£1250 mple fault, see text

separation was predicably excellent, and the output impedance at levels of little importance. Input requirements were straightforward, indeed, suitable for the direct connection of some of the higher-level output sources via a passive control.

#### Conclusion

This massive amplifier can be expected to deliver an exceptional sound for many years, and could be viewed more as an investment than, as is all too often the case, a product likely to become obsolete rapidly. For dedicated audiophiles the Krell will justify its high price in an enduring sonic pleasure. We managed also to briefly audition the matching PAM1 pre-amplifier (too late to do a full report) we can confidently say that this beautifullybuilt product was capable of attaining a similar fine sonic standard.

> HiFi Consultants We recommend equipment from the following manufacturers: DUNLOP, PINK TRIANGLE, WALKER, HELIUS, FIDELITY RESEARCH, HADCOCK, LINN, ELITE, SUPEX, KOETSU, SUGDEN, MYST, CRIMSON CELEF, PROAC, CELESTION..... appointment on



Well-presented and finished in the usual Lux not to BS recommendations. manner, the L230 is a medium-priced integrated amplifier and comes with a comprehensive specification. Rated at 60W per channel (17.5dBW), it offers moving-coil and moving-magnet disc inputs plus tuner and aux/CD and facilities for two tape decks.

Elaborate tone controls offer a choice of frequency turnovers for bass and treble plus a loudness contour, plus 30Hz subsonic and 7kHz treble-cut filters. Two sets of speakers can be used (connected by bare-wire spring clips) and a headphone socket is provided. All input sockets are phonos.

Built on one large printed circuit board, the L230's internal constructional quality was considered to be average, with a number of trailing wires in evidence. As noted with certain other cost-conscious designs, the tone controls are integrated in the feedback circuitry of the power amplifier, the latter a direct coupled complementary type using bipolar transistors. A large transformer feeds 2×10000μF reservoir capacitors, and while a primary fuse protects the mains side of the equipment, the mains wiring is unshrouded.

An integrated circuit is used for the disc input/RIAA equaliser, gain adjusted for moving magnet and moving coil sensitivities, with good quality components in evidence through out.

#### Sound quality

The L230 gave an encouraging performance during its auditioning. Rated as 'good' which is competitive at its price level, it was felt to have a slightly 'thin' tone quality giving a clinical effect which was however not too severe.

Via moving-coil input the sound was judged precise and well-controlled with a pleasant mid and treble. Focus and depth were both better than average, though the bass was midly lumpy. Via moving-magnet some moderate improvement in focus and detail were apparent, while the bass extension also seemed to be improved.

The amplifier gave a pleasant relaxed presentation via auxiliary, with fairly good perspectives, although it failed to properly capture the attack and life of the best digital programme. It could be driven hard, though,

and did not deteriorate appreciably into clipping using normal loudspeakers. It's performance on adverse loading was also pretty fair.

#### Lab results

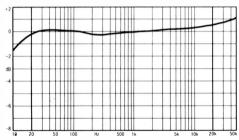
Rated at 60W. 17.5dBW, the L230 could produce a continuous full-bandwidth output into 80hms happily exceeding 19dBW, and on peaks it reached 20dBW (100W). Lower load impedances were however handled less well. with a fall of 3dB on 4ohm peak, and a serious 10.5dB into 20hms. The maximum current limits checked out at ±6A, so this model clearly preferred higher impedance speakers.

Low levels of distortion were measured throughout the test range, while the signal-tonoise ratios were fine considering the sensitivity, with the exception of moving coil. Speaker terminal dc offset was negligible and input overloads ample. Stereo separation was pretty average for all inputs, while channel balances were well maintained except at the lowest volume setting.

RIAA equalisation did show a mild uptilt which might have influenced the comment of a 'thin' tonal balance, but the deviation was quite small. Tone controls and filters were all satisfactory (see graph).

#### Conclusion

While more difficult speaker loads are inadvisable, in all other respects this model represents a competent and versatile package offering a pleasant sound and better-thanaverage stereo presentation. A recommendation is in order since in this instance such a combination of attributes costs well under £200.



Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

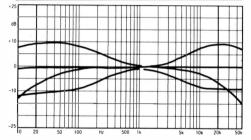
GENERAL DATA	Integrated	amplifie
Power output Rated power into 8ohms, maker's spec	60W( -	17 5dRW
Power output 20Hz	1kHz	20kH
One channel, 80hm load 19.1dBW Both channels, 40hm load	19.4dBW 14.9dBW	19.3dBV 14.9dBV
One channel, 2ohms, pulsed 9.5dBW	9.5dBW	9.5dBV
Instantaneous peak current	+6 A	-6

Distortion Total harmonic distortion, at rated power, aux input Intermodulation, 19/20kHz, rated of Intermodulation, 19/20kHz, at Odb Intermodulation, 19/20kHz, at Odb	81dB power, aux in 3W. disc (mr	nput	- 80dB > - 80dB > - 80dB
Noise Disc (mm) input (IHF, CCIR weight Disc (mc) input (IHF, CCIR weight Aux/CD input (IHF, CCIR weight	ed)		. – 70dB

Residual, unweighted (volume control at min). — 72dB DC output offset			
Input overload Disc (mm) input (IHF) Disc (mc) input (IHF) Aux/CD input (IHF)		1kHz 29dB 34dB >20dB	20kHz 23dB 29dB >20dB
Stereo separation	_ 57dB	- 60dB	_ 34dB

Aux input	- 75dB	- 63dB	- 38dB
Output Impedance (damping)0. Channel balance, disc, at 1kHz			0.2ohm 0.4dB
Volume/balance tracking Aux input	0dB 0.2dB	– 20dB	-60dB 2.7dB

IIIput data			loauling
Disc (mm) input		0.23mV	55kohms, 160p
Disc (mc) input	Phono	0.023mV	117ohms
Aux input		24mV	52kohms, 200p
Disc equalisation error,	30Hz-15kHz.		+0.3dB, -0.2d
Size (width, height, dept	th)		45 x 32 x 11ci
Typical price inc VAT	£180	when revi	ewed, now £19



Tone control/filter responses





Substantially more expensive than the L230 also reviewed the 430 claims nearly twice the output at 105W (20dBW). Comprehensively equipped, it comes in a substantial case and provides good input facilities — disc movingmagnet and moving-coil, tape 1 and 2, tuner, and aux/CD. Subsonic and treble filters are provided, togther with mono switching and 'four frequency' tone controls at 20Hz and 400Hz in the bass, with 1kHz and 10kHz in the treble. A headphone socket is included plus facilities for two sets of speakers, their cables connected via substantial binding-post termis present.

The control layout is logical and the standard of finish is high. Inside the amplifier is well built, but employs the multiple-board style of construction, the boards linked by neat wiring looms. A large power transformer is fitted, the rectifier feeding 2 x 15000μF special audioquality reservoir capacitors.

The disc input stage begins with low noise dual FETs, these followed by an integrated circuit RIAA equaliser section. Later circuitry is discrete, with a complex FET input amplifier

leading to the substantial output stage, the latter employing parallel pairs of complementary output devices, direct-coupled to the load. The mains cabling is well managed and high quality components are used in the construction.

Sound quality

Rated as 'good plus', the L430 did guite well on the auditioning. Its strong points were its clarity and stereo depth, the latter exceptional among Japanese-type integrated designs.

No specific problems were noted via moving inals. A direct path for high-quality CD signals coil though changing to the high-level moving magnet input provided a significant improvement in several areas. Stereo focus was pretty good, with pleasing depth, and a wellcontrolled overall impression but the tonal balance remained slightly thin-sounding.

> Moving on to the aux input, further gains in sound quality were noted. Here the amplifier seemed capable of providing a large scale sound stage, plus decent depth and good midband clarity, focus and articulation. It could also be taken to the limit on the normal load, providing a substantial 105dBA, and

although 104dBA was attained on the adverse loading, the amplifier did not sound quite so comfortable here

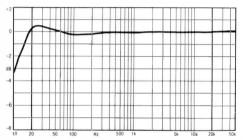
#### Lab results

Demonstrating an excellent power bandwidth. a fine tolerance to 40hm resistive loading, the 430 proved itself to have a substantial power supply, 21.6dBW was available into 80hms on peaks, this barely reduced into 40hms. However, the 20hm load was not favoured, with a 7dB shortfall here. In practice, the 'worst' 80hm speakers should be avoided, but most others will be driven very well by this model.

Peak current was just satisfactory at ± 16 amps, while harmonic distortions were negligible as were the intermodulation figures. Noise levels were generally good, and dc offset satisfactorily low. The disc overload levels were sufficient, particularly in view of the higher than average input sensitivities: but stereo separation was only about average, and could be improved for CD purposes. Channel balance was accurate with fine input characteristics the usable with the least sensitive models. RIAA equalisation was pretty flat, aside from a mild bump at 25Hz. before the subsonic rolloff comes in.

#### Conclusion

A robust, well-finished and well-built amplifier. the L430 offers a good blend of facilities. power and sonic performance. If severe loudspeaker loads are avoided, it will perform well. and although it is above the true 'value for money' price limit, this design is strong enough to merit a performance recommendation.



Disc input: RIAA equalisation accuracy

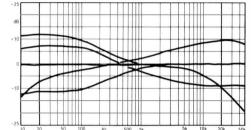
#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

GENERAL DATA		Integrated	amplifier
Power output Rated power into 8ohms, maker's s Power output One channel, 8ohm load	20Hz 21.2dBW 19.1dBW 14.1dBW	1kHz 21.2dBW 19.6dBW 14.1dBW	20kHz 21.1dBW 19.5dBW 14.0dBW
Distortion Total harmonic distortion, at rated power, aux input Intermodulation, 19/20kHz, rated pointermodulation, 19/20kHz, at 0dBV intermodulation, 19/20kHz, at 0dBV	ower, aux N, disc (n	input nm)	.> – 80dB – 76dB
Noise Disc (mm) input (IHF, CCIR weight Disc (mc) input (IHF, CCIR weighte Aux/CD input (IHF, CCIR weighted Residual, unweighted (volume cont CO output offset.	d) ) rol at mir		– 71dB – 85dB – 80dB
Input overload Disc (mm) input (IHF) Disc (mc) input (IHF) Aux/CD input (IHF)	24dB	28dB 21dB	26dB 19dB
Stereo separation Disc input			
Output impedance (damping)	140hm	0.160hm	0.260hm

Channel balance, disc, at 1kHz.,,, Volume/balance tracking Aux input		0dB		0.1dB -60dB
Input data Disc (mm) input Disc (mc) input Aux input	socket type Phono Phono	sensitivity	y loa 50kohn 220ohn	ding ns, 100pF ns
Disc equalisation error, Size (width, height, dep	30Hz-15kHz . th)		+ 0.5dB,	-0.15dB 12 x 14cm

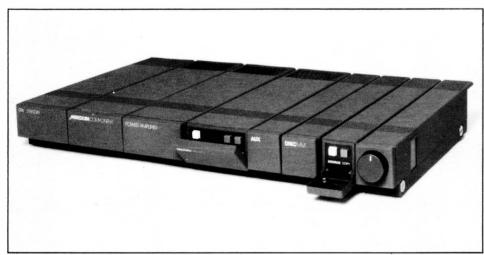
Typical price inc VAT..... £325 when reviewed, now £340



Tone control/filter responses

# Meridian MCA-1

Boothroyd Stuart Ltd. 13 Clifton Road, Huntingdon, Cambs PE18 7EJ Tel (0480) 57339



In the space available here we cannot do full justice to the new Meridian modular system of electronics. When complete, the range of modules will allow the purchaser to select the combination to meet his requirements. For example, if you only play records you need only buy the amplifier with phono facilities, but modules can be added to give other combinations of multiple inputs, with tuner, tone controls, headphone outputs, and separate power amplifiers.

All the modules clip readily together with automatic electrical interconnection, so there are no trailing wires. The slimline cases are all finished in durable grey Nextel paint.

We tested the MCA-1 unit, which assumes the role of an integrated amplifier selling at about £375, offering only a single movingmagnet disc input: in adding moving-coil and auxiliary input options we brought the total cost to nearer £500.

Internal design of the MCA-1 is also unusual - the power amplifier has complementary transistor outputs in a double-mono configuration, fed from a balanced input signal. Power supplies use 'flyback transformer' switching and are regulated. The pre-amp itself is designed with balanced signal handling stages based on the use of multiple high

quality integrated circuits. The moving-coil input is discrete and employs shunt feedback which gives a 'universal' input with a terminating impedance of 120hms resistive.

#### Sound quality

As an integrated amplifier, the MCA-1 rated a 'good plus' score, and as a pre-amplifier used with more substantial power amplifiers, this improved to 'very good.'

Via moving-coil input, the sound was substantially good, with a clean and articulate bass, a natural and pleasant midband, and guite good treble, the latter suffering from just a hint of 'edge' or 'featheriness'. In stereo image terms it was particularly competent. proving capable of fine natural perspectives with good space and depth, plus much low level detail. The moving-magnet input was generally similar; these input options are in each case dedicated modules rather than 'add on' compromises.

Via aux the sound was still clearer, and slightly more 'open'. The mid treble anomaly remained however. Driven hard the amp did not clip well, and sounded a little 'small', while heavy drive into the adverse load constrained the maximum level to a modest 97.5dBA. The pre-amp section could sound better with a

larger power amplifier, where the dynamics were better reproduced.

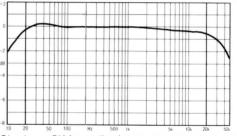
#### Lab results

Measured output levels were close to specification, with a good power bandwidth into the 80hm load. Sufficient peak current, ± 12A, was available to fully drive all the loads on the peak GENERAL DATA programme tests, while the loss from 8 to 20hms was only 0.8dB — an excellent result. Clean, short peaks will be well handled into some of the most difficult loads. Harmonic and intermodulation distortion results were fine and even better at low levels, with the signal to noise ratios particularly good, even though some dc offset was observed at the speaker terminals.

Input overload margins were ample, while the pre-amp could produce decent output levels from a 600ohm balanced or 300ohm unbalanced terminal. Stereo separation was very good, and output impedance negligible. while channel balance was fine and the input characteristics well in order. Disc equalisation was to a good accuracy, with a subsonic rolloff on moving-coil but not on moving-magnet.

#### Conclusion

Its musical, spacious and relaxed sound quality makes this combination a natural candidate for recommendation despite the fairly high price tag, which is not particularly competitive in view of its 100dBA or so maximum sound level. The pre-amplifier section also sounded good, and is also a competitive contender in the quality stakes: this too is recommended, especially for use with Meridian's own active speaker systems.



Disc input: RIAA equalisation accuracy

#### Test measurements

Total harmonic distortion

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### Pre- and power amplifier Power output Rated power into 80hms, maker's spec. .35W( = 15dBW)20Hz 1kHz 20kHz Power output One channel, 8ohm load..... 14 6dBW 15 3dBW 14 2dRW/ Both channels. 40hm load. . . . . . 13.8dBW 14.0dBW 13 0dRW One channel, 20hms, pulsed. ....14.2dBW 14.7dBW 14.0dBW Instantaneous peak current..... + 12 A - 11 A

at rated power, aux input
Noise         — 84dB           Disc (mm) input (IHF, CCIR weighted).         — 76dB           Disc (mc) input (IHF, CCIR weighted).         — 94dB           Aux/CD input (IHF, CCIR weighted).         — 94dB
Residual unweighted (volume control at min) — 87dB

20Hz

1kHz

20kHz

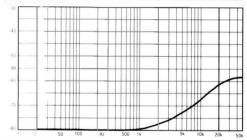
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	29dB	30dB
Disc (mc) input (IHF)	24dB	23dB	22dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	- 80dB	- 78dB	- 58dB

DC output offset.....

Aux input..... - 80dB

Output impedance (dan Channel balance, disc,				
Volume/balance tracking		0dB	<ul><li>20dB</li></ul>	-60dB
Aux input				
Input data	socket type	sensitivit	y loa	ding
Disc (mm) input	Phono	0.36mV	50kohn	ns, 100pF
Disc(mc) input	Phono	•	12ohn	ns, 0nF
Aux input	Phono	24.4mV	49.5kohi	ms, 130pF

.....>6V 600/300ohms Output, pre-amp. Disc equalisation error, 30Hz-15kHz + 0.2dB, - 0.3dB Size (width, height, depth)......480 x 6 x 31cm .....£375 (disc only) Typical price inc VAT. Cartridge-dependent



Disc input: stereo separation

Mission Cambridge, Stonehill, Huntingdon, Cambs PE18 6ED Tel (0480) 57477



A recent introduction to the Mission range. this elegant and compact amplifier forms the disc playing system.

Finished in satin black, this model belongs controls or filters provided — there is not even a balance control. The calibrated volume control is accompanied by two selector switches. one for input (disc, aux, tuner, CD or tape) and the other being the tape record output selector. The latter includes an off position to prevent distortion due to an unpowered anciliary. Inputs are in phono, with output to 4mm sockets/binding posts, these rather closely spaced for comfortable access. A neat rearmounted plug/switch selects moving-coil or moving-magnet sensitivity.

Inside, the main circuit is largely based on the established Mission separates. The power amp is a direct-coupled design with FET output devices and no protection circuits. A modest power supply is fitted, though this here to a more modest 101dBA. section can be upgraded by the user with the addition of an optional extra plug-in power booster. The standard of construction was Rated at 50W per channel (17dBW), the 778 high with fine quality components employed extensively.

#### Sound quality

Rated as 'good plus' on audition, this amplifier heart of the company's complete mid-priced has done well in its price group. Used via its moving-coil input, it delivered a well-balanced. 'musical' sound, with a pleasing accurate to the 'straight-line' generation, with no tone treble, an open and clear presentation, plus guite good bass. Occasionally a hint of hardness was noted in the upper-mid and the full depth and focus of programme was not wholly reproduced.

Comparably good results were obtained via the moving-magnet, input, together with some added precision and focus. Via aux. digital programme was well reproduced with good rendition of detail, and while the bass was well extended it lacked ultimate authority as well as attack, this aspect said to benefit from the booster supply.

High sound levels were attained on normal loading with a consistent sound into clipping. Good results were also possible with the adverse load, though maximum level reduced

#### Lab results

comfortably met this specification into 80hms. with a satisfactory power bandwidth. More

loss than usual occurred with continuous drive into 40hms, but the pulsed power delivery was fine, with 18dBW at 80hms, and a pretty good 14dBW into 20hms. The neak current was sufficient but assymetric at + 14. - 20A, and due to speaker impedance asymetry, maximum power in some cases may be obtained by reversing the cable polarity

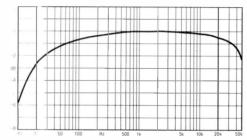
Distortion levels were satisfactory, if poorer than average, with moving-coil signal-to-noise ratio at a figure which must be rated average in view of the low sensitivity; very low output cartridges are not suitable. The other figures were however fine.

Input overloads were ample, though discinput separation could have been better Channel balance was well maintained while the input parameters were quite typical. Fitted with the IEC rolloff, the RIAA equalisation on the disc input showed the usual bass droop, in this case - 1.8dB by 30Hz. Effectively, then, a subsonic filter is inbuilt.

#### Conclusion

Suited to all sources bar really low output moving-coils, this compact and load-tolerant amplifier proved to be a lusty performer. particularly into normal 80hm speaker loads. In the listening tests, it gave a lively performance and vet had much detail and musical subtlety to boot.

While this might be regarded in some aspects as a 'minimalist' product, in fact the 778 does what it sets out to do. It is also competitively priced for the sound quality, available loudness and build quality offered, and logically it must be awarded 'Best Buy' status in this edition.

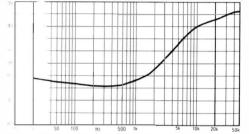


Disc input: RIAA equalisation accuracy

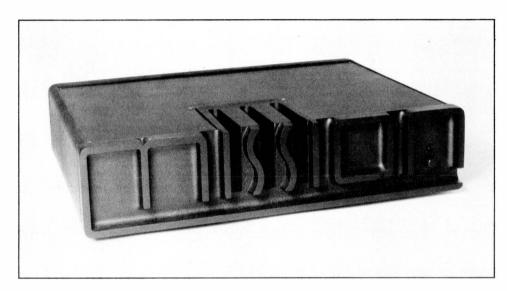
#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA	Integrated	amplifier
Power output Rated power into 8ohms, maker's spec Power output One channel, 8ohm load	1kHz 18.4dBW 14.8dBW 14.0dBW	20kHz 17.9dBW 14.1dBW 13.5dBW
Distortion Total harmonic distortion, 20Hz at rated power, aux input 68dB Intermodulation, 19/20kHz, rated power, aux Intermodulation, 19/20kHz, at 0dBW, disc (rintermodulation, 19/20kHz, at 0dBW, disc (rintermodulation, 19/20kHz, at 0dBW, disc	nm)	– 68dB
Noise Disc (mm) input (IHF, CCIR weighted) Disc (mc) input (IHF, CCIR weighted) Aux/CD input (IHF, CCIR weighted) Residual, unweighted (volume cont rol at mir DC output offset.		– 68dB – 79dB – 71dB
Input overload         20Hz           Disc (mm) input (IHF)         34dB           Disc (mc) input (IHF)         30dB           Aux/CD input (IHF)         >20dB	1kHz 32dB 30dB >20dB	20kHz 32dB 26dB >20dB
Stereo separation         - 64dB           Disc input		
	0.08ohm - 20dB 0.1dB	0.1dB - 60dB
Input data     socket type     sensitive       Disc (mm) input     Phono     0.31m       Disc (mc) input     Phono     0.02m       Aux input     Phono     17.11m	nV 46kohn nV 119ohn	ns, 110pF ns
Disc equalisation error, 30Hz-15kHz Size (width, height, depth)	22 x	35 x 8cm



Disc input: stereo separation



Mission's largest component power amplifier currently awaits a pre-amp revision and so was assessed alone. The distinctive cast enclosure has the front deeply sculpted in the company logo, this styling feature also being exploited as a heat radiator.

Massively constructed, this amplifier was by far the heaviest for its size in the test group. Generous screened toroidal transformers are paralleled complementary FET output devices. The design has a wide bandwidth, nominally dc to 1MHz, and it uses a low order of negative feedback, guoted at 14dB. Inputs are in phono while the single speaker connections are via minimise its effects on the loudspeakers.

#### Sound quality

With a comfortable 'very good' rating for sound quality the 777BU is up with the best in its price range.

while tonally it was essentially neutral, with measured at better than -60dB and the two-

perhaps a trace of mid hardness. Subjective frequency response was very wide with a clean sparkling treble, plus articulate powerful bass of good transient attack, despite a slight effect of low frequency overhand. Stereo images were quite stable and well focused, with both depth and ambience effects well portraved. It could play to very high volume levels with an above-average clipping tolerance; 104dBA was used these feeding a total of 70.000 µF reservoir reached into the normal load, and 102dBA into capacity. It is built as a double mono unit in the adverse load. It also proved tolerant of a one case, and rated at 100W per channel, using wide range of speaker types including electrostatics.

#### Lab results

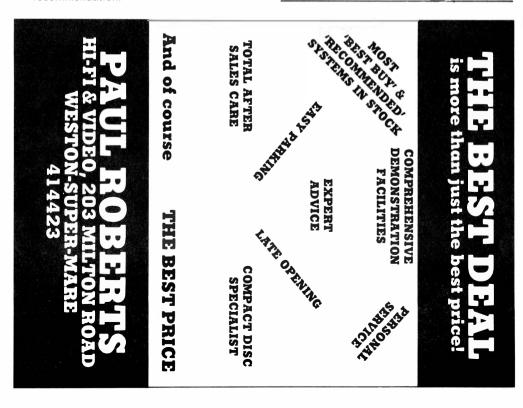
Rated at 100W (20dBW), the 777BU proved to have a substantial power supply and its output 4mm socket/binding posts. The output speaker into 4ohms was barely lower than that into fuse is included in the feedback loop to 80hms. Power bandwidth was excellent at 20.8dBW with the peak 8ohm output at 21.3dBW backed by a high but rather asymetric peak current capacity of +17, -28A, the imbalance fortunately in the preferred negative direction. The output was well maintained into 20hms at 19.4dBW, approaching 275W burst It sounded lively with an impressive clarity, per channel, with total harmonic distortion tone intermodulation figure at -66dB.

Signal-to-noise ratio was fine, output impedance negligible and dc offset satisfactory. Input sensitivity was high enough for direct connection of some auxiliary signals especially CD. For its power rating. mechanical hum was fairly low.

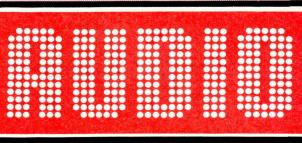
#### Conclusion

While this is an expensive amplifier, it was pretty powerful, with double mono power supplies of a size that bring the unit close to a regulated supply performance. The output was comfortably load tolerant and could be driven into mild clipping, producing high sound levels. The sound quality was in the very good class which goes some way towards meeting the price, and aside from strict value considerations, such results do justify a firm recommendation.

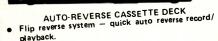
GENERAL DATA	Power amplifier
Power output Rated power into 8ohms, maker's spec Power output 20h One channel, 8ohm load	lz 1kHz 20kHz W 20.9dBW 20.8dBW W 20.4dBW 20.2dBW W 19.4dBW 19.1dBW
Distortion Total harmonic distortion, 20H- at rated power, aux input – 63d Intermodulation, 19/20kHz, rated power.	B - 64dB - 60dB
Noise PA input (ref 1W, 8ohms CCIR weighted). DC output offset	– 91dB .left 25mV, right 25mV
Output impedance (damping)0.12ohr	m 0.12ohm 0.15ohm
Input data soc Power amp. Size (width, height, depth). Typical price inc VAT.	45 x 10 x 32cm







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#### DD V7

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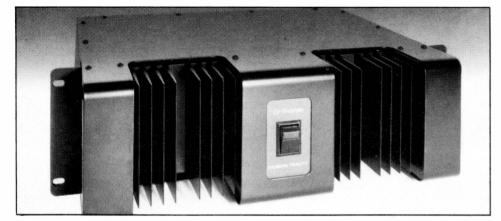
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On the market for some time now, and priced at around £250, The Preamp has already made a good name for itself. The matching power amplifier has only become available more recently.

Outwardly, the *Preamp's* appearance is unusual and rather plain, except that when switched on, its name is brightly illuminated in red. Simple lever switching provides for tape, tuner and disc selection while interchange between moving-magnet and moving-coil reguires the lid to be removed to gain access to an internal switch (but disconnect from the mains first).

The Dr Thomas power amplifier offers a substantial 120W per channel, and is conceived with elongated proportions, the sides clad in finely-finned heatsinks.

Constructional details of the review sample suggested that the pre-amplifier's mains wiring was not to full safety standards; for example the transformer appeared not to be double insulated but the case is not grounded. Integrated circuits are used — for example. LM394 for the moving-coil input and LF363W for later stages.

The power amplifier uses a large transformer plus a generous reservoir capacity and paralleled Hitachi MOSFET output transistors from the direct coupled output stage. The speaker protection fuses are incorporated in the feedback loop in order to reduce their spurious effects.

#### Sound quality

As a combination this system held up well during the listening tests, scoring a 'good plus'. Dynamics were strong and the power amp could play very loud, attaining 106dBA for the normal loudspeaker load and 104.5dBA for the adverse load.

Via the moving-coil input, the sound showed good clarity and was generally well balanced. particularly in the midrange but overall it did tend to a mild 'brightness'. Bass was well above average, however, with fine power and attack, with vocal lines nicely articulated.

On the debit side, the stereo presentation was a little two dimensional, and the depth effects were not as strongly portraved as by some models.

Moving-magnet input performance proved to be guite similar, confirming the good mc result. Via aux, digital programme was clear and articulate with good weight and extension in the bass. Impressive in scale and power, more depth and subtlety would have further enhanced the sound.

#### Lab results

Rated at 120W (21dBW), the amplifier showed a good power bandwidth at a 22dBW level, and held to practically its rated power into 40hms, both channels continuously driven. Peak ratings were good, measuring 23dB (200W) into 80hms, falling only 1.2dB into 40hms, and a reasonable - 4dB into 2ohms. For its power. the amp's +21, -19A peak current capacity is just satisfactory.

Distortion and high frequency intermodulation levels were negligible over the measurement range, while signal-to-noise ratios were good, and output offsets, for both pre and power amp, were negligible. Input overload levels were fine and the power amp output impedance low. Good at higher settings channel balance deteriorated at -60dB volume setting to a poor - 10dB, due to the cheap volume control used.

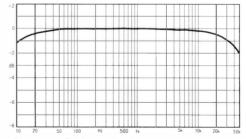
Input characteristics for The Preamp were very satisfactory, but it should be noted that the power amplifier has a lower than usual input impedance, not suited for example, to weak pre-amps or passive control units.

#### Conclusion

Priced well above the 'value-conscious' brackets, the Musical Fidelity combination was a clear candidate for recommendation on the ground of its basic sound quality, as well as dynamic range and maximum sound level.

Considered separately, the power amplifier was load-tolerant as well as powerful, and provided a pretty good sound. If it had sounded a little 'sweeter', with more stereo depth our enthusiasm would be greater. The Preamp continues to stand up well as a musical performer, with particularly good midrange.

(Note: Since this review was completed, Musical Fidelity have changed the cabinet and internal layout of the Dr Thomas power amp; although the circuit itself is unchanged, the new layout is claimed to improve performance in the areas criticised (pic shows new amp).



Disc input: RIAA equalisation accuracy

#### Test measurements

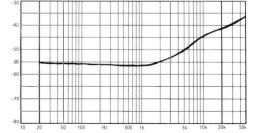
To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### GENERAL DATA

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Pre- and power amplifier

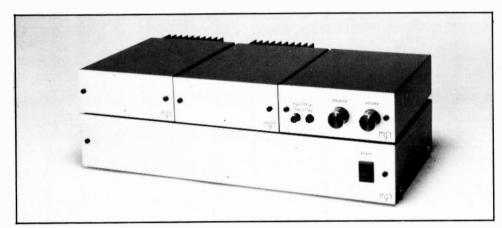
Power output			
Rated power into 8ohms, maker's s			
Power output One channel, 8ohm load2	20Hz	1kHz	20kHz
One channel, 8ohm load2	2.0dBW 2	2.4dBW	22.1dBW
Both channels, 40hm load, 1	9.8dBW 21	0.4dBW	20.1dBW
One channel, 20hms, pulsed 1	8.4dBW 19	9.0dBW	19.0dBW
Instantaneous peak current		+ 21 A	– 19 A
Distortion			
Total harmonic distortion, at rated power, aux input	20Hz	1kHz	20kHz
at rated power, aux input	<ul><li>77dB</li></ul>	<ul><li>77dB</li></ul>	<ul><li>77dB</li></ul>
Intermodulation, 19/20kHz, rated po	wer, aux in	put	– 71dB
Intermodulation, 19/20kHz, at 0dBV			
Intermodulation, 19/20kHz, at 0dBV	V, disc (mc)		– 79dB
Noise			
Disc (mm) input (IHF, CCIR weighted	ed)		– 79dB
Disc (mc) input (IHF, CCIR weighted	d)		– 78dB
Aux/CD input (IHF, CCIR weighted)			– 82dB
Residual, unweighted (volume cont	rol at min).		65dB
DC output offset			13mV
DC offset, pre-amp			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32dB	32dB	32dB
Disc (mc) input (IHF)	24dB	25dB	14dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 55dB		<ul><li>41dB</li></ul>
Aux input	– 68dB		<ul><li>43dB</li></ul>
Output impedance (damping)(	).04ohm (	).04ohm	0.12ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	<ul><li>20dB</li></ul>	- 60dB 10dB
Volume/balance tracking Aux input			
Input data socket type	e sensitivit	y loa	ıding
Disc (mm) input Phono	0.35mV	47kohr	ns, 170pF
Disc (mc) input Phono	0.016mV	198ohr	ns, 10nF
Aux input Phono	18.5mV 101.6mV	44kohr	ns, 60pF
Power amp Phono	101.6mV	10kohr	ns, 380pF
Output, pre-amp (tape) Disc equalisation error, 30Hz-15kH	9	.4V max,	ohms
Disc equalisation error, 30Hz-15kH	z	+ 0dÉ	3, -0.3dB
Size (width, height, depth)	30 x	11 x 5cm.	. See note
Typical price inc VAT £241	,£490 wh	en revie	wed, Dr T
•		n	ow £590



Disc input: stereo separation

# Myst G-Ohm and Tma-3

Myst Ltd. The Old Surveyors Office, Weobley, Hereford Tel (05445) 8811



When this review of the established G-Ohm amplifier system had been completed, we were informed by the manufacturers that we should were happy to do. Bearing in mind broad similarities in circuitry and design, the test results were pretty close with the proviso that the integrated Tma-3's output level was 3dB less than the G-Ohm separates.

Built into a set of excellently finished cases which are assembled together and interconnected at the rear, the G-Ohm comprises a large power supply, the bottom unit, a small pre-amplifier (moving-coil or moving-magnet available) plus two 80W power amplifier units. The Tma-3 integrated comes as a single lowline case, and as with the G-Ohm, also has only input selection buttons and a volume control. Inputs are in DIN, with speaker connection via 4mm socket/binding posts.

Technical details for the G-Ohm include a fine standard of construction and a minimum of wiring. Disc input (mm) is by a 5534 IC buffer followed by TL071 ICs for the two stage RIAA equalisation. Variable gain and loading is possible, while moving-coil uses the LM394 multiple transistor chip, and a TL072 used in shunt/feedback configuration. The power amplifiers are straightforward, and used a complementary MOSFET output stage, and a large transformer is fitted, feeding 2 x 15000µF computer grade reservoirs.

#### Sound quality

Fairly well-regarded in the listening tests, the G-Ohm was felt to be in good control, but with try out their new integrated model, which we some mid-hardness, this notwithstanding a good performance in the vocal register. The bass and treble were not obtrusive, and the amplifier showed good focus and depth in the stereo image. Both moving-coil and movingmagnet inputs were of comparable quality.

On master programme via aux, the sound appeared quite dry in the bass, and well balanced, crisp and clear, but somehow seemed held back. Transparency and depth were not present in full measure, while a trace of 'edge' was also apparent in the treble. A decent 102dBA was available into the adverse load.

The integrated *Tma-3* was not as powerful, producing 102dB into 8ohms, and just 97.5dBA into the adverse load. The family resemblance was clear, though this model appeared to show some improvement in transparency and detail, sounding more 'open' than the G-Ohm.

#### Lab results

Rated at 80W (19dBW), the G-Ohm demonstrated an excellent power bandwidth, holding fairly well into 40hms. Peak current capability was +15, -21A, rather assymetric, and not really sufficient for the 20dBW maximum available. 40hm was handled well on peaks, but into 20hms a 5dB loss was recorded relative to 80hms. At full power the distortion results were good, except at 20kHz, but the high frequency intermodulation was found to improve at lower power levels.

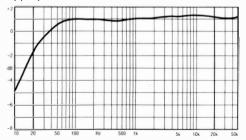
Signal-to-noise ratios were satisfactory, but input sensitivities were on the low side, suggesting the use of higher output cartridges. Output dc offset was within acceptable limits, as was that of the pre-amplifier. Via movingmagnet input, disc overload level were fine. while the lower figures obtained at 20kHz via moving-coil were still just sufficient to avoid trouble. Stereo separation was better than usual, though worse on aux than disc. Channel balance was fine except at very low volume settings. However, 220pF of capacitance is present on the moving-magnet input, which should be allowed for when matching cartridges. The power amplifier input resistance is also rather low at 8kohms.

Following the IEC bass rolloff, the disc equalisation met close limits above 50Hz, but showed no ultrasonic filtering.

#### Conclusions

The G-Ohm represents that now not-souncommon British phenomenon — a carefullydesigned and built product, coming from a small manufacturer. Despite one or two oddities the system did provide good sound levels at a well above average sound quality. which warrants a recommendation.

Turning to the integrated version, costing about half as much as the G-Ohm, it offered a further improvement in sound quality, though with an indication of poorer adverse load tolerance. Since the smaller model was not subject to full test, a reserved recommendation is appropriate here.



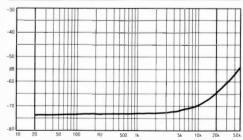
Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### GENERAL DATA Pre- and power amplifier

Power output			
Rated power into 80hms, maker's sp	рес	80W(	= 19dBW)
Power output	20Hz	1kHz	20kHz
One channel, 80hm load19	9.7dBW	19.7dBW	19.7dBW
Both channels, 40hm load 17	7.2dBW	17.7dBW	17.5dBW
One channel, 2ohms, pulsed 14	4.1dBW	15.0dBW	15.0dBW
Instantaneous peak current		+ 15 A	– 21 A
Distortion			
Total harmonic distortion, at rated power, aux input	20Hz	1kHz	20kHz
at rated power, aux input	-76dB	<ul><li>80dB</li></ul>	– 60dB
Intermodulation, 19/20kHz, rated po	wer, aux	input	72dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (m	m)	75dB
Intermodulation, 19/20kHz, at 0dBW	, disc (mo	(0	78dB
Noise	,	,	
Disc (mm) input (IHF, CCIR weighte	ed)		76dB
Disc (mc) input (IHF, CCIR weighted	1)		70dB
Aux/CD input (IHF, CCIR weighted)			
Residual, unweighted (volume contr	ol at min)		71dB
DC output offset			22mV
DC offset, pre-amp			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	33dB	30dB 17dB >20dB	- 18dB
Disc (mc) input (IHF see note 1)	20dB	17dB	– 7dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input		73dB	
Output impedance (damping)	0.10hm	0.10hm	0.19ohm
Channel balance, disc, at 1kHz			
Volume/balance tracking	0dB	<ul><li>20dB</li></ul>	-60dB
Aux input	0.1dB	0.1dB	6.5dB
Input data socket type Disc (mm) input DIN	sensitiv	ity loa	ding
Disc (mm) input DIN	0.45m	V 47kohn	ns, 220pF
Disc (mc) input DIN			ee note 2
Aux input (See note 3). DIN	38m1	V 32kohn	ns, 100pF
Power amp DIN	974m\	V 8kohms	3
Output, pre-amp		9.7V max,	160ohms
Disc equalisation error, 30Hz-15kHz			
Size (width, height, depth)		. 37.5 x 20	.5 x 12cm



600ohm source Z; 3, LOW gain position

Disc input: stereo separation

# AD 3020A

Hi-Fi Markets Ltd, Cousteau House, Greycaine Road, Watford WD2 4SB Tel (0923) 27737



When first produced a few years ago, the budget-price 3020 amplifier showed original design work. In fact, its introduction helped a re-evaluation of standards at this end of the market. The 3020A is an updated version of this bestseller, with a moving-coil input now fitted.

A 20W per channel model, it has many facilities such as bass and treble controls, a loudness button, mono and a headphone socket. A row of LEDs gives a coarse-scale indication of peak power, this shared for both channels. Inputs include tuner, aux, tape, and disc; moving-magnet or moving-coil options are selected via a lever at the rear. Spring-clip connectors are provided for the speaker cables, while input connections are via phono sockets, with tape duplicated in DIN. The moving-coil input has been added by altering the disc input gain, but the input characteristic remains unaltered at 47kohms.

Engineering examination revealed an untidy layout with considerable surface wiring, although the soldering quality was superior to that of earlier 3020 versions. The output is direct-coupled complementary, with 'workhorse' 3055/2955 transistors on an aluminiumbracket heatsink. Commercial quality 4400µF

reservoir capacitors are used for the power supply. Some circuitry has been simplified since the design was first introduced, but the A form is otherwise quite similar to the original, including the optional 'soft clip' mode, which allows working into clipping but with a reduction in 'edgy sounding' distortion harmonics.

#### Sound quality

Scoring above average on audition, the NAD lent a slightly bloomed or rich character to the reproduction, which was quite pleasant. Via moving-coil input it provided quite good definition but lacked real 'see-through' clarity. Complex passages showed some confusion in the midrange and neither stereo focus or depth were very strongly shown. Via moving-magnet. the sound improved a little with more explicit presentation, but bass was still just average.

The output was however notably improved via aux, with better focus and depth as well as a feeling of better control all round. It could play rather louder than the specification suggested, reaching 100dBA and falling only 1dB into the adverse load.

Towards full output the sound hardened somewhat, while at higher mild clipping level, the 'soft clip' switch did smooth the sound at the expense of added muddle, which was not really considered an advantage.

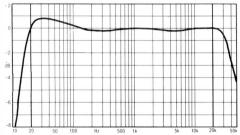
#### Lab results

Rated at 14dBW, the amplifier produced 15.6dBW over the power bandwidth into 80hms. The small power supply was reflected by the greater-than-usual fall into 40hms on continuous loading; but the peak delivery was, however, good, with nearly 50W (16.5dB) available into 80hms, falling only by 3.6dB into 20hms.

Distortion, both harmonic and intermodulation was exemplary, measuring typically better than 80dB down overall. Signal-to-noise ratios were also good, bar the moving-coil input where some compromise was evident. Disc overload margins were ample, and channel separation good at low and mid frequencies. More separation at 20kHz is desirable though, especially via CD/Aux. Channel balance was fine throughout, and the input characteristics were satisfactory, bearing in mind the lower than average sensitivities, as well as the 50kohm input resistance. Typical bass and treble control responses were obtained, while the RIAA equalisation was pretty linear with the mild 0.8dB lift at 30Hz rated as unimportant.

#### Conclusions

The NAD 3020A continues to justify its position as a popular budget amplifier. Strong on maximum sound levels, it was also load tolerant, and will now accept the higher output moving-coil cartridges. Sound quality was also above average at a well below average price, a sure recipe for recommendation.

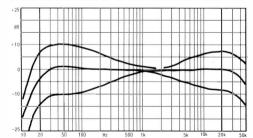


Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA		Integrated	amplifier
Power output Rated power into 8ohms, maker's s Power output One channel, 8ohm load	20Hz 5.6dBW 2.4dBW 2.0dBW	1kHz 16.3dBW 13.8dBW	20kHz 16.1dBW 13.7dBW 13.0dBW
Total harmonic distortion, at rated power, aux input	– 84dB wer, aux /, disc (n	- 86dB input nm)	−81dB − 78dB .> − 80dB
Disc (mm) input (IHF, CCIR weighted Disc (mc) input (IHF, CCIR weighted Aux/CD input (IHF, CCIR weighted) Residual, unweighted (volume contr DC output offset	ol at mir		– 70dB – 88dB – 86dB
Input overload Disc (mm) input (IHF) Disc (mc) input (IHF) Aux/CD input (IHF)	35dB 33dB	32dB	34dB 32dB
Stereo separation Disc input Aux input	– 76dB – 78dB	- 60dB - 61dB	– 35dB – 36dB
Output impedance (damping)0 Channel balance, disc, at 1kHz Volume/balance tracking Aux input	0dB	– 20dB	0.1dB



socket type sensitivity

0.48mV

33.5mV

0.033mV

Phono

Phono

Disc equalisation error, 30Hz-15kHz.....+0.8dB, -0.2dB

Phono

loading

50kohms, 80pF

50kohms, 80pF

84kohms

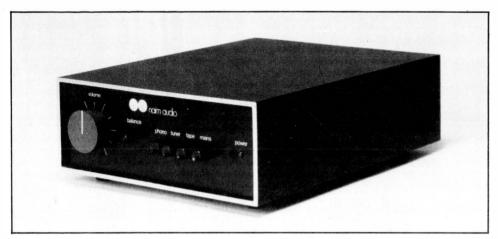
Tone control/filter responses

Input data

Disc (mm) input.....

Disc (mc) input.....

Aux input.....



Awaited with eager anticipation, the NAIT, Naim's inexpensive integrated amplifier was included in this issue on the basis of its market importance. At well under £200 it offers an 'unspecified' low output power, with a 'straightline' circuit design format.

Tape, tuner, and disc mm inputs are provided, the first two in DIN and the lastnamed in phono. Controls comprise pushbutton selectors, balance and volume. The unit is built in a traditional Naim extruded alloy case with a black texture finish and the front edge satin polished. The effect is simple and clean, this aspect also reflected by the interior. which from an engineering viewpoint, is most elegant. A single printed circuit board is employed, well laid out and using good quality components. A toroidal transformer supplies the modest reservoir capacitors, chosen to give a quick recovery as well as high peak current capacity. The output stage is fully complementary direct-coupled, while the tested in this issue. electronic protection integrates voltage and current against time, and allows the use of complex speaker loads. In fact the circuitry is largely borrowed from Naim's more costly amplifier line.

Sound quality

The NAIT was found to produce a clear crisp sound with a surprisingly good exposition of

the depth and atmosphere present on many recordings. It played louder than expected. louder in fact than the peak programme ratings suggested, due to its good subjective behaviour into mild clipping. For the normal loudspeaker load, it provided 97.5dBA with 95.5dBA into the adverse load

Via disc the tonal balance was a trifle thin. but vocal detail was impressive with decent focus and depth rendition. The bass was not perfect and vet it seemed articulate and gave a good impression nonetheless. The treble was not too precise, but did not raise objections from the panelists.

On auxiliary input, the sound quality was better still, with the detail and mid transparency of this design remaining its strongest point.

Overall the effect was that of a lively. involving and musical sound, one which bore comparison with some of the best amplifiers

#### Lab results

Hearsay suggests a 15W programme rating (12dBW), though Naim offer no specifications whatever. Measurement indicated 13dBW over the audio bandwidth, with a fair tolerance of 40hm loading on continuous duty. The ± peak current delivery was fine for the size of amplifier, with the 80hm peak output level

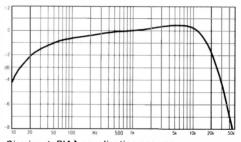
measuring 13.5dBW and still holding up well at 11.3dBW for the 'extreme' 20hm load.

Harmonic distortion was just satisfactory at 20kHz, but improved at lower frequencies. Via aux the full-power intermodulation was fine. but via disc at a lower output it was less impressive. The input signal level was closer to the disc overload point in this test. Signal-tonoise ratios were fine, though the disc input sensitivity was lower than average. Disc input overloads were satisfactory and stereo separation about average, with output impedance negligible and channel balance good, except at the lowest volume settings.

While the auxiliary frequency response was essentially flat, the disc input showed a mildly rising characteristic, with fair agreement to the IEC rolloff in the bass. Mild lift around 7kHz and a subjective treble rolloff of -1.5dB at 20kHz were also apparent. Such a response may help to 'flatter' inexpensive mm cartridges, however.

#### Conclusion

Despite its mild RIAA response aberration. which in a sense is inextricably bound up with any judgement of sound quality, and also bearing in mind the modest output, the NAIT must nevertheless be viewed very favourably. Possessing an excellent build quality and good load tolerance, it also delivered a sound which comfortably bettered its immediate competition, and it went on to demolish a number of more expensive and established performers. With little hesitation, then, we give the NAIT a Best Buy rating. We were not, however, impressed by the switch-on thumps from the loudspeakers!



Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### GENERAL DATA

Power output			
Rated power into 8ohms, maker's	spec	15W( =	12.5dBW)
Power output	. 20Hz	1kHz	20kHź
One channel, 80hm load	13.0dBW	13.3dBW	13.1dBW
Both channels, 40hm load	10.0dBW	11.6dBW	11.4dBW
One channel, 20hms, pulsed	9.4dBW	11.3dBW	10.9dBW
Instantaneous peak current		+9 A	-9 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 68dB	– 72dB	-51dB
40/001-1-			70 - 10

Integrated amplifier

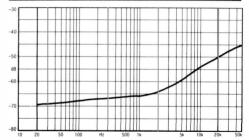
Intermodulation, 19/20kHz, rated pointermodulation, 19/20kHz, at 0dBV			
Noise Disc (mm) input (IHF, CCIR weighted Aux/CD input (IHF, CCIR weighted Residual, unweighted (volume cont DC output offset	) rol at min)		. – 80dB . – 75dB
Input overload		1kHz 25.5dB	20kHz

Stereo separation Disc inputAux input		- 66dB - 66dB	– 50dB – 42dB
Output impedance (damping) Channel balance, disc, at 1kHz			
Volume/balance tracking	0dB	- 20dB	-60dB

Aux/CD input (IHF)......>20dB

Aux imput		005	0.005	0 0 0
Input data	socket type	sensitivity	loadin	g
Disc (mm) input	Phono	0.52mV	46kohms,	140pF
Aux input	DIN	21.1mV	61kohms.	220pF

		 ,	
Disc equalisation error, 3	0Hz-15kHz	 +0.5dB	- 1.5c
Size (width, height, depth	)	 28 x 22 >	< 7.5c
Typical price inc VAT			£12



Disc input: Stereo separation

## Naim NAC32/NAP250

Naim Audio Ltd. Southampton Road, Salisbury SP1 2LN Tel (0722) 332266



Designed as a system, these Naim components are rarely assessed as separate items. It is probably true to say that their manufacturer has dominated the UK audiophile amplifier area for many years now, and in conjunction with the special power supply (SNAPS) for the pre-amplifier, the units here reviewed represent the company's top line models. Active crossovers are also available for selected speakers, allowing the use of multiple power amplifiers.

The NAC32 lacks tone controls or filters but can offer moving-coil and moving-magnet disc inputs, as well as tuner and tape. Sockets are mainly DIN, with disc duplicated in gold plated phonos. Both output signal and supply power are sent via the pre-amp power supply, en route to the power amplifier, using special cable and 4-pin DIN connectors.

Both units are built to an excellent constructional standard, the 250 power amplifier using a refined version of a traditional quasicomplementary circuit, direct-coupled and employing high quality power regulators, these as complex as the amplifier itself. A large torodial transformer is fitted. The pre-amplifier employs a mother board with an array of plugin circuit cards. The mm and mc sections are separate, and following an input buffer. passive high frequency and active low frequency RIAA equalisation is used. Top

quality components are used throughout. The power amplifier uses electronic protection. this set so as not to prejudice the peak delivery into complex loads.

#### Sound quality

Though the price is high the 32/250 quickly demonstrated the standard of sound quality appropriate to its high reputation.

Although a trifle 'doctored' or 'bandlimited' in character, with a mildly 'forward' stereo presentation, the amplifier sounded superbly confident and controlled. It proved to be both detailed and articulate throughout the frequency range and held a good standard of image focus and reasonably good depth. Relaxed and musical, the performance was both involving and revealing.

Via moving-coil the results were fine, improving a little further on clarity and focus via moving-magnet. Via auxiliary, a good impression of the scale and attack present on the PCM programme was also given. It clipped well and could provide 103dBA into the normal speaker load, with a decent 101dBA into more difficult loads. Good subjective volume levels were possible, with more 'power' than the specification suggests.

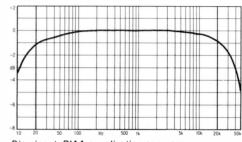
#### Lab results

Rated at 70W (18dBW) the 32/250 showed a

superb power bandwidth into 80hms, delivering 19dBW. The loss into 4ohms was very small, though the amp disliked the 20hm pulses at 20kHz. A sufficient ±16A peak current rating was noted, with the fall in level from 8 to 20hms held to just 2.5dB, which was a fine result. This is clearly a load tolerant model. Distortion levels were low, except at high frequencies where the results were poorer than average, and were considered just satisfactory. Signal-to-noise ratios were fine and output terminal dc offsets also commendably low. Input overload margins were fine, and stereo separation better than average, though it could be better still via aux. Channel balance and tracking were very good, with the pre-amp input characteristics fine. The power amplifier was not considered a difficult input to drive. and with short or even low-capacitance interconnects, it is possible to use even a passive control unit. The pre-amp will happily drive other models of power amp. The disc equalisation showed a broad, tailored response, very uniform through the middle octaves, and 1dB down at 20Hz and 10kHz.

#### Conclusion

This costly amplifier system comes with an excellent reputation and an evidently high build quality. It was well finished and produced reasonably high sound levels, with a fine tolerance of the more awkward speaker loads. The sound quality was rated at the 'very good' level, consistently maintained via the various inputs and over the whole dynamic range. The two units are well matched to each other, and set a standard that justifies recommendation despite the substantial price.



Disc input: RIAA equalisation accuracy

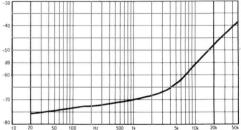
#### Test measurements

GENERAL DATA

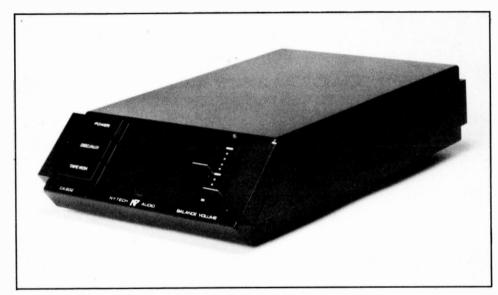
To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

Pre- and nower amplifier

GENERAL DATA	Pre-	an a power	amplifier
Power output Rated power into 8ohms, maker's s Power output One channel, 8ohm load	20Hz 9.0dBW 8.3dBW 6.3dBW	1kHz 19.0dBW 18.3dBW 16.5dBW	20kHz 19.0dBW 18.3dBW 16.9dBW
Distortion Total harmonic distortion, Total harmonic distortion, Total harmonic distortion, Intermodulation, 19/20kHz, rated pc Intermodulation, 19/20kHz, at 0dBV Intermodulation, 19/20kHz, at 0dBV	wer, aux V, disc (n	input nm)	– 69dB – 65dB
Noise Disc (mm) input (IHF, CCIR weighte) Disc (mc) input (IHF, CCIR weighte) AuxCD input (IHF, CCIR weighted) Residual, unweighted (volume cont) DC output offset. DC offset, pre-amp.	d) ) rol at mir		– 72dB – 80dB – 75dB 11mV
Input overload Disc (mm) input (IHF)	20Hz 30dB 25dB >20dB	1kHz 32 dB 25dB >20dB	20kHz 32dB 25dB >20dB
Stereo separation Disc input	– 74dB – 75dB ).18ohm	- 70dB - 70dB 0.18ohm	- 47dB - 48dB 0.18ohm
Channel balance, disc, at 1kHz Volume/balance tracking Aux input. Input data socket typ: Disc (mm) input. Phono Aux input DIN Power amp XLR Output, pre-amp (tape). Disc equalisation error, 30Hz-15kl- Size (width, height, depth) 32 x 2t Typical price inc VAT.	0dB 0.5dB e sensiti 0.20n 0.01n 10.3n 105.4n  dz	- 20dB 0dB vity loa nV 46koh nV 1koh nV 20kohr nV 18kohr .7.7V max +0dE em, 32 x 43	- 60dB 0.2dB ading ms, 100pF im ns, 220pF ns, 190pF , 4.9ohms 3, - 0.7dB
20	-		



Disc input: stereo separation



Nytech's CA202 is the least expensive model in their current range of electronics. It borrows much from the more costly 252, essentially only lacking the latter's moving-coil facility.

Ergonomically styled, with a conveniently sloped front panel, this compact unit offers input selection from disc, tuner and tape, the only other controls being balance and volume sliders. At the rear there are 4mm sockets for connectors being DIN save for the disc, which is via phono sockets mounted on short lengths of cable. A rear headphone socket is provided, which mutes the second set of speaker outlets.

Of good workmanship, the interior displays a surprising total of five printed circuit boards interconnected by extensive wiring. The amplifier output is capacitor coupled complementary, with quite complex circuits, and a single-rail power supply is used, with a 3300µF capacitor plus separate regulators to the low level stages. Good quality components are employed, though I would not like the task of servicing this model, as I feel that disassembly is likely to prove something of a headache.

#### Sound quality

Despite its modest price, the 202 rewarded the panel with a generally above-average sound quality. Pleasant and lively, with a mildly 'thin' or light texture, it was easy on the ears — an important aspect, as some budget amplifiers can prove fatiguing over extended listening.

Via the disc input quite good detail was shown, and singing voice demonstrated good speaker cable connection, the signal input exposition and detail. Bass was of average definition, with some loss of power in the lowest register, while stereo focus was guite good, with an above-average representation of depth.

> Via auxiliary, a hint of treble 'grain' and imperfection was heard but not considered to be too serious. The 202 sounded comfortable up to full power, providing a moderate 98dBA with the normal load, and a presentable 96dB into the adverse speaker load. It was found to clip quite well, subjectively.

#### Lab results

Rated at 20W (13.5dBW), the 202 could produce 15dBW at mid and treble frequencies but the power bandwidth was reduced at 20Hz, pos-

sibly due to the small power supply. This shortfall was shown more severely under 40hm continuous drive, where only 8.9dBW was available at 20Hz. It did better on the pulsed tone tests, producing 15.5dBW into 8ohms with a good 14dBW into 4ohms and a reasonable 10.6dBW into 2ohms. Peak current was asymetric and just satisfactory at +4. -6A.

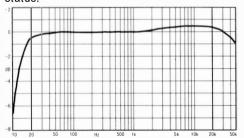
Distortion, both harmonic and intermodulation, was fairly satisfactory, with the weak two tone IM result partly due to the poorerthan-average result for disc input overload. Disc signal to noise was reasonable, and do offset quite negligible.

At just 13dB, the disc overload measurment suggests that some of the higher-output moving-magnet cartridges should be avoided. and indeed CD players with a 2V maximum output level will also overload the aux input by a few dB (1.4V max). Stereo separation was rather below average with a 3dB channel imbalance noted via disc. The auxiliary input sensitivity was rather high at 16.8mV IHF, and a line attenuator would be advisable for CD players with fixed 2V maximum output levels.

The disc equalisation was uniform and welltailored bar a mild 0.5dB lift in the treble, and showed an effective subsonic filter.

#### Conclusion

Despite some weaknesses that were exposed during the lab testing, it would be difficult not to recommend this model on the simple grounds of its good sound quality for the price. Assuming the dealer is helpful in the choice of ancilliary equipment, to avoid input problems. then the 202 does in fact merit a recommended status.

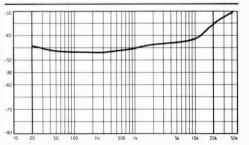


Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **GENERAL DATA** Integrated amplifier Power output Rated power into 8ohms, maker's spec . . . .20W(=13.5dBW)Power out put 1kHz 20kHz One channel, 8ohm load...... .13.4dBW 15.0dBW 15 0dBW Both channels, 40hm load. . . . . . 8.9dBW 12.0dBW 12 0dRW One channel, 20hms, pulsed..... 8.2dBW 10.6dBW 10.5dBW Instantaneous peak current..... Total harmonic distortion. at rated power, aux input..... - 64dB -62dB Intermodulation, 19/20kHz, rated power, aux input.... - 60dB Intermodulation, 19/20kHz, at 0dBW, disc (mm), .... – 54dB Disc (mm) input (IHF, CCIR weighted)..... Aux/CD input (IHF, CCIR weighted)..... - 82dB Residual, unweighted (volume control at min)..... - 74dB Input overload Disc (mm) input (IHF)..... 13dB 13dB 12dB Aux/CD input (IHF)............ 9.6dB 9.6dB 9.6dB Stereo separation - 45dB - 35dB Disc input..... - 43dB Aux input..... - 49dB 0.18ohm 3dB -60dB0.2dB Aux input..... 0dB 0.6dB Input data socket type sensitivity loading 42kohms, 140pF Disc (mm) input..... Phono 0.33mV Aux input..... DIN 16.8mV 46kohms, 20pF Disc equalisation error, 30Hz-15kHz.....+0.5dB, -0dB



Typical price inc VAT.....£125

Disc input: stereo separation



Onkyo products are now available again in the UK after a gap of some years. The A22 amplifier is an inexpensive but presentablyfinished model, which offers 35W per channel. It is comprehensively specified to the IHF A202 recommendations. Front panel facilities include a headphone socket, speaker selection ('A' or 'B' speaker sets or both), bass and treble controls and a loudness switch. Also on the front is a jack socket for connection of an electronic musical instrument such as a keyboard. There is a selector for disc, tuner and tape 1 and 2 inputs, while the volume and balance controls are arranged concentrically. Rear connectors for all input sources are phono, with spring clip type sockets for the loudspeaker cables.

Internal inspection showed the wiring to be none too tidy, and the mains cabling was unshrouded. Obviously built to a budget, the input is designed to use mainly ICs, with the STK 645 output dual power IC mounted on a large heatsink and fed from 6800µF reservoir capacitors. The signal circuits are catered for by a 45590 IC dual amplifier equaliser, and the mains transformer was considered guite small. Protection steps included a muting relay and speaker plus power supply fuses.

#### Sound quality

Without doubt the A22 performed well on audition. Barring a mild 'thinness' or hardness in tonal balance, vocal soloists 'sang' well with guite good clarity and articulation. Focusing of the stereo image was better than usual and a good representation of depth and space was conveyed. The treble was fairly tidy, with a slightly brittle, forward character and the bass was likewise above average with a decent subjective extension to lower frequencies, this degrading a little at high sound levels.

Via the auxiliary input the sound quality continued to impress, the unit sounding generally tidy, and comparable with models at higher prices. Towards full power it became marginally more aggressive, but it clipped fairly well and produced a decent 101dBA into the normal load, with a well sustained 100dBA into the adverse loudspeaker load. It was thus guite load-tolerant and will be able to sustain its output into two pairs of speakers simultaneously.

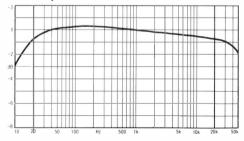
#### Lab results

Rated at 35W (15.5dBW), the A22 comfortably produced 16.8dB over the whole 20Hz to 20kHz bandwidth. 4ohm power delivery was also quite good, with sufficient peak current, although this was rather asymetrical at + 15A, - 10A. Peak level into 80hms was a generous 17.7dBW, fine into 4ohms at 16.0dBW and moderately reduced to 13.1dBW for 2ohms. Both harmonic and intermodulation distortion results were fine, as were the input noise levels. The dc offset at the speaker terminals was well within bounds and the input overload margins were ample. Stereo separation was above average, and the power amplifier output impedance was negligible.

Channel balance was well maintained throughout, and the input characteristics satisfactory, bar the higher than usual input capacitance values. The auxiliary response was quite uniform and the tone controls of gentle action, the RIAA equalisation smooth, though showing a mildly downtilted response from 100Hz to 20kHz, which is perhaps suprising in view of its subjectively good detail and clarity. Perhaps this compensates for a character which might otherwise sound too bright.

#### Conclusion

Attractively priced, this well-equipped amplifier showed a generous output power, good load tolerance plus a well-ordered and predictable lab performance with no matching or overload problems. Its sound quality was above average but its price rather below, such a combination assuring this newcomer of 'Best Buy' status.



Disc input: RIAA equalisation accuracy

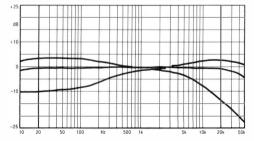
#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

#### **GENERAL DATA**

Integrated amplifier

Power output Rated power into 8ohms, maker's sper Power output One channel, 8ohm load	20Hz 1kHz dBW 17.1dBW dBW 14.5dBW dBW 13.1dBW	20kHz 16.9dBW 14.3dBW 13.0dBW
Distortion Total harmonic distortion, at rated power, aux input	77dB – 84dB er, aux input	-70dB .>-80dB
Noise Disc (mm) input (IHF, CCIR weighted) Aux/CD input (IHF, CCIR weighted) Residual, unweighted (volume control DC output offset	at min)	– 83dB – 81dB
Disc (mm) input (IHF)	20Hz 1kHz 33dB 32dB 20dB >20dB	32dB
Stereo separation Disc input Aux input	72dB – 65dB 73dB – 66dB	– 41dB – 42dB
Aux input	0dB - 20dB 0dB 0.5dB	- 60dB - 60dB 0.4dB
Input data socket type s Disc (mm) input. Phono Aux input. Phono	ensitivity lo 0.43mV 47koh 24.9mV 43koh	ading ms, 210pF ms, 400pF
Disc equalisation error, 30Hz-15kHz Size (width, height, depth)	44 x	39 x 12cm



Tone control/filter responses



A respected American-made amplifier system. the PS Audio range offers several possible options. We chose the model IV, a comprehensive pre-amplifier which includes a passive control option for high level sources, plus the 50W Two C power amplifier.

Presented in slim satin black aluminium cases, both units use separate power supply transformers, with that for the pre-amp not much smaller than the generous power amplifier supply unit. Pre-amp facilities include a choice of inputs from tape 1 and 2, video/aux. tuner and disc (moving-magnet). Input connections are phono sockets, which lock when the appropriate locking plugs are used. The Two C uses 4mm socket/binding posts for speaker connection, and may be switched to mono bridged mode to give 150W plus per channel when a second power amplifier is added.

Beautifully built, the pre-amplifier uses entirely discrete circuitry with passive RIAA equalisation, plus special three-wire signal cabling, comprising signal and ground, twisted together, plus a screen wire. High quality components are much in evidence.

The power amplifier is less tidy, but uses careful decoupling of the reservoir capacitors with smaller-value components. The output is complementary direct-coupled, with Darlington type power transistors, and no electronic protection is provided bar simple speaker line fuses which are not feedback corrected.

Sound quality

Via moving magnet, the sound was thought a trifle brittle and clinical, but very transparent. Stereo focus was very good, with fine vocal articulation as well as a sharp, well-defined bass full of detail. A good proportion of the depth available in the programme was present in the reproduced sound stage. Via auxiliary (active), the 'cool', clinical impression remained, with the treble a trifle edgy and prominent, but the overall sound was nonetheless very good. Switching to 'passive' operation, the sound stage opened up, and the effect was one of better dynamics with a rather clearer and purer treble, a more rounded voice balance and improved depth.

The power amplifier could play quite loud, reaching a measured 101.3dBA before clipping on the normal load, and its fine clipping performance meant that higher subjective levels were possible. It proved very tolerant of the adverse load, as a 'bridgeable' amplifier should be, and could still produce 100dBA. In bridge mode on the standard load, 106dBA was possible, a substantially high sound level.

#### Lab results

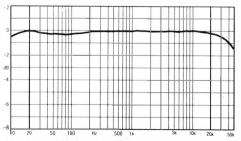
Rated at 17dBW, the amplifier returned an excellent power bandwidth at 17.6dBW. The strength of the power supply was demonstrated by the good 40hms continuous delivery, both channels driven. It also possessed a very generous current capacity for its output

level, at +25A, and drove the peak levels into Test measurements 20hms very well, falling only 2dB below the 80hm level. This amplifier is superbly loadtolerant and will therefore drive most loudspeakers even in bridge mode. Harmonic and intermodulation distortion results were fine, as were the signal-to-noise ratios for the various inputs. Overload margins were more than satisfactory, while stereo separation was above average.

Input and output impedances were in accordance with sensible practice, though the fairly low 10kohms auxiliary input impedance should be noted. RIAA equalisation met verv close tolerances, and although tailored at the treble end (above the limit of audibility), no rolloff appeared in the bass, this responsibility left to the switchable subsonic filter.

#### Conclusion

Overall this combination was bigger and better than its specification might suggest. Despite the 'clinical' character noted, the sound quality was nonetheless very good, with a consistently open and transparent sound, a fine articulate bass, sharp stereo focus plus good ambience and image depth. Of the two PS models tested here the power amp is in our view the superior unit, in fact near to Krell class so far as load tolerance is concerned. As a system, this PS combination can be recommended despite its high price, with the sweeter sounding power amplifier possibly justifying further investigation if coupled to an even better pre-amplifier. The potential for a fourfold increase in power output by adding a second unit in bridge mode is a further consideration in its favour.



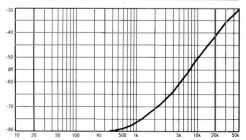
Disc input: RIAA equalisation accuracy

**GENERAL DATA** 

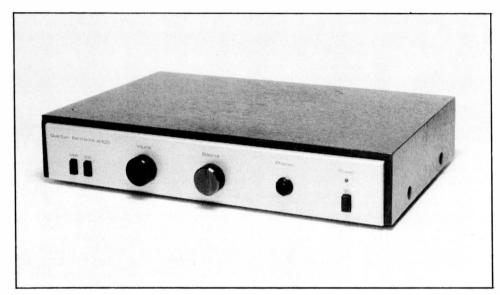
To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Pre- and power amplifier

Power output		ina pomoi	umpimoi
Rated power into 8ohms, maker's sp Power output One channel, 8ohm load	20Hz 7.6dBW - 5.7dBW - 5.0dBW -	1kHz 17.7dBW 17.0dBW	20kHz 17.7dBW 17.0dBW 16.0dBW
Distortion Total harmonic distortion, at rated power, aux input	wer, aux i , disc (mi	nput m)	.> – 80dB – 72dB
Noise Disc (mm) input (IHF, CCIR weighted) Disc (mc) input (IHF, CCIR weighted) Aux/CD input (IHF, CCIR weighted) Residual, unweighted (volume contro DC output offset. DC offset, pre-amp.	ol at min)		– 71dB – 82dB – 75dB 3mV
Input overload Disc (mm) input (IHF) Disc (mc) input (IHF) Aux/CD input (IHF)	20Hz 31dB 25dB >20dB	1kHz 30dB 24dB >20dB	20kHz 22dB 16dB >20dB
Stereo separation Disc input. Aux input. Output impedance (damping) 0.0 Channel balance, disc, at 1kHz. Volume/balance tracking Aux input. Input data socket type Disc (mm) input. Phono Disc (mc) input. Phono Aux input. Phono Output, Pre-amp (tape). Disc equalisation error, 30Hz-15kHz Size (width, height, depth). Typical price inc VAT	- 79dB 04ohm ( 0.1dB 0.1dB sensitivi 0.23mV 0.01mV 33.0mV 137mV 48 x 24 x	- 64dB 0.04ohm - 20dB 0.2dB ty loa / 100kohn / 50kohn / 10koh / 36koh 0.2V max, + 0dB 6cm, 48 x	- 40dB 0.05ohm - 60dB 0.5dB ding ns, 100pF ns, 100pF ms ms, 30pF 1.3ohms 0.2dB 26 x 9cm



Disc input: stereo separation



before updating the styling to a black ash wood-surround case with a silver grev front panel. In addition a moving-coil amplifier board may now be fitted internally at an extra cost of some £10.

'straight-line' model, with no tone controls or tection. filters. Input selection is via two push buttons which cover aux/tuner, tape and disc (movingmagnet as tested). A headphone socket is provided on the front panel, and at the rear the speakers are connected via 4mm socket/binding posts. Both tape and aux inputs are in DIN. with the disc in phono type sockets.

chassis plate with the majority of components ence was noted. On the debit side the tonal mounted on a single printed circuit board, this balance tended to brightness, together with helping to reduce construction costs. The cir-some brittle effects in the treble. cuitry is quite comprehensive; for example the

Quantum had been making the IA-100 for some trol, thence feeding the power amplifier sectime, housing it in a plain black metal case, tion. The latter's output configuration is quasicomplementary, direct coupled. It uses sturdy Toshiba devices, these rather better than the ubiquitous 3055s often encountered.

The construction standard is quite good while both 2A speaker fuses and an electronic The IA-100 is essentially an inexpensive circuit provide for fault and overload pro-

#### Sound quality

Scoring a little above average, the IA100 did quite well during the listening tests. Commencing with the moving-magnet input, the sound was judged quite lively and detailed. Bass was encouraging, and the stereo focus above aver-Internally the unit is built on a strong steel age, and some impression of depth and ambi-

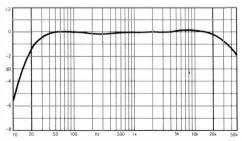
Via aux, there was some improvement in disc section employs a linear input buffer terms of both clarity and depth. At higher followed by the RIAA equalisation section, the sound levels the tonal balance began to latter using a TL082 IC in shunt feedback mode harden, though the amplifier's clipping and working from a single rail supply. A further performance was pretty fair and it also coped IC stage follows the selector and volume con- with the severe loudspeaker load test quite well. It provided 97dBA maximum sound level here, as opposed to 99dBA for the normal loading.

#### Lab results

Rated at 25W or 14dBW the IA 100 managed to produce a decent 16.1dBW level over the 80hm power bandwidth and held up fairly well into 40hms. Peak current was generous at ± 12A, though the peak level into 20hms did not quite reflect this ability. At 17dBW, peak level into 80hms was equivalent to 50W: this fell 1.2dB into 40hms and 4.4dB into 20hms, which was pretty reasonable. Harmonic and intermodulation distortion levels were sensibly low, while noise levels were more than satisfactory. However, the dc offset was marginal at almost 50mV. Input overload margins were fine but the stereo separation measured oddly, improving at higher frequencies to 65dB (this noted with a second sample), but only 45dB mid band. Output resistance was negligible, and the input characteristics normal. The RIAA equalisation was pretty uniform, particularly for a budget amplifier, and illustrated desirable outof-band rolloff tailoring, below 20Hz and above 20kHz.

#### Conclusion

Selling at present at £120 for the movingmagnet and £130 for the moving-coil version. this Quantum in its latest form provides a generally good performance with a quite respectable output power. Its load tolerance was also above average and its sound quality. similarly, of a promising standard. All in all, this UK - built amplifier fully deserves a HFC recommendation.

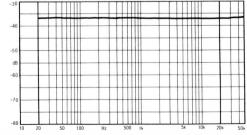


Disc input: RIAA equalisation accuracy

#### Test measurements

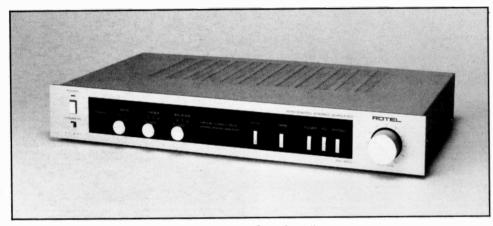
To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

		_	
GENERAL DATA		Integrated	amplifier
Power output Rated power into 8ohms, maker's spr Power output One channel, 8ohm load16. Both channels, 4ohm load14. One channel, 2ohms, pulsed10. Instantaneous peak current	20Hz 1dBW 6dBW 8dBW	1kHz 16.5 dBW 15.0dBW 12.6dBW	20kHz 16.2dBW 14.2dBW 12.4dBW
Distortion Total harmonic distortion, at rated power, aux input Intermodulation, 19/20kHz, rated pow Intermodulation, 19/20kHz, at 0dBW, Intermodulation, 19/20kHz, at 0dBW,	ver, aux disc (n	input nm)	– 72dB – 79dB
Noise Disc (mm) input (IHF, CCIR weighted) Disc (mc) input (IHF, CCIR weighted) Aux/CD input (IHF, CCIR weighted). Residual, unweighted (volume contro DC output offset.	) ol at min		– 83dE – 62dE
Input overload Disc (mm) input (IHF). Disc (mc) input (IHF). Aux/CD input (IHF).	30dB	1kHz 29dB >20dB	23dE
Stereo separation Disc input	- 37dB - 37dB	- 37dB - 36dB	– 37dE – 37dE
Output impedance (damping) 0.0 Channel balance, disc, at 1 kHz Volume/balance tracking  Aux input	06ohm	0.06ohm	0.13ohm 0.1dE – 60dE 6.7dE
Input data socket type Disc (mc) input DIN Disc (mc) input DIN Aux input DIN Disc equalisation error, 30Hz-15kH Size (width, height, depth) Typical price inc VAT	26.5n	nV 120kol	nms, 30pf 3, – 0.2df 28 x 7cm



\*Moving-coil input version not available in time for lab tests.

Disc input: stereo separation



Rotel have had a successful 820 model in their range for some time now, but this review relates to the more recent version which will be available by press date. If critics thought the last model was promising, then wait until they hear this one!

Rated at 20W (13.5dBW), the 820 seems to all outward intents and purposes to be a normal 'Japanese style' amplifier, Taiwan-made, with tone controls, headphone sockets and the like. Inside however it has benefited from a sizable injection of British audio circuitry, directed towards maximising sound quality. An audiophile version (RA820B) will also be available, offering a mild further improvement in sound quality by stripping out the tone controls and other related non-essentials, and spending a little more on components.

Using a simple, single board construction, the power supply is reasonable at the price, with a high current rectifier bridge feeding  $6800\mu F$  reservoir capacitors. A dual integrated circuit 5532(4) is used in the disc input stage with normal series feedback equalisation. The tone controls are passive. The power amplifier is quite standard, direct-coupled complementary, and dispenses with protection, using high current output transistors. The speaker fuses are included in the negative feedback loop to null their effect, while special phase compensation is used and the usual output choke is absent.

#### Sound quality

The 'good' sound quality rating achieved was disbelieved at first until rechecked, whereupon the 820 happily demonstrated a repeat performance. This economy lightweight easily bettered a large number of rather more expensive designs.

It provided, on disc, a musical-sounding immediacy, with a sound field conveying depth, space and ambience, all in good proportion. The bass was reasonably articulate, and the mid tonal balance generally good with presentable focus; the treble had a 'silvery' quality, a trifle too bright with a hint of 'edge'.

Via auxiliary, the stereo focus showed a further improvement, the sound impressive as regards both dynamics and clarity. Reasonably good sound levels were provided into the normal loudspeaker, reaching 99dBA, while on adverse load it showed signs of mild weakness, this more a 'running out of breath' than a protection-initiated limiting. It also sounded a trifle 'glassy' and bright played to the power limit but was considered to clip fairly well.

#### Lab results

Rated at 20W (13.5dBW), this little amplifier produced a generous 15.4dBW over the power bandwidth into 8ohms. On 4ohms some loss was seen at the band edges and the design recipe was clearly balanced more towards

peak than continuous delivery. A high 16.3dBW (nearly 50W) was available on 8ohm peaks which held up well at 15.1dBW into 4ohms while into 2ohms it was still 13.0dBW, almost equaling the 8ohm specification. Peak current was a surprisingly high + 25A.

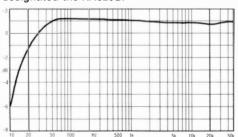
Harmonic and intermodulation distortion results were satisfactory and noise levels equally unspectacular. The dc output offset was a little high but probably not sufficient to do any harm. Input overload levels were fine and the output impedance moderate and consistent over the frequency range. Stereo separation was below average, particularly the 20kHz results, which could so easily be improved. Channel balance was satisfactory.

Input sensitivities were rather low, particularly on auxiliary, but I understand from Rotel that this has subsequently been improved.

RIAA equalisation was quite uniform with a sensible rolloff at low frequencies corresponding to a built-in rumble filter. The tone controls gave a sensibly mild action, with treble cut also acting as a useful treble filter.

#### Conclusion

For the price the *RA820* proved a remarkably good product. Offering a good standard of load tolerance, it produces a fairly decent output with a basically neutral sound of good clarity, musical quality and solid stereo imaging. The rating in this issue is a good one, as reference to the comparator table will quickly demonstrate. 'Best Buy' classification is a certainty for such a high value product, and this rating must also be extended to include the 'straight-line' version, which is designated the *RA820B*.



Disc input: RIAA equalisation accuracy

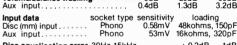
#### Test measurements

Power output

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### GENERAL DATA Integrated amplifier

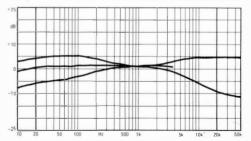
Rated power into 8ohms, maker's s Power output One channel, 8ohm load	20Hz 5.6dBW 2.4dBW 2.0dBW	1kHz 15.9dBW 14.3dBW 13.0dBW	13.5dBW) 20kHz 15.4dBW 13.8dBW 12.3dBW - 26 A
Distortion Total harmonic distortion, at rated power, aux input	- 62dB wer, aux	-70dB input	- 62dB 58dB
Noise Disc (mm) input (IHF, CCIR weighted, Aux/CD input (IHF, CCIR weighted), Residual, unweighted (volume control CO output offset	) rol at min		– 71dB – 64dB
Input overload Disc (mm) input (IHF) Aux/CD input (IHF)		30dB	29dB
Stereo separation Disc input		– 40dB – 39dB	– 25dB – 27dB
Output impedance (damping)0	).30ohm	0.30ohm	0.30ohm



Channel balance, disc, at 1kHz.....

Volume/balance tracking

Disc equalisation error, 30Hz-15kHz	+ 0.2dB, - 1dB
Size (width, height, depth)	.43 x 27 x 6.6cm
Typical price inc VAT	083



Tone control/filter responses

# Rotel RA-870 and RB-870

Rotel Hi-Fi Ltd. 2-4 Erica Road. Stacev Bushes. Milton Kevnes MK12 6HS Tel (0908) 317707



Rotel's current flagship amplifier system included in the error-correcting negative feedconsists of the integrated 60W per channel RA870 partnered by the RB870 power amplifier. When both are set to bridge mode, a system Sound quality giving around 200W per channel results! We assessed the combination, the RA870 alone, and finally the RB870 taken as a separate stereo power amplifier.

Taiwan, the RA870 is a 'straight-line' model lacking such frills as tone controls or the usual Rotel power meters. Nonetheless, two sets of speakers may be used, with binding posts for connection, and a headphone socket is included. The input sockets are all in phono.

Internally, the RA870 contains rather a lot of integrated, lively effect and good detail. messy wiring interconnecting a number of printed circuit boards. The power supplies are capable of very high sound levels but did not substantial with double mains transformers and 2 x 8200 µF reservoir capacitors. The disc input uses a high-gain input amplifier of variable gain for the mc and mm input sensitivities, followed by two stage RIAA equal- of relaxed detailed power, with good marks isation, first the passive 75µS rolloff and then scored for stereo depth and focus despite a the active low frequency boost.

straightforward differential input types, but they are distinguished by a good performance in the driver stage, thereby providing a high peak current capability from the paralleled pairs of complementary, direct coupled output Lab results transistors. Electronic protection is deliber- Rated at 60W (18dBW), the RA870 delivered

back loop.

As an integrated amplifier the RA870 aguitted itself very well. Via moving coil, good stereo images were produced, with a decent rendition of both focus and depth. The bass showed Mainly designed in the UK though built in good extension and tunefulness, but the tonal balance was a touch 'bright' with mild 'brashness' in the treble. The latter aspect improved via the moving magnet input while stereo depth and focus also advanced a little. Via aux, the character remained unchanged a touch light and hard but with a well-

The bridged RA870/RB870 combination was sound quite as tidy, with mild bass softness. However it was a different story when a separate preamplifier was employed. Here the RB870 proved to be a very pleasant device, full midly 'slow' character. It worked well in The power amplifiers in both models are bridged mode reaching a very good 105dBA into the normal load, while unbridged the amplifiers reached 102dBA into the adverse load and illustrated a fine load tolerance.

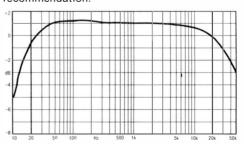
ately omitted, while the single output fuses are 18.3dBW over the 80hm power bandwidth and

the all under 40hm continuous drive was mild. Peak current capability was a whopping + 34A. providing a good peak power into adverse loads. With 19dBW into 8ohms, the fall into 20hms was fine at less than 3dB for programme peaks. In bridged mode 24dB peak was available falling to 18dBW for 20hms. such a load rather tough for bridge duty. Distortions were generally low though the moving coil intermodulation result was not too encouraging. Both dc output offset and input noise levels were fine. Input overload margins were considered ample and stereo separation was rather above average, with power amp output impedance negligible.

Disc input capacitance was a little high, but the other input characteristics were fine. It is worth noting that the power amp sensitivity was slightly low, especially in bridge. The RIAA response was pretty flat over the midband and mildly over-tailored at the band extremes, measuring - 2dB at 20Hz and 20kHz.

#### Conclusion

Once again Rotel UK have been instrumental in producing an amplifier design which is rather better than the opposition - load tolerant, offering decent output power a good stereo sound with versatile input facilities. The basic RA870 comfortably scored a 'Best Buy'. but the RB870 plus suitable pre-amp is priced out of this category, so must be content with 'strongly recommended.' Finally, although it is not reviewed here, the author has also assessed the RA860, the cheaper, tone-controlequipped version of the 870 whose performance would also justify a warm recommendation.



Disc input: RIAA equalisation accuracy

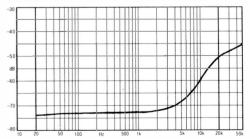
#### Test measurements

**GENERAL DATA** 

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Integrated amplifier

GLITCHAL DATA	integrated	ampinici
Power output Rated power into 8ohms, maker's spec Power output 20Hz One channel, 8ohm load	1 18.6dBW 1 17.6dBW 1 16.5dBW	20kHz 18.6dBW 17.6dBW 16.4dBW
Distortion Total harmonic distortion, 20Hz at rated power, aux input	ıx input (mm)	– 77dB
Noise Disc (mm) input (IHF, CCIR weighted) Disc (mc) input (IHF, CCIR weighted) Aux/CD input (IHF, CCIR weighted) Residual, unweighted (volume control at m DC output offset.	in)	– 78dE – 86dE – 75dE
Input overload         20Hz           Disc (mm) input (IHF)         34dE           Disc (mc) input (IHF)         31dE           Aux/CD input (IHF)         >20dE           Stereo separation	1kHz 34dB 31dB 320dB	20kHz 28dE 23dE >20dE
Disc input. — 74dE Aux input. — 75dE Output impedance (damping) . 0.04ohn Channel balance, disc, at 1kHz Volume/balance tracking OdE Aux input 0.2dE	3 - 75dB 0.06ohm 3 - 20dB 3 0dB	- 52dE 0.08ohm 0.3dE - 60dE 1.6dE
Input data Disc (mm) input. Phono 0.2 Disc (mc) input. Phono 0.01 Aux input. Phono 19.5 Power amp. Phono 135 Disc equalisation error, 30Hz-15kHz. Size (width, height, depth). Typical price inc VAT. * Note: Test results refer to RA870 only.	itivity loa 7mV 44koh 8mV 270oh 5mV 54kohr 5mV 21kohr +0.2dE 43 x 3	ading ms, 240pf ms, 0.2nf ns, 110pf ns, 400pf 3, -0.5dE 32 x 9.4cm



bridged mode, power at 1kHz was 217W (23dBW) into 8ohms.

Disc input: stereo separation



A budget model, the 101 is specified at 30W per channel and comes in a low, slim-profile satin black case. Tidily presented, the front panel offers a headphone socket, speaker muting, bass and treble controls, a high frequency filter, and selection of inputs: these are tape 1 and 2, aux/CD and tuner. A loudness contour switch is also provided and there are coloured lamps to show which input function is selected.

Sansui are pursuing a policy of continuous product development, and this explains why an earlier sample of the AUD-101, which I reviewed in a monthly magazine some months ago, did not do as well as this one has done in the HFC test programme.

Inside, an average sized mains transformer is fitted, with  $2 \times 4700 \mu F$  reservoir capacitors. The output stage is fully complementary using Sanken A1102/62377 output transistors, in a Sansui 'Super Feedforward' circuit. Electronic output protection is employed with peak current limiters and the heatsinking is generous, cooling both faces of the power transistors. The disc input is built around a M5220L dual integrated circuit stage with good 2% tolerance equalisation components, and the tone controls are incorporated in the feedback loop of the power amplifier. The usual line buffer amplifier is absent.

The construction is of good quality but the main terminals are unshrouded internally, and located rather close to the headphone socket - possibly a questionable aspect of the construction!

#### Sound quality

On disc the 101 scored an 'average sound' quality rating which was quite good for its modest price. Via the moving magnet disc input vocal sections sounded a touch 'thin'. while the bass and treble regions were satisfactory. Some 'featheriness' and 'grain' could be heard in the upper register and while the stereo focus was quite good, the impression of depth was weak.

Via the auxiliary input, some improvement was noticed particularly with regard to clarity. Some 'lispiness' was heard on vocal sibilants and the overall sound was lacking real attack and life. It was however relativity unfatiguing. The amplifier also sounded quite pleasant into mild clipping, and reached a 101dBA equivalent sound level into the normal load. The adverse load was less well handled, however, with a reduction of 4dB in maximum level.

#### Lab results

Rated at 30W per channel or 15dB, this amplifier produced considerably more output

on test, meeting a 17.7dBW level over the 8ohm Test measurements power bandwidth; this is more than 50W. The small capacity power supply was reflected by the shortfall into 40hms on continuous loading, this averaging 3dB. Peak current was modest at +6A, and clearly curtailed the peak delivery into the most severe load. A generous 18.5dBW was available into peaks into 80hms but this fell by 9dB into 20hms, and difficult speaker impedances are therefore to be avoided.

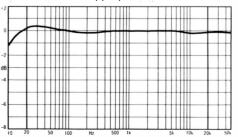
As claimed by the makers, harmonic and intermodulation distortion results were excellent, while input noise levels were also very good, and the dc offset satisfactory.

Disc and auxiliary input overload margins were fine while the channel separation was reasonably good. Output resistance was negligible and channel balance well maintained on all inputs over a range of volume control settinas.

Input characteristics were typical, while the RIAA equalisation was very good, especially for a budget model. The tone controls has sensibly moderate control ranges, the treble action centred more in the main treble range than usual, and continuing to roll off at higher frequencies.

#### Conclusion

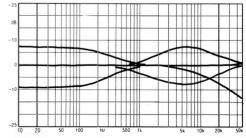
This neat little amplifier has been improved since first introduced, and into straightforward speaker loads it provided good 'strain-free' sound levels, all for a modest price. It was relatively unfatiguing on audition, and offered a presentable overall quality, with the combination of test and subjective results making recommendation appropriate.



Disc input: RIAA equalisation accuracy

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

GENERAL DATA	Integrated amplifier
Power output Rated power into 8ohms, maker's spec Power output 20Hz One channel, 8ohm load	1kHz 20kHz
Distortion Total harmonic distortion, 20Hz at rated power, aux input. — 83dB Intermodulation, 19/20kHz, rated power, aux Intermodulation, 19/20kHz, at 0dBW, disc (n	input> $-80dB$
Noise Disc (mm) input (IHF, CCIR weighted) Aux/CD input (IHF, CCIR weighted) Residual, unweighted (volume control at mir DC output offset	83dB n)77dB
Input overload         20Hz           Disc (mm) input (IHF)         -32dB           Aux/CD input (IHF)         >20dB	-31dB -30dB
Stereo separation Disc input	- 76dB - 48dB - 76dB - 51dB
Input data     socket type     sensiti       Disc (mm) input     Phono     0.39m       Aux input     Phono     36.7m	nV 46kohms, 160pF
Disc equalisation error, 30Hz-15kHz	+ 0.4dB, - 0.2dB



**Size** (width, height, depth)......43 x 27 x 8cm

Typical price inc VAT......£99

Tone control/filter responses

## Sondex S230

Aston Audio Ltd. 4 West Street, Alderley Edge, Cheshire Tel (0625) 582704



This moderately-priced amplifier comes from a employed, the mains wiring neat and well small UK manufacturer whose chief designer was responsible for the early Radford valve amplifiers. Rated at 30W per channel, it is a 'straight-line' type where, unusually, the auxiliary/CD input bypasses the pre-amp section and instead is fed direct to the power amp via the volume control. Alternative plug-in circuit boards can be fitted by the dealer to give moving-coil or moving-magnet disc input as required, with no difference in price.

A compact unit, the S230's rear input socketry is in phono while speaker connection is via 4mm socket/binding posts. The internal construction is very tidy, employing a single printed circuit board. Unusually, the output stage is capacitor-coupled, this component being included in the feedback loop to correct its residual errors. The main reservoir of 6800µF is fed by a toroidal transformer, the supply shared between the two channels. The output stage employs complementary output transistors biased in conventional class A/B mode. Load-line electronic protection is fitted: we are informed that this will be tailored to the low load. provide higher peak currents than on the review sample before this review goes to press. Lab results

The disc input begins with a variable-gain, RIAA equalisation and then active LF equalisation, a good system. Discrete transistors are

shrouded.

#### Sound quality

Scoring a respectable 'good plus' in the listening tests, the Sondex gave a good result for an under-£200 model. Via moving-coil input it seemed marginally bright, but with a neutral mid range balance and pleasant voice reproduction. Stereo focus was quite good, and depth better still. Slight bass softness and treble grain were evident but not enough to detract from the musical performances.

Via the moving-magnet input the sound was similar except it was slightly sweeter in treble tonal balance terms.

Via auxiliary a further improvement in definition occurred, with superior bass and allround detail. Good results were obvious via this input, and the amplifier also proved tolerant of mild clipping, producing decent sound levels. In practice it also coped better than expected with the adverse load, with 101dBA possible into 8ohms and 99dBA into

For a full power bandwidth at 80hms, the low noise input buffer followed by passive Sondex just met the 30W specification at 15.1dBW. The modest power capacity was reflected by the fall on 40hms continuous duty, both channels driven, but peak current capacity at ±8A was reasonable for the power level concerned peak output level into the adverse loads was quite well held, measuring about a 5.5dB drop from 8 to 20hms.

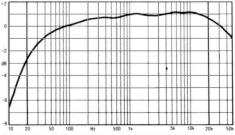
Distortion levels were satisfactory except via disc where the intermodulation results was marred by premature input overload. Due to its passive control unit construction, the disc sensitivity needs to be correctly matched to the chosen cartridge to get the best results. and if this is done, the input overload margins will be sufficient. Noise levels were satisfactory, and the output offset negligible.

Stereo separation was ample and the output impedance low even at 20Hz. A mild disc channel imbalance was noted, but tracking over the volume control range was very good. Input characteristics were quite standard bar the auxiliary which has a designed low sensitivity to give suit high output sources such as CD. However, check that your tuner or tape unit will also produce sufficient level.

RIAA equalisation follows the IEC rolloff. nominally - 3dB at 20Hz and above this range the curve is nicely accurate.

#### Conclusion

Given the versatility offered by the manufacturer, with respect to input sensitivity and cartridge matching, the limited overload margin should not present a problem. Fairly load tolerant, this compact, 'musical sounding amplifier offers good clarity and depth effects in the stereo image, and its objective score was sufficiently high compared with the group average to indicate a Best Buy rating at its well-under £200 price.



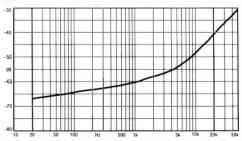
Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

GENERAL DATA	Integrated	d amplifier
Power output Rated power into 8ohms, maker's spec. Power output' 20 One channel, 8ohm load	Hz 1kHz BW 16.0dBW BW 13.6dBW BW 11.0dBW	20kHz 16.0dBW 13.5dBW 10.8dBW
Distortion Total harmonic distortion, at rated power, aux input 59 Intermodulation, 19/20kHz, rated power, Intermodulation, 19/20kHz, at 0dBW, dis	dB ~61dB aux input	- 54dB 68dB
Noise Disc (mm) input (IHF, CCIR weighted). Disc (mc) input (IHF, CCIR weighted). Aux/CD input (IHF, CCIR weighted). Residual, unweighted (volume control at DC output offset.	t min)	– 77dB – 75dB – 72dB
Input overload         20           Disc (mm) input (IHF)         18           Aux/CD input (IHF)         >20	0Hz 1kHz 3dB 16dB 3dB >20dB	20kHz 17dB >20dB
Stereo separation Disc input	6dB - 60dB 6dB - 60dB	– 40dB – 36dB
Output impedance (damping) 0.1o Channel balance, disc, at 1kHz Volume/balance tracking Aux input	0dB – 20dB 0dB 0.4dB	- 60dB - 60dB 0.3dB
Input data     socket type     ser       Disc (mm) input     Phono     0       Disc (mc) input     Phono     0       Aux input     Phono	nsitivity lo ).36mV 48koh .04mV 330ol 82mV 48koh	ading ims, 130pF nms, 22nF ms, 316pF
Disc equalisation error, 30Hz-15kHz Size (width, height, depth)	+ 0.2dl	B, - 2.6dB .5 x 7.5cm

\* Note: dislikes capacitive loads



Disc input: stereo separation



Sugden's latest amplifier combination consists of the unusual C128 pre-amplifier and the P128 power amp. The review sample P128 was only C128 available was in what appeared to this report can only be provisional.

The P128 is a double-mono unit, constructed as two power amps literally strapped together under a cosmetic top cover. With heatsinks real front panel as such. Rated at 130W per channel it employs MOSFET output stages and each channel has double mains transformers, making four in all.

The C128 interior was also rather messy and would have thought rather hard to make. Discrete transistor 'op amp' stages are used with a special selection of component types, are used. Input buffers are employed for both mm and mc, inputs, and the volume control is a class with a most musical overall character. top quality model.

#### Sound quality

was not supplied by press date. The movingdesign should actually be representative of both disc inputs. As a combination, the

audition, the mid tonal balance proving pleasantly sweet and lacking the usual hard or brittle quality so often encountered. Stereo a production item, but at the time of writing the focus and image precision were fine and good ambience and depth were also heard. The be a rather rough pre-production form, and so sound was well detailed, bass good and the treble better still.

Via auxiliary a neutral, musical sound emerged with only a mild restriction of depth. Auditioned separately, the power amplifier dominating the front and rear aspects it has no sounded slightly bandlimited with a mild lack of crispness and a slightly in articulate exposition of transients and dynamics. It proved to be a 'powerhouse' reaching 107dBA into the normal speaker and 104.5dBA into the adverse load, making it one of the most powerful models tested. It also sounded pleasant in mild clip and could get very loud indeed.

The pre-amplifier, tried separately, proved and high quality separate supply regulators capable of a still better-focused and defined sound, and is potentially in the 'very good'

#### Lab results

The 8ohms continuous output over the power On the review sample, the mc buffer stage bandwidth was close to specification at gave problems and so the amp was not 21.5dBW. A good bandwidth and level was auditioned via moving-coil, as a replacement maintained into 40hms on continuous drive. A quite good peak current capacity was measmagnet input was fine, and from the system ured at + 21, - 23A, this reflected by the good peak level delivery. A substantial peak 22.8dBW into 8ohms (nearly 200W) fell to C128/P128 scored a respectable 'good plus' on 21.5dB 4ohms, and a still reasonable 18.0dBW

into 20hms. At full power to 20kHz, harmonic distortion was worsening but elsewhere both IM and harmonic distortion levels were very good. Signal-to-noise ratios were also satisfactory. The power amp dc offset was satisfactory but that from the pre-amp was not - beware using it with a dc-coupled power amp, if this sample is representative.

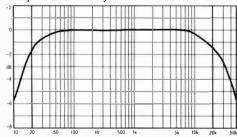
Input overload margins were exemplary and while stereo separation was satisfactory it was measured as strangely constant over the spectrum. Channel balance and volume tracking were fine. All the input and pre-amp output characteristics were entirely satisfactory, while the power-amp sensitivity was compatible with direct line source connection via a passive control.

Perhaps contributing to the sweet sound via disc, the RIAA equalisation rolled off above 10kHz, to -3dB at 20kHz, which was a trifle premature. The bass rolloff sensibly follows the IEC practice, and the response was otherwise very flat.

#### Conclusion

Taking the P128 first, this very powerful unit is sweet-sounding, and produces good stereo, offering guite good value for money. Where wide dynamic range is required with an output of 200W and good load tolerance, the P128 can be recommended.

The C128 partners it well and the pair make a worthwhile combination. Although judged here in pre-production form the C128 promises more, and could be a front rank product in its own right in its chosen price category. It can certainly do justice to a smaller but superior power amplifier but only trial of a production sample could finally determine its abilities.



Disc input: RIAA equalisation accuracy

#### Update

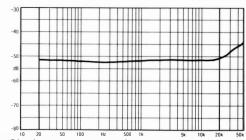
Our photograph shows the C128SL preamplifier, with slope-fronted 'desk-top' styling. The C128 model itself is now a conventionally-styled unit with front-panel mounted controls.

#### **GENERAL DATA**

Pre- and power amplifier

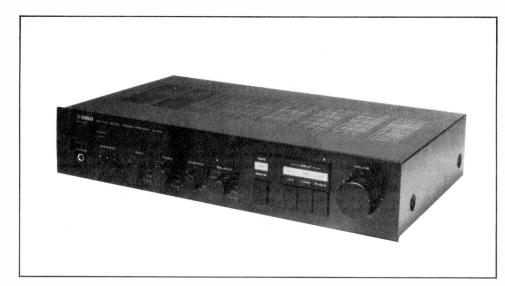
Power output Rated power into 8ohms, make Power output One channel, 8ohm load One channel, 2ohms, pulsed Instantaneous peak current. Distortion	20Hz 21.9dBW 19.7dBW 17.2dBW	1kHz 22.0dBW 20.0dBW 18.0dBW	20kHz 21.5dBW 19.4dBW 17.4dBW
Total harmonic distortion, at rated power, aux input Intermodulation, 19/20kHz, rat Intermodulation, 19/20kHz, at Intermodulation, 19/20kHz, at (Noise	ed power, aux 0dBW, disc (n	input nm)	.>-80dB .>-80dB
Disc (mm) input (IHF, CCIR wei Disc (mc) input (IHF, CCIR wei Aux/CD input (IHF, CCIR weig Residual, unweighted (volume DC output offset. DC offset, pre-amp.	ghted)hted)control at mir	n)	– 72dB – 97dB . – 64dB* 11mV
Input overload Disc (mm) input (IHF) Disc (mc) input (IHF) Aux/CD input (IHF)	2011-	1147	2014
Stereo separation Disc input	2		0dB
Volume/balance tracking Aux input	0dB	- 20dB 0.1dB	-60dB 1.1dB
Disc (mm) input Pho Disc (mc) input Pho Aux input Pho Power amp Pho Output, pre-amp (tabe)	ono 0.17m ono 0.017m ono 16.5m ono 53m	nV 50kohr nV 1kol nV 18kohr nV 50kohr . 16.1V max	ns, 150pF hm, 0.1nF ns ns k. 48ohms
Disc equalisation error, 30Hz- Size (width, height, depth)	22.5 x 26 x 12.	+ 00 .5cm, 47 x 3	зв, – 1ав 31 x 7.5cm

.....£275, £385 Typical price inc VAT. 



Disc input: stereo separation

Natural Sound Systems Ltd, Unit 7, Greycaine Road, Watford WD2 4SB Tel (0923) 36740



A budget amplifier in a smart satin-black case, the A300 offers the usual set of facilities on its well laid-out front panel — switching for A and B speaker sets, a headphone socket, bass and treble rotary controls plus a fully variable loudness control. Input selection is for tape/aux. tuner and disc (moving-magnet). The speaker cables connect to rather light-duty spring clip terminals while all inputs are via the usual phono sockets.

Internally the A300 was very tidy, partially reflecting a need to minimise the internal circuitry and components to meet a cost target. A single printed circuit board is used with a large and space was encouraging, with once again a aluminium 'U' bracket as a heatsink. The common power supply is modestly sized, and the pre-amp, usual line buffer stage is omitted. The power amplifier section has a higher than normal gain, and has the tone control circuits incorporated in its feedback loop. The output stage is direct coupled complementary, with a relay for switch on muting. Disc amplification for the moving-magnet input is carried out by the usual dual integrated circuit with series feedback equalisation.

Construction is to the usual Yamaha standard and is of good quality overall.

#### Sound quality

The A300 scored 'above average' on the listening test sessions, this a fine result at the price. While it demonstrated a slightly 'hard' tonal quality, tending to place the stereo image rather up front, at the same time it showed promising depth and ambience and good stereo focus.

Via the disc input, the bass was a little soft but not seriously so, and programme dynamics were portraved with greater faithfulness than usual at this price level.

Via the auxiliary input the rendition of depth reasonably solid central image focus. Detail was good with a pleasing separation of complex musical strands. In the bass it lacked the real power and definition of the larger models. but performed quite well nonetheless. It sounded satisfactory into mild clipping, providing 100dBA into the standard load, and a modest 97dBA into the adverse load.

#### Lab results

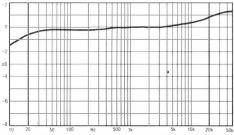
Rated at 25W (14.5dBW), the amplifier specifications were cut a little fine, the amplifier just reaching 13.9dBW over the single-channel 80hm power bandwidth. On the plus side, the level held up well on 40hms continuous dualchannel duty. For the size, the peak current available was quite generous at ± 9A. Into 80hms, the peak output level reached 15.1dB, falling very little into 40hms, and a reasonable 3.6dB into 20hms; a pretty tolerant amplifier, this.

Both harmonic and intermodulation results were low and good signal-to-noise ratios were also demonstrated. The dc offset at the output terminal was satisfactory. Input overload margins were ample, while stereo channel separation was rather better than average, and channel balance and volume control tracking were in fact very good.

Disc input capacitance was on the high side at 260pF, though this is now quite a common feature. The other input characteristics were fine. The tone control responses were a little odd showing mild shelf cut, and stronger narrower boost at the frequency extremes. RIAA equalisation was essentially uniform, with a hint of treble lift above 10kHz, and no bandlimiting or tailoring was evident.

#### Conclusion

This attractive budget amplifier offered good value for money. The sound was clear, well focused and compared with favourably with many designs at higher prices. It also provided a well-balanced overall performance, with good build quality and finish, plus a versatile set of facilities, and at a price rather under the £100 level; such a performance indicated a Best Buy rating.



Disc input: RIAA equalisation accuracy

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB = 1W), without adding 3dB or 6dBrespectively, as in usual 'power' ratings.

#### **GENERAL DATA** Integrated amplifier Power output Rated power into 8ohms, maker's spec . . . . . . . . . 25W( = 14dBW)

Power output One channel, 80hm load	20Hz 14.3dBW 12.9dBW 11.4dBW	1kHz 14.5dBW 13.2dBW 11.7dBW + 9 A	20kHz 13.9dBW 12.7dBW 11.5dBW – 9.4 A
Distortion Total harmonic distortion, at rated power, aux input Intermo dulation, 19/20kHz, rated pu Intermo dulation, 19/20kHz, at 0dBv	<ul> <li>82dB</li> <li>ower, aux</li> </ul>	- 85dB input	<ul><li>73dB</li><li>73dB</li></ul>
Noise Disc (mm) input (IHF, CCIR weight Aux/CD input (IHF, CCIR weighted Residual, unweighted (volume cont DC output offset	l) rol at min		– 82dB – 75dB
Input overload Disc (mm) input (IHF) Aux/CD input (IHF)	32dB		
Stereo separation Disc input			
Output impedance (damping)( Channel balance, disc, at 1kHz Volume/balance tracking			0.3dB

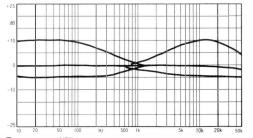


0.3dB

0.6dB

0.1dB

Disc equalisation error, 30Hz-15kHz	
Size (width, height, depth)	44 x 30 x 10cr
Typical price inc VAT	



Tone control/filter responses

Aux input.....

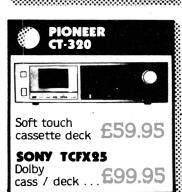




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# LOUDSPEAKERS

The market for loudspeakers has been changing dramatically over the past few years with a marked increase in quality at or around £100. However, the upper end of the market is still alive and represented here by a good handful of expensive and interesting speakers.

The loudspeaker's role is to convert electrical energy from the amplifier into sound pressure waves in the air. Designers are faced with very specific problems; at low frequencies, a large drive unit is needed to move enough air at low frequencies to produce deep bass. But at the treble end of the spectrum you need a small lightweight driver to disperse the short-wavelength high frequencies evenly. The two-driver system uses one driver for middle and bass frequencies (commonly called the woofer) and a specialised unit for the high frequencies only (called the tweeter). Using a dedicated driver for the high frequencies overcomes the problem that large drivers radiate high frequencies from a very small part of their diaphragm area, which 'beams' the treble rather than giving an even dispersion to a reasonably wide listening area. Control of the dispersion pattern of a loudspeaker has in fact become more and more important in loudspeaker design.

Tweeters must be protected from the large low-frequency signals that are meat and drink to the woofer. The simplest solution is to use a blocking capacitor which acts as a filter to rolloff the unwanted low from the signal feed to the tweeter. This is the simplest form of crossover. More sophisticated crossovers are electrical filter circuits match drive units in multiple drive unit systems with regards to sensitivity as well as response (both at the driver's band limits, where it 'hands over' to another, and to correct of any in-band response anomalies).

Moving-coil drivers work by the passing of the signal through a voice coil which reacts against a magnetic field in the gap in a fixed magnet; moving in time with the signal, the coil moves the diaphragm to which it is attached creating the pressure waves we hear as music. Other techniques have been used, most notable in the context of these revews being the electrostatic driver in the Quad loudspeaker.

Materials now used in drive unit cones range from metals and cloth in tweeters to plastics and paper in woofers. No one material has the edge.

The correct application of materials and adhesives to achieve the right sensitivity and lowest colouration is the key to a successful driver.

#### Cabinets are not just boxes

The loudspeaker's woodwork is not just a convenient package or piece of furniture. The cabinet plays a vital role in the sound of the finished system.

When a driver rushes forwards to create a positive pressure wave in the room it also creates a negative wave behind the cone. These two must never meet or the back waves will cancel the music pressure fronts we wish to hear. Drive units used to be mounted on very large boards or baffles to stop this effect and so subsequent sealed-box designs became known as infinite baffle designs to distinguish them from the all-too finite baffles which didn't stop phase cancellation problems at low frequencies. Acoustic Research first used the compliance or compressibility of the sealed air in the box to act as part of the speaker's suspension — the acoustic suspension design which has become almost the norm today.

Other cabinet types are variations on the theme of tuning the output from the back of the bass unit, rather than attenuating it. A port or tuned pipe in the box gives you a reflex design while the use of a motorless (passive) unit in the port to tune the system gives an Auxiliary Bass Radiator (or ABR) system. Transmission Line systems use the length of whole or half bass wavelengths in which to attenuate the rear waves and can be enormously wasteful of space.

#### Colouration

'Colouration' describes the sound character of the speaker and is a subjective attempt to describe its departure from neutrality. Gentle changes in the response of a speaker alter the tonal balance but a peak or dip in the response introduces recognisable 'colourations'. The storage of sound in the cabinet or the transparency of the cabinet at certain frequencies also causes colouration. A range of adjectives, hopefully self explanatory, are used to describe colouration.

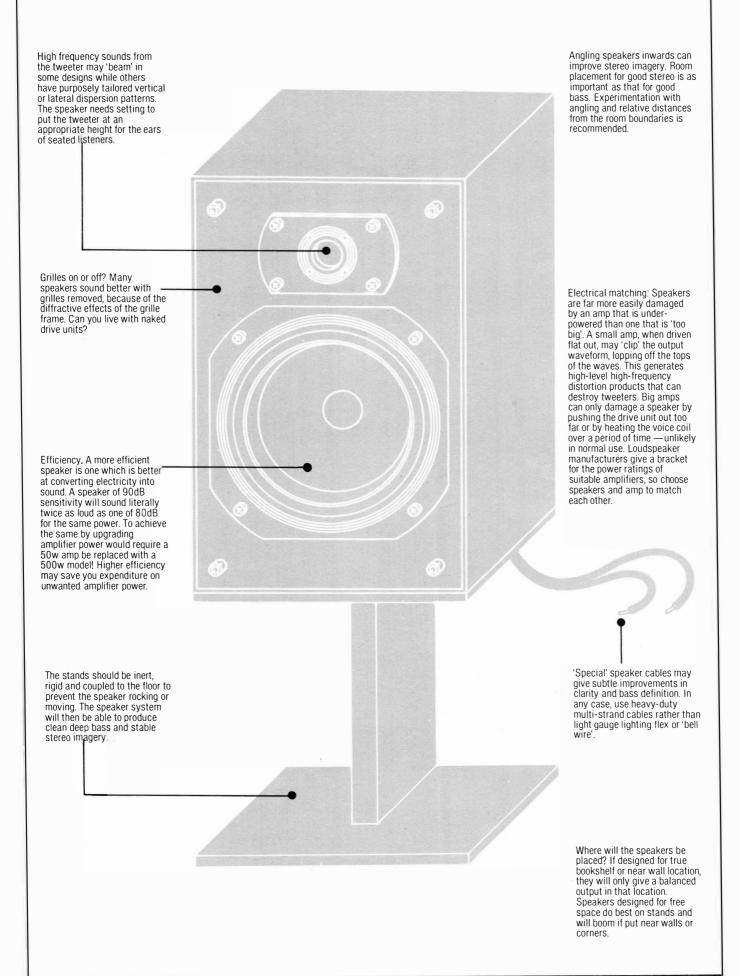
**Stereophony** Stereo is still large misunderstood despite being 'sold' commercially for over quarter of the century. It is an attempt at recreating the image of the recorded sound-field by using two channels of sound. To capture

this solid image requires the use of two coincidently placed micro-phones. Records are made which mimick stereo by 'panning' sounds to a point between left and right channels using amplitude only; this is not stereo. A good pair of speakers with suitably miked material will create a solid image of the players set in a spacious acoustic — our listening tests rely on suitably miked material to assess stereo performance.

Other models worth considering

The Acoustic Research 28LS (£129) sounded quite hard and coloured in a way unlike its many competitors; technical performance was satisfactory. B&W's LM1 (now£159) is one of the best micro speaker systems made with first rate finish and build though it doesn't qualify for recommendation by conventional Hi-Fi Choice standards. B&W's 802 (£650) had a fine finish and a well integrated sound but failed to meet expectations on digital source. The classic BBC LS3/5a (£210) (now made by Goodmans, Rogers and Spendor) still provides good articulation with reasonable tonal balance but has been bettered in many parameters by much cheaper speakers. The Heybrook HB3 (£425) was thought not very competitive in today's market and had a somewhat coloured or 'dated' sound but the manufacturers suggest it is intended, like the Linn Sara, to give optimum results with LP discs and subjectively compatible equipment. IMF's Compact Monitor 3 (£275) did not match the standard set by other speakers on digital source. The JBL L96 (£599) provides good bass, wide dynamic range with low distortion and good transient performance but hardness caused disagreement among the listening panel — a idiosyncratic and expensive speaker. **KEF**'s **Carina** (£140) lacked transparency and sounded rather 'boxy' although it performed well technically. The KEF R105.4 (£650) now lacks definition, detail and transparency alongside more recent competition though it remains highly satisfactory on conventional programme. The Linn Kan (£219) and Linn Sara (£552) both provided an idiosyncratic blend and require considerable care with amplifier and source matching and in room location. **Mission's 770S**(£399) was felt to be now rather coloured; it is shortly to be replaced. The **Spendor** SA3 (£900) was censured for its colouration and impaired stereo focus.

# LOUDSPEAKER BUYER'S CHECKLIST





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**ROTHERHAM** (0709) 70666

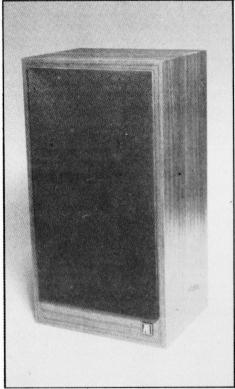
2 WEST GATE, ROTHERHAM.



REVISED AND REPRINTED

# Acoustic Research AR48S/AR48LS

Acoustic Research, High Street, Houghton Regis, Bedfordshire LU5 5QJ. Tel (0582) 603151



For what it is worth, the origins of the AR48 can be traced back to an earlier three-way model, the AR5. Both use similar sized enclosures and a common line up of 250mm bass, 100mm mid and small soft-dome tweeter, which in the case of the '48 comprises a 25mm dome unit. However, while the '5 was American-orientated and suited to bookcase mounting, with asymetrically placed 96dBA. drivers, the AR48 uses a vertical in-line array for optimum stereo performance, and its specification also advocates the use of open stands to give low coloration.

sealed-box loading the integrated pulp cone bass driver which operates to 400 Hz. A new and very highly damped pulp-cone midrange is fitted, employing a translucent plastic termination surround and back-loaded by a cylindrical cardboard enclosure. This driver works up to 2.5kHz. above which the ferro-fluid soft-dome takes over to above audibility. Only seven good quality

components are used in the crossover, with the unusual series/parallel configuration resulting in a saving of one inductor.

The cabinet is constructed of synthetic veneered chipboard, with no panel damping or special bracing, and input connections are via the usual AR screw down terminals, around which bare wires have to be securely wrapped. As with the budget AR18, the grille is no acoustic plus point: its 14mm unrebated thickness does little for stereo imaging or the response. In the past AR used to fit vastly superior open cell foam grilles. but these appear to have gone out of fashion.

#### Lab performance

Some untidiness was apparent on the reference 1 metre sinewave frequency response, which was partially emphasised by the grille. However the latter was not responsible for the lumpy tendency in the 400 Hz-3kHz region, suggesting that the mid unit was not working as well as AR would have us believe: as pair matching was good (typically within 1.5dB overall), the effect was clearly not an isolated one.

Inspecting the forward characteristic, the 1.5kHz to 2kHz trough can be seen to be axis dependent, suggesting a mild phasing problem between the driver bands. The low frequency range was well damped, providing a 40 Hz -6dB point, and a  $\pm /-3$ dB range of 50Hz to 20kHz. While fairly good consistency and integration was demonstrated by the forward response, the off-axis fall-off at higher frequencies was greater than usual.

The sensitivity was usefully higher than claimed at 88dB/W, but amplifier loading was classed as average in view of an impedance dip to 4.3 ohms, 700 Hz (a high power region). In fairness, however. AR do rate the '48 as a 6 ohms model. Its power handling was estimated at 100W, and a generous 106dBA maximum level is theoretically possible. with 15W per channel producing a satisfactory

A moderate 0.6dB of compression was noted on 100W pulses, with distortion at the 1% level. 500 Hz. Moving up to 5kHz the compression was negligible, but distortion had increased to 7.0%. The enclosure contains a 38 litre volume 2nd, 3.0% 3rd, and 0.3% of 5th (the latter usually negligible). Drive beyond this level appeared unpromising. On steady state distortion 3rd harmonic was generally quite low at around 0.6% mid band, with 2nd harmonic at similar levels, and with low frequency distortion well controlled. As with the AR18, however, above 6kHz the tweeter exhibited distortion at around the 1% level even at 90dB, though this had relatively harmless second order content.

The averaged room characteristic demonstrated some promising features, notably the relatively even and extended low frequency range, plus well controlled and near correct energy fall above 10kHz. However, a prominance around the upper mid 400 Hz-1 kHz band measured some 4dB above adjacent regions, and this could with advantage be lower.

#### Sound quality

On the live tests the panel were not convinced of this model's true accuracy, finding it fairly coloured. But it achieved quite a high score as its faults were fairly innocuous. A degree of 'hollowness', 'boxiness', and 'hardness' were apparent, with some loss of clarity, but the overall balance was fairly neutral, with a reasonable bass extension showing an even character. The bass sounded a little 'nasal' and 'thinned', but the speaker could withstand considerable peak inputs of up to 200W of electric bass guitar without serious overload.

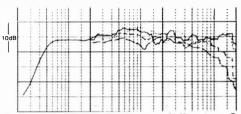
This picture was similar for the stereo sessions also, with the speaker sounding a trifle 'old fashioned in terms of coloration levels, but at the same time considered easy on the ears. Lateral stereo presentation was to a good standard, although some loss of depth and 'see-through' ambience was experienced by most panelists. The midband was also a touch resonant on piano, for example, and loss of 'crispness' was felt on some transient signals.

#### Summary

We were pretty keen on the 48S and the new LS version carries a dual improvement, namely a welcome price reduction and an improved grille. As such its 'Best Buy' rating is continued. A fine allrounder, suited to stand mounting, we still regard it as one of AR's most civilised speakers in the popular price range.

#### GENERAL DATA

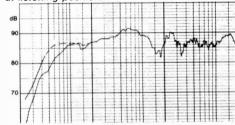
Size (h x w x d)
Recommended amplifier power per channel
(for 96dBA per pair at 2 metres minimum)(15)-100W
Recommended placement stand
Frequency response within ± 3dB (2m)50Hz to 20kHz
Low frequency rolloff (-6dB) at 1 m40Hz
Voltage sensitivity
(ref 2.83V, ie: 1 watt in 8 ohms) at 1 m
Approximate maximum sound level (pair at 2m)105dBA
Impedance characteristic (ease of drive) average
Forward response uniformity good
Typical price per pair inc VAT £250 when reviewed, now £219



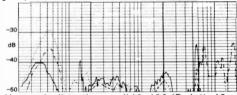
Forward characteristic response (1/3-octave @ 2m. dotted 15° vert., small dash 30° lateral, long dash 45° lateral)



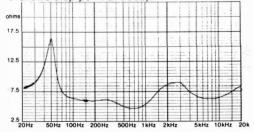
Averaged forward characteristic response in room at listening position.



Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response without arille).



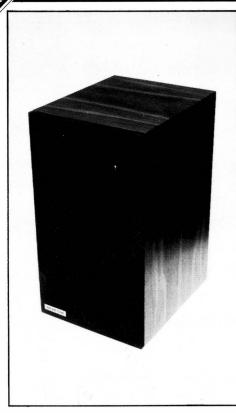
Harmonic distortions: solid 3rd 96dB, dotted 2nd 96dB, dashed 3rd 90dB, chain-dashed 2nd 90dB, o shows stop point at 96dB).



Impedance (mod Z).

Arcam One

A&R Cambridge Ltd, Denny End Industrial Centre, Waterbeach, Cambridge CB6 9PB Tel (0223) 861550



A&R's first venture into the field of loud-speakers, the Arcam *One* is a medium-sized, two-way bass reflex system aimed at the higher quality end of the market. The recipe is straightforward enough — a 200mm bass/mid unit plus 25mm soft fabric dome tweeter, but A&R's approach shows considerable care and attention to detail.

The tweeter is actually a modified VIFA design, mounted above an A&R-designed, Elacbuilt bass/mid unit. Constructed on a strong damped steel frame, the latter uses a generous motor system driving a synthetic flared cone formed from Cobex (a pvc material). The crossover is a high-quality, high power design, with 12dB/octave slopes and may be disconnected by the user via a terminal patch panel on the enclosure rear. Direct active connection to the two drivers is then possible, using matching A&R electronics.

Built from 19mm chipboard, the substantial enclosure is internally braced and loaded by a thin bituminous cladding. A 120mm deep ducted port is located on the rear and is fitted with a user-removable damping plug to allow fine adjustment of the lower bass output.

Externally, the system was well finished in a high-quality walnut veneer on all surfaces. The 12mm-thick grille panel has a step effect, although this is partially ameliorated by a foam strip around the tweeter. Against A&R's recommendation, we felt the grille was better removed, and it could do with some modification.

#### Sound quality

A strong concensus of opinion favoured the Arcam *One*. Its numerical rating was high, backed by complimentary judgements and few criticisms. Bass was a trace boomy with the port plug removed (as suggested by A&R), while some mild boxiness was heard in the lower mid, and the upper treble occasionally hinted at fizziness.

Conversely, this speaker produced lively, open, balanced and transparent stereo images. Ambience, air and depth were well portrayed while natural perspectives and musical detail were also evident over the whole frequency range. Stereo images were stable and well focused, and transients were convincingly reproduced.

#### Lab results

The reference 1metre response showed the mild improvement with the grille removed (dotted), and illustrated a smooth overall result. Sensitivity was above average at 88dB/W with a typical bass rolloff at 55Hz (porous plug in). Pair matching was good for these early samples. A minimum amplifier power of 15W per channel is suggested, and the general performance indicated a capacity of up to 150W of unclipped music programme, generating respectable 104dBA maximum sound levels.

At 2metres a well ordered and integrated forward response output was demonstrated. 15° above and below axis, responses dipped mildly at the 2.7kHz crossover frequency and the speaker median axis should aim accurately at the listener for the best results. The lateral responses were particularly good.

by the user via a terminal patch panel on the enclosure rear. Direct active connection to the two drivers is then possible, using matching A&R electronics.

At a 96dB sound level, one metre, the second and third harmonic distortion levels were typically around 0.8% to 1.5%, which was a good result. At 86dB the second harmonic

improved but third did not, and here the system is possibly somewhat worse than average, the cause probably being magnet pole linearity.

The impedance curve showed an easy, well controlled 80hm amplifier load, and for interest's sake the result with and without the port plugged is shown.

Room averaged, (port open) the Arcam a fine result. The response showed a slight bass excess with quite good integration and depth, while the middle register was surprisingly smooth, with textbook rolloff at higher frequencies.

#### Summary

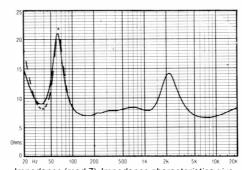
A&R have a convincing performer in this fine loudspeaker. The subjective scores, the quality of construction and finish justify a strong recommendation (we have not given 'Best Buys' to speakers over £275 a pair). The sound was clear and open, with fine musical detail and accurate stereo presentation. Distortion was satisfactory to good, power handling and maximum sound level fine and the system easy to drive.

With A&R's acknowledged electronic expertise the active version could sound even better. To conclude, the Arcam *One* happily justifies its price tag.

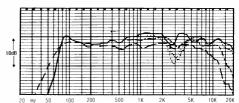
#### GENERAL DATA

Size (height $\times$ width $\times$ depth)
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres) (15)—150W
Recommended placementopen stands
Frequency response, within ±3dB, a 2 metres 60Hz to 20kHz
Low frequency rolloff ( – 6dB point) at 1 metre 55Hz
Voltage sensitivity

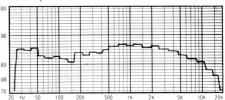
(ref. 2.83V, or 1W into 8ohms at 1 metre	88dB/W
Approximate maximum sound level (pair) at 2 metres	104dBA
Impedance characteristic (ease of drive)	
Forward response uniformity	good
Typical price per pair, inc VAT	£299



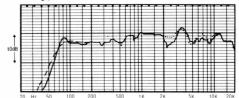
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



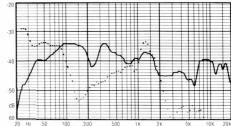
Forward characteristic response (½ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



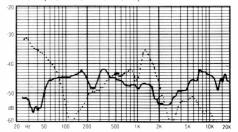
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

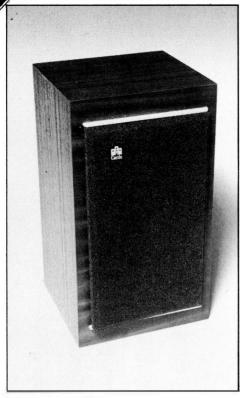


Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

#### REVISED AND REPRINTED

# Castle Clyde

Castle Acoustics Ltd., Shortbank Road, Skipton, N. Yorks. Tel (0756) 5333



This diminutive speaker has a *Richmond*-like specification, and at £80.00 a pair, the price is even comparable with that of a *Richmond* some five years ago! Castle take a pride in building the majority of the components for their systems themselves, the *Clyde* being no exception, and the Castle designer has shown great skill in tailoring his speakers to give relatively uniform frequency responses irrespective of size or cost.

Possessing a 9.8 litres internal volume, the system is reflex-loaded by a small ducted port, 28mm long by 37mm in diameter, which does more for the power handling than the bass extension. Both drivers are made by Castle; the lightweight pulp-cone bass/mid unit is built on a 130mm frame, and is partnered by a unique 30mm plastic cone/dome tweeter using a phase-corrected diaphragm. The undamped chipboard cabinet is also made by Castle themselves, having a fully finished teak veneered exterior with alloy trim, plus an acoustically favourable

foam grille. A 4-element crossover is fitted with fuses for each driver, accessible through the bass unit aperture.

Flush-mounted spring clip terminals are used for electrical connection, and an acoustic foam lining provides absorption within the enclosure. If Castle are true to form, the system should be fairly sensitive as well as capable of decent sound levels for its size.

#### Lab performance

The test samples showed a good pair match, measuring typically +/-1dB: a fine result for a speaker in this price category. Sensitivity was indeed high at 89.5dB/W, and was uncompromised by the impedance/amplifier loading, the latter rated as 'good' and averaging 9 ohms. As expected the low frequency range was somewhat curtailed with a -6dB point at 64Hz, but the axial reference response was inspiring, meeting fine +/-2.5dB limits overall, and showing a promisingly even balance.

Under 1/3-octave analysis at a 2m measuring distance the output was excellently uniform and integrated; in this respect the system illustrated almost a textbook performance. However the tonal balance showed a gentle rise in output with increasing frequency, with a mild but discernible hump in the treble region centred on 15kHz.

The high sensitivity allowed steady state distortion measurements to be carried out over the whole range at both 90 and 96 dB. Above 150 Hz, aside from isolated peaks at 1.8 kHz and above 10kHz, distortion held to below 0.3%. While a 100W pulse at 500 Hz was approaching overload, with 4% 2nd and 8.0% 3rd harmonics; this in fact represents some 108 dB, which is a very high sound level. At 5kHz the 100W pulse gave no trouble at all, with a typical value of 1% for both 2nd and 3rd harmonic.

The averaged room response in energy terms did suggest some mid prominence between 600Hz and 1.5kHz, but the overall trend above 1.5kHz was very good, and close to the theoretically ideal characteristic. While the low frequency range had some depression coupled with an early rolloff below 50Hz, it was otherwise fairly uniform.

With comfortable sound levels achieved on as little as 10W per channel, this speaker will happily accept 50W unclipped programme without blowing fuses, thus allowing up to 102dBA sound levels, which is quite loud considering the box size. At some penalty to the stereo imaging, it will also in fact perform quite well on an open shelf or bookcase, and does not become too 'rich' or 'boomy' in such a location.

#### Sound quality

The Clyde achieved good scores on the live comparisons. Although it was felt to sound a little 'small' with a degree of 'forwardness' in the midband, negligible accompanying 'loudness' or 'shout' was apparent, and the general effect was smooth and well integrated with good detail and natural tone colour. On occasion the treble could sound a little 'sibilant' and 'edgy', while some coloration was also identified, mainly of the 'boxy' kind.

Promising scores were also obtained on the stereo tests, where the imaging was found to be clearly defined with some depth and good lateral precision over a wide listening angle. Low bass notes were lacking in power, but the balance was surprisingly good if tending to be slightly 'light' and 'middy' in character, and the overall effect was almost as smooth as the remarkable responses indicate. Note however that the latter are of course unable to show the mild 'boxy' coloration and slight upper treble 'tizziness' that we experienced.

#### Summary

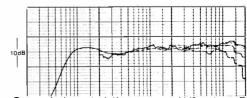
Once again we find a Castle speaker in the Best Buy category. This tidy little box packs a surprising 'punch' in terms of a clear even and lively sound, offering a high sensitivity, easy amplifier load, high dynamic range and moderate distortion, plus fine finish and engineering. At the price and size one can hardly quibble with the lack of deep bass, and the *Clyde* compares well with some of the best miniatures ever made at any price.

#### Update

A new full length grille has now been fitted, dispensing with the alloy trim.

#### **GENERAL DATA**

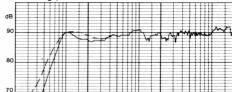
Size (h x w x d)
Recommended amplifier power per channel
(for 96dBA per pair at 2 metres minimum)(10)-50W
Recommended placement open stand
Frequency response within ± 3dB (2m)
Low frequency rolloff (-6dB) at 1m64Hz
Voltage sensitivity
(ref 2.83V, ie: 1 watt in 8 ohms) at 1m89.5dB/W
Approximate maximum sound level (pair at 2m) 102dBA
Impedance characteristic (ease of drive) good
Forward response uniformity excellent
Typical price per pairinc VAT £80 when reviewed, now £105



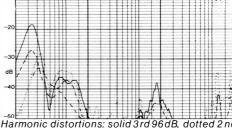
Forward characteristic response (1/3-octave @ 2m, dotted 15° vert., small dash 30° lateral, long dash 45° lateral).



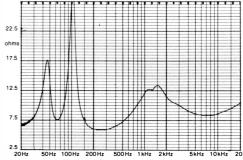
Averaged forward characteristic response in room at listening position.



Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response without arille).



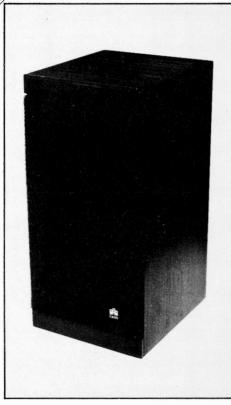
Harmonic distortions: solid 3rd 96dB, dotted 2 nd 96dB, dashed 3rd 90dB, chain-dashed 2 nd 90dB, o shows stop point at 96dB).



Impedance (mod Z).

### Castle Lincoln

Castle Acoustics Ltd, Shortbank Road, Skipton, North Yorkshire Tel (0756) 5333



A compact, finely finished loudspeaker, the Lincoln can be said loosely to inherit the position established but now vacated by the discontinued Richmond. In contrast to the vast majority of cheaper designs, which have gone for vinyl covering, the Lincoln retains a real wood-veneered cabinet, with an expanded reticulated foam grille of good acoustic although the result is nonetheless good. properties.

tuned by a decently sized port, 55mm in diameter by 70mm deep. This system loads the bass/mid unit, while treble is handled by crossover comprises eight elements plus two power resistors, and a decently large magnet

sensitivity.

Interior box details include a cross brace and thin bituminous damping pads, the whole lined with a thick grade of polyurethane acoustic foam.

Castle specify a 50W power rating, in conformity with the 80hm impedance standard, and placement on open stands is also recommended, though at a pinch shelf mounting is possible, in view of its compact dimensions.

Sound quality

With an 'average' rating overall, the Lincoln can be seen to have achieved a fine result at a price which is about half the group average.

Plus points included a clear, open sound with lively, integrated detail, and although the bass lacked some definition, it was firm and free from boom. The treble was well extended and even.

However the speaker did demonstrate mild boxy and hard colorations, with some lispiness in the treble. Low bass was attenuated and some of the stereo depth impression was absent, although on the other hand, frontal stereo was well focused with good left-right stability.

#### Lab results

Remarkable pair matching was shown to within ±0.5dB over the entire frequency range. An 88dB/W sensitivity was indicated, with a flat bass response extending to -6dB, 53Hz. Up to 100dBA should be possible from a pair in a typical room.

From the 2metre forward response group the Lincoln can be seen to present a highly uniform characteristic with an axial response extending from 60Hz to 20kHz, within fine limits. In the lateral plane the 30° off-axis response showed more falloff than is usual for the speaker size, suggesting that the driver phase integration was not quite perfect at the crossover point,

Happily meeting an 80hm specification, and The 15litre chipboard enclosure is reflex- with a minimum value above 60hms, the Lincoln was classed as an easy amplifier load.

At 96dB, the speaker was in overload below 145mm diameter steel framed pulp cone 50Hz (not surprising in view of its size), but above that frequency, distortion, both second another Castle driver, this a 30mm plastic unit and third harmonic, was moderate, averaging possessing annular radiating geometry, around 1%. With the exception of the 2kHz Operating at around 3.5kHz the high-quality region where third harmonic was fairly constant, a reduction in level to 86dB brought with it a substantial decline in distortion which energises the bass unit, promising a good measured typically around 0.2% over much of

the range, which was a good result.

Assessed by room averaging, the Lincoln maintained its uniformity. The treble rolloff was nicely rounded, the mid smooth and the low frequency integration well controlled down to the 45Hz working limit.

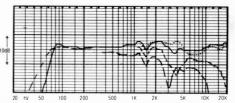
#### Summary

For some panelists the Lincoln did not quite 'gel' as a total sound but it remains a fine, well balanced, well designed and well constructed system, offering good value for money. Other attributes include an easy amplifier loading, and an above average sensitivity, and is certainly well worth hearing. Castle continue to demonstrate their ability to produce fine speakers and the Lincoln is recommended.

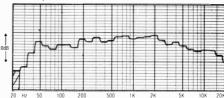
#### **GENERAL DATA**

Size (height $\times$ width $\times$ depth)	m
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres) (15)—50\	Ν
Recommended placementopen stand	ls
Frequency response, within ±3dB, a 2 metres 60Hz to 20kH	łz
Low frequency rolloff ( – 6dB point) at 1 metre 53H	łz
Voltage sensitivity	
(ref. 2.83V, or 1W into 80hms at 1 metre 88dR/V	Ν

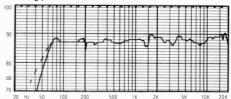
Approximate maximum sound level (pair) at 2 metres. . . . 100dBA Impedance characteristic (ease of drive) . . . . . . . . very good Forward response uniformity......good Typical price per pair, inc VAT. . £135 when reviewed, now £169



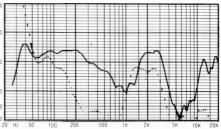
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash



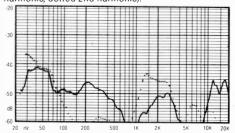
Averaged forward characteristic response in room at listening position.



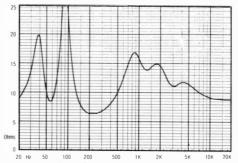
Reference sine wave response (1 m on axis, 2.83 V input shows sensitivity). Dashing corrects for chamber LF



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic)



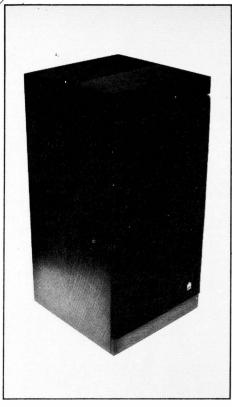
Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

Castle Pembroke

Castle Acoustics Ltd, Shortbank Road, Skipton, North Yorkshire Tel (0756) 5333



Although basically a compact design the *Pembroke* nonetheless encompasses a bass-reflex-loaded volume of some 32litres. Its design recipe is in fact derived from an earlier model, the successful *Kendal*, but with the application of Castle's continuing refinements plus a new style of cabinet. The enclosure has a shaded stain/varnish finish with the black foam grille flanked by horizontal veneered bars at the top and bottom of the cabinet.

A 200mm bass/mid unit is married in a vertical in-line arrangement to a 30mm plastic cone tweeter, both drivers being of Castle's own manufacture. The bass unit is constructed on an aluminium cast frame, with a substantial magnet. The good quality crossover operates at approximately 3kHz and is of 12dB/octave basic order, although this is adjusted to 'fine tune' the driver responses.

The heavy enclosure is braced and damped,

the interior lined with an acoustic absorbent. A conventional moulded rear connector panel is fitted with plain 4mm sockets — as opposed to the prefered 4mm socket/binding posts more suited to 'special' cables. Internal fuses, accessible behind the bass driver, protect against sustained amplifier overload — a system used on previous Castle models.

#### Sound quality

As we have come to expect from Castle, this speaker gave a good account of itself during the listening tests. Favoured by all the panelists it produced a consistently smooth sound, free from fatiguing effects. Tending to mild richness tonally, it was felt that the bass could have been a little drier while some boxiness and plumminess in the lower midrange was also noted, although this was not serious. The treble could also demonstrate a little 'breathiness' in the upper range.

Overall the scund was 'big', with good bass power and extension. Stereo images were quite well focused although they showed some loss of depth and transparency Frontal detail was however good with a pretty natural tonal balance. In fact, it sounded as smooth as the remarkable lab test results would indicate!

#### Lab results

Pair matching was good except around the 14kHz area where significant 2dB errors were observed. The grille had no deleterious effect on the sound however. Sensitivity was rated as above average at 88dB/W, providing maximum sound levels of up to 103dBA, and a 10-100W amplifier power range is considered appropriate.

Bass was quite extended — to 44Hz, —6dB — and quite uniform in anechoic terms. Overall the response in the 70Hz to 12kHz range was quite remarkably smooth with only ±1dB ripples apparent.

Out at 2metres, a very good forward output was demonstrated showing great consistency, phase control and integration. Can you believe a ± 1.5dB response from 60Hz to 20kHz here? John Collinson, Castle's designer improves his mastery of the response curve year by year!

At 96dB, second harmonic distortion typically measured 1-1.5%, with third rather lower than that except at 2kHz. Third harmonic was little altered at the lower 86dB level, but second was much improved to 0.3% and better. With third harmonic often at the 0.15% level, the Pembroke essentially gave good results for

distortion.

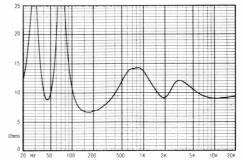
Impedance never fell below 6.4ohms, making it very easy to drive by any amp of good repute. The computer-averaged room response also looking very promising, with the low frequencies integrating well with the room, down to 40Hz. The mid register was also very smooth and while the lower treble seemed slightly depressed, the upper treble was in fact marginally too well extended, hinting at the upper 'edge' heard on audition — a fine result however.

#### Summary

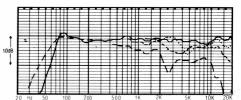
Comfortably 'recommended', this traditional-looking speaker offers a sweet, smooth sound with an excellent overall balance of engineering-based performance. For the size the bass is good, and the system will also play loud when required, being easy to drive. In fact some purchasers may prefer this speaker to others which come more highly recommended by the panel as a whole — this will depend on taste and to some extent the choice of programme as the *Pembroke* suited classical works slightly more than it did rock.

#### GENERAL DATA

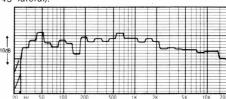
Size (height x width x depth)	55 x 27.5 x 30.5 cm
Recommended amplifier power per c	hannel
(for 96dBA minimum per pair at 2 me	etres) (10) — 100W
Recommended placement	open stands
Frequency response, within ±3dB, a 2	metres 50Hz to 20kHz
Low frequency rolloff ( - 6dB point) at	1 metre46Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 me	tre88dB/W



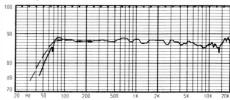
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



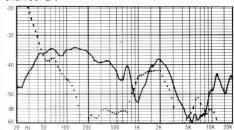
Forward characteristic response (½ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



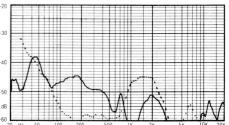
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

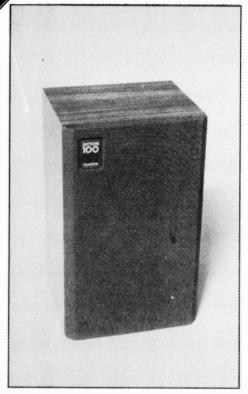


Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

REVISED AND REPRINTED

# Celestion 100

Ditton Works, Foxhall Road, Ipswich, Suffolk IP3 8JP. Tel (0473) 73131



The latest Celestion model, the 100 is an ultra-compact, sealed-box design, with a 7 litre internal volume loading the 170mm bass/mid driver. This is built on a pressed steel frame using an unusual flared pulp cone of advanced design, which is light enough to offer a usefully high sensitivity even though only a modest magnet is involved. The treble register is covered by a new version of Celestion's 2.5mm soft-fabric dome, which it is claimed has benefitted from laser analysis in improving its performance. A good quality 4-element crossover is employed, with sprinc-loaded clip terminals.

The enclosure is a conventional chipboard box constructed using the cost-effective mitrefold technique and finished in a good quality synthetic veneer. The driver panel looks good with the grille off, which is fortunate since the speaker sounds better that way. 12mm rebated board is used for the driver baffle but the proximity of the port to the treble unit can give rise to possible undesirable diffraction effects.

One would expect that boxes of this size would be suitable for shelf mounting, and the midrange characteristic of the 100 indicates that this should indeed be the case.

#### Lab performance

At 1 m measured on the nominal mid/treble axis under anechoic or free field conditions, the 100 showed a dip 6dB deep at 7kHz. However removal of the grille did wonders for the response, as shown by the dotted line, and clearly this is one speaker crying out for a sensible foam grille. With the grille removed, the response met +/-2.5dB limits 90Hz-18kHz, which is not bad at all for a budget model. The sensitivity checked out at slightly above the average at 88dB/W, though the bass response was restricted, measuring 6dB down at 76Hz.

At 2m, the 1/3-octave characteristic showed evidence of a loss in output around 6kHz, the overall curve having a 'humped' appearance with prominences located at 130Hz, 2kHz and 14kHz. (In practice however the response is a little better than this, since these measurements were taken with the grille on.) The off-axis curves suggest that the speaker output is well integrated and not over-critical of listener axis.

During the distortion tests, the 100 happily survived a 100W power input at 500 Hz and 5kHz, with minimal amplitude compression and harmonic distortion levels of 5.0% 2nd and 0.8% 3rd at 500 Hz, 2.8% and 1.1% respectively at 5kHz. Moderate levels of distortion were present over much of the band at both 96 and 90dB sound levels steady state. Second harmonic was typically 1.0% and third 0.4%, these increasing to 3.0% below 250 Hz.

The impedance curve demonstrates a rather high 100 Hz system resonance, and an average rating for amplifier loading which stems from a dip to just above 5 ohms, 6kHz, a region of high programme energy. However a satisfactory maximum sound level of 100 dBA could be achieved in a listening environment with inputs up to 50/W channel.

Assessed by %-octave averaging in a listening room, the 100 was judged a trifle 'forward' in the midband, with the steep rise from 300Hz to 600Hz part of this effect. Bass fell significantly below 80Hz, and the extreme treble was also deficient, though not seriously so.

#### Sound quality

The 100 fared quite well on the live comparisons. The bass output was clearly curtailed in the lower registers, with a slightly 'nasal' quality resulting from emphasis of the harmonics of the funda-

mental notes. While the sound was quite lively with a good impression given on sharp transients, the midband was described as 'boxy' with some 'hardness'. Overall the effect could have been smoother.

On the stereo sessions it was not so well regarded, although in view of its budget price the grading was reasonable. The upper treble was considered a trifle prominent, while the sound lacked 'weight'. Although it gave a reasonable impression of ambience, and the stereo presentation was quite good, it often sounded 'louder' than expected, which is not a good sign so far as mid smoothness and balance are concerned.

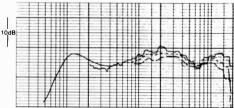
#### Summary

This small and inexpensive speaker is quite presentable, particularly when used without the grille. At £80.00 it justifies a recommendation on value grounds and is worth trying. On the debit side the frequency balance was none too even, distortion was poorer than average and the bass response was rather limited. But it possessed a lively character, was capable of good rendition of detail, and also worked quite well when wall-mounted.

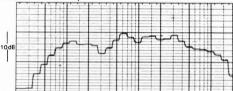
#### GENERAL DATA

GENERAL DATA
Size (h x w x d)
Weight
Recommended amplifier power per channel
(for 96dBA per pair at 2 metres minimum)(15)-50W
Recommended placementopen shelf
Frequency response within $\pm$ 3dB (2m)85Hz to 20kHz
Low frequency rolloff (-6dB) at 1 m76 Hz
Voltage sensitivity
(ref 2.83V, ie: 1 watt in 8 ohms) at 1 m
Approximate maximum sound level (pair at 2 m)100dBA
Impedance characteristic (ease of drive)average
impodance characteristic (case or arre)

Forward response uniformity......very good
Typical price per pair inc VAT ......£80



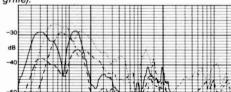
Forward characteristic response (1/3-octave @ 2m, dotted 15° vert, small dash 30° lateral, long dash 45° lateral).



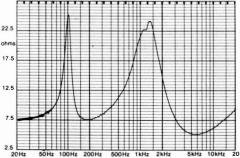
Averaged forward characteristic response in room at listening position.



Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response without arille).



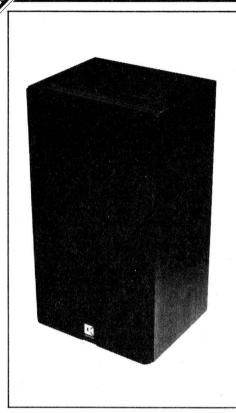
Harmonic distortions: solid 3rd 96dB, dotted 2nd 96dB, dashed 3rd 90dB, chain-dashed 2nd 90dB, o shows stop point at 96dB).



Impedance (mod Z).

Celestion 110

Celestion International Ltd. Ditton Works, Foxhall Road, Ipswich, Suffolk IP3 8JP Tel (0473) 73131



Well presented and inexpensive, the 110 could be regarded as Celestion's answer to the KEF Coda. A sealed box, two-way system, it incorporates a 200mm pulp cone bass/midrange unit plus a 25mm fabric-dome tweeter. Built on a steel frame, the bass unit has a decent-sized magnet on a 25mm pole, the diaphragm a flared design with a surface coating of pva. Crossover frequency is set at approximately 3kHz, and the network is essentially 12dB/octave using commercial quality components.

With an internal volume of 15litres, the enclosure is made of plain 12mm chipboard. clad externally in a vinyl walnut-effect material with a complementary black cloth grille. The grille frame is not be velled and is 12mm thick not conducive to good uniformity in the lower treble. No side wall damping is used inside the box, though the space is filled with some acoustic wadding. Connection is via spring

clips on the rear panel surface.

#### Sound quality

Auditioned on open stands with the grilles in position, the 110 delivered a substantially above average performance on the listening tests. which is a fine result for the price.

An open punchy sound was heard, with a forward 'up front' presentation, and the bass. while not very extended was nonetheless considered to be relatively clean and articulate. Tonally it sounded light and the treble was slightly rough with reduced transparency, while in the midrange it could appear a little congested with a 'loud' effect. 'Tunnelly' and boxy colorations were also audible in the lower midrange

Stereo images showed a slight 'double mono' effect - that is, the central focus was not too clear and the impression of depth and ambience was curtailed. In fact, we found the treble improved and became a little smoother with better detail if the grilles were removed.

#### Lab results

Pair matching was fine up to 16kHz, beyond which some deviatins were apparent. The dotted line on the reference 1metre trace shows the significant improvement obtained with the grille removed. Sensitivity averaged 88dB/W which was above average while the -6dB point was at 60Hz, about the group mean, and was also well damped. Overall the 110 showed quite a tidy reference response.

At 2metres the favourable aspects were retained with a well-integrated group of off-axis responses. Slight prominences were in evidence at 600Hz and 16kHz, but these were minor, and the output comfortably met ±3dB limits from 70Hz to 20kHz.

Only when the room averaged curve is assessed can the reason for the subjective comments of 'forwardness' be explained. The main bass register integrated well with the room, but the last couple of octaves were depressed relative to the midrange, while the mid/treble transition showed a 'corner' at 2kHz. The extreme treble was itself a little too extended, a gentle rolloff here correlating with a smother sounding top end.

Essentially an 80hm system, the 110 dips a little below 50hms at 7kHz, but the rating for the amplifier loading was still fairly good. System resonance lay at 73Hz, associated with the moderate bass depth measured.

Measured at 96dB, second harmonic distor-

tion averaged 1.5% even at low frequencies. with third a bit irregular at around 0.8%. A reduction in sound level to 86dB gave a worthwhile improvement, with midband second harmonic then around 0.2%, but higher towards the band extremes. Third harmonic did not change much however and averaged 0.6%.

#### Summary

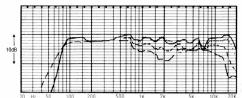
Well-made and finished, the 110 is reasonably easy to drive and it will reproduce decent sound levels, possessing an above average sensitivity. Its lightish tonal balance also suggests that it might suit wall mounting as well as the open stands used for our tests.

Celestion have a well behaved compact system in the 110. Value for money is good, and the commendable sound quality only fails the Best Buy category by a small margin.

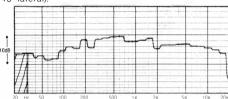
#### GENERAL DATA

Size (height $\times$ width $\times$ depth)	1
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres) (10)—100W	/
Recommended placement	
Frequency response, within ±3dB, a 2 metres 70Hz to 20kHz	Z
Low frequency rolloff ( – 6dB point) at 1 metre60Hz	,
Voltage sensitivity	
(ref. 2.83V. or 1W into 8ohms at 1 metre	1

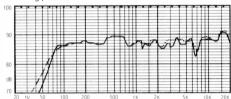
Approximate maximum sound level (pair) at 2 metres.... 103dBA Impedance characteristic (ease of drive)......good Forward response uniformity..... very good Typical price per pair, inc VAT.....£99



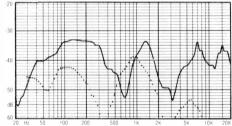
Forward characteristic response (1/3 octave at 2m. dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



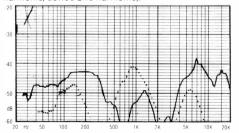
Averaged forward characteristic response in room at listening position.



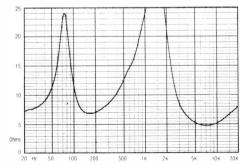
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



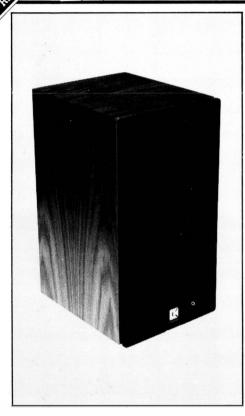
Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

Celestion SL6 and SL600

Celestion International Ltd. Ditton Works, Foxhall Road, Ipswich, Suffolk IP3 8JP Tel (0473) 73131



Along with the established SL6, this review covers the more recently developed SL600 model, which features a special alloy honeycomb enclosure and selected drivers. Both are of essentially identical peformance. but price and sound quality differ greatly due to the advanced cabinet used for the model 600.

A two-way miniature box sealed box design of 12litres internal, volume, the design employs a die-cast, Kobex-coned 165mm bass/mid unit fitted with a generous magnet. The special 37mm copper-dome tweeter has an integral motor coil former and offers a high power capacity. Both units are of excellent quality, having benefited from new design and constructional techniques plus laser analysis.

this on separate bass and treble boards in the case of the SL600. Each crossover is matched to a specific tweeter to correctly align the 21kHz

compensation network.

The SL6 cabinet is of heavy 17mm MDF, this braced and bitumen damped, with 4mm socket/ binding post connectors and a thick unrebated grille, which in our opinion is best discarded on acoustic grounds. By contrast the SL600 has an ultra-light, ultra-rigid alloy honeycomb box, with special multilayer graded acoustic absorption within. The very high material cost is in fact the main reason for the higher price. Plain 4mm sockets are provided for connection and the grille is omitted. The SL6 is covered in real veneer while the 600 is finished in a handsome charcoal colored Nextel with gold legends. Special stands are available, supplied as standard with the 600 and as extras in the case of the cheaper SL6.

#### Sound quality

The SL6 scored well above average. It provided a rich, slightly dulled sound (in fact our samples were duller than usual), with some boxiness and recession in the presence band. Stereo imaging was very good with fine central focus and fine impression of depth while the treble was outstandingly smooth and natural. The bass did not reach to the very lowest notes but was well balanced, detailed and articulate. It proved unfatiguing with a 'distant' presentation, and conveyed a good musical impressions.

The SL600 (with a correct, brigher balance) scored better still, with a remarkable, almost 'holographic' stereo precision maintained over the entire spectrum. Coloration was very low. detail abundant, and the overall effect one of airy transparency and subtlety. The bass was reasonably extended, 'quick' and well differentiated, and high scores were awarded clearly this speaker was an exceptional device.

#### Lab results

Both speakers results are shown at 1metre for comparison, the tighter balance and integration of the 600's selected components apparent here. Sensitivity was low at 82-83dB/W with a maximum sound level of 96dBA and a 30-150W power capacity range. The -6dB rolloff point was at 55Hz, good for the size.

At 96dB the SL6 was working hard, with second harmonic distortion at 2.5% even in the midband, but third harmonic rose quickly below 100Hz. At 86dB the distortion levels were con-A high power 12dB/octave crossover is fitted, siderably reduced to a satisfactory level, with second and third at similar levels of between 0.3 and 1.0%.

Forward responses for the 600 show excel-

lent integration and good uniformity, with the 15° above-axis result particularly good. A slightly below-ear-level listening position would be ideal. The balance was still slightly rich, with a full midrange.

Generally 80hms, the impedance fell to 4.50hms at 15kHz but was still considered to be a fairly good amplifier load - low-resistance cable is recommended.

Room-averaged, the output showed a near perfect interface with the room at low frequencies, having a slight presence droop, a midly rich treble balance and a smooth rolloff.

#### Summary

The SL6 is a remarkably musical if slightly colored performer for the price, offering a fine stereo performance albeit at a low sensitivity. It is recommended but its particular warm balance suggests an audition before purchase.

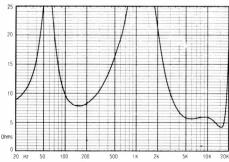
The SL600 is arguably one of the finest speakers of its size ever produced. Its stereo performance was revelatory, while its overall accuracy and natural scale belied its miniature dimensions. Apart from a moderately limited maximum level and the need for large amplifier, the SL600 can comfortably take on some of the world's finest speakers. At £600 a pair it can hardly be said to represent good value, but qualifies for a recommendation on sheer merit.

#### **GENERAL DATA**

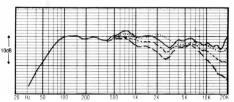
Recommended amplifier power per channel

(for 96dBA minimum per pair at 2 metres) . . . . . . . (30)—150W Recommended placement . . . . . . open stands (Celestion) Frequency response, within ±3dB, a 2 metres . . . . 60Hz to 20kHz Voltage sensitivity

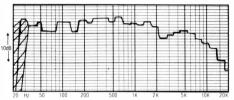
(ref. 2.83V, or 1W into 8ohms at 1 metre . . . . . . . . . . . . . . . . 82.5dB/W Approximate maximum sound level (pair) at 2 metres..... 98dBA Impedance characteristic (ease of drive). . . . . . . fairly good Forward response uniformity.....very good Typical price per pair, inc VAT ......SL6, £260, stands extra SL600, £599 inc. stands



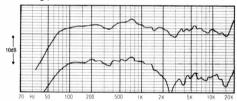
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



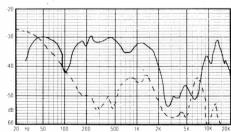
Forward characteristic response (1/3 octave at 2 m. dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



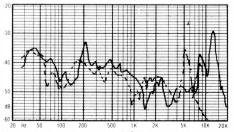
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input) Upper trace, SL600, lower trace SL6.

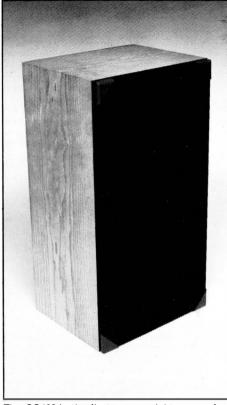


Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

DW Labs Ltd. PO Box 43, Dunstable, Beds LU6 2NZ Tel 0582 872138



The GS402 is the first new model to come from Gale for some years now and represents a development of the 401, incorporating a new Lab results tweeter. The latter comprises a well-respected 25mm soft-dome unit from Philips, but many other details remain unaltered.

A sealed box enclosure of some 40litres, each 402 employs two heavy coned long throw 200mm bass drivers working in parallel, located towards each end of the cabinet. A 100mm doped pulp cone midrange (Peerless) and the tweeter are aligned horizontally in the central area of the front panel. Thus two methods of positioning the speakers suggest themselves. Standing the speakers in a conventional vertical position, with the treble units outermost, will give the best lateral dispersion in the mid- and lower ranges, but at the expense of the midtreble. Alternatively, the famous horizontal

wide-looking box mounted on a high stand. In this case the stereo in the upper crossover range is improved to the detriment of the lower ranges (see forward output graph).

A new grille made of cloth tensioned by steel bars and set off by triangular corner plates also confers good acoustic properties. The corner plates come in a range of different colours. The crossover is well constructed and ventilated to the outside to minimise overheating, which is a good idea. The sturdy cabinet has internal bracing, is filled with mineral fibre and well finished externally, with 4mm binding posts used for electrical connection. The tweeter is separately fuse-protected, and has a phasecorrecting front plate.

#### Sound quality

The new Gale scored well in the listening tests. and, surprisingly, it was not felt to differ appreciably in overall attainment whether horizontally or vertically disposed - while some sound quality differences were apparent, these did not alter the overall high scoring. However stereo was not its strongest point images were a little wide and somewhat defocused centrally, with only moderate depth.

Colorations were considered to be mild. comprising slight sibilance, boxiness and a subtle 'oddness' on human voice.

On the plus side however it was considered 'big hearted', with a powerful large scale presentation and abundant clean bass (slightly excessive), reproducing a detailed acoustic of a lively nature and a well balanced tonal effect. The output was felt to be smooth, well controlled and of good quality.

The samples supplied demonstrated a weakness in that the pair match was below par, with a 2dB imbalance above 1kHz, this capable of detracting from the stereo focus and general consistency. Sensitivity was above average at 88dB/W, but was compromised by the low impedance. Bass was fairly well extended to -6dB, 48Hz with some overhang, but with a gentle rolloff to lower frequencies. The grille worked well, having no significant output effects.

Average impedance was 60hms but there were several areas closer to 40hms, and in view of the small reactive content, a 'just satisfactory' rating was deemed appropriate for amplifier loading

With the speaker disposed horizontally, the position can be adopted, resulting in rather a 2metre forward response set showed a weakened lateral output due to the breadth of the radiating area, this recovering well above 5kHz. The 15° above-axis response showed some loss, suggesting that the mid driver represents the optimum radiation axis. The response looked lumpy and yet the averaged output suggested a smoother sound — this should be confirmed by the room response. Sure enough, the room characteristic was quite promising with good bass extension, the output notably even over the range with a desirable gentle rolloff towards the highest frequencies.

At 96dB the distortion was average on second harmonic above 500 Hz but below this frequency very good results were obtained. At 86dB the second harmonic improved greatly while third remained very low throughout — a fine performance here.

#### Summary

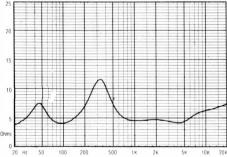
While the Gale needs a beefy amplifier to exploit it to the full, it has proved to be a wellordered and good-sounding system. Power capacity was high, allowing sound levels of up to 106dBA, while the bass was clean and powerful, right up to the limit. Distortion was moderate and the sound pretty accurate as well as detailed. Constructional quality and performance justify the price, and so the new Gale qualifies for a recommendation. We hope that pair matching is improved in future.

#### GENERAL DATA

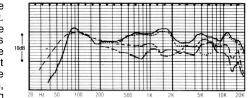
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres) . . . . . . . (25) - 200W Recommended placement.....on matching stands

Frequency response, within ±3dB, a 2 metres .... 50Hz to 18kHz Low frequency rolloff ( – 6dB point) at 1 metre............. 48Hz Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre .................... 88dB/W

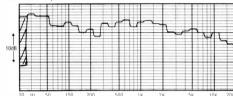
Approximate maximum sound level (pair) at 2 metres.... 106dBA Impedance characteristic (ease of drive) . . . . . . satisfactory Forward response uniformity ...... fair Typical price per pair, inc VAT. . . . . . . . . . . £430



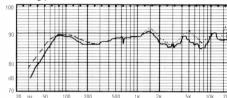
Impedance (mod Z), Impedance characteristics give an indication of amplifier loading.



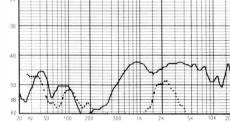
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



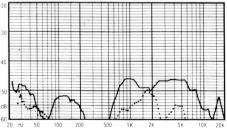
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



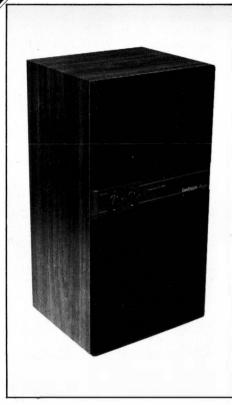
Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic)



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

# Goodmans Mezzo

Goodmans Loudspeakers Ltd. Downley Road, Havant, Hants Tel (0705) 486344



The Mezzo is the middle sized model in Goodmans new 'M' series of moderately priced speakers, and revives the name of a model popular many years ago.

Price may be on the low side, but the specification certainly is not, this model comprising a substantially built 37 litre bassreflex enclosure with a three-way driver system. The design is striking with a horizontal bar across the upper third of the divided grille carrying level controls for the mid and treble. plus a line of LED lamps for the peak power level indication. The 80mm cone midrange unit and the 25mm soft dome tweeter are mounted side by side in the upper section — neither this arrangement nor the 15mm thick grille baffle edges are conducive to good lateral dispersion, pulp cone bass driver occupies the lower section of the enclosure, bass loaded by a small

reflex port.

Externally, the rigid chipboard enclosure is well finished in a synthetic vinyl print. The commercial-quality crossover is basically of 12dB/octave form, employing eight elements plus power resistors. Thick foam blocks provide acoustic absorption for the interior, whose panels are otherwise undamped. Both 4mm sockets and DIN electrical connections are provided on a moulded panel.

#### Sound quality

In spite of its dispersion handicap, the Mezzo acquitted itself well on the listering tests. comfortably achieving a score worthy of HFC recommendation. It was considered lively and well balanced, with good detail in some regions. while the bass was powerful with quite good extension if a little plummy. The treble was guite pleasant and free of obvious vices, and the midrange sounded open if trace boxy, while 'cuppy' coloration was also audible.

Opinions about this speaker did however vary a little, mainly due to the somewhat inconsistent stereo. Only moderate depth was portrayed, the central focus seeming rather diffuse by comparison with the group average. Despite this, the Mezzo had a pleasant character not usually encountered at its price level.

#### Lab results

On the median axis, measured at 1metre, the output looked unpromising, but as we shall see the overall forward response was rather better. The dotted graph shows the effect of removing the upper grille and we in fact preferred the sound in this condition. Mean sensitivity was above average at 88dB/W, with a guite extended -6dB bass rolloff at 46Hz, and in conjunction with a 100W peak power handling, substantial 104dBA sound levels were possible. Pair matching was fairly good.

Fine distortion results were obtained at 96dB: around 1.5% second harmonic at low frequencies and just 0.3% for both second and third above 200Hz. At 86dB both showed a further reduction to very good levels.

At 2metres, the off-axis responses were fairly well grouped apart from the 30° lateral, with the general characteristic slightly 'rich', possessing a gentle suckout at 3kHz.

Assessed by computer room averaging, the or to low diffraction. A larger-than-usual 250mm output was rather more consistent than anticipated, and correlated well with the smooth impression gained on the subjective

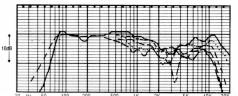
tests. Technically this model produced some confusion, this due to its anomalous dispersion.

Failing to meet the 80hms spec, the Mezzo showed an impedance dip to 50hms, but it modest reactive content and average value of 70hms meant that it remained quite easy to drive.

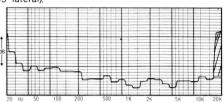
#### Summary

This larger-than-average speaker is good value for money, offering a pleasant, uncritical 'big' sound. The bass extended deeper than usual while high sound levels with low distortion were possible. If stereo precision is not too important then the Mezzo would be a strong contender. and in any case at its realistic price level, it carries a firm Choice recommendation.

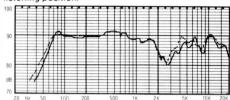
#### GENERAL DATA



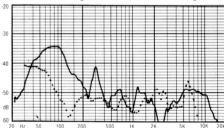
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash



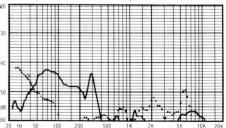
Averaged forward characteristic response in room at listening position.



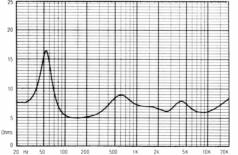
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic)



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

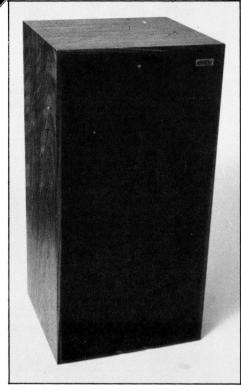


Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

REVISED AND REPRINTED

Harbeth HL1 III

Harbeth Acoustics, 1a Birchanger Road, South Norwood, London SE25 5BA Tel 01-654 9549



Since its introduction the *HL1* has been subject to small detailed improvements culminating in the latest Mk III version reviewed here. We experienced some quality control and consistency problems with earlier models, but happily these now seem to be behind the company, with current review samples showing good matching and agreement with the designer's target specification. In particular, recent improvements have concerned the need for greater low frequency power handling.

A 50 litre enclosure reflex tuned by a large 62mm diameter tunnel port, the cabinet is of thin wall high quality veneered plywood, with bituminous panel damping and extensive seam battening. Front and back panels are well screwed down and a sculptured foam grille improves the cabinet diffraction. An exclusive polypropylene 200mm covers the bass/midrange, and a 25mm Audax soft dome tweeter the high frequencies, with a good

quality crossover dividing the input at approximately 2kHz. Provision has been made for sensible matching of mid and HF using an auto transformer to aid consistent frequency balance.

#### Lab results

A useful above average sensitivity of 87.5dB was recorded, which is on target and not compromised by the impedance, which was judged to be a good amplifier load. Typically of the order of 8 ohms, a 6.6 minimum was recorded, and while some high phase angles were apparent (for example 70° at 2kHz) the impedance was substantial enough at these points to avoid censure. The -6dB rolloff point was noted at 46Hz, and with a 100W per channel amplifier limit, a good maximum sound level of 102dBA should be possible in a typical room.

The axial response at 1 m was fairly uniform and ignoring the 5 kHz notch, met  $\pm 3 \text{ dB}$  limits, 55 Hz-18kHz. Third harmonic distortion levels were also very well controlled at 96dB, typically measuring 0.5% or better above 150Hz. The less annoying second harmonic content peaked at 8% around 100Hz, and this might be audible on sustained bass notes. The system fared less well on a diet of 100W pulses despite the low 2Hz repetition rate. Although perfect at 500Hz, a +0.3dB expansion occurred at 5kHz generating 5% of second and 1.8% of third harmonic distortion. Crossover saturation is the probable cause at this equivalent 100W programme level.

Examining the forward 1/3-octave responses at 2m, distinct trends were apparent. The bass region was mildly humped around 100Hz, above which the output rose gently to 700Hz before a trough 2dB deep appeared to 2kHz, the latter an intended design feature. The treble range was more or less level and matched to the midrange, while the offaxis curves can be seen to be very uniform, indicating excellent forward dispersion.

#### Sound quality

Designed as a monitor, the *HL1* gave a very good performance when compared with live sounds. In general terms it was clear and low in coloration, and sustained a modest 20W average (100W peak) of bass guitar, providing a fairly even and deep bass register.

On the stereo sessions it was not quite as highly favoured, though it still did well. Vocal lines were clear if slightly 'chesty' and exhibited some sibilance, with an apparent emphasis in the treble

occasionally lending a slightly 'metallic' effect. Top: Frequency response, 1 m sinewave, plus 2nd (solid) and The bass was also judged a trifle 'soft'. Stereo imaging was quite good with promising depth ambience, but sometimes the treble region axial; thick dashed, 30° horizontal; thin dashed, 45° horizontal; sounded displaced from the midrange – a function zontal; dotted, 15° vertical). of the system's frequency balance perhaps?

#### Summary

The standards of clarity and workmanship together worth trying.

3rd (dashed) harmonic distortion @ 96dB Middle: Impedance (modulus)

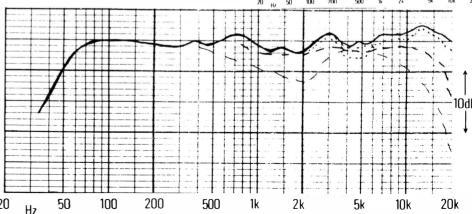
Bottom: Frequency response, 2m 13-octave averaged (solid,

with low coloration still set this speaker apart from the common crowd. It has been a couple of issues since we reviewed the HL1 - then it was considered good enough for recommended listing. In view of rising standards, the HL1 cannot necessarily be expected to hold its place indefinitely, but we still hold the design in favourable regard and feel it well

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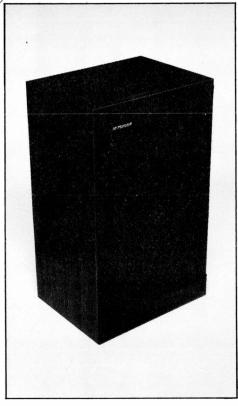
Size
Weight
Recommended amplifier power per channel (for
96dBA per pair at 2 metres minimum)
Recommended placement
Frequency response within ± 3dB (2m)
Low frequency rolloff (-6dB) at (1 m)
Approximate maximum sound level (pair at 2 metres)
Third harmonic distortion (96dB at 1 metre)
65 Hz-2%, 100 Hz-1%, 200 Hz-0.2%,
500Hz-0.35%, typically 0.3%
Impedance characteristic (ease of drive) good
Forward response uniformity
I vpical price per pair

\*Check text



#### Heybrook HB1

Mecom Acoustics Ltd, Knighton Hill, Wembury, Plymouth, Devon Tel (0752) 863188



This low-cost speaker is rather better made than usual. The exterior of its rigid chipboard cabinet in vinyl 'walnut', while internally it is damped by bituminous cladding plus acoustic foam absorption. A superior reticulated foam grille is fitted and electrical connection is via binding posts/4mm sockets of good quality.

Internal volume is 22litres, and two drivers are used, both of Danish 'VIFA' origin. The 200mm doped pulp cone bass/midrange is fitted with a decent magnet and a superior frame, and the high frequencies are handled by a 25mm soft plastic dome tweeter, whose chassis is reinforced inside the cabinet, this also serving to brace the front panel. A 12dB/octave crossover of superior quality integrates the two units at 3.7kHz.

Appearances response-wise suggested a character which might suit shelf mounting against the wall, and in fact the HB1 did work

quite well in this position, but for the listening tests the cleanest results were felt to come from positioning on rigid open stands.

#### Sound quality

Personally I had some reservations concerning this model's sound quality, these based on the results of an earlier audition, but under blind conditions, the panel (myself included) thought highly of the *HB1*. Consistently good marks were awarded, placing it high in the field irrespective of price.

Good qualities included a highly revealing transparency which was truthful to the programme character. Stereo images showed quite good depth with a realistic acoustic and decent frontal focus; in fact it sounded almost too 'clean' in the 'open' sense, as opposed to 'shut-in' or enclosed. The bass was articulate, with fair extension if a mite too 'dry', although this helped on percussion.

On the minus side, the sound showed some boxy colorations plus mild tizz and hiss emphasis in the upper treble. The mid could also appear somewhat hard and foward. Using first-rate programme, these effects were somewhat less serious than when juxtaposed with the more distorted output of a brighter and less expensive analogue disc player. Tonally speaking, the *HB1* was balanced on the bright side.

#### Lab results

Excellent pair matching was demonstrated, with a high 90dB/W sensitivity, and despite this the bass was reasonably extended to 55Hz, -6dB, on the anechoic response, as well as being free of overshoot.

In the view of the 80W maximum power handling, decently loud 104dBA sound levels were possible, while a little as a 10W input raised pretty good levels of around 95dB in a typical room.

Out at 2metres the general trends can be seen and the speaker only just scraped into the nominal ±3dB response limits for axial output. The upper mid was indeed forward by 2-3dB while an energy suckout occurred at 7kHz, high enough not to be felt subjectively as a loss of presence or 'air'. The treble recovered soon after, with a broad hump centred on 14kHz. Both plus and minus 15° vertical off-axis responses were run, showing the *HB1* was axis-critical and should be directed straight at the listener in the vertical plane. Crossing the axes in front of the listener for 10°-15° lateral angle also improved

the tonal balance.

Measured at 96dB the distortion was moderate at 0.8% to 1.5%, with a further improvement noted on reducing the signal level to 86dB.

Occasionally the *HB1* impedance almost approached 5ohms, but it represents a simple amplifier load reactively and should prove fairly easy to drive. System resonance was noted as 65Hz.

Room averaged, the bass was smooth but somewhat deficient, being a few dB down in the fundamental midrange. Consequently, the mid remained forward although the integrated treble works better than the axial responses might otherwise suggest.

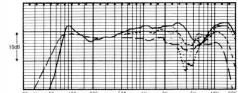
#### Summary

The HB1 offers a distinctly bright character plus an above average build quality. Moderate distortion levels, high sensitivity as well as good maximum acoustic power are also all apparent, while the sound is strikingly clear with a fine transient performance. On the basis of its sound quality ratings as well as its modest price, the HB1 attains 'Best Buy' status.

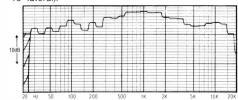
#### GENERAL DATA

GENERAL DATA
Size (height $\times$ width $\times$ depth)
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres) (10)—80W
Recommended placementopen stands
Frequency response, within ±3dB, a 2 metres 65Hz to 20kHz
Low frequency rolloff ( – 6dB point) at 1 metre 55Hz
Voltage sensitivity
/ ( 0 0 0 )

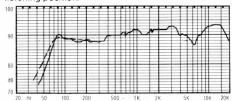
(ref. 2.83V, or 1W into 8ohms at 1 metre	B/W
Approximate maximum sound level (pair) at 2 metres 1046	
Impedance characteristic (ease of drive)g	ood
Forward response uniformityfairly g	ood
Typical price per pair, inc VAT	129



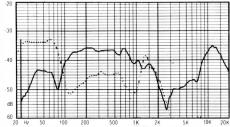
Forward characteristic response (% octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



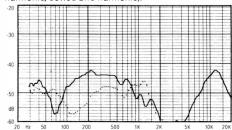
Averaged forward characteristic response in room at listening position.



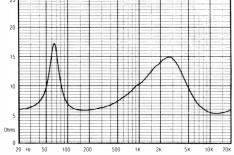
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

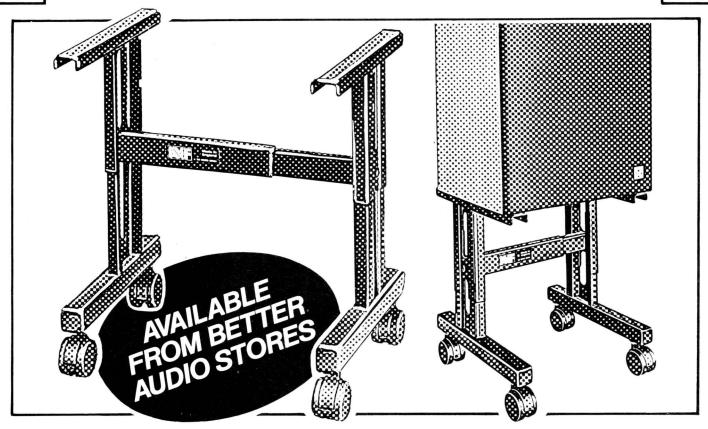


Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

# EASY LISTENING



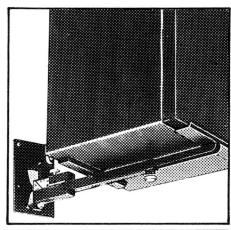
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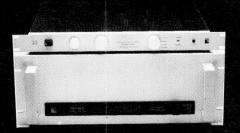
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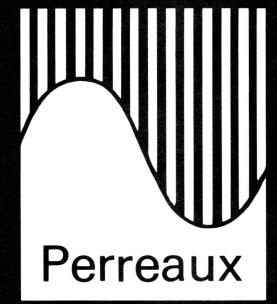
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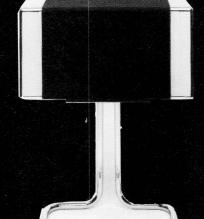


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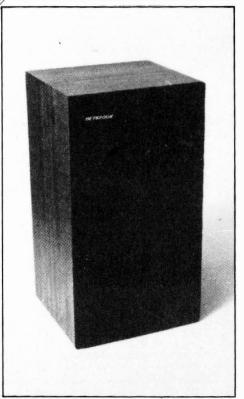
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Heybrook HB2

Mecom Acoustics, Knighton Hill, Wembury, Plymouth, Devon

Tel (0752) 863188



British made and designed using French Audax units, the compact HB2 speaker is intended to be unobtrusive when mounted on light stands about 0.5 m away from the back wall of a listening room. This is a design showing great attention to detail: for example, the reflex port – a tube 105 mm long by 28mm diameter – would be expected to suffer from audible distortion due to its small size, but by locating it on the cabinet rear and damping the exit with a soft foam ring, this is in fact kept to a minimum. The 12 litre braced chipboard cabinet is heavily damped by bituminous pads as well as a thick foam lining. The 25 mm soft dome and 160mm bextrene cone drivers are mounted vertically in line behind the acoustically transparent low diffraction grille.

The good quality and complex crossover comprises some 13 elements including resistors, and is described as including phase compensation for the drivers to provide a smooth amplifier load.

#### Lab results

Very good pair matching was exhibited with the discrepancies barely greater than the linewidth on a B&K chart. The lab sensitivity was rather low at 84dB/W suggesting a minimum of 30W/channel; with a 100W ceiling, a modest maximum sound level of 96dBA is possible in a typical room. The low frequency rolloff was nominally at 60Hz, -6dB, but some extension to 40Hz was apparent on the axial sinewave curve and this would be present in normal room conditions. Limits of ±4dB were required to contain the sinewave response which was otherwise reasonably uniform.

Subjected to 1/3-octave analysis the response may be seen to elevate by 2dB or so above 500 Hz: if referred to the lower level, the bass extension is good for the box size. Around the 3kHz crossover point the same unevenness was present, and the tendency to a loss in output here was exaggerated on the '15° above' vertical response. This speaker should be more or less at ear level for the best results. On the lateral axis the responses were good, and furthermore showed that the most neutral subjective balance will be obtained with the speakers over-angled inwards.

96dB was quite a high level for this box size, and vet the crucial third harmonic distortion was reasonably low until below 90Hz. Second harmonic values were also acceptable at 2.5%. 400Hz and around 2%, 5-10kHz. However the 100W pulsed input caused some problems, for while the 0.2dB compression was slight at 500 Hz, 4% of second harmonic distortion was also recorded; fortunately at 5 kHz the behaviour was near perfect. With an average value of 10 ohms. the  $\dot{H}B2$  was considered a good amplifier load. despite the rapidly falling impedance above 10kHz (tapering to below 4 ohms, 30kHz).

#### Sound quality

Rated consistently at 'good' throughout the listening tests, the HB2 clearly did well for its price. The bass was plausible if lacking in power on the live comparisons; 60-80W of peak bass guitar could occasionally 'crack' it. The light and open balance suited live percussion sounds, and coloration was

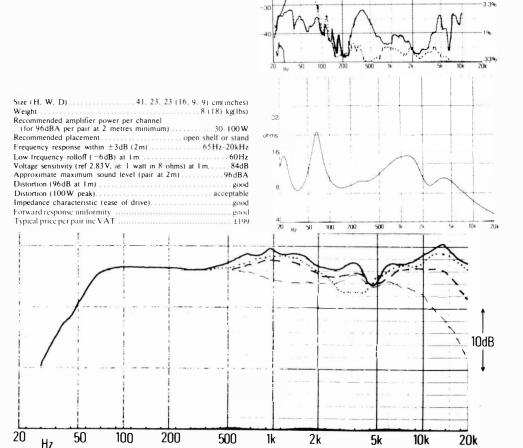
On commercial programme stereo imaging was good, with a fine representation of space and depth. Again the bass was more than satisfactory if balance tended to openness with light sibilance, 3rd (dashed) harmonic distortion (a 96dB but in a smooth and acceptable manner.

#### Summary

Although possessing a restricted maximum level and power handling, the HB2 was a refined low coloration performer of compact dimensions. It gave a good overall sound quality as well as a consistent character throughout the frequency range, and is undoubtedly worthy of recommendation. This was Heybook's first venture into the commercial world, and it represents a welcome addition to the market.

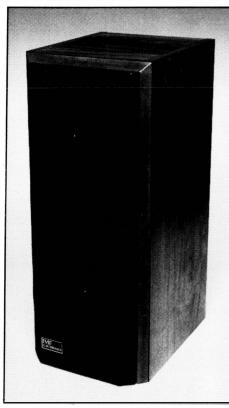
the speaker was not driven too hard, and the Top: Frequency response, Im sinewave, plus 2nd (solid) and Middle: Impedance (modulus)

Bottom: Frequency response, 2m 13-octave averaged (solid, axial: thick dashed, 30° horizontal: thin dashed, 45° horizontal; dotted, 15° vertical).



#### IMF HPCM

IMF Electronics Ltd, Westbourne Street, High Wycombe, Bucks HP11 2PZ Tel (0494) 35576



A fairly tall looking speaker, the *HPCM* is in fact smaller than it looks. The enclosed volume of this three-way sealed-box system is estimated at 35litres, this large volume being partly devoted to a large triangular upper compartment used to backload the midrange unit located in the upper part of the front panel. An oval bass unit of approximately 230mm equivalent circular diameter is vertically aligned to allow a narrow front panel, which has bevelled edges and is fitted with a foam grille to minimise cabinet diffraction. If the drivers are good, very flat responses should result.

The bass unit has remarkable excursion capability of over 3.0cm peak-to-peak and employs a generous high-power motor system, founded on a rigid cast chassis. A fibreglass-reinforced polystryrene diaphragm is used.

The midrange unit has a specialised 100mm doped Bextrene cone, and a small grille-

protected plastic dome tweeter completes the lineup. All drivers are made by IMF themselves.

Substantially built from 20mm chipboard, the cabinet has some crossbracing and general reinforcement. Superb walnut veneer is used on the exterior with 4mm socket/binding posts used to connect the complex crossover, which includes six inductors, five electrolytic capacitors and four plastic film capacitors. Heavy duty wiring, fully soldiered, is employed throughout.

#### Sound quality

The HPCM demonstrated a consistently good sound quality on all programmes, which did justice to its 'control monitor' title. Hallmarks were the moderate coloration, the extended 'airmoving' bass, and the open, lively character demonstrating fine musical detail. Stereo images were well staged showing satisfactory depth as well as good focus, while some instability in treble imaging was associated with a measured imbalance here (see results), and could well be better on other samples.

Tonal balance was well received attracting little criticism, and was felt to give a pleasing scale and weight to most programmes. Colorations were slight, with a little boxiness and nasality in the mid, plus a trace of 'lispiness' in the treble.

#### Lab results

Measured at 1metre, responses of both speakers were taken — the dotted line is that for the second enclosure and shows a 1-2dB treble imbalance. Bass was smooth and shelved down slightly with fine extension to 40Hz, – 6dB, while the speaker was also remarkably flat elsewhere. Sensitivity was average at 86.5dB, which in conjunction with a 20 to 200W power capacity allows maximum levels of up to 105dBA, which is a pretty decent level.

located in the upper part of the front panel. An oval bass unit of approximately 230mm equivalent circular diameter is vertically aligned diffraction properties of the cabinet geometry. to allow a narrow front panel, which has bevelled edges and is fitted with a foam grille to range!

The impedance characteristic was however not so favourable, with dips in two areas to 40hms and with some reactive content also present, this indicating a fairly difficult amplifier loading. System resonance was low at around 33Hz.

Room response showed an extended bass which did not rise above midband levels but was mildly deficient in the low hundreds of Hz. The

dispersed treble energy was less than anticipated, the speaker rolling gently away above 2kHz, this partially accounting for the smooth 'soft' nature described on test.

At 96dB the distortion was good at 0.3% third and 1% or better second harmonic, and at the reduced level of 86dB, it showed a general improvement to a more than satisfactory level especially at high frequencies. Considering the bass extension, the low frequencies were surprisingly linear.

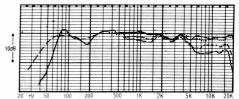
#### Summary

The HPCM has many good qualities — a fine consistent sound; extended bass from trim dimensions; a good dynamic range and a strong stereo performance. Of course at £550 a pair we would expect no less and a tough amplifier will be needed to drive this poorer-than-average load; nonetheless the system achieves a full recommendation.

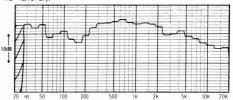
#### GENERAL DATA

Size (height × width × depth)	$.67 \times 29 \times 37$ cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(20)-200W
Recommended placement	open stands
Frequency response, within ±3dB, a 2 metres	46Hz to 20kHz
Low frequency rolloff ( - 6dB point) at 1 metre	40Hz
Voltage sensitivity	
(ref. 2.83V or 1W into Robme at 1 metre	86 5dB/M

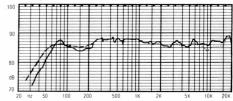
Voltage Sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 metre	
Approximate maximum sound level (pair) at 2 metre	
Impedance characteristic (ease of drive)	fairly difficult
Forward response uniformity	excellent
Typical price per pair, inc VAT	£550



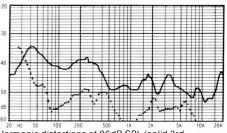
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



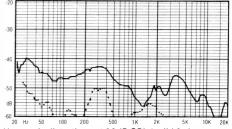
Averaged forward characteristic response in room at listening position.



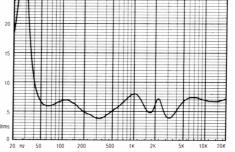
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

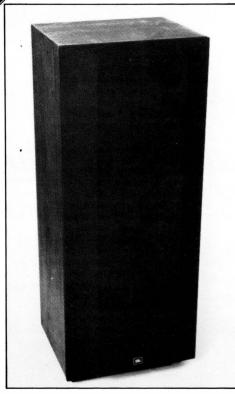


Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

Harman Audio UK Ltd., Mill Street, Slough, Berks SL2 5DD. Tel (0753) 76911



Previously reviewed and recommended, the L150 now carries an A suffix denoting the substitution of a new and improved treble unit, distinguished by a protection grille, and further crossover refinements. An imposing structure just over a meter high, the vertical-in-line driver array comprises a 305mm auxiliary low frequency radiator of exceptional throw, plus a high power 305mm bass unit fitted with a rigid coated-pulp cone and built on a die-cast frame. A high linearity ceramic magnet system is employed. The traditional 100mm pulp cone mid unit is positioned above the bass driver and is followed by a 25mm aluminised dome tweeter, the latter a hardened phenolic linen structure. The crossover possesses good power handling with low loss components. and the mid and treble level controls are now marked with an 'O' 'flat' position in addition to boost or cut. (JBL used to deny the existence of a flat curve, preferring to let the customer choose it for himself in the final listening position).

The internal volume is large at 110 litres, with the massive and rigid enclosure built from high density chipboard fitted with extensive bracing and a fibreglassacoustic absorption fill. Externally the American walnut veneer was of the highest quality.

For the new review the speaker was fully auditioned and substantially re-measured. While the 2 metre and distortion curves refer to the previous version, they are still relevant, the only exception being the treble lift above 15kHz which on the new version is now replaced by a gentle rolloff.

#### Lab performance

The new axial reference curve was remarkably similar to the previous samples right up to 6kHz, beyond which the slightly ragged character plus off-criticised peak at 19kHz has been replaced by a smoother trend, plus a gentle hump at 15kHz, rolling off thereafter. The sensitivity remains high at 89dB/W, and the drive characteristic with a minimum impedance of 5.5 ohms was rated as average, and should embarrass very few amplifiers.

As the existing forward characteristic shows, the *L150A* is a very well integrated system, especially considering its size. The low frequency response was superbly extended to a -6dB point at 32Hz, gently tapering below 200Hz to improve the room energy balance (which tends to augment the lower frequencies by a few dB or so). It is essentially well balanced as the reference response indicates, +/-3dBlimits sufficing for a 33Hz to 19kHz range, even sinewave measured.

At 96dB distortion levels were very low throughout the range, typically around 0.4% and remaining well below 0.3% at 90dB. Fed 100W peak power pulses the system exhibited negligible compression at both 500Hz and 5kHz, while a mild 3.0% 3rd harmonic was recorded at the lower frequency; elsewhere the remaining measured harmonics were consistently low, which is indicative of a fine dynamic range.

With 500W peak power handling, the 150A is capable of a hall-filling 111dBA, and should satisfy all but the most insensitive disco fan. Room averaging showed an interesting interaction, with the 100Hz to 5kHz range exemplary at +/-2dB, although above 5kHz the rolloff should have been smoother and slower. Below 100Hz the strong low frequency output of this model produced an elevated response right down to 40Hz, and by implication a touch of low bass cut on an accompanying amplifier may be necessary in some situations.

#### Course dans

The L150A continued to set a high subjective standard throughout the listening tests. On the live comparisons it showed some mild colorations, and was inferior in this respect to the smaller classic BBC designs; 'boxiness', 'nasality', slight 'sibilance' and 'hollowness' were all noted. But on the plus side the frequency balance was highly neutral, with a well-defined and crisp, clear rendition.

On stereo programme the speaker gave a 'big' sound, partly as a result of its physical height and its wide bandwidth. The bass was superbly clear and unusually extended, if slightly excessive, while 1000W of electric bass guitar was handled without knocking or distortion. Stereo imaging was to a good standard, with fine detail, well articulated vocals, and promising depth. Overall the effect was a trifle 'hard', which suited rock programme best, but results were impressive on all material, with plenty of information reproduced.

#### Summary

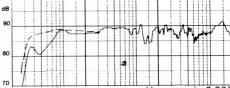
Continued refinements have helped to maintain the competitiveness of this model, and despite its high UK price it provides a sufficiently good standard of sound quality to deserve continued recommendation. Its particular merits include low distortion, a wide dynamic range and exceptional power handling, plus above average sensitivity, clear articulate sound with great bass extension, and an essentially neutral frequency balance. Finally the system is relatively easy to drive, and is superbly engineered and finished.

#### **GENERAL DATA**

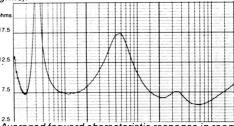
Size (h x w x d)
Weight36kg
Recommended amplifier power per channel
(for 96dBA per pair at 2 metres minimum) (10)-500W
Recommended placement on floor clear of walls
Frequency response within ± 3dB (2m)35Hz to 18kHz
Low frequency rolloff (-6dB) at 1 m32 Hz
Voltage sensitivity
(ref 2.83V, ie: 1 watt in 8 ohms) at 1m89dB/W
Approximate maximum sound level (pair at 2m)111dBA
Impedance characteristic (ease of drive) average
Forward response uniformityvery good
Typical price per pair inc VAT £1000 when reviewed, now £1350



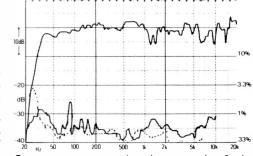
Impedance (mod Z).



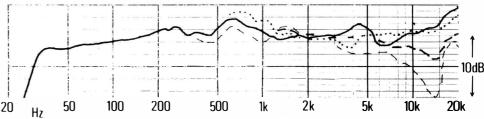
Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response without axillo.)



Averaged forward characteristic response in room at listening position



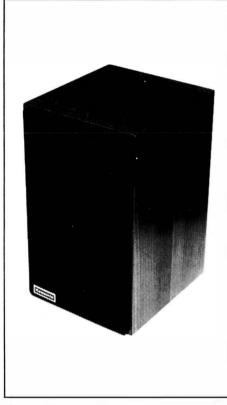
Frequency response, 1m sinewave, plus 2nd (solid) and 3rd (dashed) harmonic distortion at 96dB.



Forward characteristic response (1/3-octave @ 2m, solid axial, thick-dash 30° horiz, thin dash 45° horiz, dotted 15° vert.).

#### Keesonic Kub

Keesonic Audio Developments Ltd, Halldore Hill, Cookham, Maidenhead, Berks Tel (06285) 22726



This miniature speaker has been available for some years now and is still popular. We felt that the event, this proved a highly worthwhile exercise.

Apparently best suited to wall mounting, the Kub is rigidly constructed in chipboard and is well finished in real wood veneer on all surfaces. The internal volume is a diminutive 5litres. (LS3/5a size), reflex tuned to 40Hz by a rather too-small 35mm diameter port, whose duct runs to a 120mm length (not the preferred ratio). The grille is unrebated, but this does not upset the output, due to the large treble unit employed an unlikely-looking 87mm flared paper/pulp cone tweeter. Bass and midrange are handled by an above-average long-throw 130mm pulp cone unit built on a die-cast chassis.

The crossover comprises seven elements. including two power resistors, and is of good

commercial quality, electrical connection for this speaker being via 4mm sockets on the

No panel damping is used or felt to be necessary but the cabinet interior is lined with acoustically absorbent plastic foam plus a volume filling of long-haired wool. Over the vears the price has changed very little and the system is still available at around £82 a pair.

#### Sound quality

Wall-mounted, facing ahead, that is not directed inwards (see axial and off axis curves) the Kub proved remarkably successful in pleasing the listening panel. It scored 'above average' which is very good for the price. Positive qualities included a fine level of clarity, transparency and detail, and it also sounded open and lively. Positioning inevitably affected the stereo presentation, but the image was still quite well focused with some depth.

Low bass was clearly missing, but the upper bass was present in good balance and could produce surprising levels on bass percussion. Upper-bass notes were felt to be sufficiently articulate and actually better than average.

On the minus side the treble had a distinctly breathy zingy quality — even a scratchy effect - which was emphasised on poor programme. Nonetheless the panel score sheets clearly showed that some listeners were fooled into thinking that the Kub was much larger than it really was.

#### Lab results

Examined for pair matching the treble level on one speaker was 1.5dB more than the other — a greater difference than I would like but still it was time to look at a current pair again, and in satisfactory at the price. Average sensitivity was a little below the norm at 85dB/W, but it proved capable of withstanding considerable power inputs with a sensible 75W maximum allowing quite good sound levels of up to 99dBA from a pair. The reference response gave a - 6dB rolloff at a modest 63Hz.

> At 2metres, the response showed some lumpiness notably a 3-4dB treble upward shelf, also heard on the auditioning. Forward integration was guite good at angles up to 30° off-axis and began to fail more quickly in the treble at 45°. A 30° off-axis listening position gave the best overall result, typified in use by somewhat over-wide wall-mounted positioning. beaming straight ahead.

> Measured at 96dB the Kub (not unexpectedly) produced some distortion peaking at 9%

second harmonic at 150Hz and 3% at 10kHz. with third harmonic somewhat better. Fortunately a reduction in level to 86dB resulted in a major improvement and so overall, the distortion performance here was quite satisfactory.

Room averaged, the response showed some lumpiness but a tolerably good balance. The treble should not rise as it does here towards 12kHz, and it also falls away too suddenly above this. Reasonable bass was available down to 50Hz in the room, the low frequency irregularity being typical of wall mounting.

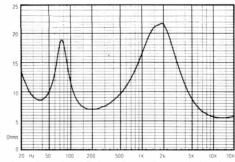
The Kub's impedance averaged 10ohms with a minor dip to 5.60hms at 14kHz, thus rating as a good amplifier load.

#### Summary

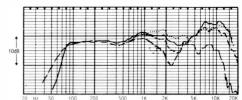
Despite its diminutive size, and our minor reservations, the Kub has again scored a Best Buy rating in this edition. It packs a surprisingly clean and detailed punch, with a pleasing tonal quality, and it offers unobtrusive wall mounting. The treble is its weak area, and bright pickup cartridges should be avoided with this speaker. With a 'rounded' cartridge characteristic and a clean tuner or digital programme, this small loudspeaker can perform suprisingly well.

#### **GENERAL DATA**

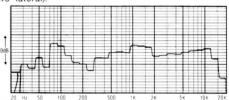
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres) (10)—75W
Recommended placementshelf
Frequency response, within ± 3dB, a 2 metres 80Hz to 6kHz
Low frequency rolloff ( – 6dB point) at 1 metre 63Hz
Voltage sensitivity
(ref. 2.83V, or 1W into 8ohms at 1 metre
Approximate maximum sound level (pair) at 2 metres 99dBA
Impedance characteristic (ease of drive)good
Forward response uniformity fair
Typical price per pair inc VAT 682 when reviewed now 689



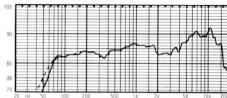
Impedance (mod 7). Impedance characteristics give an indication of amplifier loading.



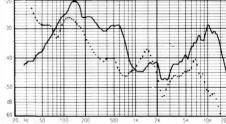
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral)



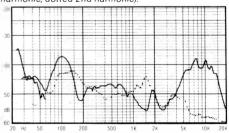
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LE



Harmonic distortions at 96dB SPL (solid 3rd) harmonic, dotted 2nd harmonic)



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

KEF Electronics Ltd., Tovil, Maidstone, Kent ME15 6QP. Tel (0622) 672261



In recent years KEF have been noted for some of the more costly 'reference' speakers on the market, but they have now reaffirmed their interest in the budget class, with this substantial two-way model retailing at around £80.00 a pair.

The Coda comprises a 19 litre sealed-box tuned to a 3rd order low frequency alignment by a series capacitor of computed value. The bass/midrange is handled by a 200mm flared pulp cone driver, whose cone is light enough to offer useful sensitivity without excessive magnet expenditure (the latter is surprisingly small but sufficient to properly damp the low frequency response). The treble unit is the Audax 25mm fabric dome which is already used by KEF in their successful Celeste/Concord series. A four-element crossover of high power capacity marries the units around 4kHz.

The enclosure is simply constructed of chipboard with a rather dull synthetic walnut covering. No panel damping is used, but some internal absorption is achieved by a polyester blanket fill. Electrical connection is *via* rear flush fitted spring clip terminals, and the driver panel is well finished which is fortunate in view of our recommendation that this model should be used with the grilles removed! The grille is a plain unrebated panel 12mm thick which had surprisingly severe effects on the speaker's frequency response and stereo image properties, as well as causing a smaller but noticeable change in subjective smoothness. Having discerned these effects early on, the listening tests were done with the grilles removed, and this should be borne in mind by the prospective purchaser.

#### Lab performance

The sensitivity was higher than claimed at an above average 88.5dB/W, and KEF's frequency response was substantially met (they specify with the grilles removed in any case!) At 2m the characteristic curve showed a very fine set of off-axis results, with the evidence suggesting that 25° should give the flattest result and provide the most pleasant tonal balance as well as good stereo imaging. The range 80Hz-2kHz was remarkably smooth for such an inexpensive system.

Good dynamic potential was shown by its handling of the 100W pulsed inputs, with a mild 0.2dB compression at 500Hz accompanied by 3.8% 2nd and a modest 0.55% of 3rd harmonic distortions. At 5kHz, there was 0.6dB of compression as well as more distortion, namely 4.5% 2nd and 1.0% 3rd, though neither was considered serious at this high 108dB spl. 3rd harmonic distortion was low at both 90 and 96dB steady state, rising above 1.0% only below 100 Hz, and measuring only 3.5%, 50Hz 96dB. The printed graph was in fact dominated by less serious 2nd harmonic at the 1.0% level. The 8 ohm specification was almost perfectly met, so the system will be easy to drive to the full voltage/sensitivity rating of the amplifier. Averaging showed just how well this speaker worked within the room, +/-2.5dB limits sufficing from 60Hz to 15kHz. The rolloff beyond 15kHz was a little steep, the bass falling below 50Hz and the midrange being slightly humped, but the room system response nevertheless beat many models at much higher prices.

Our power rating was for a minimum of 10W/channel rising to 100W peak maximum, the latter allowing high sound levels of up to 104dBA in the listening room from a stereo pair. Reasonable extension was shown at low frequencies with the -6dB point at 50Hz.

#### Sound quality

REASSESSED

This speaker scored very well on all the listening tests, performing with a consistency that we have come to expect only from much costlier models. It would be all to easy to ignore its faults in the light of this astonishing performance, but obviously it is not perfect. Some coloration and a tendency to brightness was demonstrated, while the treble also showed an uneven tendency on occasion, with some of the characteristic Audax 15kHz 'fizz'.

Conversely it provided a fine stereo presentation with above average depth, good spatial effects and ambience plus a transparency and detail which conveyed a high proportion of the musical information contained in a variety of programme.

More coloration was noted on the live comparisons, but the system's detail and tonal accuracy won the day and high scores were recorded. Up to a 150W peak of bass guitar was happily tolerated, the system demonstrating a fair fundamental bass power, a neutral and even character, plus an ability to play loud.

#### Summary

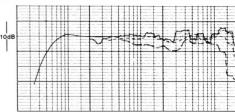
With a new tweeter and numerous detail refinements, the Coda III arrived in time for auditioning. although the measurements given here relate to the // which it supersedes. The new version if anything sounded better, and hence the Best Buy rating is comfortably retained despite its higher price. The Coda is a speaker of many attributes, notably good sensitivity, wide dynamic range and power handling with moderate distortion, and an essentially neutral frequency balance with satisfactory bass extension. It also demonstrated fine stereo, good clarity and detail, so it deserves to be fed good quality material a second rate turntable with a 'fizzy' cartridge will destroy it. The Coda is not only a classic Best Buy but will, I believe, set the standard for budget compacts for years to come. If used on stands without the grilles and angled inwards by about 20° to cross in front of the listener, the results compare with many models costing up to £300 a pair.

#### GENERAL DATA

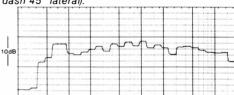
Typical price per pair inc VAT.

Size (h x w x d)
Weight
Recommended amplifier power per channel
(for 96dBA per pair at 2 metres minimum) (10)-100W
Recommended placement open shelf or ideally on open stands
Frequency response within ± 3dB (2m) 62Hz to 18kHz
Low frequency rolloff (-6dB) at 1m50Hz
Voltage sensitivity
(ref 2.83V, ie: 1 watt in 8 ohms) at 1m
Approximate maximum sound level (pair at 2m)104dBA
Impedance characteristic (ease of drive) very good
Forward response uniformity excellent (grille off)

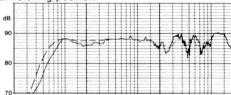
£80 when reviewed, now £99



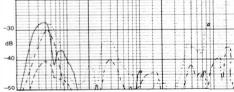
Forward characteristic response (1/3-octave @ 2m, dotted 15° vert., small dash 30° lateral, long dash 45° lateral).



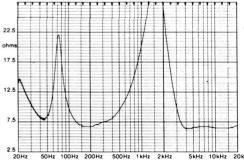
Averaged forward characteristic response in room at listening position.



Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response without grille).

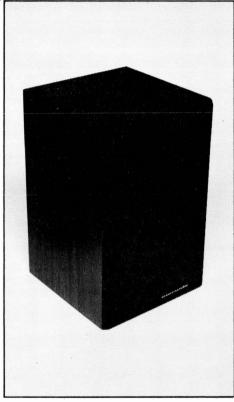


Harmonic distortions: solid 3rd 96dB, dotted 2nd 96dB, dashed 3rd 90dB, chain-dashed 2nd 90dB, o shows stop point at 96dB).



Impedance (mod Z).

Marantz (UK) Ltd, 15-16 Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middlesex UB7 0LW Tel 01-897 6633



Inexpensive Marantz speakers have in the past sufficient to produce a pretty loud 100dBA from often been best regarded as sensitive 'noise a pair in a typical room. A 20W to 100W generators'. But with their new offerings this maximum amplifier power range seems approview may need to be revised! Designed in a classical framework, the LD30 sports an handling results. impressive list of optimum design features speakers from this company. The chipboard enclosure is surfaced all over in vinyl walnut length to breadth ratio.

with a cone fabricated from sheet material and a generous 45mm diameter motor coil is

coupled with a decently large ceramic magnet.

Crossing over at 1.7kHz, the electrical network is quite complex (especially for Marantz) and comprises ten hard-wired components of good quality. Rear connection is by means of spring clamps.

Great attention to detail is evidenced by the instruction manual, which suggests that the arille might be removed for optimum results. The speakers should be used on open stands some 30-40cm high and spaced well clear of the walls.

#### Sound quality

Scoring a little above average the LD30 has done well for its price. Major criticisms were centred around its rather rich tonal balance. with some boxiness and related coloration in the low mid as well as a mild boominess in the bass.

Conversely it sounded civilised and relaxed. offering reasonable detail, as well as pleasing transparency. Stereo images showed good depth and frontal focus, although heavy bass transients were felt to be a little 'slow', while tympani and the like were not 'sharp' enough. the speaker showing some coloration and hollowness on these sounds.

The overwhelming impression was one of a smooth relaxed sound with good bass extension particularly in view of the price, with above average stereo staging.

#### Lab results

Fractionally below average, the LD30 voltage sensitivity worked out at 85.5dB/W which was priate, on the basis of the distortion and power

Bass extension reached 47Hz. - 6dB, which many of which have never appeared before in was good for size and price, and pair matching was fine. With the grille removed (dotted line on 1metre reference graph) a mild improvement and is quite strongly built, with a loose fibre was observed, this backed by subjective trial. blanket fill. The internal volume of 23 litres is Out at 2metres on the smoothed response the reflex tuned by a 53mm diameter by 170mm long trends were clear. The speaker possessed a ducted port, possessing a larger than ideal gentle downtilt of 3dB from 100Hz to 10kHz, the main explanation of its rich tonal balance. In Two vertically in-line drivers are used, namely general the forward set of responses was good. a 200mm bass/midrange and a 25mm soft dome a mild dip at 15° above-axis suggesting a tweeter, the latter a ferro-fluid damped type. The reasonable stand height for optimum sound bass unit is built on a substantial steel frame quality Limits of ±3dB were met over a 52Hz to 14kHz range.

Distortion was higher than average at 96dB

sound level, second harmonic reaching 8% at 150Hz. typically 1% while. Third harmonic ranged from 1% to 0.2%. An improvement was noted at 86dB sound level but the result was still poorer than average, ranging from 2% to 0.3% distortion.

Assessed by room integration, the output was as smooth and extended as the speaker sounded, which was a good result for this type of system.

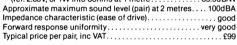
Impedance dipped to 6ohms, at 150Hz, with the typical value nearer 10ohms, and the LD30 was thus quite an easy amplifier load.

#### Summary

The LD30 is not an entirely neutral sounding speaker and vet is has a character which can make less expensive turntables and amplifiers sound rich and spacious with a relaxed, musical stereo. Digital programme revealed some colorations but none were too serious, and having demonstrated a good standard in most respects, the LD30 can be comfortably recommended.

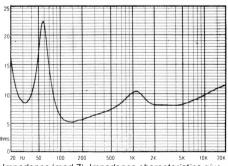
#### CENEDAL DATA

GENERAL DATA
Size (height $\times$ width $\times$ depth)
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres) (20)—100W
Recommended placementopen stands
Frequency response, within ±3dB, a 2 metres 52Hz to 14kHz
Low frequency rolloff ( – 6dB point) at 1 metre 47Hz
Voltage sensitivity
(ref. 2.83V, or 1W into 8ohms at 1 metre
Approximate maximum sound level (pair) at 2 metres 100dBA
Impedance characteristic (ease of drive)

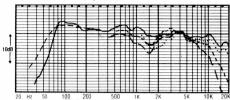


#### Update

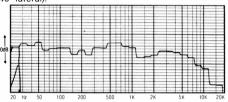
A MkII version of the LD30 is now on sale with revised tweeter and cosmetics - rosewood vinvl cabinet finished and chromed trim rings.



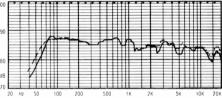
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



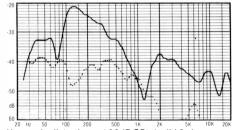
Forward characteristic response (1/3 octave at 2m. dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



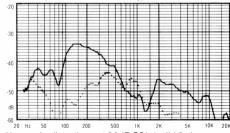
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83) input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill



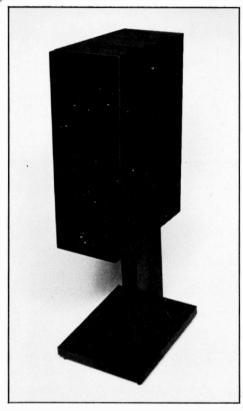
Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic)



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Meridian M2

Boothroyd-Stuart, 13 Clifton Road, Huntingdon, Cambridgeshire PE18 7EJ Tel (0480) 57339



Now well established, the M2 from Meridian is perhaps the leading UK active loudspeaker system, consisting of a slim compact enclosure mounted on a new heavyweight (and how!) rigid stand.

The box is well packed with electronics and drivers, the latter all being KEF units — two 110mm Bextrene-cone bass/mid drivers, one mounted above and one below a fairly large 38mm plastic dome tweeter. As a group this array approximates in effect to a 300 × 120mm bass unit with a concentric treble driver. The 17 litre enclosure is reflex tuned by a ducted port, which has a multi-hole aperture to improve air flow linearity as well as enclosure coloration. The box itself is superbly built in 14mm thick top-grade multi-ply and finely veneered, the back panel consisting of a metal plate which acts as a heat disspator for the electronics. In addition to providing the electrical crossover at

2kHz, the latter realigns the bass system to a sixth order, and extended bass can be expected possibly at the expense of a rapid final rolloff as well as a possible low-frequency hangover.

DIN and phono inputs are provided at nominally 1V sensitivity and the system may be driven by a balanced output preamplifier for optimum performance — for example a Meridian 101B).

The grille components are rather close to the drivers on the narrow front panel, so measurements were taken with the grille removed and in place to assess its effects.

#### Sound quality

In general the *M2* sound was favoured by the panel. It portrayed dynamics well and was felt to have a clean, punchy and controlled character throughout the range. Good stereo images were developed, being well focused and showing reasonable depth. However, its slightly forward, hard and bright tonal balance was felt by some panellists to mildly flatten some stereo images.

Bass was considered well controlled with fine articulation in the upper registers and a very slight extreme low frequency hangover, the latter almost a mild 'thundery' effect. In presentation the M2 was clear as well as detailed, with a slightly cold and clinical ambience; possibly the presence band was indeed a little too forward.

#### Lab results

Considering the small size of the box, quite loud 102dBA sound levels were possible and the bass power handling was satisfactory at this level. The axial frequency response was of the 'stepped' variety, which placed the bass rolloff – 6dB at 45Hz referred to the mid band. Conversely if referenced to the upper bass level, the cutoff improved to 38Hz — remarkable for the cabinet volume.

Some pair matching imbalance was apparent (solid and dashed lines above 500Hz), this amounting in places to a significant 2dB or so, and stereo focus could well have been better with a tighter match. The grille was also found to disturb the 2.5 and 8.0kHz range though it is hard to say which response was better.

At 2 metres the trend suggested upper-mid forwardness with the main range shelf-lifted above the 80-300Hz bass range. The 15° above-axis frequency response was poor, flawed by a dip at 2.2kHz, but on axis and 15° below it was perfect. Here the wisdom of Meridian's adjustable-tilt stand can be seen in bringing up

the main radiating area to the listener. The lateral off-axis curves were good except above 10kHz where the falloff was too rapid.

Room-averaged response showed a 'lumpy' bass at 30-50Hz which, however, did not subjectively prove as audible as you might expect. The mid was thin in balance terms, while the treble was sweet, though rolled off somewhat prematurely.

At 96dB distortion was fairly low, in fact surprisingly so at low frequencies. Interestingly the picture did not change at the lower 86dB level where the result was about average.

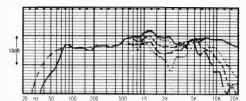
#### Summary

On the basis that the amplifier section of these active speakers is worth about £400, the actual speaker contribution (about £300) is what we have to consider.

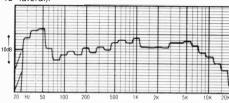
While not entirely neutral, the M2 had many likeable qualities, and gave a 'big speaker performance' from a tidy attractive package, including the sturdy integral stand. Personal audition is recommend, preferably in your own home, but with its sound quality rated in the 'good plus' category the M2 nonetheless achieves recommended status.

#### GENERAL DATA

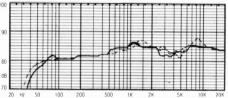
Size (height x width x depth)	50* $\times$ 18 $\times$ 38cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	active
Recommended placementopen space,	on integral stand
Frequency response, within $\pm 3dB$ , at 2 metres .	
Low frequency rolloff (-6dB point) at 1 metre	45Hz
Voltage sensitivityactive	, 1V for full power
Approximate maximum sound level (pair) at 2 m	etres 102dBA
Impedance characteristic (ease of drive)	active/balanced
Forward response uniformity	
Typical price per pair, inc VAT includ	ling stands £899
*83cm including stand	



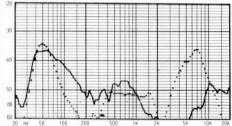
Forward characteristic response (½ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



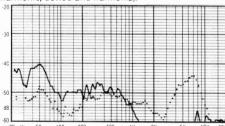
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

#### Mission 70

Mission Electronics, Stonehill, Huntingdon, Cambs PE18 6ED Tel (0480) 57477



The 70 is a diminutive new speaker from Mission, their smallest yet, measuring just 13litres in internal volume. Some early production models were released to the press and dealers but Mission subsequently felt they had Lab results acted prematurely, as further development of Pair matching was judged very good, the systhe model was undertaken; indeed, even after submitting the samples here reviewed further basic 70 theme, which complicate the findings we believe the measured findings at least give a performance.

In this two-way sealed-box system, the bass/midrange unit is a shallow paper-coned tance) the output was fairly uniform, meeting 160mm steel-framed type with heavy damping ±3dB limits from 80Hz to 20kHz, but it also coating, and a Vifa 19mm soft plastic dome showed some lupiness around 1kHz and tweeter covers the treble above 3kHz, this a 12-14kHz. ferro-fluid cooled and damped driver.

Binding posts incorporating 4mm sockets are used for electrical connection to the hard-wired four-element crossover, which uses high-power components. The cabinet is built of MDF and chipboard panels. The styled front has a deep wraparound cloth section with an integral grille, while the entire rearward section of the cabinet. including the back panel, is covered in woodeffect vinyl. Internally the enclosure is filled with a dense acoustic foam block.

We found the fitting of the two cabinet shells was none too perfect on a couple of samples we had, but understand that this area has now been reinforced inside to prevent splitting of the internal frame.

#### Sound quality

Earlier samples we received were quite promising, but the following comments relate to the 'final production' samples eventually delivered.

Reasonably good marks were obtained from the listening panel, indicating a 'average plus' rating which was fine at the price. Undoubtedly the 70 had some faults, but none of the criticisms were too serious - though the adjectives boxy, hollow, small, zitty, bright and uneven were all in evidence.

Bass was free of boom and reasonably defined, with the midrange promisingly clear, showing realistic stereo effects on occasion, as well as quite a good tonal balance. The speaker sounded quite open, but at the same time somewhat bright, while the overall treble quality was somewhat grainy as well as uneven sounding. It often sounded more interesting on rock programme rather than on classical orchestras, the overall balance tending to lightness and thinness: a trace more richness would be preferable.

tem demonstrating an 87.5dB/W sensitivity, which was a little above average. Bass was well variations and refinements have occurred to the damped, possibly even overdamped, falling to - 6dB at 60Hz. The effect of the grille could not somewhat and gave me a headache! However be judged since it was integral with the enclosure. The available 15-75W power handling good idea of the speaker's basic technical capacity produced maximum sound levels of 101dBA.

At 2metres (a more realistic measuring dis-

As usual two vertical measuring axes were

tried, namely 15° above and below the median axis. The latter was inferior, suggesting that in use the median position should not be above ear level, but in all other planes the speaker showed excellent off-axis dispersion and linearity.

In the room-integrated response the 'shy' nature of the bass balance was evident, plus a slight 'corner' in the treble around 10kHz; otherwise the result was quite smooth.

At 96dB sound level, distortion was just satisfactory, averaging 1%, and rising to 3% at 200Hz. Reducing the level to 86dB, a general improvement took place, though third harmonic was still average, and had not improved as much as one would have liked.

With a dip to 50hms at 150Hz, the impedance was still typically 80hms, and the 70 can thus be considered a good amplifier load.

#### Summary

In view of the possible variation deriving from continuing or future development of this model, I feel I must advise audition at a reliable dealer prior to purchase. With this reservation in mind. the 70 has nonetheless done pretty well on test in view of its price, and must be included in the Best Buy category.

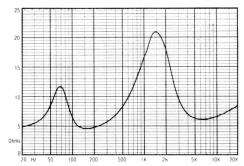
#### **GENERAL DATA**

Size (height $\times$ width $\times$ depth)
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres)(15)—75W
Recommended placementopen stands or wall mounting
Frequency response, within ± 3dB, at 2 metres80Hz to 20kHz
Low frequency rolloff ( – 6dB point) at 1 metre60Hz
Voltage sensitivity
(ref. 2.83V, or 1W into 8ohms at 1 metre)87.5dB/W

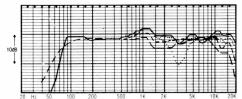
Approximate maximum sound level (pair) at 2 metres ...... 101dBA Impedance characteristic (ease of drive) .... ....good Forward response uniformity... Typical price per pair, inc VAT ... .. £89 (MkII)

#### Update

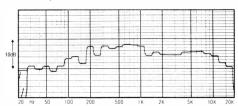
The 70/MkII features revised drivers and cabinet. Crossover design is still as in the model 70.



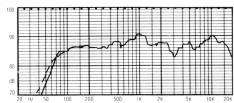
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



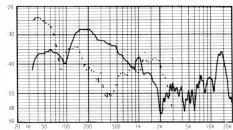
Forward characteristic response (1/3 octave at 2 m. dotted 15° vertical, small dash 30° lateral, long dash



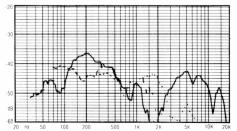
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V) input shows sensitivity). Dashing corrects for chamber LF



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

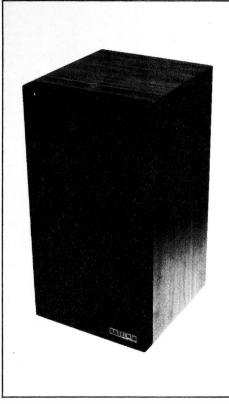


Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

N<sub>Mis</sub>

Mission 700S

Mission Electronics, Stonehill, Huntingdon, Cambs PE18 6ED Tel (0480) 57477



The original Mission 700 did well over the past two editions, as indeed it did in the pages of other hi-fi journals. It now carries an 'S' suffix to denote extensive improvement, and now built using the new and better Mission reinforced cabinet with wrap-around grille.

The 700S is a two-way bass reflex design, the port now using the Mission multicellular moulding with a 55mm exit diameter. Internal volume is approximately 22litres, the enclosure tuned to 33Hz with quite heavy damping, and the interior si filled with an acoustically absorbent foam block. MDF is largely used for the construction of the cabinet itself, the exterior walnut veneered.

Bass unit is a Mission-designed 200mm pulp cone unit using a decent-sized magnet system, with the treble allocated to a 20mm soft plastic dome tweeter, ferro-fluid damped and capable of high power handling.

A large reinforced moulded panel is employed for the back connector board, which carries sections internally for various crossover components which are then wired by hand using high quality cable. Decently sized 4mm socket/binding post connections are provided.

#### Sound quality

The 700S scored a 'good' rating which was impressive at the price. Panelists agreed on its open, lively and transparent character, revealing of programme acoustics and detail.

Stereo staging was also good, and images were well focused with pleasing depth effects. The bass gave moderate extension with good articulation and power handling, and although it was slightly bright and sibilant as regards tonal balance, it was not severely so.

Some boxiness and plumminess was also observed on vocal sections, but not enough to upset the favourable scoring, and it seemed equally well suited to both digital and analogue material.

#### Lab results

Pair matching was very good, with the sensitivity established at a high 89dB/W, this complemented by a favourable impedance loading. The response was pretty smooth with a -6dB bass rolloff at an average 57Hz with a well damped decline thereafter.

Decent sound levels of up to 104dBA were possible, from the 10-100W power handling capability.

At 2metres the highly uniform nature of this speakers forward response was evident, and in this respect it represents Mission's best effort to date. A mild bump at 10kHz was all that is worth criticising while the off axis curves were exemplary.

From the room response the bass appears well integrated as well as quite extended, if a little shallow in relation to the midrange. The mid/treble was very good but marred slightly by the 10kHz 'corner' — a slightly too sharp rolloff is seen here.

Measured at 96dB spl, good results for second and third harmonic distortion were obtained, averaging 0.8% and 0.3% respectively. Reducing the sound level to 86dB gave a substantial improvement to a fine 0.3% second and 0.3% third.

Dipping only slightly below 60hms at 7kHz, the 700S was in other respects a kind 100hm average amplifier load which means it easy to drive.

#### Summary

Offering high sensitivity, low distortion and a uniform response together with fine dispersion, the 700S provides a 'kind' amplifier load plus good stereo and overall sound quality, all at a very realistic price. Best Buy listing is comfortably attained here.

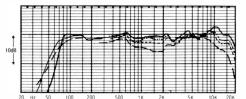
#### GENERAL DATA

Size (neight x width x depth)4	0 X 20 X 20CIII
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(10)—100W
Recommended placement	open stands
Frequency response, within ± 3dB, at 2 metres7	'0Hz to 18kHz
Low frequency rolloff ( - 6dB point) at 1 metre	57Hz
Voltage sensitivity	
(set 2.93) or 1) (into Oobmo et 1 metro)	904P

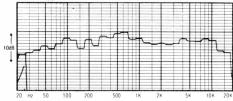
(ref. 2.83V, or 1W into 8ohms at 1 metre)	.89dB
Approximate maximum sound level (pair) at 2 metres 10	4dBA
Impedance characteristic (ease of drive)very	good
Forward response uniformityexc	ellent
Typical price per pair, inc VAT	£139

#### Update

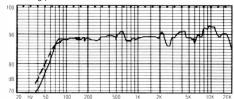
A replacement for this model is scheduled and production has ceased though stocks do remain.



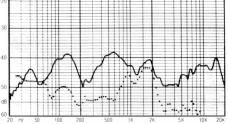
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral)



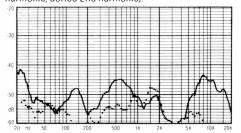
Averaged forward characteristic response in room at listening position.



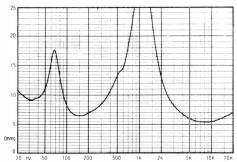
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



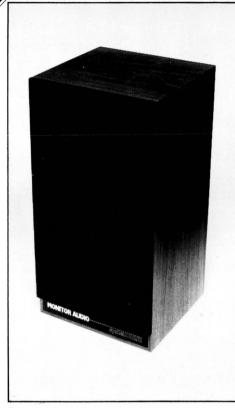
Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

#### Monitor Audio R252

Monitor Audio Ltd, 347 Cherry Hinton Road, Cambridge CB1 4DJ Tel (0223) 42898



The R252 is an inexpensive, two-way sealed box 200mm steel-framed pulp cone bass/midrange is hard-wired internally including the high-power capacity, good-quality crossover network.

unit was fitted with an improved chassis which significantly altered the subjective performotherwise pretty similar.

Unusually for this price level, the solid enmade from fully-rebated plywood.

No box panel damping is used, but the with an average of 0.3% recorded here. interior has been lined with acoustic foam to

suppress internal resonances, while electrical connection is by means of 4mm socket binding posts.

Sound quality

Initially the R252 sounded rather below average on audition, appearing aggressively forward as well as brash. However with the bass/mid unit revision, a significant improvement occurred in tonal balance as well as general character. which was sufficient to move it up to an average score, this good for the price.

Some colorations did remain, notably a residual upper mid-hardness, some lower-mid boxiness and a rather dry character to the sound. Low bass was rather curtailed, though upper bass was quite detailed, and the treble was also much better than before, due to the improved balance. However the treble was still felt to be mildly rough and forward.

Stereo images were quite well focused with moderate depth and quite clear spatial effects, and the speaker also showed a good level of instrumental detail

#### Lab results

Sensitivity was 89dB/W which was well above average, and in conjunction with a 10 to 75W power range, sound levels of up to 102dBA were possible. Pair matching was very good, while the bass register was very uniform and well damped, measuring 62Hz, -6dB, but rolling off quickly below this point. Note that this and other measurements here are for the unmodified speaker.

At 2metres the axial response was fairly smooth meeting ±3dB limits from 80Hz to speaker of 17litres internal volume, employing a 30kHz, and dispersion was excellent in the lateral, plane. However 15° above-axis a driver plus a 19mm soft plastic dome tweeter. It noticeable 4kHz notch appeared and we recommend using this speaker directed at ear level. In fact Monitor Audio's matching stands and During the progress of this review the bass designed for exactly that purpose. The forward responses were good for the type.

Room-integrated response evidenced the ance, and while these effects have been 'dry' nature of this speaker, with a fairly accounted for on audition, the measurements extended but shallow bass plus a slightly relate to the unmodified unit, which was prominent midrange. Overall however the effect was pretty smooth.

Distortion at 96dB sound level was moderate closure is finished in real wood veneer to a high at around 1% second and third harmonic even standard, the panels built of 12 and 15mm at low frequencies, while higher in the range board. The grille is a low profile component, third harmonic was particularly good. Further improvement was apparent at an 86dB level,

Bar a mild dip to 5.50hms at 10kHz, the

impedance was well behaved over the range. and the R252 was classed as a good amplifier

#### Summary

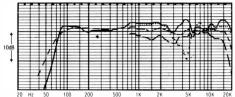
For the price this powerful two-way design is unusually well finished and constructed. It possesses low distortion, a usefully high sensitivity and quite a good standard of sound quality in its latest form. It comfortable attains recommendation, and in addition to open stand mounting, its size indicates that shelf mounting would also be a possibility.

#### **GENERAL DATA**

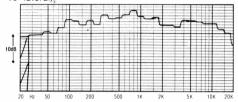
Size (neight x width x depth)	47 X 25 X 24CM
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(10)—75W
Recommended placement	
Frequency response, within ± 3dB, at 2 metres	80Hz to 20kHz
Low frequency rolloff ( - 6dB point) at 1 metre	62Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 metre)	89dB
Approximate maximum sound level (pair) at 2 me	etres102dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good

#### Update

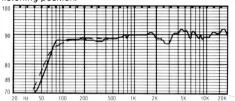
The price above refers to the 252V vinvl model: real wood veneer finish is available at £119.



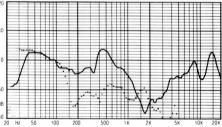
Forward characteristic response (1/3 octave at 2m. dotted 15° vertical, small dash 30° lateral, long dash 45° lateral)



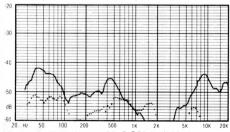
Averaged forward characteristic response in room at listening position.



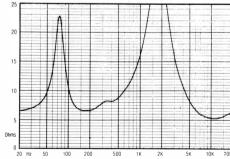
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic dotted 2nd harmonic)



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

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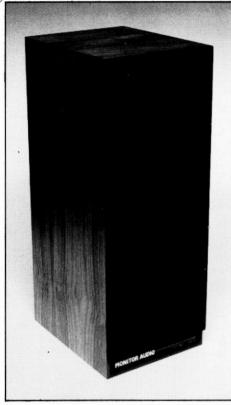
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#### Monitor Audio R352

Monitor Audio Ltd, 347 Cherry Hinton Road, Cambridge CB1 4DJ Tel (0223) 42898



This speaker is larger than usual for its price range and consists of an excellently-veneered 36litre enclosure that has been rigidly constructed from 18mm-thick heavy chipboard. Internal bracing has been used to raise the frequency and also to moderate the amplitude of the panel resonances. A fine rebated grille is interior, and the system is bass-reflex tuned to 50Hz by a realistically-dimensioned tunnel port.

cone bass unit uses a special magnet system which provides a better flux distribution at the pole tip, while the controlled local pole saturation should also reduce second harmonic distortion due to improved motor coil flux uniform to 45Hz and well integrated while the modulation.

A 20mm soft plastic dome tweeter (not ferro fluid damped) completes the lineup and this

wired crossover is fitted showing heavy duty wiring, and 4mm socket/binding posts for rear connection. Both this model and the companion 252 come with very helpful and well written instruction manuals.

#### Sound quality

The 352 scored well up the field, achieving a good overall rating which was impressive for its price category. It was liked for its well controlled, smooth and yet lively character, the bass appearing articulate but gutsy and demonstrating reasonable extension. The mid sounded clear and showed less boxiness than usual while the slightly bright treble was even and well detailed.

Stereo effects were sharply focused, with presentable depth effects where appropriate. and the speaker also proved itself capable of revealing the different ambience and acoustics present on a variety of recordings.

Rock programme was reproduced with a lively, tuneful beat and some panelists remarked that the sound 'grew on them' as the tests proceeded.

A slight muddiness and graininess was however present in the reproduction, as well as a touch of fundamental bass overhand, but none of these effects were at all serious.

#### Lab results

Pair matching was good, as judged by the 1metre responses. A narrow notch was present at 5kHz but did not appear to affect the results, and overall the response was pretty flat with a well tuned bass extending to 50Hz. -6dB. which is average for the type but with a well damped and slow rolloff. Sensitivity was high at 90dB/W, providing good levels from as little as 10W and a rather loud 105dBA from the 100W per channel maximum input power. Grille effects were negligible.

At 2metres the lateral off-axis responses were also fitted. Foam absorbent blocks line the fine but the speaker was clearly a mite critical in the vertical plane. Dips were recorded at and 15° above and below so accurate beaming to The interestingly-designed 200mm flared pulp the listener would be important with this model. ±3dB limits comfortably held a 50Hz to 15kHz range.

> Room averaged, the speaker's fine overall balance could be appreciated. The bass was treble showed a correct and gentle rolloff towards the extreme frequencies.

At the 96dB sound level distortion was quite crosses over at around 3kHz. A high-power hard- low, particularly above 500Hz, and at 86dB the

results were especially good, averaging 01.% (!) over most of the range for both second and third

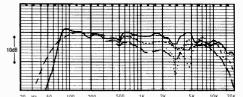
Impedance averaged 12ohms and possessed no injurious low levels at any frequency, so the 352 should be particularly easy to drive, and as such presents a 'kind' amplifier load.

This well-finished and constructed speaker provides a sound quality and engineering performance that only a few years ago was expected of models costing twice as much. It is sensitive, low in distortion, accurate in balance and predominantly faithful to the programme fed it, and it will also provide good stereo effects. It is tonally well balanced and can provide high sound levels, being easy to drive and capable of extracting the most from any decent amplifier. All in all, the R352, one of the designer Robin Marshall's best efforts yet, comfortably scores a Best Buy rating.

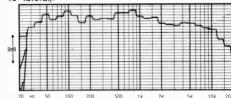
#### **GENERAL DATA**

Size (height x width x depth). .64 x 25 x 32cm Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)... Recommended placement......stands (Monitor Audio optional) Frequency response, within ± 3dB, at 2 metres ......55Hz to 15kHz Low frequency rolloff (-6dB point) at 1 metre... Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre).... ..90dB

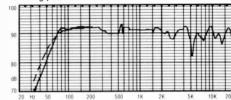
Approximate maximum sound level (pair) at 2 metres .... .105dBA Impedance characteristic (ease of drive) .very good Forward response uniformity.



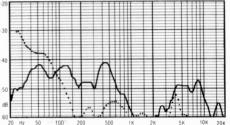
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



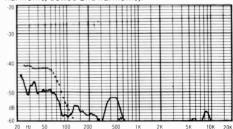
Averaged forward characteristic response in room at listening position.



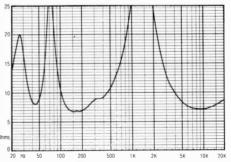
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



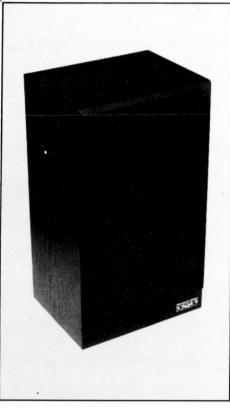
Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Impedance (mod Z), Impedance characteristics give an indication of amplifier loading.

Mordaunt-Short MS20

Mordaunt Short Ltd. Durford Mill. Petersfield. Hants GU31 5AZ Tel (0730) 80721



Already acquiring a good reputation, the MS20 could possibly be regarded as an economy version of the Carnival — with its vinvl-wrap cabinet, it offers a substantial cost saving. Fortunately for the consumer, things do not always turn out exactly as the manufacturer intends, and this is just one of those instances of an 'economy' model where the end result turns out to be embarassingly good!

A slim, two-way 14litre box enclosure. the MS20 is well finished in a convincing black ash vinyl with an unrebated grille, which as the tests show is best discarded.

Bass is provided by the wide-range Mordaunt Short doped pulp-cone 200mm driver, complemented by a diminutive plastic-dome Audax tweeter, the latter ferro-fluid cooled.

Working at around 3.5kHz, the crossover uses five medium power components and rear connection is by means of plain 4mm sockets. The enclosure is made of 15mm rigid chipboard. with a volume filling of polyester wadding. While it probably will work best on open stands. the MS20 will also survive shelf mounting if such a location is deemed essential.

Sound quality

Rated at the upper end of the 'good' category. the MS20 sound is quite exceptional at the price. When re-entered several times in the 'blind' listening tests, as one of the 'repeat' references, its performance was judged consistently good.

Bass, although of moderate depth was felt to be well balanced, tight and tuneful, while the midrange was relatively uncolored, detailed and possessed of good transient definition. The treble was slightly recessed, but pleasantly so, with only mild fizziness and sibilance in evidence. The lower-mid did however show some moderate boxiness.

The overall effect was tidy and civilised with good control over the whole frequency range. Stereo images were well focused and revealing of recording acoustics, possessing fine depth and fairly good transparency was also evident, these results fine at the price.

#### Lab results

Marginally above-average, the sensitivity measured 87dB/W and with a 15 to 75W amp power range, up to 102dBA could be obtained from a pair. The bass rolloff was typical at 55Hz, -6dB, while pair matching was fine. As can be seen from the dotted response on the one metre measurement, the output was rather smoother with the grille detached, this also confirmed by the listening tests.

At 2metres a mild mid plateau was evident but otherwise the output was quite uniform on all measured axes. At 15° above-axis a mild dip was evident, suggesting that the speaker should not be positioned below the listener's head level. Conversely the 30° off-axis lateral position looked to provide a fine result, and, so the speakers do not need to directly face the listener in the lateral plane.

At 96dB distortions were about average, at typically 2% second harmonic and 0.8% third, with a worthwhile improvement at 86dB spl. The tweeter showed a distinct distortion peak at 20kHz, but this was not considered too important.

With the impedance close to the 80hm standard, the MS20 was classed as a very good amplifier load, and so can make the most of its available sensitivity.

The integrated room response was most revealing, showing the midrange forwardness, plus a surprisingly extended, slightly 'shy' bass as well as a treble which uniformly decayed with the right curvature.

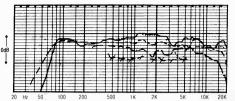
#### Summary

This speaker produced a remarkably good performance for the price. Slightly upper-mid forward, in all other respects it offers a finely-balanced array of subjective and objective qualities, which made Best Buy classification mandatory. Subsequent experiments with the MS20 have shown that if well positioned it can do justice to very costly ancilliary equipment and in a very real sense must be said to be one of the outstanding successes of this edition.

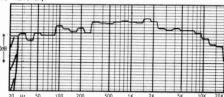
#### **GENERAL DATA**

Size (height x width x depth)... 42 x 25 x 20cm Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)... Recommended placement ... onen stands or shelf Frequency response, within ± 3dB, at 2 metres ......65Hz to 20kHz Low frequency rolloff ( - 6dB point) at 1 metre. Voltage sensitivity

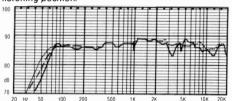
(ref. 2.83V, or 1W into 8ohms at 1 metre)... Approximate maximum sound level (pair) at 2 metres ......102dBA Impedance characteristic (ease of drive). very good Forward response uniformity... .good Typical price per pair, inc VAT...... £89 when reviewed, now £98



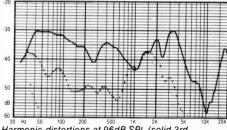
Forward characteristic response (1/3 octave at 2m. dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



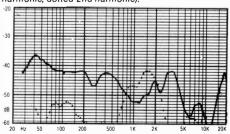
Averaged forward characteristic response in room at listening position.



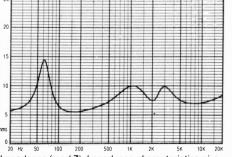
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic)



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

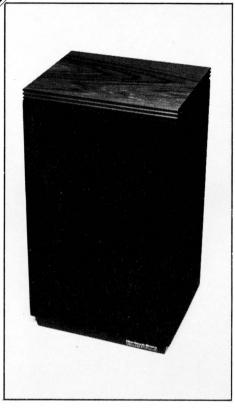


Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

60

Mordaunt-Short Carnival 3

Mordaunt Short Ltd, Durford Mill, Petersfield, Hants GU31 5AZ Tel (0730) 80721



Such are the vagaries of speaker design, that the *Carnival* did not do as well on test as its close but cheaper relative the *MS20*, even though it offers an apparently better technical performance.

Fitted with real wood end caps, the main body of the speaker is wrapped in good quality cloth. A two-way sealed-box, the *Carnival* uses the same drivers as the *MS20* — bass and midrange are covered by a 200mm doped cone unit, the MS D208BB, and the treble is allocated to the 20mm cone/dome Audax tweeter. The latter is inexpensive but can sound surprisingly good if skillfully handled by the system designer.

A good-quality crossover is used to marry the units, with 4mm sockets for electrical connection, plus a small fuse to protect the high frequency unit.

Matching slim pillar stands with four-spoke

bases are available as an optional extra. The system carries a five year warranty.

Sound quality

The Carnival was rated as 'above average' by the listening panel, which is good for the price and indicative of recommendation. The sound appeared open and lively with good clarity, able to reveal more than just a hint of the different recorded acoustics. Stereo quality was quite good with some depth effects.

Colorations included mild mid 'boxiness' plus some nasality, and a sibilant, rather 'obvious' treble register. It was definitely a little too bright and open, and in consequence did not present a well balanced tone. As regards its bass, it was quite tight and articulate if lacking in final extension.

#### Lab results

The Carnival's sensitivity measured 87.5dB/W, a little above average, and with its 100W maximum power handling capacity it could provide up to 103dBA for a pair in a typical room.

Closely toleranced, pair matching was almost perfect, while bass rolloff measured 54Hz, –6dB, and was quite uniform. Overall the frequency response at 1metre was slightly uptilted but it was remarkably smooth. At 2metres the upwards tilt effect with frequency was a little more obvious but the speaker nonetheless illustrated a very good set of forward responses of good uniformity.

Measured at a 96dB sound pressure level, the distortion was unexceptional averaging 2% second and with third harmonic rather better at 0.3%. Some improvement in both harmonics was evident at 86dB, at which distortion now measured around average or marginally poorer.

Room integrated by the computer analyser, the result was rather good, showing a very well-integrated lower frequency range plus a smooth mid but a marginally humped treble. Correct subjective balance remains a very subtle aspect of speaker 'voicing.'

The impedance curve showed a simple, easy-to-drive characteristics, and the *Carnival* thus rated as a very good amplifier load.

#### Summary

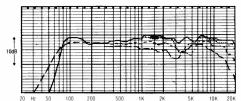
The Carnival is a good all rounder possessed of many qualities, including a very even response, and it deserves to be taken seriously. Its main weakness appears to be one of tonal lightness, with its mildly sibilant and excessive

treble register, and how this affects the end result may well depend on the programme source — a 'duller' sounding moving magnet cartridge could also be beneficial here. However despite our reservations, the speaker has nonetheless done well enough to merit recommendation.

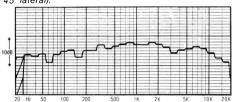
#### GENERAL DATA

Typical price per pair, inc VAT.

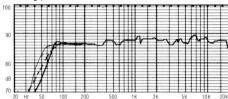
Size (height × width × depth),	42 × 25 × 20cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(20)-100W
Recommended placement	open stands
Frequency response, within $\pm 3dB$ , at 2 metres	65Hz to 20kHz
_ow frequency rolloff ( – 6dB point) at 1 metre	54Hz
Oltage sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 metre)	87.5dB
Approximate maximum sound level (pair) at 2 me	tres103dBA
mpedance characteristic (ease of drive)	very good
orward response uniformity	very good



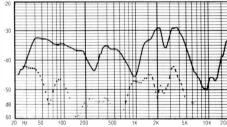
Forward characteristic response (½ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



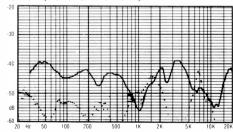
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

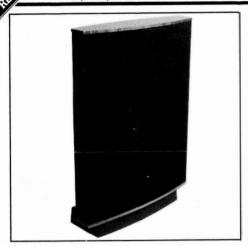


Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

0 10 20 Hz 50 100 200 500 1k 2k 5k 10k 20h 10k

#### Ouad ESL-63

The Acoustical Manufacturing Co Ltd, St Peters Road, Huntingdon PE18 7DB Tel (0480) 52561



This new design was very long awaited, and we received our samples just in time for inclusion in the last issue. The original *Electrostatic* was reviewed some years back by a different author in *Choice*, and certain of the problem areas which emerged, namely directivity, bandwidth sensitivity, power handling and amplifier loading have all found partial solutions in the new model, albeit at a high price.

A single large-area damped plastic film diaphragm has been electrostatically energised to operate as a phased array of eight concentric elements, and the emerging wavefront is an approximate simulation of the radiation from a theoretical point source 30cm behind the centre of the panel. A high voltage delay line feeding the multiple elements incorporates compensation for the clamped boundary of the diaphragm, and also equalisation for the axial frequency response. The size and apportionment of frequency range and delay to the elements allows control of directivity, which is adjusted to give a smooth and uniform decay at increasing off-axis angles. But it should still be borne in mind that the directivity of the 63 is poor by comparison with the best moving-coil designs, and that the speaker remains rather critical of listening angle.

The latter characteristic presented a problem on tests, since in the modest confines of my listening room only two of the six Quad panelists could be in the optimum zone, and when used as suggested on the floor at our typical 3–3.5m listening distance, the main axial treble response was directed nearer to their chests than their ears. Accordingly, the speakers were elevated by

about 20 cm on open stands and marginally tilted backwards. As with the Acoustat, further auditioning was also conducted with solo listeners to augment the panel subjective data.

The Quad 63 is a bipolar design which generates regions of acoustic power fore and aft, but is suppressed in the sideways directions. In consequence a rather different drive of room reverberation results compared with small box speakers which are considerably more omnidirectional. Thus even if the Quad did provide an identical axial frequency response to a low coloration moving-coil model, it would not sound the same due to the significantly different room reverberation tonal balance.

#### Lab performance

The sensitivity reading was not comparable with a normal speaker due to the doublet directivity, and furthermore, the 1 m reference response was theoretically too close, risking proximity and integration errors. Approximation or not, the reading was below average at 84dB/W, the reference response meeting +/-2dB limits between 50 Hz and 9kHz, outside of which some irregularities were charted which could not be wholly blamed on proximity, as a 2m and 3m check verified.

Averaged in 1/3-octave bands at 2m, the speaker demonstrated a superbly even mid and low range response, with some mild 'lumpiness' above 5kHz. The response sensitivity to axis was shown by the special dotted curve, just 7.5° off axis vertically, which reveals more than a 5dB loss above 12kHz. The output decayed much more than average off-axis, but the decay pattern was exceptional in terms of consistency and evenness (see Acoustat.) In practice the bass rolloff point was indeterminate, depending on the listening room boundaries and in particular the distance to the rear wall (with zero bass when placed against the latter). In open air or in large rooms 34Hz

-6dB is possible, but at a modest acoustic level. While not as kind a load as Quad suggest, the speaker should not cause most amplifiers too much trouble, but when the speaker is heavily overloaded it protects by a short-circuit 'crowbar' which may damage some amplifiers and dips to 3.5 ohms were recorded at 50Hz and 10kHz. Above 60Hz, even at a full 96dB, the distortion performance was superlative, though the curve does not illustrate the 63's inability to accept inputs over 30W or so below this frequency without diaphragm rattling. Above 100Hz the distortion was 10-100times better than usual but due to the speaker's protection circuit compression occurred at a 100W peak input.

however at 50W, just 3dB less, the pulse reproduction was simply too perfect to register measurements.

Due to the unusual directivity the room response is probably of marginal value, and certainly cannot be directly compared with the results for normal box systems. It is however included just for the record, but did not correlate well with the subjective data. The midrange at least is notably smooth, but the 60Hz prominence is more exaggerated than usual.

#### Sound quality

At risk of appearing to makes excuses for the 63, the subjective data did partly reflect its directionality, and side positioned listeners were not well served. Prolonged solo sounds suggested that to some extent the sound was something of an acquired taste, and that if its particular qualities appealed, these could assume such overriding importance than no other model would suffice. On first hearing however it can sound somewhat 'dead' and 'clothy' due in part to the loss of reverberant energy in the upper frequencies when compared to a conventional speaker. A trace of a 'whistly' quality in the extreme treble was audible to a few keen-eared listeners, while the sweetness and integration of the mid/treble band at first lends a dim impression until experience shows that the necessary treble detail still exists but in an unusually natural form.

Listeners accustomed to a dynamic and punchy bass of good power handling, particularly on rock -oriented programme, found the 63 disappointing since it could not play very loud, and the bass power though a little more extended than a 3/5 A, was little greater. Without the 'liveness' and 'excitement' of some of the better box systems, it at first appears to lack detail and transparency. But prolonged listening showed that this was due to the misleading frequency balance, and that on axis superb image depth as well as detail were apparent. Respectable scores were nevertheless achieved throughout the sessions.

#### Summary

Since our original review minor improvements have been made to this speaker, notably considerably revised protection circuitry, allowing louder and better reproduction of bass transients. While not a powerhouse, it does at least now do respectable justice to the bass on rock material, particularly if this is digitally derived and hence free of overhang or subsonic excitation. Fully re-auditioned for this edition, it achieved very respectable scores especially on digital masters.

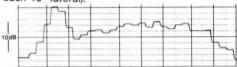
The Quad has uniquely musical qualities through the vital mid registers, and deserves auditioning on high quality material if its blend of strengths and weaknesses are to be fairly assessed by the intending purchaser. The results continue to justify a *Choice* recommendation despite the elevated price.

#### GENERAL DATA

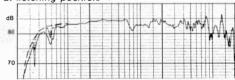
Recommended amplifier power per channel	
(for 96dBA per pair at 2 metres minimum)	.(25)-100W
Recommended placement on open stand, well clear	ar of rear wall
Frequency response within ± 3dB (2m) 401	Hz to 18kHz
Low frequency rolloff (-6dB) at 1 m	34 Hz

10dB

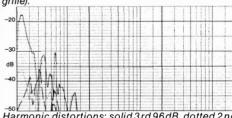
Forward characteristic response (1/3-octave @ 2m, dotted 15° vert., small dash 30° lateral, long dash 45° lateral).



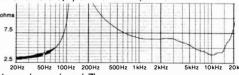
Averaged forward characteristic response in room at listening position.



Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response without arille).



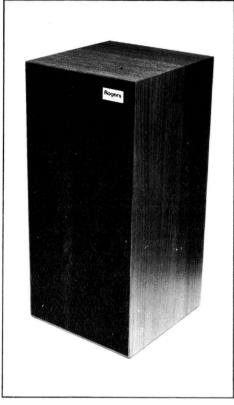
Harmonic distortions: solid 3rd 96dB, dotted 2nd 96dB, dashed 3rd 90dB, chain-dashed 2nd 90dB, o shows stop point at 96dB).



Impedance (mod Z).

#### Rogers LS7

Swisstone Electronics Ltd, 310 Commonside East, Mitcham, Surrey Tel 01-640 2172



Rogers' LS7 is a fairly compact stand-mounted system, with an internal volume of 30litres. The design has been refined since it was first introduced, and the pair reviewed here are representative of current production.

Tuned to give a damped quasi-Butterworth alignment, the large reflex ducted port is 65mm in diameter, its exit flared to reduce distortion. The excellently finished enclosure is constructed of 12mm bituminous damped MDF with a reinforced 19mm-thick MDF front baffle. None of the panels are removable, internal access gained via the bass unit aperture.

The bass/midrange unit has a nominal diameter of 200mm, and uses a generous magnet, a high-power voice coil and a patented polypropylene cone possessing the classic BBC profile. A selected version of the Celestion HF1000 soft-dome 25mm tweeter covers the remaining frequency range, the excellent-

quality 13 element 3kHz crossover.

External connection is by means of 4mm socket/binding posts and the internal wiring is to a high standard, the *LS7* typifying Rogers traditionally fine workmanship.

One component which I do feel needs revision, though, is the grille. Strong enough to resist warping by its now rather dated Tygan cloth, the assembly is acoustically unfavourable — a foam replacement would help here.

#### Sound quality

The panel were highly impressed by the *LST*. It was felt to be tonally accurate and well balanced, with an extended and uniform frequency response. Good instrumental detail was preserved throughout the frequency range, while coloration was held to a consistently low level.

Stereo images were spacious, focused and full of the intended recorded acoustic detail. Images also demonstrated impressive depth, with an almost crystalline transparency.

The LS7 provided good extension in the bass, and while they seemed slightly 'leaden' footed here, powerful and clean articulation were in evidence. The sound was consistently clean and free of boxy effects.

Very mild criticisms were recorded concerning a slight edgy and sibilant treble, with a mild vocal chestiness but neither was of much consequence. The speaker gave fine results on analogue sections but clearly excelled on the digital programme.

#### Lab results

The LS7 showed fine pair matching when measured at 1metre, the axial response disfigured by a notch at 7kHz. Removal of the grille gave the more elegant dotted response illustrated. The well-damped bass response was uniform and well balanced in character, extending to 48Hz. - 6dB, which was fine for the size of enclosure. Sensitivity was above average at 88dB/W, and an impressive 200W power capacity was established. Maximum sound levels of 106dBA were possible from a stereo pair, while as little as 10W would give interesting results. The sensitivity was not compromised by the impedance, which showed only a minor dip at 8kHz, with a mean value of 10ohms, thus making the LS7 a very good amplifier load.

Out at 2metres a fine set of off-axis responses were demonstrated. At 15° above a mild 4kHz dip occurred (still affected by the grille) so the speaker should be directed or elevated sufficiently to face the listener.

Panelists felt the balance to be slightly 'rich', this confirmed by the 2metre trend.

When room-averaged, very good correlation with the subjective findings was established. The bass was only marginally 'rich' and showed a well-integrated response extension in the room. The mid was quite uniform and married correctly with the treble register which smoothly decayed above 8kHz.

Measured at 96dB, low frequency distortion held to below 3% second harmonic and 1% third, and was very fine above 300Hz, which is the more critical range in this respect. At 86dB distortion improved greatly with the midband readings excellently low, measuring less than 0.1% over a couple of octaves!

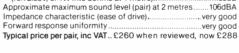
#### Summary

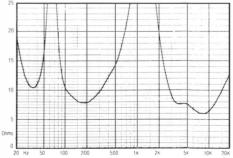
Clearly 'digital ready' the *LS7* in its latest form provides a remarkably well-balanced subjective and objective performance. All aspects of sound quality such as extension, balance, stereo clarity and coloration were very good, while technically speaking it was easy to drive, low in distortion, sensitive, and consistent as regards frequency balance.

The LS7 sets the upper price limit among the Best Buys in this issue and proves that a realistically priced, compact speaker can reproduce a very high degree of audio fidelity.

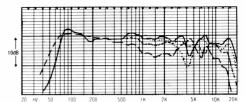
#### GENERAL DATA

Size (height $\times$ width $\times$ depth)
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres)(10)—200W
Recommended placementopen stands
Frequency response, within ± 3dB, at 2 metres55Hz to 18kHz
Low frequency rolloff ( – 6dB point) at 1 metre48Hz
Voltage sensitivity
(ref. 2.83V, or 1W into 8ohms at 1 metre)88dB
Approximate maximum sound level (pair) at 2 metres106dBA
Impedance characteristic (ease of drive)very good

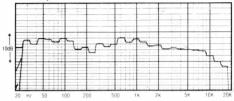




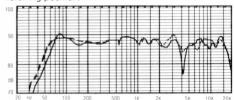
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



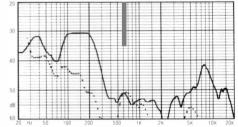
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



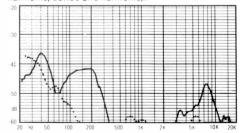
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



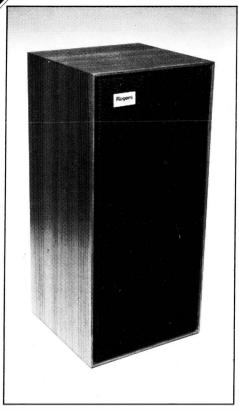
Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic)



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

#### Rogers Studio One II

Swisstone Electronics Ltd, 310 Commonside East, Mitcham, Surrey Tel 01-640 2172



Well-received in previous issues, the Rogers *Studio One* has now been extensively revised by the manufacturers, with improvements to the bass cone, sensitivity, bass alignment and cabinetry.

A 'classic' Bextrene-cone design, the *Studio One* is a medium-sized bass-reflex model of comparatively high power capacity. Its 44litre enclosure is built of MDF panels, fully veneered and clad internally with bituminous damping pads. It is tuned to a partially-damped 'quasi' bass alignment using a large-diameter ducted port with a large volume velocity, which uses a chamfered front exit to further reduce distortion.

The main driver is a 200mm bass/mid unit, built on a cast-alloy chassis and employing a generous magnet plus high temperature capability Kapton motor coil former. The primary tweeter is a version of the long-lived Celestion

HF1300, while the final half-octave is filled in by a KEF T27, a 19mm plastic dome.

A top quality crossover integrates the drivers, and the XLR rear connector is now joined by a pair of 4mm socket/binding posts.

Overall, finish and engineering are to a very high standard.

#### Sound quality

The previous *Studio* did well in our tests, and was mainly criticised for a significant bass overhang. The new version did show much better control in the bass although it still suffered from a trace of bass excess, this admittedly more noticeable on digital as opposed to analogue sourced programme.

Measured against the higher standards of this new issue, the *Studio One* did not fare as well as its predecessor, but nonetheless it achieved an above-average rating which was sufficient for a recommendation.

Overall the performance was quite good, with well focused stereo images, fairly good depth and a pleasing level of clarity as well as detail. Tonally, it appeared accurately balanced, with an even, wide response.

We noted some confusion on heavy bass percussion, while there was some mild 'boxiness' and 'hollowness', plus a mild brashness, with less than perfectly sweet rendition in the treble registers.

#### Lab results

As before, pair matching was excellent with a very smooth frequency response over most of the range. A slight bass excess was present at 80Hz, while the dotted curve on the one metre response showed the effect, which was slight, of removing the grille.

This latest version of the design showed a 2.5dB improvement in sensitivity, which was now about average at 86.5dB/W. Power capacity ranged from 20 to 200W and sound levels of up to 104dBA are expected to be available from a pair in a typically sized room. Good bass extension was shown by the rolloff to 36Hz, – 6dB.

Out at 2metres a very uniform response was demonstrated, with good off-axis results, these closely matching the axial curve. In balance terms this speaker now looks a little rich.

Room-averaged, the *Studio* definitely produced bass of fine extension, if somewhat excessive. The mid was slightly forward but the remaining response was nicely controlled.

Measured at 96dB, distortion above 500Hz

was very good, measuring under 0.3% second and with negligible amounts of third harmonic. Below this frequency, an average of 2% distortion was noted, and a general improvement resulted with a reduction to the 86dB spl, typically measuring 0.3% or less over the whole range for both second and third harmonic content. These results are much better than those recorded for the earlier version.

There were no serious impedance anomalies, with the value typically at the 12ohm level, and the *Studio* may thus be classed as a good amplifier load.

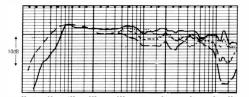
#### Summary

The Studio remains a finely-crafted and well engineered system, offering a quite good value and a good all round performance. Although falling a little behind on the new digital material, it still performs well on analogue material, and continues to merit recommendation. The bass extension is extraordinary for a system of this moderate size and reasonable sensitivity.

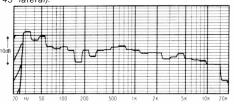
#### **GENERAL DATA**

Size (height $\times$ width $\times$ depth)
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres)(20)—200W
Recommended placement
Frequency response, within ± 3dB, at 2 metres42Hz to 20kHz
Low frequency rolloff ( – 6dB point) at 1 metre36Hz
Voltage sensitivity
(ref. 2.83V, or 1W into 8ohms at 1 metre)86.5dB
Approximate maximum sound level (pair) at 2 metres 104dBA
Impedance characteristic (ease of drive)very good
Forward response uniformityvery good

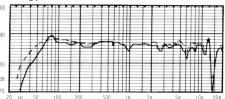
Typical price per pair, inc VAT £380 when reviewed, now



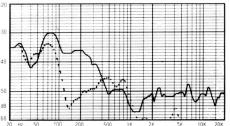
Forward characteristic response (½ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



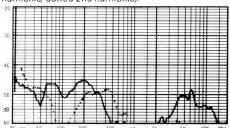
Averaged forward characteristic response in room at listening position.



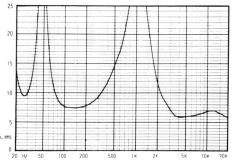
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

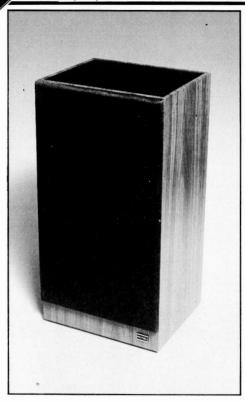


Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

Rotel Hi-Fi Ltd., 2-4 Erica Road, Stacey Bushes, Milton Keynes, Bucks. Tel (0908) 317707



It is probably to the advantage of both Rotel and Mordaunt-Short to explain the origin of this UK designed speaker. It is in fact a custom version of the M-S Pageant 2, possessing a similar internal volume, crossover and drivers but with a new enclosure shape plus certain detail improvements to the overall recipe, which has resulted in what is essentially a new model.

Moderately priced, the well finished vinyl walnut exterior is complemented by a smoked glass top, neatly inset and fitted by the purchaser after unpacking. A plain 12 mm thick detachable grille is used and has no rebate. The internal volume is 28 litres with the main system resonance at 56 Hz, and the system is reflex-tuned by a small ducted port37 mm in diameter, with the box/vent resonance occuring at 25 Hz.

Comprising an integral part of the rear connector panel (which offers DIN and spring terminals), the crossover comprises an 8-element high power design, and includes two resistors.

Bass/midrange is allotted to the established Mordaunt-Short 200mm unit, a rigid damped pulp cone driver possessing a useful sensitivity. The vertical line up is completed by a 25 mm softdome tweeter.

When last reviewed the Pageant 2 showed considerable merit but was marred by a degree of prominence in the lower mid which made the sound tonally unbalanced and emphasised a 'boxy' coloration. It is therefore interesting to see whether the new Rotel version has overcome this weakness, bringing the design up to date.

#### Lab performance

Checked by the 1 m reference curve, pair matching was fine to within  $\pm -0.75$  dB, and the axial responses also gave a promisingly smooth result. Sensitivity is fractionally above average at 87 dB/W, which in conjunction with the good power handling will provide high maximum sound levels of up to 104dBA for a stereo pair. The low frequency response was quite well extended to 43Hz -6dB, and the overall range met +/-2.5dB limits from 55 Hz to 16kHz.

At 2m the forward characteristic was better defined, with the system showing a slight upwards trend with frequency. As may be seen from the off-axis curves, the speaker was very well integrated, showing fine lateral uniformity and only a slight dip at 5kHz, 15° above axis. In 1/3octave tests and despite broadband trends, the system met +/-1.5dB, 65Hz-9kHz, which is no mean achievement.

Inspection of the distortion graphs shows that our selection of 5 kHz and 500 Hz as the high power pulse test frequencies was particularly fortunate for this design. At 500 Hz. compression was slight at 0.3dB, with 2.0% 2nd and 0.4% 3rd harmonic distortions, while at 5kHz compression was negligible with 0.24% 2nd and 0.5% 3rd harmonic. At the 90dB test level, the swept distortion results were good, with less than 1.0% 3rd; above 40Hz 2nd was slightly higher but still under control. At 96dB 2nd harmonic increased, particularly at 300 Hz and 2 kHz, reaching 2-3.0%.

Classed as an 8 ohm system, and thus a very good amplifier load, the minimum impedance was precisely 6.4 ohms at 140 Hz, and exactly to spec. Reactive effects were low, with a mean impedance of 12 ohms above 500Hz.

Assessed by room averaging the Rotel was most impressive. Including the room modes, the overall tolerance was +/-2.5dB from 40Hz to 10kHz, with the response commendably balanced. The only minor criticism might be directed at the steep fall above the 16kHz third octave band.

#### Sound quality

The RL915 scored above average results on all the listening tests, and looking back to the data for its progenitor, this would appear to represent an improvement over the Pageant. Capable of high power handling, the bass register showed minor port chuffing and distortion at a 50W peak input, but went on to accept over 100W before more serious overload. A reasonable bass extension was demonstrated, with a trace of 'lumpiness' when driven hard, and the lower register was relatively diminished due to port blocking resulting from airflow turbulence - an effect common to all small ports driven to high sound levels.

Compared to live sounds, a fair measure of the 'sharpness' and clarity of the original was demonstrated. Negative effects included a degree of midrange 'thinness' and 'harshness', a trace of 'tizz' in the high treble, and a degree of general 'boxiness', with one panelist noting aptly that speech reproduction sounded a little bit 'speakerish'.

On recorded stereo programme the 915 made a good effort. Detail was evident throughout the tonally well-balanced range, and the image quality showed good stability as well as precision in the lateral plane. Residual coloration appeared to mask the full impression of stereo depth, and the sound stage was thus flattened in perspective terms, while mid coloration was noted as mild 'graininess' and 'boxiness'.

#### Summary

Well made and finished and possessing a quite natural neutral balance and a wide response, the RL915 has done well enough to be included in the Recommended category at its price of a little under £200.00 a pair. Producing the best results on an open stand clear of the walls. Rotel have chosen this model wisely.

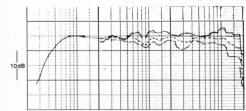
#### GENERAL DATA

312e (11 x w x u)
Weight
Recommended amplifier power per channel
(for 96dBA per pair at 2 metres minimum)(15)-150W
Recommended placement stand, clear of walls
Frequency response within ± 3dB (2m)58Hz to 18kH:
Low frequency rolloff (-6dB) at 1m43Hz
Voltage sensitivity
(ref 2.83V, ie: 1 watt in 8 ohms) at 1 m
Approximate maximum sound level (pair at 2m)104dBA
Impedance characteristic (ease of drive)very good
Forward response uniformity excellen

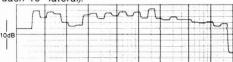
#### Update

Production of this model has now ceased though some stocks do remain - which dealers are offering for as little as £1500.

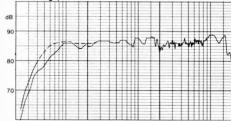
Typical price per pair inc VAT......£200



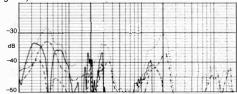
Forward characteristic response (1/3-octave @ 2m, dotted 15° vert., small dash 30° lateral, long dash 45° lateral).



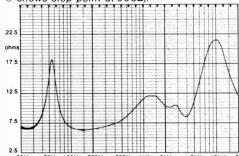
Averaged forward characteristic response in room at listening position.



Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response without grille).



Harmonic distortions: solid 3rd 96dB, dotted 2nd 96dB, dashed 3rd 90dB, chain-dashed 2nd 90dB, o shows stop point at 96dB).



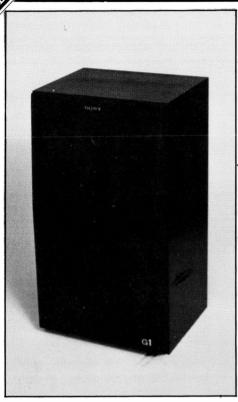
20Hz 50Hz 100Hz 200Hz 500Hz 1kHz 2kHz

Impedance (mod Z).

REVISED AND REPRINTED

#### Sony SSG1 II

Sony (UK) Ltd, Sony House, South Street, Staines, Middx TW18 4PF Tel 0784 61688



In line with the current policy among Japanese hi-fi manufacturers to seek closer ties with their European markets, this new system from Sony is built in West Germany, using special versions of SEAS drive units made in Norway. Finely finished in the Sony tradition the 37 litre enclosure is well veneered in a dark rosewood or equivalent material.

A vertical array of drivers is employed, namely a reflex loaded 250mm bass (carbon fibre reinforced pulp cone), a doped 80mm pulp cone midrange and a 25mm soft plastic dome tweeter. The crossover points, basically 12dB/octave, are placed at 800Hz and 4kHz, and while time-delay-compensate properties are not claimed, the bass unit is in fact brought forward from the front panel on a cast ring mount.

#### Lab results

A very good pair match was illustrated to within

0.5dB over the whole frequency range. Claimed at 91dB/W, our estimate for sensitivity was nearer 89dB/W, which is still well above average, while the -6dB bass rolloff was well damped at 50Hz, being typical for the size and sensitivity. (It is in any case amenable to bass lift).

Rated as excellent on third harmonic distortion, values were very low in the bass and quite remarkable in the treble where they measured well under 0.1%.

Scoring average on amplifier loading, largely due to a dip to 5.5 ohms at 100Hz, the remaining range was near to 8 ohms and was notably free of reactive components, helping to mitigate the impedance dip. Power handling was exceptional with the clear and even sound on electric bass guitar sustained up to 200W peak program. While a touch 'hard' on rock program, a very high 105dBA was produced at 250W, with the peak level per channel causing the *G1* little embarrassment.

Using sine wave drive on axis at 1m, the G1 did not look so promising, with some minor diffraction problems between 5 and 10kHz, increased irregularity from 1.5 to 5.0kHz, and a trough in the 200Hz region.

When averaged in <sup>1</sup>3-octave band (much as the human ear perceives the frequency response), the result was much tidier, in practice meeting +/-2dB limits from 63Hz to 14kHz. A mild plateau was evident around 250Hz, while the vertical off-axis responses were a little untidy above 4kHz, the best response being that obtained on axis. Clearly the speaker should be axially aligned to face the listener in the vertical plane. On the lateral axis the results were fine and appeared less critical.

#### Sound quality

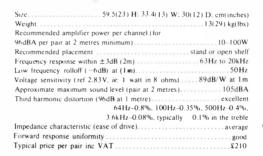
The G1 performed very well on all listening test sequences. Rated as 'good' on the live tests, it demonstrated a relatively neutral if slightly hard and forward sound with a trace of hollowness, but its fine bass performance and 'open' clarity were strongly in its favour.

Ranked as 'very good' on stereo programme, the imaging was commended with satisfactory stability and a fair depth impression. Possessing above average clarity, nonetheless it did not escape certain criticisms of coloration, these

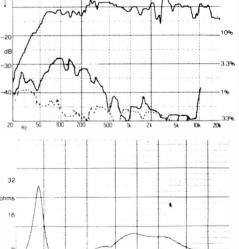
mainly concerned with mild 'hard 'wiry', nasal, boxy and 'brash' effects whose subjective importance will tend to vary with each listener

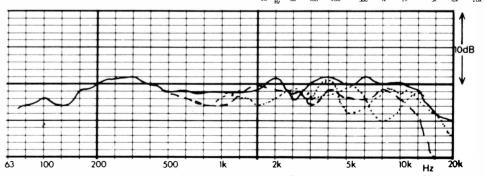
#### Summary

Reviewed originally two issues ago, and in its Mk II form for the last edition, the *G1* design is ageing gracefully. Against recent competition it can no longer claim a 'Best Buy' rating, but it still deserves inclusion in the 'recommended' group. Its tight bass and open forward sound will stand it in good stead on digital programme, although this is countered by an increasingly noticeable mid-hardness and mild treble brashness, accentuated by the primitive grille. For a well engineered and finished three way system, capable of punchy high levels, the Sony *G1* II still represents good value for money.



Top: Frequency response, 1m sinewave, plus 2nd (solid) and 3rd (dashed) harmonic distortion (a 96dB Middle: Impedance (modulus)

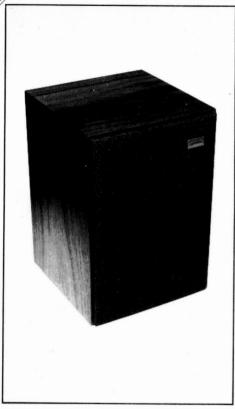




<sup>1</sup>3-octave averaged frequency response, 2m solid axial; dotted 10° above and below; dashed 30° horizontal

Spendor SA

Spendor Audio Systems Ltd, Unit 12, Station Road Industrial Estate, Hailsham, Sussex BN27 2ER Tel (0323) 843474



The diminutive Spendor SA1 has been available for some years now, but has been somewhat neglected by the press. In fact it was last reviewed in HFC a few issues back, and as there had been strong hints that this could be a 'sleeper' model, we felt it was time we had another go at it.

In a sense the SA1 is Spendor's own earlier equivalent SL6, these miniature 10litre sealed box systems using a high-power 160mm plastic cone bass/mid range unit which possesses a critical cone flare and termination. Both units use decently sized magnets and cast alloy frames, but the SA1's 25mm fabric dome tweeter is possibly not as good a companion as the midrange driver deserves. However the SA1 is certainly a lot cheaper than the SL6!

Intended primarily for use as a miniature broadcast monitor, and avoiding the deliberate 'voicing' tweaks of the LS3/5A, the SA1 is

superbly built in thinwall multi-ply with heavy wall damping and internal absorption. Anechoically 'flat', it performs best in free space on relatively high, open stands, about 45cm off the floor. The grille frame is however rather close to the tweeter considering the small front panel dimensions, and this would be expected to cause problems.

#### Sound quality

Considering its size and low sensitivity, the SA1 did remarkably well in the 'blind' listening trials. Considered to be tonally accurate with fine voice reproduction, the sound was well balanced as well as transparent. The response sounded smooth and tidy, with reasonable bass extension and no boominess, while stereo imaging was particularly good, showing a pleasing three dimensional effect, depth and ambience. with and sharp frontal plane focus.

Unless driven very hard with over 100W per channel, the bass was reasonably clear and clean, while the speaker sounded well controlled and low in distortion. Understandably, the sound improved in treble sweetness with the grille removed. Coloration levels were quite low - a mild tubbiness in the lower mid, with a trace of sibilance and an occasional sonic hint as to the miniature dimensions of the design.

#### Lab results

Measuring a rather low 81dB/W sensitivity, the SA1 needs a minimum of 30W per channel amplifier power. Pair matching was considered very good, while the bass was uniform and of quite good extension to 52Hz, -6dB. The grille did spoil the measured treble response as suspected, and when removed the fine dotted line was measured, this  $\pm$  1.5dB from 67Hz to 20kHz, which is a very fine tolerance. With a 100W power capacity, high acoustic levels were impossible though the 96dBA maximum should be sufficient for most moderate domestic applications.

At 2metres a fine set of forward responses were obtained, especially with the grille removed. The 15° above-axis response was however a little weak and the SA1 should be adjusted in the vertical plane so as to aim at the listeners head. The ±3dB limits were comfortably met from 59Hz to 20kHz.

Like the SL6, this extended-response miniature integrated very well with the room, its high stand mounting position minimising floor reflections. Grille off, the overall characteristic was very promising and correlated well with the perceived sound quality.

Distortion was average at 96dB, reaching 5% at 60Hz for second harmonic with third a little better. However the distortion was less at higher frequencies even though the system was clearly working hard at this level. At 86dB the SA1 improved considerably with quite good third harmonic distortion level, consistently at 0.3% or below.

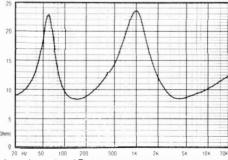
The impedance was father high, and never fell below 8.5ohms, with its typical value at 16. Obviously this is an excellent load for any amplifier, and in fact these impedance values could be reduced to improve sensitity without compromising the load characteristic.

#### Summary

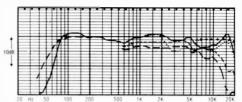
The SA1 achieved an important revival in our tests, using modern digital programme. On grounds of sound quality alone it almost achieves Best Buy status, but when its low sensitivity, somewhat limited maximum sound level and power handling are taken into consideration, a 'recommended' rating would seem more suitable. This surprising miniature is well worth trying on tall open-frame stands, using a generous amplifier. But please, Spendor, do something about that awful grille!

#### **GENERAL DATA**

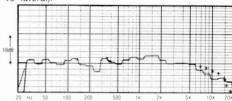
Size (height $\times$ width $\times$ depth)30.5 $\times$ 22.5 $\times$ 21.5cm
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres)(30)—100W
Recommended placementtall open stands
Frequency response, within ± 3dB, at 2 metres59Hz to 19kHz
Low frequency rolloff ( – 6dB point) at 1 metre52Hz
Voltage sensitivity
(ref. 2.83V, or 1W into 8ohms at 1 metre)81dB
Approximate maximum sound level (pair) at 2 metres96dBA
Impedance characteristic (ease of drive)excellent
Forward response uniformityvery good
Typical price per pair, inc VAT £210 when reviewed, now £234



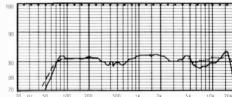
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



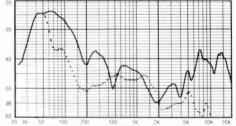
Forward characteristic response (1/3 octave at 2m. dotted 15° vertical, small dash 30° lateral, long dash 45° lateral)



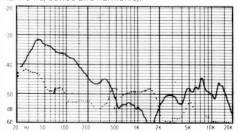
Averaged forward characteristic response in room at listening position



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



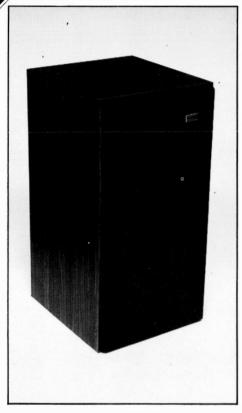
Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic)



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

#### Spendor Prelude and SA2

Spendor Audio Systems Ltd, Unit 12, Station Road Industrial Estate, Hailsham, Sussex BN27 2ER Tel (0323) 843474



This review covers both the SA2 and the new Prelude from Spendor. Aside from a cabinet change from costly veneered multi-ply (SA2) to vinyl-wrapped chipboard (Prelude), the overall engineering and technical performance of the two models is very close indeed. The Prelude however offers a cost saving of some 30%, largely due to the cheaper cabinet construction.

The 28litre internal volume is reflex-tuned by a large ducted port, 75mm in diameter. The interior of the thinwall enclosures is damped by a bituminous cladding plus an acoustic foam lining. While the SA2 has a superior foam grille, the *Prelude* is fitted with a attractive framed wooden grille, whose acoustic effects can be seen from the response charts.

A Spendor-designed high-power Bextrene-

A Spendor-designed high-power Bextreneconed bass unit is fitted to both systems, this using a 40mm pole and massive magnet, and built on a strong die-cast frame. The tweeter is a selected version of the once ubiquitous Audax 25mm soft dome.

A close-tolerance 8 element crossover marries the units at around 3kHz, with electrical connection made by 4mm socket binding posts in the case of the SA2, and less worthy spring connections for the *Prelude*. Both systems are intended for free space positioning on open stands.

#### Sound quality

Taking the newer *Prelude* first, listening panel scores were very promising and placed it in the 'good plus' category which was a fine result at the price. As with the other Spendor models, the midrange tonal quality and balance was a strong point, with voice and piano reproduced well. Overall frequency balance seemed accurate with a wide smooth response, while the bass was firm, and possessed quite good extension — if slightly bumpy or heavy at times, it was nonetheless low in distortion and high in detail.

Good clarity and detail were evident everywhere except in the lower mid where some cabinet boxiness and 'muddiness' were observed. The SA2 also suffered from this phenomenon though this time the result was an over-rich and almost chesty effect and on this aspect, the *Prelude* was ultimately preferred to the SA2.

Both gave fine stereo images with good staging and focus, plus impressive depth. Mild sibilance as well as a little 'slurring' was however observed in the treble. However, it was obvious that the difference in sound quality was not commensurate with the *Prelude's* lower price.

#### Lab results

At one metre an above average 88dB/W sensitivity was recorded and the bass was perfectly tuned to rolloff at 48Hz, -6dB.

With a fine 200W maximum power handling the SA2 (and Prelude) is capable of a substantial 105dBA sound level in a room, using a stereo pair. Pair matching was itself very good, the two models very similar with the effect of removing the Prelude grille shown in the dotted response.

At 2metres the design demonstrated a very even, well-integrated forward characteristic, the overall trend being that of a gentle downtilt with increasing frequency. Limits of ±3dB were comfortably met from 55Hz to 20kHz.

In the listening-room computer-averaged re-

sponse the bass was slightly uneven, and mildly prominent at 50Hz. The mid was broadly uniform, with a slight presence dip evident before the treble rolled gently away.

Driven to a 96dB sound level, fine distortion results were demonstrated, averaging 1% at low frequencies and reducing to 0.3% above 500Hz. At 86dB the distortion improved considerably to a very good level for both second and third harmonic.

Averaging 13ohms, the impedance fell to a minimum of 6.7ohms in the treble. The system may be happily classed as an easy amplifier load, allowing full use to be made of its good measured sensitivity.

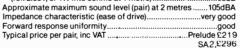
#### Summary

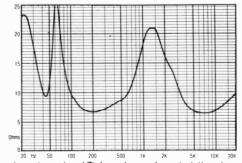
The SA2 version offers a superb finish and construction with a slightly different balance of coloration plus an acoustically-superior grille. It continues to be recommended.

The *Prelude*, at a small sacrifice in cabinet finish achieves much the same performance as the *SA2*, and in the opinion of some may even achieve a better sound. Good sensitivity, smooth natural sound and fine stereo, all at an extremely attractive price, ensure that the *Prelude* is awarded a Best Buy.

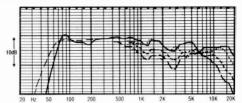
#### GENERAL DATA

GENERAL DATA
Size (height $\times$ width $\times$ depth)50 $\times$ 26 $\times$ 28cm
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres)(15)—200W
Recommended placementopen stands
Frequency response, within 73dB, at 2 metres55Hz to 20kHz
Low frequency rolloff ( - 6dB point) at 1 metre48Hz
Voltage sensitivity
(ref. 2.83V, or 1W into 8ohms at 1 metre)88dB
Approximate maximum sound level (pair) at 2 metres 105dBA

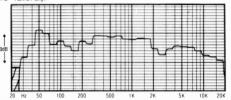




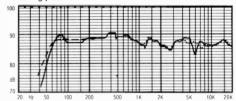
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



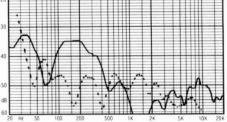
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



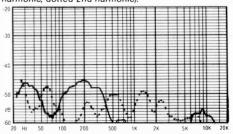
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

REVISED AND REPRINTED

Spendor BC1

Spendor Audio Systems Ltd., Unit 12 Station Road Ind. Est., Hailsham, Sussex BN27 2ER. Tel (0323) 843474



As is our custom in each succeeding issue, we have taken another look at a speaker which has established itself as a long term reference by virtue of its consistent ability to fight through to a front rank position in more blind listening tests than I care to remember. This year's sample is of some interest due to two small design changes, but neither of these, it must be said at the outset, affect the sound very greatly. One concerns the reflex port which has had its acoustic power capacity increased by substituting a foam lined duct of larger diameter for the original foam lined aperture; the other is the application of a little damping to the pleated surround of the supertweeter.

First produced in the late 1960s and widely used since as a compact medium power professional monitor, this reflexed system has 44 litres of internal voume and uses two main drivers. The 200 mm bextrene-cone bass/midrange of Spendor design and manufacture covers the

40Hz to 3kHz range, while above 3kHz the specially selected Celestion *HF1300* comes in. The final half octave is augmented by a 19mm plastic dome unit. The professional quality crossover has auto-transformer provision to match the driver sensitivities on production test.

Another Spendor special is the unusually low coloration enclosure, a costly birch multi-ply carcase heavily damped with bituminous pads and lined with absorptive acoustic foam. Both front and rear panels are screwed into place, and far from representing a weakness these joins are in fact part of the complex boundary conditions affecting internal resonance damping of the enclosure panels.

#### Lab performance

Partly re-measured for this issue, a new axial response was produced together with distortion, sensitivity and room averaged data.

Still showing the characteristic mild bass response 'hump', the revised tuning appears to have provided more bass extension, with the -6dB point now appearing at 39 Hz. Sensitivity was much the same at 83.5dB/W, below average for the group, and in conjunction with the comparatively modest peak power capacity, the maximum possible sound level from a pair is limited to around 98dBA, with 30W a sensible minimum rating.

As before, excellent pair matching was shown, with the axial response demonstrating a fine overall balance. There are the usual mild anomalies at 4kHz and 14kHz, which nonetheless do not seem to prejudice the subjective results unduly.

Possessing a minimum impedance of 6 ohms, the *BC1* rates as a good amplifier load, and was easy to drive.

Comparing the new and old 96dB distortion data, above 150Hz the satisfactory performance was unchanged, though the 4.4% 2nd at 200Hz is still more than I like. However, below 150Hz and down to 60Hz, 3rd harmonic has been reduced by several orders of magnitude, and 2nd has also benefited. On balance the low frequency distortion has been reduced to between a half and a third of that found previously. As before the system happily tolerated the 100W pulsed input with little compression and no increase in distortion.

The forward characteristic responses were generally very good, though some misbehaviour was evident around the 3.4kHz crossover region. The balance is as before, and the bass region is still prominent, but with a uniform trend elsewhere.

Assessed by room averaging the result was very promising, fitting +/-3dB limits above 80 Hz and up to 16kHz, and with a fine mid/treble transition. The bass extension is clear enough and the 30 Hz band is well maintained, tending to disguise the effect of the 60 Hz prominence in an overall gently rising bass trend.

#### Sound quality

Extensively reauditioned, the *BC1* demonstrates with little difficulty that its continuing high reputation is wholly justified. Scoring very well on the live sound comparisons despite its 'richer' than average tonal balance (the brighter speakers as a rule have the advantage here) the *BC1* was felt to be a consistently smooth all-rounder. The usual criticisms in this area, although some 'deadening' and 'nasality' was noted in the mid, while speech was a little 'chesty' (*a la BBC*). The bass was somewhat deeper and clearer than before, and the overload limit was little changed at around 100–150W.

Firmly placed up with the leaders on stereo programme, the *BC1* showed excellent tonal balance transparency and depth in the midrange, without the usual emphasis or exaggerations. Good bass extension was apparent, though frankly the bass was of a mildly 'leaden' quality as well as somewhat excessive, particularly at high volume levels. This speaker proved more faithful to intrinsic programme balance and tonal differences than almost any other model we tried – the hallmark of a true monitor.

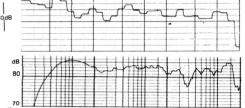
#### Summary

The high subjective ranking and general attainment merits Best Buy classification, particularly in terms of the still unrivalled mid and treble performance for the price. However it is not without its faults, and the prospective purchaser should bear in mind that by recent standards the *BC1* leaves something to be desired in terms of bass neutrality and damping, as well as in overall power handling and sensitivity.

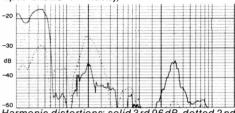
#### GENERAL DATA

Weight	14kg
Recommended amplifier power per channel	
(for 96dBA per pair at 2 metres minimum)	. (30)-130W
Recommended placement stand, well c	lear of walls
Frequency response within ± 3dB (2m)44H	z to 20kHz*
Low frequency rolloff (-6dB) at 1 m	39Hz
Voltage sensitivity	
(ref 2 83V ie: 1 watt in 8 ohms) at 1 m	83 5dR/W

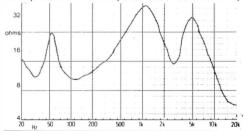
(ref 2.83V, ie: 1 watt in 8 ohms) at 1 m	3/W
Approximate maximum sound level (pair at 2m)986	dBA
Impedance characteristic (ease of drive)	ood
Forward response uniformityvery g	ood
Typical price per pair inc VAT	350
*depends on precise mike axis when reviewed, now $\dots$ £3	379

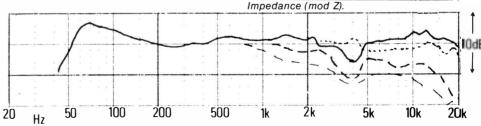


Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity)



Harmonic distortions: solid 3rd 96dB, dotted 2nd 96dB, dashed 3rd 90dB, chain-dashed 2nd 90dB.

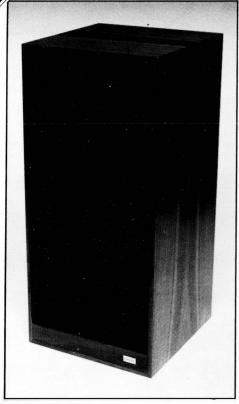




Forward characteristic response (1/3-octave @ 2m, solid axial, thick-dash 30° horiz, thin dash 45° horiz, dotted 15° vert.).

Spendor SP1

Spendor Audio Systems Ltd, Unit 12, Station Road Industrial Estate, Hailsham, Sussex BN27 2ER Tel (0323) 843474



Over the past years Spendor have produced variants on the theme of the legendary BC1 for example, the higher sensitivity BC2 — but none of them have quite captured the subtlety and midrange quality of the original.

While the new SP1 is built in the BC1 exclusive to Spendor for the bass/mid unit. This 200mm driver has an extensively-developed system than the BC1 in order to provide higher sensitivity and power handling. It is built on a die-cast chassis and energised by a massive magnet assembly. The cone is doped by hand, and has its front pole cavity filled by an alloy plug, this attached to the pole face.

Spendor's traditional radiometal cored inductors are used for the high-quality crossover which also employs plastic-film capacitors. Above 3kHz Spendor's own closely selected

version of the Celestion HF1300 dome tweeter takes over, the final half-octave filled in by the Coles 19mm plastic dome unit.

The 44litre enclosure is excellently veneered and is built of thinwall multi-ply, heavily bitumen damped and lined with acoustic foam.

The system is reflex-tuned by a large, offset ducted port and is intended for free space mounting on open stands.

The SP1s were initially supplied in a provisional prototype form, but these models were updated with final production samples before completion of the review.

Sound quality

The SP1 did well on the HFC test programme, providing favourable results on analogue material and even better scores using digital masters.

In balance terms it was felt to be tonally accurate with very good reproduction of human voice, showing natural sibilants and character. The frequency response sounded wide and uniform, with good extension, although with a slight excess in output at the lowest frequencies.

Mid coloration was generally low, the treble sweet and clear, while stereo perspectives were well constructed. Frontal focus, width and depth were all well presented.

High sound levels were possible with low apparent distortion and while some mild lower mid plumminess was observed, plus a touch of 'BBC' nasality this was not considered to be very important.

#### Lab results

Measured at 1metre on axis, the SP1 delivered a smooth response except for a small 3.5kHz peak (improved later on production speakers). The bass was precisely tuned and well extended to 41Hz. - 6dB. Sensitivity measured 87dB/W. a little above average and more than double that tradition, it uses a new grade of polypropylene of the BC1 (in decibel terms, an increase of more than 3dB), and pair matching was judged very close. The recommended power input cone, intended to work with a larger motor range is 12-150W, and maximum levels of up to 103dB were possible, again rather higher than

> At 2metres the averaged response was very uniform, meeting ±2dB limits for 60Hz to 13kHz. The vertical dispersion was very satisfactory and laterally it proved well above average.

> In the listening room the integrated response was very good indeed, and only marred by the slight bass excess noted previously.

Fine distortion results were obtained at 96dB

sound pressure level, measuring around 0.3% above 200kHz and holding to around 0.3% at lower frequencies. With the sound level reduced to 86dB, a substantial improvement to 0.8% or better was recorded at low frequencies, with negligible midrange second harmonic and an average of 0.2% third. These were fine results. The impedance curve averaged 14ohms, with a momentary and pretty harmless dip to 5.3ohms at 20kHz, and the SP1 was therefore classed as a very good amplifier load.

#### Summary

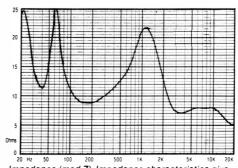
The SP1 has evolved into a subtle and musical sounding performer in the true Spendor tradition. It is expensive, but the good test results go guite some way towards justifying the price. Offering an easy amplifier load plus improved bass power, articulation and clarity, reduced midrange distortion and a higher sensitivity, the SP1 can give a decently high acoustic level. It possesses a clean, neutral tonal balance and should be equally valuable for medium-level monitoring or domestic use.

The SP1 receives a warm recommendation and will probably slowly displace the BC1 from its time-honoured position, especially where master-quality programme reproduction is concerned.

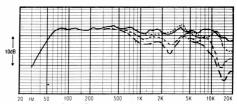
#### **GENERAL DATA**

Typical price per pair, inc VAT.

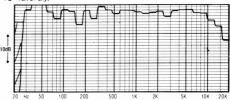
\$ize (height × width × depth)
Recommended amplifier power per channel
(for 96dBA minimum per pair at 2 metres)(12)—150W
Recommended placementfloor stand
Frequency response, within ± 3dB, at 2 metres45Hz to 20kHz
Low frequency rolloff ( – 6dB point) at 1 metre41Hz
Voltage sensitivity
(ref. 2.83V, or 1W into 8ohms at 1 metre)87dB
Approximate maximum sound level (pair) at 2 metres 103dBA
Impedance characteristic (ease of drive)very good
Forward response uniformity yeary good



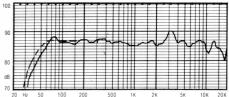
Impedance (mod Z), Impedance characteristics give an indication of amplifier loading.



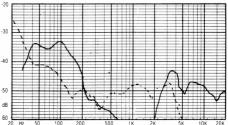
Forward characteristic response (1/3 octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral)



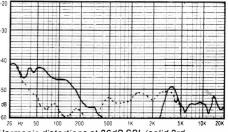
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

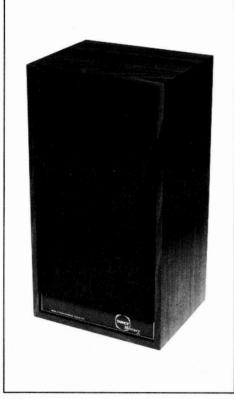


Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

10 **(10)** 

Tannoy Mercury

Tannoy Products Ltd, Beadman Street, West Norwood, London SE27 0PW Tel 01-670 1131



The *Mercury* is the smallest in a new range of speakers from Tannoy, using their variety of the polypropylene cone plastic which they call 'polyolefin' — a vague-sounding name, though chemically correct! This 19litre enclosure is rigidly constructed from 15mm thick chipboard with a presentable vinyl walnut finish. Bass reflex tuning is employed, the ducted port 50mm in diameter by 70mm deep.

Bass and midrange is provided by a powerful controlled-excursion driver, steel-framed and 200mm in diameter, using a 25mm pole plus a modest magnet. Treble is covered by the popular 25mm soft fabric dome Audax unit, and the crossover is of unusually high quality, employing air-cooled inductors and a plastic film capacitor. 4mm socket/binding posts are used for secure electrical connection, though pushon connectors are used for internal driver wiring.

With a good overall appearance, this system unfortunately has unrebated 9mm thick grille frame — luckily this is easily removed, which will marginally improve the sound.

#### Sound quality

The fine panel results bore little relation to this speakers modest size or price. Rated 'good plus' it was well up in the field, a very promising result indeed.

It was liked for an essentially neutral tonal balance with moderate levels of coloration, but in particular its lively, transparent and detailed nature won it appreciation.

Stereo images were well focused with a fair presentation of depth where appropriate and stereo information was present throughout the range — bass, mid and treble — in a balanced manner. The good quality bass had somewhat limited extension at the lowest frequencies but voices spoke and sang correctly, and the system could convey the natural acoustic present on many recordings.

Some coloration was present but to a mild degree. The usual boxiness, slight featheriness and sibilance in the treble were all evident together with a hint of 'plastic nasality'.

#### Lab results

Measured at the standard 1metre distance, this Tannoy provided a pretty uniform frequency response, improved a little by grille removal (dotted graph line). Sensitivity was above average at 88dB/W, and not compromised by the impedance characteristic, whose trends suggested that the Mercury was a very kind amplifier load. Reasonable bass extension was noted, to 52Hz, -6dB.

In conjunction with the 100W maximum power handling capability, sound levels of up to 103dBA should be possible from a pair.

At 2metres the speaker's good frequency balance was well established, if mildly flawed by the suppressed treble lump at 14kHz. This speaker proved to be somewhat axis-critical in the vertical plane, both plus and minus 15° offaxis responses showing a 4kHz dip, so the speaker should be positioned to face the listeners head, and mounted on a reasonably high stand to give the best sound. Fine results were obtained off-axis in the lateral plane.

ploying air-cooled inductors and a plastic film capacitor. 4mm socket/binding posts are used for secure electrical connection, though push-on connectors are used for internal driver wiring.

Room averaged, its basic character was plain to see, with a smooth well controlled output shown over most of the range. Bass was reasonably extended and in good balance with the uniform midrange.

At 96dB sound level, distortion was good in the important midrange and about average at lower frequencies, peaking to 8% second harmonic at 100Hz which is probably just audible as a bass tonal quality change. Third harmonic was rather better, this in any case arguably the more important result, averaging 0.2% at both 96 and 86dB spl. At the lower level second harmonic also showed a great improvement attaining a very fine level.

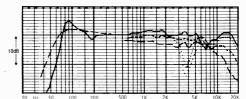
#### Summary

Tannoy have an undoubted winner in the *Mercury*. If treated like a big speaker and mounted on stands clear of room walls, a highly satisfactory sound was obtained, with fine detail, clarity and stereo image presentation. Essentially neutral and vice-free, the *Mercury* was usefully sensitive and easy to drive, fully deserving its Best Buy rating. This system will do good justice to some surprisingly expensive ancilliary equipment!

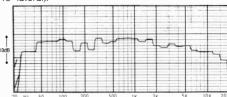
#### **GENERAL DATA**

Impedance (mod Z). Impedance characteristics give

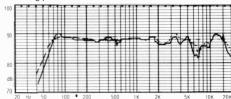
an indication of amplifier loading.



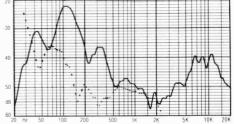
Forward characteristic response (½ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



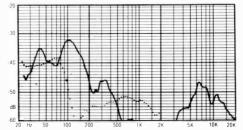
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



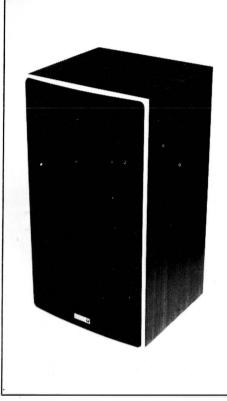
Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

#### Wharfedale Laser 90

Wharfedale Loudspeakers Ltd, Highfield Road, Idle, Bradford BD10 8SF Tel (0274) 61131



One of the new-generation Laser range, the 90 is a compact 20litre sealed-box system. A light steel frame supports the bass/mid range unit, which is fitted with a modest motor system and a flared pulp cone. The tweeter is Wharfedale's own 19mm polyamide soft dome unit, which has recently undergone considerable in-house refinement. A commercial-quality crossover divides the frequency range at around 3kHz.

The enclosure is built of 15mm chipboard material with an exterior covering of walnut-effect vinyl with the grille assembly based on a moulded plastic frame. This is trimmed by a light grey edge which at a distance resembles satin alloy, but the metallising is less convincing on the rather flashy plastic trims used for the drive units.

Sound quality

We obtained the best results with this speaker

when it was positioned on open stands. It scored a little above average, which was a good result considering the price.

In a general sense the 90 sounded quite smooth and well balanced, with good control at both frequency extremes, a thing unheard of with earlier Laser models! Some coloration was evident, notably a degree of boxy hollowness and a 'cardboard' quality to bass percussion, together with some mild treble sibilance.

Stereo images were fairly clear with reasonable depth, and recorded acoustic, and some central focus was demonstrated in the later plane, but on occasion the image was over-wide tending to localise at the box positions.

The bass possessed average extension and was a bit coloured, but firmer than usual. Overall the panel felt this speaker to be relatively relaxed and unfatiguing.

#### Lab results

At the reference 1metre distance, the *Laser 90* frequency response was exemplary and only slightly modified by the grille being in place. The bass was accurately tuned to -6dB at 50HZ and pair matching was also pretty good, the sensitivity a little above average at 87.5dB/W.

Out at 2metres, which is a more representative listening distance, the uniform characteristic was maintained, showing a slightly 'rich' tendency. In general a good set of off-axis responses was produced.

In the listening room the well balanced trend was continued with quite good bass integration down to 50Hz.

Distortion was about average at the 96dB sound level, measuring 0.3 to 1.0% third harmonic and 0.4 to 5.0% second, the latter poorest in the comparatively harmless low frequency region. Improved results were obtained at the lower 86dB test level, and classed as good.

The impedance characteristic was well controlled, happily meeting the 80hms standard and thus the 90 was classed as a very good amplifier load. Easy to drive, the sensitivity-versus-power handling equation will allow maximum sound levels of up to 103dBA.

#### Summary

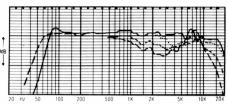
This smooth and well-balanced model gave a decent all-round performance at quite a competitive price. One of Wharfedale's most civilised inexpensive models for a long time, the 90 achieves a recommendation.

#### GENERAL DATA

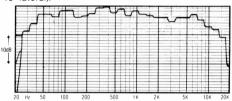
GENERAL BAIA	
Size (height x width x depth)48 x 2	$26.5 \times 25 cm$
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(15)—100W
Recommended placement,o	pen stands
Frequency response, within ± 3dB, at 2 metres538	Hz to 17kHz
Low frequency rolloff ( - 6dB point) at 1 metre	50Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 metre)	87.5dB
Approximate maximum sound level (pair) at 2 metres	103dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	good
Typical price per pair inc VAT	£90(B)

#### Update

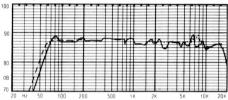
Cabinet revisions have led to a recessed back panel and lower internal volume. The new model is designated the 90B.



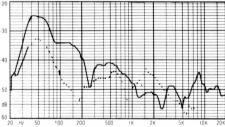
Forward characteristic response (½ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral)



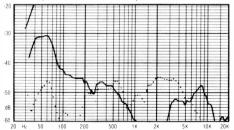
Averaged forward characteristic response in room at listening position.



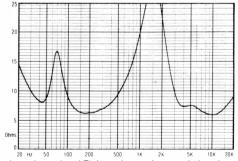
Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF, dotting shows response without grill.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic)



Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.

REVISED AND REPRINTED

#### Wharfedale TSR 108.2

Wharfedale Loudspeakers Ltd, Highfield Road, Idle, Bradford BD10 8SF Tel (0274) 611131



Previously reviewed, the 'Mk 1' 108 showed promise but possessed significant flaws which barred it from recommendation. It has since been extensively revised, and now has an improved frequency response in the midband, and a revised mounting for the treble unit (which puts it on the front panel rather than down an absorbent pit as was previously the case). Bass extension has been increased, while the sensitivity is reduced by 2.5dB.

This is a 30 litre enclosure reflex-loaded by a substantial 80mm diameter/130mm deep ducted port; the duct resonance occurs at 47 Hz, and the main driver resonance at 68Hz. The 6-element crossover includes one resistor plus a variable treble control on the front panel. With the latter set to the nominal 'O' or flat position, the treble with all the Wharfedales we tested); in our view a '10-11 o'clock' position gave the best results.

Built on a substantial rectangular casting, the

200mm bass/mid unit was fitted with a Wharfedale mineral filled (talc) polypropylene cone and a generous magnet. The chipboard enclosure panels were finely veneered in real walnut, and damped internally by bituminous cladding. A top. grade acoustic foam provides volume absorption. However the grille was less desirable, placing significant side panels near the tweeter and worsening the diffraction properties of the enclosure. Not shown on the printed graph, the grille's removal improved the smoothness of the treble between 6 kHz and 14 kHz on the sinewaye reference, and also gave better image focus in the upper frequencies. Fortunately the speaker looks guite presentable without the grille in position.

#### Lab performance

Charted at 1 m on axis (with grille), the family of curves illustrate the settings of the treble output control from '7' to '3 o'clock', with '12' at an indicated flat. Above 150Hz this speaker was pretty smooth and well balanced, and better still with the grille removed. The reduced sensitivity resulted in more bass excess than before, namely a 4dB lift at 100Hz. The low frequency cutoff is lowered to -6dB, 40Hz, which is a good extension for the volume.

At 2m the characteristic response showed an axial curve integration that was marginally less favourable, although the general uniformity was laterally good. The vertical axis was less promising, with 15° above showing a peak/trough effect of moderate severity between 2kHz and 6kHz.

The room average response was rather prominent in the bass, which is caused by coincidence of speaker excess and room mode maximum. Good output was still present at 40 Hz, while above 500 Hz the forward trend was quite favourable. Still it might be difficult to escape subjectively from the general excess of

A minor fault was shown on the distortion graphs at 230Hz, whereby the manufacturer had inadequately tightened the bass unit screws resulting in a resonance; on re-adjustment this particular feature subsided. The chart was dominated by fairly innocuous 2nd harmonic distortion at the 1-2% level, with 3rd harmonic rather less at 0.3-0.6%. At 50Hz 2nd and 3rd were equal at 5.0%, which is a reasonable value. Little change occurred in distortion on the 100W pulsed test, but some compression was noted at was considered to be excessive (this was found 500 Hz. With an impedance characteristic comfortably meeting the 8 ohm standard, and with mild reactive effects, the 108 was judged a very good amplifier load.

#### Sound quality

Capable of sustaining up to 150W peak programme on electric bass guitar and with a good result on the 100W pulsed test, a 150W maximum power rating was suggested, with 20W as a sensible minimum. Fairly high sound levels of 103dBA were possible from a pair.

Despite a fully recognised and acknowledged bass prominence, the listening panel thought so highly of the rest of the frequency range that consistently high marks were awarded. It scored well on the live sound comparisons, appearing comparatively neutral and notably transparent, with a convincing manner. Slight sibilance and 'boxiness' were also noted, with a 'chesty' effect on speech.

On the stereo programme the bass extension was appreciated despite the upper bass richness. and aside from a rather 'slow' bass character, this model seemed to be comparatively free of vices. Stereo image quality was well above average with good precision (especially with the grille off) as well as promising depth. Although mild 'plummy' and 'boxy' effects were noted, these were not serious.

#### Summary

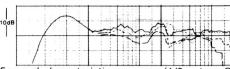
Though the TSR108.2 has lower sensitivity than its predecessor, and the bass is less even and well defined, it offers a good standard of midrange and treble quality at an attractive price. Easy to drive. well finished in natural veneer, and capable of decent sound levels, the 108.2 was awarded a Best Buy in the last edition - however, with stiffer competition this time, and also bearing in mind the requirements of digital programme, it must unfortunately lose that distinction this time.

#### **GENERAL DATA**

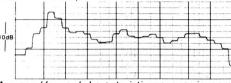
512e (11 x w x u)	0.00111
Weight	. 14kg
Recommended amplifier power per channel	
(for 96dBA per pair at 2 metres minimum)(20)-	-150W
Recommended placementopen stand clear o	f walls
Frequency response within ± 3dB (2m)130Hz to	18kHz
ow frequency rolloff (-6dB) at 1m	.40Hz
/oltage sensitivity	
(ref 2.83V, ie: 1 watt in 8 ohms) at 1m	5dB/W
Approximate maximum sound level (pair at 2m)	03dBA
mpedance characteristic (ease of drive) ver	y good
Forward response uniformity very good (gr	ille off)

Typical price per pair inc VAT ... £240 when reviewed, now £180

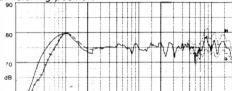
577 v 31 v 28 8 cm



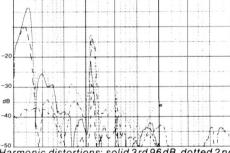
Forward characteristic response (1/3-octave @ 2m. dotted 15° vert., small dash 30° lateral, long dash 45° lateral).



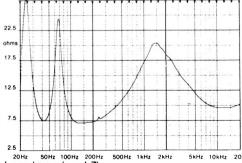
Averaged forward characteristic response in room at listening position.



Reference sinewave response (1 m on axis, 2.83 V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response variations of treble control).



Harmonic distortions: solid 3rd 96dB, dotted 2nd 96 dB. dashed 3rd 90 dB, chain-dashed 2nd 90 dB, o shows stop point at 96dB).



Impedance (mod Z).

#### Yamaha NS1000

Natural Sound Systems Ltd, Unit 7, Greycaine Road, Watford Herts WD2 4SB Tel (0923) 36740



Still current, the Yamaha NS1000 was in fact originally reviewed several years ago in the first issue of HFC Loudspeakers (1976), when the author Angus Mckenzie, purchased a pair for high-level monitoring. Though it had been retested for subsequent editions, we nonetheless felt that the Yamaha 'flagship' should again be completely reassessed, and very worthwhile this proved to be.

The NS1000 is a relatively compact, superblycrafted three-way sealed-box speaker, of a highly rigid and braced construction, with an exterior black paint surface that is best described as 'piano' finish. Working best on strong stands, it can also be placed near, but not too close to the rear wall: about 30cm is about right.

The bass driver is a top-class 300mm pulp cone unit, built on a die-cast alloy frame and employing a massive motor system. The protective grille over the bass driver rings a little, and

fussy owners could discard them, as we did for our tests. The mid and treble units, 85mm and 30mm respectively, are Yamaha's unique ultrahard beryllium dome units, both fitted with frontal phase correctors. Level controls are also provided for mid and treble, and we obtained the best balance and curves with mid at '-2' and treble '-1'.

A high-quality, high-power crossover divides the frequency range at around 600Hz, and 5kHz, with spring clips for electrical connection at the rear of the speakers.

#### Sound quality

This speaker has historically attracted some censure, notably on analogue-based programme. Past criticisms included a bass that was too damped and dry, with a somewhat colored mid and a treble that was a trifle fizzy and uneven. However this time round, using mainly digital programme, the speaker appeared to 'come to life', and produced an impressive sound. The bass was quite exceptional, with superb control and articulation, as well as fine depth to formant frequencies. It appeared to produce good stop-start transients, and was also sufficiently transparent to reproduce the natural acoustic on many recordings. Stereo images were also well focused and a decent depth effect was obtained.

Some coloration was still evident, namely a slightly deadened presence range with some mid nasality and a trace of lispiness and grain to the treble, this accentuated on distorted programme.

On high-quality material however its 'monitor' label appeared justified judging by the results, and high sound levels were also possible, with negligible subjective distortion.

#### Lab results

A high 90dB/W sensitivity was recorded, this being slightly compromised by the impedance, which dropped to 40hms at 80Hz. This qualifies the speaker as a fairly difficult load.

System resonance was 35Hz, which was lower than the previous samples, and good bass extension to 40Hz, -6dB, was achieved, with a desirably slow damped rolloff below this point. The axial response was pretty uniform at 1metre but by 2metres some 'lumpiness' had crept in through the mid treble, Aside from this however the forward integration was very good over the range of measurement axes.

Turning to the computer-averaged response,

the clean extended bass was clearly evident, while the treble register is well shaped; overall, quite a balanced result

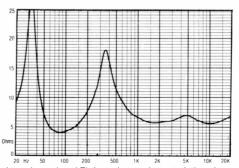
At 96dB sound level, distortion was remarkably low, with third harmonic much less than 0.1% above 500Hz and second averaging just 0.3 to 0.5%, even at lower frequencies. At the 86dB level, distortion was exemplary, with a further improvement in third harmonic, second averaging 0.15% above 200Hz, and 0.3% at lower frequencies. This makes it the best in the issue as far as distortion results are concerned.

The speaker had a peak power capacity of up to 200W and high sound levels were possible from a stereo pair — up to 108dBA in a typical room!

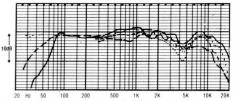
#### Summary

The long-lived NS1000 remains competitively priced. Superbly engineered and finished, it can provide powerful, clean, articulate and extended bass despite its compact dimensions, and also sets a good standard elsewhere. Stereo images were well formed, the distortion was excellent and available sound levels high, as was the sensitivity. Satisfactory on analogue sources and really coming into its own on digital, the NS1000 is a worthy contender, and the HFC recommendation continues.

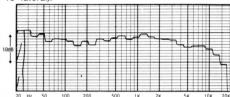
#### **GENERAL DATA**



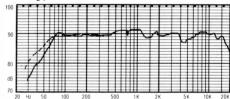
Impedance (mod Z). Impedance characteristics give an indication of amplifier loading.



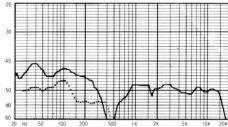
Forward characteristic response (½ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



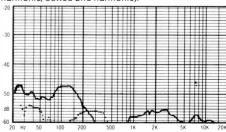
Averaged forward characteristic response in room at listening position.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).



Harmonic distortions at 86dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

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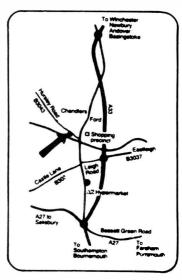
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# CASSETTE DECKS

Cassette tape was introduced by Philips in the 1960s as a convenience medium but few could have foreseen the impact cassette was to have on domestic hi-fi, ultimately ousting reel-to-reel machines as have today's metal-compatible Dolby C machines. And twenty years ago who could have predicted the 'Walkman'

Magnetic tape basic

Tape recording is a unique medium for domestic music making in that it offers the potential not only for recording but also for re-use. Recording consists of passing a plastics tape with fine metal oxide particles across a record head which alters the orientation of the magnetic particles in the oxide coating and encodes the audio signal in the new structure. Conversely, for replay, the magnetic pattern of the recording induces a small electrical signal in the play head as the

tape passes across it.

All cassette decks have an erase head, which 'scrambles' the magnetic particles to enable a new recording to be made. Erasure is achieved by a strong signal oscillating at very high frequencies (around 100kHz, way above the audible range). This same high frequency signal is also used to provide bias when recording; mixed with the audio signal, this enables the tape to make recordings at low distortion. The bias current fed to the record head needs to be set differently for different tape formulations. Also, all tape decks apply considerable boost to high frequency signals when recording and so for replay the appropriate correction must be applied to restore flat frequency response. This is called equalisation. Both bias and 'EQ' are covered in detail in the section on Cassette Tapes.

#### **Cassette limitations**

To achieve a sensible playing time the cassette tape must move very slowly over the record heads - at 4.7cm per second in fact. The tape is also very narrow and has to carry four tracks some 0.6mm wide and their guard bands. This accounts for the medium's inherent noise, poor high frequency performance and severely limited dynamic range. Or it used to account for them, until in 1970 Dr Ray Dolby largely overcame these problems with a simpler domestic version of his Dolby 'A' studio noise reduction system, which could be incorporated cheaply into every cassette deck. Dolby 'B' is designed to operate on high frequencies only - on record

it boosts the treble signals when they are low enough in level for tape noise to become a problem. On replay the de-emphasising circuit restores the balance, which is why Dolby B tapes played back without Dolby sound

too 'trebly

Once Dolby'B' had shown that cassette tape was potentially a medium of true hi-figuality, developments in tape transports and tape formulations followed rapidly. In the last few years Dolby 'C' noise reduction has been introduced - a clever 'doubling up' of Dolby 'B' to give twice as much hissreducing effect. There are other compatible and incompatible noise reduction and compression/expansion systems available on-board cassette decks but only dbx seems to hold or gain ground now against Dolby 'C'.

#### Cassette deck features

The term cassette deck refers to a machine which is designed to interface with domestic hi-fi, and which does not contain its own amp and speakers.

Tape is pulled past the heads by the capstan, a precision-made metal spindle, which of course must rotate at exactly constant speed. The tape is kept very firmly in contact with the capstan by a rubber pinchwheel. One of the cassette medium's limitations is due to the fact that the tape guides and pressure pad (which in a reel-toreel machine would be built into the recorder) are built into the cassette body. To overcome these drawbacks some cassette decks use two capstans to isolate a short section of tape from the cassette body, and these dual capstan types tend do better than others on speed stability

The least expensive decks still use ʻpiano key' transport controls though these are rapidly being replaced by electro-mechanical actuators; touch sensitive switches are now common.

While most decks have two heads, one for erase and one for record/ replay, more expensive threehead models feature separate heads for recordand replay. Part of the problem has been where to put the third head in the cramped cassette opening. 'Combination' heads have been used, the record and replay heads being separate while sharing the same housing, but require very good shielding to turn in the technical specification of discrete head machines. Athird head, however incorporated, allows 'instant' off-tape monitoring while recording. Head's themselves come with a variety of exotic names which guarantee nothing about life expectancy or per-

formance.

To make good recordings free of distortion or hiss, you need to know the amount of signal you are putting onto the tape. Record level meters are provided of either the traditional 'needle' VU/peak type or of the LED or fluorescent bargraph type which are faster-acting and allow a peak

hold facility.

A recent development is the inclusion of automatic head adjustment to ensure correct azimuth alignment, critical with cassette. There are few machines available with this feature as yet, but we suspect they will form more of a group for the next issue of Hi-Fi Choice: Cassette Decks. Other conveniences stretch to automatic bias and equalisation setting by microchip. In these machines the deck itself contains a test tone oscillator, makes and analyses a recording to enable it to set the bias for best performance.

Other models worth considering

Poor factory alignment prevented recommendation of all too many models, and this serves to underline the point that readers should really be prepared to audition the actual sample of the model in which they are interested. Just a few models came close enough to the recommended category to be listed as worth con-

sidering

The **Denon DR-M3** (£240) measured well but was let down by the auto calibration circuits which failed to give it the same performance standardasthe£40-cheaper DR-M2; however Denon are said to be working to improve this aspect. The Hitachi DE-7 (£200) measured slightly below average on wow and flutter, and this, with some hum and a poor showing on metal prevented recommendation though the machine offered the right facilities at the price and could record and replay with good sound quality. The two-head **Nakamichi BX2** (£259) which missed recommendation has now been discontinued. Sansui's D-570 (£230) is reaches the end of its life also and could be worth considering on account of its good measurements; recommendation was missed because of bias drift. The Recommended Teac V-80 (£180) too has been discontinued and though the machine as reviewed lacked careful factory alignment it was felt to be a good in expensive three-head machine with excellent metering.

#### CASSETTE DECK BUYER'S CHECKLIST Do the meters respond fast enough to be called peak Is the noise reduction system compatible with your meters? Are they suitably previously recorded tapes? Some decks don't have calibrated to enable you to use Dolby C, now more commonly microphone inputs at all the maximum headroom fitted, is capable of true high Quality with regards to noise available on peaks without fidelity hiss-free record/replay. and distortion can be distortion, or will you lose surprisingly poor. Microphones of the appropriate output and singal in the tape noise floor through over-reading? Some decks are not able to drive less sensitive impedance should be used. headphones to even If you want to make Is the deck capable of biasing acceptable levels and a check unattended recordings or use metal formulation tapes? If not should be made for compatibility. A level control is the recorder as a timercorrectly set up in the factory. operated alarm clock for replay the deck's performance on useful; sometimes a line ouput metal tape may be level control also controls then the machine must have a disappointing. Timer switch headphone level BEA বিটিল STOP REC PAUSE IUSIC SCAI Can the bias and equalisation be switched independently or are they switched from the Search facility finds tracks by detecting periods of slience during fast wind or rewind. cutouts in the spine of the cassette. A bias trimmer allows fine tuning of the deck for the tape in use. Computer bias adjustment is an option of some machines. 5 Is the ouput impedance and level suitable for your amplifier? If a DIN socket is fitted is this to DIN standards or simply to phono levels and impedances? A variable output can help match the deck into a system. See text for further details on amplifier matching.

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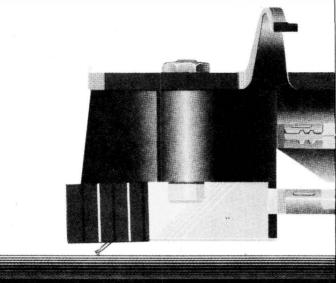
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Aiwa AD-F660

Aiwa Sales & Service (UK) Ltd. 163 Dukes Road, Western Avenue, London W3 0SY Tel 01-993 1672



Unusually styled, the new Aiwa AD-F660 deck low and high impedance headphones.) has three heads (allowing off tape monitoring). Dolby B and C noise reduction are both included as well as, most importantly. Dolby HX Professional.

Many major controls are mounted on a platform extending forward nearly 3cm from the bottom of the front panel, including the record-level control which is a very long-throw stereo-ganged fader (the minute centreindented balance control to complement this is on the front panel).

controls, which allow review and cue (press play and wind together for this) and automatic programme search. The pause control stops and re-starts play or record. A record-mute is fitted, together with 'intro play', which allows around eight seconds of each track to be heard before programme search belts on to the next one. The deck has auto cassette tape type selection for both bias and equalisation. A series of small buttons select real-time tape counting and various memory play and re-wind functions, which can allow continuous playback of a programmed selection.

The main panel incorporates the front loading cassette compartment, which is well designed, and the remaining facilities and switches plus the headphone jack socket. (This offers two volume levels, found marginally too loud, and very loud, into both

Meters consist of two rows of 12 LEDs. allowing only fair discrimination, but accurately indicating extremely short peaks excellent.

Also on the front panel are switches for remote timer-record or play, monitor/source output and Dolby, and a fine-bias centreindented pot (a large list of tapes with approximate bias settings is printed on the front of the machine). Many LEDs indicate the switching of various facilities guite attrac-Also on the platform are the tape transport tively. Automatic head demagnetisation operates whenever the machine is switched

> Microphone inputs had slightly inadequate gain and were noiser than average, although the sound quality was clean. The line inputs were quite sensitive and no clipping problem was noted, the input noise floor measuring well, and only slight hiss coming up with the volume control on a fairly low level input. We liked the record fader, but the balance control was very fiddly.

> Replay head azimuth was reasonably accurate, and replay responses were well optimised on the new IEC test tapes. Replay noise measurements were all very good except for a very slight, almost inaudible, hum on the right channel. Replay amplifier distortion and clipping measurements were excellent, the deck giving just over 0.5V for Dolby level, which

is convenient. Headphone level measurements confirmed our subjective opinion of too much volume. Dolby level came up to the correct point on the meter, which allows +7dB ref DL to be read accurately.

Overall results on a Maxell UD C90 showed very good LF MOLs, combined with better than average HF Saturations, Dolby HX Pro clearly being beneficial. Background noise measurements were excellent, especially with Dolby C. Modulation noise measured very well. The responses showed a tendency to peaking around 15kHz, the left track also being + 2dB around 10kHz, which made some programme items sound a little bright. Audio quality. though, was very much liked throughout (often rated superb and very open). I am convinced that the Dolby HX circuits helped a lot here, although 3kHz MOLs were not too good, which is strange.

BASF Chrome II gave a reasonable account of itself, having an excellent response and very low noise, but being incapable of taking very high levels, sounding slightly gritty here. LF and HF maximum output tests were good, but at 3kHz we could not even record Dolby level without very considerable distortion. Responses were thought reasonable, with and without Dolby, but there was a Dolby error of -1.4dB. Maxell XLII with Dolby C gave excellent overall results with good responses, low distortion and very open HF sound quality. with amazingly low background noise.

Results on TDK MA were excellent subjectively, with only a mild comment about LF distortion being made, the MOL actually being reasonable at 315Hz but just adequate at 3.15kHz in the lab, whilst HF performance measured and sounded superb, although the response was slightly up. Dynamic range measured very well for metal. Both ferric and chrome tapes needed bias to be set at '+1' for optimum response.

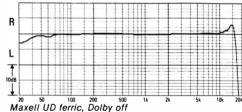
Wow and flutter measured reasonably well. although very slight flutter was heard before the deck was fully run in. Speed was very L accurate, spooling time average and tape torque slightly lower than average. Head and guide heights were reasonably set, but head penetration was slightly insufficient.

This machine has done very well for itself. both subjectively and in the lab, and is rated a 'Best Buy', while I would personally prefer the F770 because of its additional facilities. The Dolby HX Pro circuitry has clearly contributed to some superb sound quality which we heard reproduced from this deck, which was easy to use and with some excellent facilities.

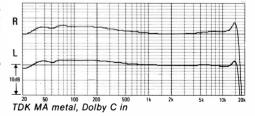
GENERAL DATA
Replay azimuth deviation from average25°
Line input sensitivity
Worst audible replay hum component – 64dB (50Hz)
Replay noise ferric CCIR/ARM weighted (NR out), 58.5dB
Replay noise chrome position CCIR/ARM
weighted (NR out) 62.7dB
weighted (NR out)
Max replay level for DL
Max replay level for DL
Speed average 0.4%
Meters under-read0dB on 8ms
Overall 10kHz sat ferric L/R ref DL 3.4/ - 3.9dB
Overall Dolby C 10kHz sat ferric L/R ref DL 0.4/ - 1.1dB
Overall MOL ferric L/R for 5% dist @
315Hz ref DL + 6.1/ + 6.8dB Overall 10kHz sat, chrome position L/R ref DL 4.2/ - 4.3dB
Overall 10kHz sat, chrome position L/R ref DL 4.2/ - 4.3dB
Overall 10kHz sat, Dolby C, chrome, L/R ref DL – 1.5/ – 1.4dB
Overall MOL chrome L/R for 5% dist @
315Hz ref DL+ 5.5/ + 5.2dB
Overall 10kHz sat metal L/R ref DL+ 0.4/ + 1.2dB
Overall 10kHz sat, Dolby C, metal L/R ref DL., + 3.8/ + 5.3dB
Overall MOL metal L/R for 5% dist @
315Hz ref DL+ 6.3/ + 6.8dB
Overall noise ferric NR out (CCIR/ARM) ref DL – 51.1dB
NR improvement Dolby B/C10.3/19.3dB
Overall noise chrome NR out (CCIR/ARM) ref DL – 55.3dB
NR improvement Dolby B/C10.3/19.0dB
Overall noise metal NR out (CCIR/ARM) ref DL – 52.7dB
NR improvement Dolby B/C10.3/19.1dB
Overall MOL metal L/R for 5% dist @ 315Hz ref DL
ref 3kHz tone
Line indut noise noor, dain min lei DL (CCIR/ARM) – 61.00D
Line input noise floor ref 160mV/DL (CCIR/ARM) 75.0dB
Spooling time (C90)
Dynamic range rerric/chrome/metal/5//8//80B
Noise reduction systemMaxell UD/BASF CR II/TDK MA
Tapes usedMaxell UD/BASF CR II/TDK MA
Typical retail price£230

#### **OVERALL FREQUENCY RESPONSES**

at - 20dB ref Dolby level



BASF Chromdioxid II. Dolby C in



## Aiwa AD-F770

Aiwa Sales & Service (UK) Ltd, 163 Dukes Road, Western Avenue, London W3 0SY Tel 01-993 1672



The Aiwa AD-F770 is very similar to the less automatic. The 'ready' light is illuminated if a expensive 660 in all basic facilities but has several additional features. On the 770, there is an automatic tape calibration setting-up button which allows a very wide range of bias pre-set of the 660 is replaced here by a stereo-ganged miniature output control which also affects headphone levels, allowing stacks of volume for those who want it!

Metering is a fluorescent bargraph display. with good discrimination. Average transients read very accurately, whilst very short ones (8mS) only under-read 3dB. The deck has three separate memories, one for each tape type, to hold the parameters as automatically set up by auto-calibration, for up to 24 hours or so, if the machine is disconnected from the mains. These parameters include bias, equalisation and record sensitivity. Memories are retained whilst mains is connected even if switched off on the deck.

The microphone inputs were a little hissy. and did not have enough gain for recording speech further than a foot or so from sensitive moving coil mics. Reproduction quality was inputs were quite sensitive, and no input larity. As with the 660, tape type switching is have been better here). Responses can be seen

tape type is stored in the memory, but calibration is achieved by depressing the 'cal' button once to wipe an existing memory if necessary. and then again to calibrate, which is achieved cassettes to work optimally with this deck. The in around 16 seconds, the tape being wound to the start point after this.

Replay azimuth was extremely accurately set, and head heights and alignment were very satisfactory. Replay amplifier noise measure ments were all excellent, and no replay hum problem was noted audibly, although very slight 50Hz breakthrough was measured on the left channel. We were slightly surprised that replay amp clipping occured at just 11dB over DL — this in general is satisfactory, but very high level recordings on metal could sound slightly clipped on extreme peaks. The output level for DL was normal, but the meter was one segment down on the left channel. Replay responses measured reasonably accurately across the board.

Overall results from Maxell UD C90s were excellent, the subjective comments being most complimentary. The sound quality was frequently said to be 'very open', and 'superb'. satisfactory from this input, though. The line A mild criticism was made that applause was marginally compressed. The test results show clipping problem was noted — input noise very good overall noise measurements, an being extremely low, and oddly, slightly better astonishing LF MOL, and a very good HF than that of the 660 despite the deck's simi-saturation, but just good at 3.15kHz (it should

to be excellent throughout, modulation noise being remarkably low.

Responses on BASF Chrome II were very flat indeed, the machine setting the tape up guite well. LF MOL and HF saturation were both a little disappointing, but background noise was amazingly low, so if you watch your peak recording level carefully, you can get some excellent sounds on the IEC II position. We tried recording 3dB lower than usual, and sounds were then superb on BASF chrome. Maxell XLII received words of praise such as. 'fabulous' and 'superb' throughout. No Dolby C problems were noted, and the remarkable openness produced a sound quality uncannily like that of the digital master, which is praise indeed.

TDK MA produced a similar reaction to that of XLII in the listening test, measurements also being very good throughout, overall noise being creditably low, and Dolby C reaching almost 20dB noise reduction. Responses were also excellent.

Wow and flutter measured well, and none was noted on the test programme. Speed was amazingly precise (within the accuracy of our test tape) and spooling time average. Torque was average with very slight juddering, insufficient to produce flutter, though.

We all liked this machine very much indeed. and in my estimation it is not just a Best Buy but one of the best ones for some time. As with the 660, the superb performance throughout of the F770 must be down in part to the incorporation of Dolby HX Professional, and this should be a lesson to other manufacturers.

I can recommend purchase of this machine without hesitation, its price being just right for those who want superb overall sound quality without the first having an appointment with the bank manager! This is a machine which places Aiwa right up front.

Line input sensitivity.... .89m\ Worst audible replay hum component. - 59.5dB (50Hz) Replay noise ferric CCIR/ARM weighted (NR out)...... - 58.5dB Replay noise chrome position CCIR/ARM weighted (NR out)... Replay amp clipping ref DL + 11dB Max replay level for DL. ...0.5v Wow and flutter average (peak weighted DIN), ..0.07% Speed average... +0.1%

**GENERAL DATA** 

315Hz ref DL.,

Replay azimuth deviation from average

Meters under-read. 3dB on 8ms Overall 10kHz sat ferric L/R ref DL -4.0/-4.0dB Overall Dolby C 10kHz sat ferric L/R ref DL .... - 1.1/ - 1.1dB Overall MOL ferric L/R for 5% dist @ 315Hz ref DL. Overall 10kHz sat, chrome position L/R ref DL..... - 5.5/ - 6.5dB Overall 10kHz sat, Dolby C, chrome, L/R ref DL..... - 2.5/ - 1.9dB

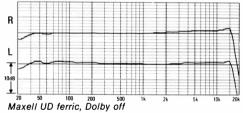
Overall MOL chrome L/R for 5% dist @ 315Hz ref DL... Overall 10kHz sat metal L/R ref DL -0.2/-0.9dB Overall 10kHz sat, Dolby C, metal L/R ref DL .... + 3.5/ + 3.7dB Overall MOL metal L/R for 5% dist @

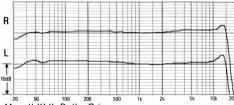
Overall noise ferric NR out (CCIR/ARM) ref DL - 50.7dB NR improvement Dolby B/C. .10.3/19.1dB Overall noise chrome NR out (CCIR/ARM) ref DL NR improvement Dolby B/C. 10.4/18.7dB Overall noise metal NR out (CCIR/ARM) ref DL. NR improvement Dolby B/C. 10.3/19.2dB Modulation noise ferric broad/close ref 3kHz tone. 41.6/ - 39.0dB

Line input noise floor, gain min ref DL (CCIR/ARM)..... - 80.9dB Line input noise floor ref 160mV/DL (CCIR/ARM)... Spooling time (C90).. Dynamic range ferric/chrome/metal. 75/76/78dB Noise reduction system. Dolby B/C Maxell UD/BASF CR II/TDK MA Tanes used Typical retail price.

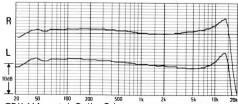
#### **OVERALL FREQUENCY RESPONSES**

at - 20dB ref Dolby level, MPX filter off





Maxell XLII, Dolby C in



TDK MA metal, Dolby C in

REVISED AND REPRINTED

Akai CS-F14

Akai (UK) Ltd. Unit 12. Haslemere Heathrow Estate, Silver Jubilee Way, Hounslow, Middlesex. Tel 01-897 6388



both Dolby B and C noise reduction. Unusually, the rotary record level control is ganged, and is complemented by a centre-indented balance control - an arrangement which we rather liked. Phono line in/out sockets are on the rear. and while the pre-production sample reviewed omitted a five-pole DIN socket, one is threatened on the production models! A trio of threeposition lever switches select noise reduction (off, Dolby B. Dolby C), tape types (ferric, pseudochrome and metal, no IEC numbers marked) and finally mains timer-start in play or record modes.

Metering is with a fluorescent bargraph display, accurately reading even fairly short transients, and with adequate discrimination - this being strong commendation for a budget deck.

Cassette insertion was simple, but painful on one occasion because of sharp corners on the door. Deck functions allowed transfer straight from play into wind and back (causing the tape to jerk a bit though), and dropping into record, whilst the pause stops but does not restart. Behind the cassette door is revealed a user - adjustable head-azimuth pre-set, useful for optimising pre-recorded cassettes. The mechanical tape counter jammed on one occasion during our tests.

Microphone inputs (1/4" plastic mono jacks) had inadequate sensitivity, but were adequate

Despite its modest price, this deck includes on hiss levels. The line inputs had average sensitivity, and noise measured well, whilst no clipping problem was encountered. Output levels (not adjustable) were average and the output impedance was reasonably low. On the Akai's headphone output, low impedance headphones were too loud, whilst high impedance ones were too quiet - circuit design was rather unsatisfactory here. Replay azimuth had been very accurately set, whilst head and guide heights were adequate. Replay hum and hiss levels measured well, whilst replay amp distortion and clipping measurements were very good.

Maxell UD ferric gave pen charts showing a slight high frequency boost, and bass 'woodles' (uneven response), with very low frequencies rather down. Sound quality was quite smooth, slightly bright, but liked. Lowfrequency MOLs and high-frequency saturation results quite acceptable, and sound quality was very good indeed up to reasonable peak levels. Overall noise measured very well. with very good Dolby improvements. Replay equalisation was slightly incorrect, there being not enough high frequencies. Modulation noise was slightly better than average. The Dolby C circuits (which make use of the Hitachi chip) had appreciably better than average dynamic distortion characteristics.

TDK SA pseudochrome gave rather a poor low-frequency MOL on the left channel, with

high-frequency saturation results not too hot. Pen charts confirmed our subjective comment that the right track was a little down at high frequence (due to being over-biased), whilst the left was reasonable (bass 'woodles' again). Overall noise throughout measured well with mod noise reasonable. Sound quality was quite good but only up to moderate peak levels, but high levels audibly distorted (Dolby C allows lower levels for recording).

TDK MA metal gave a poor MOL at 315Hz on the left channel, but HF saturations were excellent (left track under-biased). Responses were reasonably good, but showed presence droops, although subjectively the response sounded quite smooth. Quality was much liked up to moderate peak levels, but distortion was clearly evident above these. Overall noise measurements were very good throughout. Slight record current saturation was noted at high frequencies. Overall, Dolby calibration was found to be generally erring positively. SA on the right channel being plus 1.2dB.

Wow and flutter measured very well and none was noticed on the listening test programme - which is excellent for a budget deck. Speed was marginally fast, whilst spooling time was a little slow, tensions being steady and well optimised.

Considering the price of this deck, the overall sound quality was remarkably good. Since the use of Dolby C permits a fairly good dynamic range to be achieved without having a record at a high level, the deck can be strongly recommended. Though as originally reviewed the CS-F14 was a 'Best Buy', in the light of more recent competition it is now rated as recommended.

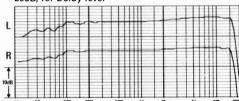


Replay azimuth deviation from average6°	,
Line input sensitivity115mV	1
Worst audible replay hum component 69dB (100Hz)	)
Replay noise ferric CCIR/ARM weighted (NR out) 59.4dB	
Replay noise chrome position CCIR/ARM	
weighted (NR out)62.8dB	3
Replay amp clipping ref DL+ 16.0dB	3
Max replay level for DL545mV	1
Wow and flutter average (peak weighted DIN)0.08%	,
Speed average+0.5%	)
Meters under-read1dB on 8ms	
Overall 10kHz sat ferric L/R ref DL 6.5/ - 7.5dB	3
Overall Dolby C 10kHz sat ferric L/R ref DL 4.5/ - 5.5dB	3
Overall distortion ferric L/R for 5% dist	
@ 315 Hz ref DL+4.6/+6.0dB Overall 10kHz sat chrome position L/R ref DL7/-7.5dB	3
Overall 10kHz sat chrome position L/R ref DL $-7l - 7.5$ dB	ŝ
Overall Dolby C 10kHz sat chrome position L/R	
ref DL	ŝ
Overall dist chrome position L/R for 5% dist	
@ 315Hz ref DL+ 3.2/ + 4.6dB	3
Overall 10kHz sat metal L/R ref DL + 0/ - 0.5dB	
Overall Dolby C 10kHz sat metal L/R ref DL + 3.5/ + 3dB	3
Overall distortion metal L/R for 5% dist	
@ 315Hz ref DL+4.4/+5.4dB Overall noise ferric NR out (CCIR/ARM) ref DL52.8dB	J
Overall noise ferric NR out (CCIR/ARM) ref DL – 52.8dB	3
NR improvement Dolby B/C	į
Overall noise chrome NR out (CCIR/ARM) ref DL – 54.0dB	3
NR improvement Dolby B/C	,
Overall noise metal NR out (CCIR/ARM) ref DL.,,, 52.0dB	
NR improvement Dolby B/C	,
Modulation noise ferric broad/close ref 3kHz tone – 38/ – 33dB Modulation noise chrome broad/close ref	,
Modulation hoise chrome broad/close rei	,
3kHz tone	,
Specifications (COO)	'
Spooling time (C90)	,
Noise reduction system Dolby B/C	

#### OVERALL FREQUENCY RESPONSES

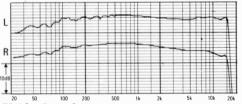
Tapes used . . . . . . . . . . . . Maxell UD/TDK SA/TDK MA

20dB, ref Dolby level

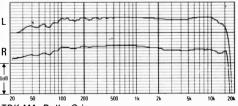


Typical retail price . . . . . . . . . . . . . . . £100

Maxell New UD



TDK SA, Dolby C in



TDK MA, Dolby C in

Akai (UK) Ltd, Unit 12, Haslemere Heathrow Estate, Silver Jubilee Way, Hounslow, Middlesex. Tel 01-897 6388



Akai's new budget deck, the HX3 is unusual in that it has no knobs at all on the front panel all functions are push button or switch operated. Automatic tape type switching is incorporated, and record level control is with a rocker push button switch for up or down. You may think this is rather swish until you find that you have no idea where its gain is at any given moment.

On the hardboard back panel are mounted phonos for line in/out and a remote control socket, the mains lead being captive two-core. The cassette compartment feels rather crude and 'plasticky', the door being very floppy, and surprisingly encompassing the mains on/off switch. The fluorescent bargraph meters were most disappointing, being little better than the old type of VUs in actual performance. Short transients under-read considerably, and speech by around 8dB.

The large tape transport buttons are mounted to the right, the wind/rewind being a rocker button. There is no normal pause control, but one labelled 'record pause' puts you into record (perhaps unexpectedly!) when you subsequently press play! An auto record mute gives four seconds silence if required. noise reduction. A three-position switch is provided for remote timer-start of record or

stereo headphone jacks are provided on the front panel.

Although there was ample gain on the mic inputs, they were rather hissy, and the record level control varied the volume maddeningly slowly if you wanted a very quick fade. Line input sensitivity was average and there was no input clipping problem. Input noise measured extremely well, but did degrade marginally when the volume was brought right up.

Replay head azimuth was accurately set, which is commendable on a budget machine. The heads and guides were accurately set, which again is creditable. Whilst replay amplifier hiss levels measured well, I was not happy with the replay hum levels, which might become a nuisance with some loudspeaker systems. Replay amplifier clipping margin was good and output levels were normal. Dolby level under-read 2dB on the meter, unfortunately. Low impedance headphones were marginally too loud, though satisfactory, but there was insufficient volume for high impedance models such as Sennheiser. Replay amplifier responses measured well, in accordance with the new IEC standards.

Maxell UD penned a remarkably flat Push buttons select Dolby on/off and B or C response up to 10kHz but rolled off gently above this frequency with Dolby out, Dolby C attenuating more rapidly at extreme HF. LF play. A built in electronic memory allows and MF MOLs were excellent, while HF saturarepeat on rewind. Two 1/4 in microphone and tion was just adequate without Dolby C, but

very good with it. Overall weighted signal-tonoise ratios were excellent throughout, 20dB of noise reduction being reached with Dolby C. Modulation noise was very poor indeed close into the tone, there being evidence of chassis vibration at mains frequency, causing the tape to vibrate on the head. Despite these criticisms the subjective sound quality was excellent throughout the programme, there being just a mild comment concerning slight EHF com pression, the sound generally being 'open'.

BASF Chrome II tended to be rather humpy at LF and had a tendency to a valley in the presence region. MOLs at LF and MF measured very well for chrome, but HF saturation was only fair, though it did improve as expected with Dolby C. Background noise measurements were good with Dolby B, but the noise floor was not low enough in the record amplifier for more than 15dB noise reduction with C. Overall quality was considered good throughout on BASF Chrome, but a mild criticism of HF compression was made, together with the occasional comment of 'LF up'. TDK SA (old formulation) produced very good overall sounds, considered better than BASF Chrome, and clearly new SA will be even better.

TDK MA metal gave good LF and middlefrequency MOLs for a budget deck, and HF saturation was excellent. Dolby-out responses were excellent, but slight HF droops were noted, especially on the right channel, with R Dolby C. The overall sound quality on metal was considered excellent apart from marginal distortion being noted on bass drum, the MOL L on UD having been better! As with the chrome position, overall noise levels measured well except for Dolby C which was again limited by record amp noise.

Although the wow and flutter performance did not measure particularly well by today's standards, no wow was heard during the R programme, which is slightly curious. Speed was rather fast and this could annoy musicians. Spooling speed was rather on the slow side and torque, whilst being average, showed some nasty judders which probably affected the wow readings.

This machine performed surprisingly well considering its budget price, and whilst I have some ergonomics criticisms, it is likely to do very well in the marketplace since it could reproduce some excellent sound quality. My main reservation is about the metering and record level control. Just achieving a 'Best Buy' rating because of its price, then, I can recommend purchase, but I hope your sample comes up to the review one which was clearly so well aligned!

### Replay azimuth deviation from average

Line input sensitivity	9	7m\
Worst audible replay hum component 56.9	dB (5)	0Hz
Replay noise ferric CCIR/ARM weighted (NR out)	–` 5	8dF
		-
weighted (NR out)	- 62	3dF
Replay amp clipping ref DI	J 1	4d F
May replay level for DI	+ 1	0.5
Mow and flutter average (neak weighted DIM)		1.40/
Conned average (peak weighted Dily)	0.	90/
Speed average	+ !	.0%
Meters under-read4dB on 64ms, 15d	Bou	ams
Overall 10kHz sat ferric L/H ref DL	7 – 6.	4a E
	o/ — 3.	/dE
Overall MOL ferric L/R for 5% dist @		
315Hz ref DL+ 7.1	l/ + 6.	5dE
Overall 10kHz sat, chrome position L/R ref DL – 6.8	3/ <b>–</b> 7.	2dE
Overall 10kHz sat, Dolby C, chrome, L/R ref DL 4.7	′I <b>–</b> 5.	1dE
Overall MOL chrome L/R for 5% dist @		
315Hz ref DL + 5.2	4 + 5.	0dE
Overall 10kHz sat metal L/R ref DL 0.5	i/ - 1.	2dE
Overall 10kHz sat, Dolby C, metal L/R ref DL+2.5	i/ + 2.	0dE
315Hz ref DI + 6.5	1/+5	8dB
Overall noise ferric NR out (CCIR/ARM) ref DI	_ 50	5dB
NR improvement Dolby R/C	5/19	5d B
Overall noise chrome NP out (CCIP/APM) ref DI	_ 55	240
NP improvement Delby P/C	- JJ.	540
Overall poles motel ND and (CCID/A DAI) ref DI	5/15.	240
NH improvement Dolby B/C9	. פו וס	OUL
Modulation noise terric broad/close		
	Worst audible replay hum component	weighted (NR out)

Line input noise floor, gain min ref DL (CCIR/ARM)..... - 82.9dB

- 37.9/ - 27.1dB

2 min 13 sec

Maxell UD/BASE CR II/TDK MA

74/74/74dR

.Dolby B/C

## **OVERALL FREQUENCY RESPONSES**

Line input noise floor ref 160mV/DL (CCIR/ARM)...

at - 20dB ref Dolby level

Dynamic range ferric/chrome/metal.

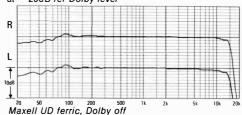
ref 3kHz tone.

Spooling time (C90).

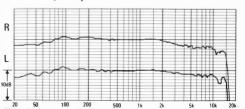
Typical retail price.

Tapes used.

Noise reduction system



Maxell XLII, Dolby C in



TDK MA metal. Dolby C in

Akai GX-R6

Akai (UK) Ltd, Unit 12, Haslemere Heathrow Estate, Silver Jubilee Way, Hounslow, Middlesex. Tel 01-897 6388



some interesting facilities including autoreverse. Styled very similarly to the model HX3, it is also housed in a metal case with a hutch door on the front panel. hardboard back cover, and is, unfortunately, door being very floppy.

manual or automatic changeover taking only record level push up/down lever has its own separate indication of gain setting. Deck functions include a rocker switch for play in which is a little irritating. either direction, with a similar switch for possible. No normal pause control is fitted.

filter on/off, B/C noise reduction on/off, 'intro was on the low side and slightly jerky, All scan' and programme search functions, replay hiss and hum levels measured well and remote timer start for record and play, and comprehensive control of cyclic play and reverse functions. A separate ganged-stereo replay gain slider control also adjusts the headphone output levels, giving adequate latest IEC standards. volume into all normal types.

under-read transients appallingly badly, being

A medium-price machine, the Akai GXR6 offers incorporated the appropriate IC to allow proper peak reading. The mic jacks and headphone jack are recessed behind their own private bug

Microphone inputs had inadequate gain, rather 'plasticky' in appearance, the cassette and the input circuitry was rather hissy, although sound quality was reasonable here. The machine will record and playback in The line inputs (phonos on the rear panel) had either direction which is very useful indeed, adequate sensitivity, and no clipping problems were experienced. Input noise was sufficiently half a second, which is astonishing, there low for a very good noise reduction improvebeing no quality change on reversal. Dolby B ment figure to be achieved on Dolby C even and C noise reductions are included, and the with the inherently-quiet BASF Chrome II. which is excellent. We noted that the recorder 'whined' acoustically even in the stop mode,

Replay azimuth in both directions was spooling, and transfer between functions is acceptably set. Head penetration was good, but one of the guides was slightly high. The Additional front-panel switches include MPX reverse head height accuracy was poor. Torque the replay amplifier clipping margin was excellent. Output for Dolby level was average, but the meters under-read by one segment. Replay responses were very accurate to the

Maxell UD produced quite good overall The fluorescent bargraph metering system response charts, but showing a tendency towards slight bass loss, which was noted no better than a VU meter - which is a shame subjectively. Response was well maintained up for it shouldn't have cost much more to have to 15kHz and was fairly even. Tests showed

reasonable distortion measurements across the board, overall noise measuring well throughout. The quality sounded good, but was not in the top class. The modulation noise plots give a very poor result, showing strange noise bumps around the causatory tone.

BASF Chrome II penned very flat charts without Dolby, but the anticipated valley in the presence region was noted because of the Dolby record sensitivity being low (-2dB). Subjectively, most programme material sounded slightly thin because of this, and some compression of peaks around 3kHz was noted. Overall measurements were a little bit poorer than expected for Chrome II. but background noise was always extremely low, which is very creditable. TDK SA (old formulation) at its best gave some excellent sound quality, but we noted uneven responses on left and right, so in the lab the pen charts were made on Maxell XLII which showed an even response with an HF tilt up, strongly accentuated with Dolby C in. Stability was good on chrome but better on pseudochrome.

TDK MA metal penned good charts, but just marginally uneven at extreme HF. Again, slight bass loss was noted with Dolby out, but Dolby C charts were not good. At 315Hz, MOL was just adequate, but HF saturations were good, and superb with Dolby C, overall weighted **OVERALL FREQUENCY RESPONSES** noise measurements all being excellent. Very slight roughness was heard on speech and very high level signals, but at best the sound was excellent. Just occasionally we thought we could hear slight Dolby C transition problems, and curiously also sometimes on L Dolby B, although the noise reduction circuits were clearly better than the early ones were.

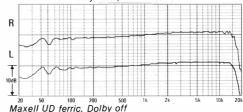
Wow and flutter measurements in both directions could only be described as adequate by today's standards, and slight flutter was noticed during the test programme, but this was not considered serious. Speed in both directions averaged 1.6% fast, which could agonise musicians. Spooling was a little

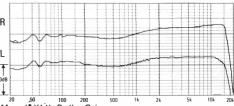
This machine is much more expensive than the HX3, and because of this it receives a recommendation, only if you require the reverse direction facility which is quite useful. The machine was reasonably well set up, but the metering is not good enough, and I do miss a normal record level control. Not a bad machine, though, if you want the special facilities.

GENERAL DATA			
Replay azimuth deviation from average,		–	25°
Line input sensitivity		9	1mV
Line input sensitivity  Worst audible replay hum component	65 1d	B (5)	)Hz)
Replay noise ferric CCIR/ARM weighted (NR out)	-	- 50	8dB
Poplay poice observe position CCID/ADM			
weighted (NR out)	_	- 63	1dR
weighted (NR out)		± 1	5dB
May replay level for DI		. T 1	0.54
Max replay level for DL			U.5V
Coard suggest average (peak weighted DIN)		∪.	60/
Speed average		. + 1	.070
Meters under-read – bdB on b4ms, –	- 20aB	on	8ms
Overall 10kHz sat ferric L/R ref DL Overall Dolby C 10kHz sat ferric L/R ref DL	- 5.6/	- 1.	9aB
Overall Dolby C 10kHz sat ferric L/H ref DL	-2.//	- 1.	9 <b>d</b> B
Overall MOL ferric L/R for 5% dist @			
315Hz ref DL Overall 10kHz sat, chrome position L/R ref DL	+ 5.8/	+6.	3dB
Overall 10kHz sat, chrome position L/R ref DL	-6.0/	<b>-</b> 6.	.0dB
Overall 10kHz sat, Dolby C, chrome, L/R ref DL	-4.3/	- 3.	.8dB
Overall MOL chrome L/R for 5% dist @			
315Hz ref DL	+4.6/	+ 4.	.8dB
Overall 10kHz sat metal L/R ref DL	-1.7/	-1.	3dB
Overall 10kHz sat, Dolby C, metal L/R ref DL	+ 1.	2/+	2dB
315Hz ref DL	+5.2/	+5	2dB
Overall noise ferric NR out (CCIR/ARM) ref DL		- 50	2dB
NR improvement Dolby B/C	10 4	4/19	7dB
Overall noise chrome NB out (CCIB/ABM) ref DI	-	- 55	4dB
NR improvement Dolby B/C	10 4	1/19	3dB
Overall noise metal NR out (CCIR/ARM) ref DI		52	5dB
NR improvement Dolby B/C	10	1/10	7dB
Overall MOL metal LIH for 5% dist @ 315Hz ref DL.  Overall noise ferric NR out (CCIR/ARM) ref DL NR improvement Dolby B/C.  Overall noise chrome NR out (CCIR/ARM) ref DL NR improvement Dolby B/C.  Overall noise metal NR out (CCIR/ARM) ref DL NR improvement Dolby B/C.  Modulation noise ferric broad/close	10	*/ 13	., 40
ref 3kHz tone	36 5/	24	24B
Line input noise floor, gain min ref DL (CCIR/ARA	A) -	80	6dB
Line input noise floor ref 160mV/DL (CCIR/ARM)	1/	75	ODD.
Charling time (COO)	2	- 73.	duo
Spooling time (C90)	2 IIII	77/7	250
Naise reduction eveters	/2/	1///	IND
Noise reduction systemMaxell UD/BASF	D	JIDY.	B/C
rapes useumaxell UD/BASF	CH II/	IUK	MA.

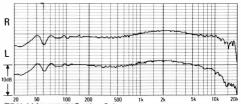
Typical retail price..

at - 20dB ref Dolby level, MPX filter off





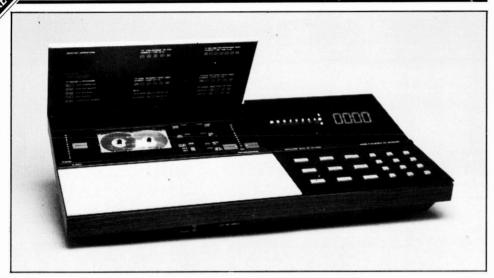
Maxelf XLII, Dolby C in



TDK MA metal, Dolby C in

## Bang & Olufsen Beocord 8004

Bang & Olufsen (UK) Ltd, Eastbrook Road, Gloucester GL4 7DE Tel (0452) 21591



This new B & O deck follows on from their 8002 model, the first to incorporate Dolby HX Professional, which was actually designed by B & O engineers. A 7-pin DIN socket on the rear, which can accept 5-pin leads, is intended for direct interconnection with other B & O equipment. This is complemented by a normal 5-pin DIN socket on the front, switchable to mic in, or auxilliary in, a third switch position transferring the input to the back socket. Underneath the chassis are output level presets and MPX filter switch.

The machine is very much dependent on a microprocessor for its operation, a keypad on the front allowing some excellent and useful facilities. All the normal tape functions work admirably, and additionally there is the facility of going to any desired timing point on the tape, the tape counter being in real time even during spooling. The machine calibrates itself automatically for tape thickness as well, and can give you time elapsed.

Bias and equalisation are switched automatically, but a metal switch is provided for over-ride when necessary. Separate faders control left and right record input levels, but these can easily be brought up together with one hand. A separate ganged fader adjusts stereo headphone levels, the ¼in stereo jack on the front giving more than enough volume for all normal types. A built-in digital clock is provided, along with push buttons for using it

to start and stop recording at any desired times. A three-position switch selects Dolby off, B or C noise reduction, Dolby HX Pro being permanently effective on record. A record safety lock is provided for absent-minded audiophiles!

Microphone inputs are via the DIN socket on the front, but no adaptor was provided to allow ¼in jacks to work with it. The auxilliary input sensitivity was quite high, but no clipping problem was noted, distortion being very low here. The DIN input was quite normal, but with lower noise than of old. The noise floor on the input circuitry was adequate, but not very good considering Dolby C requirements.

The bargraph-type meters read normal transients very accurately, but underestimated very short ones. Their resolution was rather poor, and the response was equalised, unfortunately, which may make them difficult to interpret.

Replay azimuth was set reasonably accurately, but head heights were not so accurate. Replay amplifier noise measurements were generally good although with Dolby C, noise did not go down sufficiently. Replay hum measurements were superbly low, and the replay clipping margin was very good.

Output levels were quite normal, but headphone output potential showed that you could almost damage your brain! Replay

response tests revealed, unfortunately, that B & O adhere to the aged and incorrect DIN responses, HF being down by 1½dB or so.

GENERAL DATA Replay azimuth cline input sensit worst audible reg

We listened to Maxell XLI, and our entire test programme reproduced superbly well with an apparent flat response and wonderful openness, 'superb' being frequently written by the listeners. Measurements on Maxell UD were excellent for the tape type, HX Professional clearly giving a very fine top end.

Overall noise measured well without Dolby, but the left-channel Dolby circuits seemed a little noisy, and even the right channel failed to achieve the full expected low noise. Modulation noise measured very well, and responses were very flat indeed, with just a slight tilt up at extremely high frequencies, which most like.

Although there was a negative 2.4dB Dolby error on BASF *Chrome II*, the subjective quality produced on this tape was good throughout, although a response valley in the presence region was noted subjectively. Measurements of MOL and saturation were good for the tape type, and overall dynamic range measured extremely well without Dolby — but on the left channel Dolby *B* gave only 6dB improvement, Dolby *C* giving only 10dB noise reduction approximately left channel, and on the right only 16.5dB. Responses on Maxell *XLII*, which was more sensitivity-compatible, were very good indeed.

TDK MA metal gave excellent pen charts, and was also audibly superb throughout, the sound quality being highly praised. The low frequency MOL was very mediocre for metal however, but HF saturation measurements were fantastic, thus showing a slightly odd bias compromise. Overall noise levels on the left channel were again poor, but the right channel was satisfactory. There was clearly something strange about the left channel noise performance throughout.

Wow and flutter measured well, and none was heard on the programme. Playback speed was so accurate that it was right down the centre line of our special test tape, which is outstanding. Spooling speed was average, and torque was on the low side and with only very mild juddering.

This deck in general performed extremely well throughout and we very much liked it, although the noise performance showed that there must have been a sample fault. Clearly recommendable for B & O people, but a deck that might be awkward to interface in some other installations, although well worth trying because of its *HX Professional* facility, built-in timer and other features.

Replay azimuth deviation from average	+ 20°
Line input sensitivity	55.2mV
Line input sensitivity	- 72.6dB (100Hz)
Replay noise ferric CCIR/ARM weighted (NR or	ut) 61.2dB
Replay noise chrome position CCIR/ARM	,
weighted (NR out)	- 64 6dB
Replay amp clipping ref DL	13dB
Max replay level for DL	
Wow and flutter average (peak weighted DIN)	0.089/-
Speed average	
Meters under-read	= 9dP on 9ma
Overall 10kHz sat ferric L/R ref DL	OUD UII OIIIS
Overall Delby C 10kHz and forcial /B ref DI	1.9/ - 2.50 5
Overall Dolby C 10kHz sat ferric L/R ref DL	+ 1.0/ + 0./00
Overall MOL ferric L/R for 5% dist @	
315Hz ref DL Overall 10kHz sat, chrome position L/R ref DL	+ 5.3/ + 5.80B
Overall 10kHz sat, chrome position L/H ref DL	4.6/ - 4./dB
Overall 10kHz sat, Dolby C, chrome, L/R ref DL	– 2 <i>J</i> – 2.2dB
Overall MOL chrome L/R for 5% dist @	
315Hz ref DL Overall 10kHz sat metal L/R ref DL	+ 4/ + 4.4dB
Overall 10kHz sat metal L/R ref DL	+ 1.5/ + 1.8dB
Overall 10kHz sat, Dolby C, metal L/R ref DL	+ 4.8/ + 5dB
Overall MOL metal L/R for 5% dist @	
315Hz ref DL Overall noise ferric NR out (CCIR/ARM) ref DL	+ 4.5/ + 4.8dB
Overall noise ferric NR out (CCIR/ARM) ref DL	51.9dB
NR improvement Dolby B/C	10.7/18.6dB
Overall noise chrome NR out (CCIR/ARM) ref DL	56.4dB
NR improvement Dolby B/C	
Overall noise metal NR out (CCIR/ARM) ref DL.	53.5dB
NR improvement Dolby B/C,	8 9/17 9dB
Modulation noise ferric broad/close	
	40.0/ 27.740

Line input noise floor, gain min ref DL (CCIR/ARM)..... - 73.7dB

76/77/76dB

Dolby B/C

Maxell UD/BASE CR II/TDK MA

#### **OVERALL FREQUENCY RESPONSES**

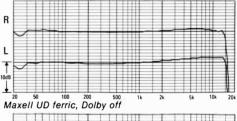
Line input noise floor ref 160mV/DL (CCIR/ARM)...

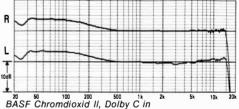
at - 20dB ref Dolby level

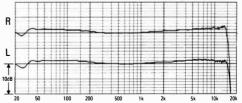
Dynamic range ferric/chrome/metal.

Spooling time (C90)...

Noise reduction system.





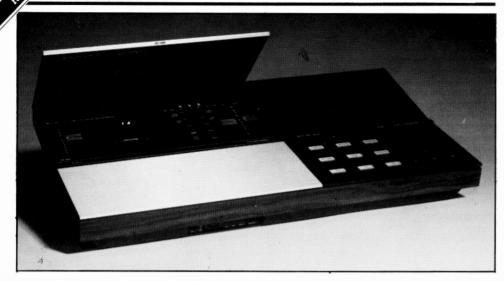


TDK MA metal, Dolby C in

REVISED AND REPRINTED

Bang & Olufsen Beocord 9000

Bang & Olufsen (UK) Ltd, Eastbrook Road, Gloucester GL4 7DE Tel (0452) 21591



This latest deck from the Bang & Olufsen stable is quite the most remarkable that I have vet seen, being almost completely microprocessor-controlled throughout. A combination record and replay head is fitted, but no off tape monitoring is provided. Dolby B and C noise reduction systems are complemented by B & O's patented HX Professional system (developed from Dolby HX) which works very well. DIN interconnections on the back and front allow for normal DIN inputs and outputs and alternative high-level DIN, the choice of either a DIN socket of a stereo jack being available for mic input. A stereo jack with its own level fader provides ample volume for all normal headphones. The 'amplifier' DIN. although five-pin-compatible, has additional pins for remote operation/control with other B & O equipment.

The deck is most unusually styled, with the main pushbutton controls on the front right, in the form of a calculator-type keyboard. In addition to all normal deck functions, these allow tape playing time calibration for the counter (elapsed or time-to-go can be displayed), 'go to' (selects any desired timing point for access), and almost any other function that you might imagine, including cycling and a vast memory facility.

Tape calibration and setting-up is automatic and fast, and the built-in metering can indicate the tape MOL, normal levels, bias, sensitivity

and equalisation. The programme meters did not have good discrimination, whilst the 0dB point always indicated the tape's 2% distortion level at mid frequencies, but were heavily equalised. There is no room to detail further the amazing possibilities offered by the microprocessor control system.

The microphone inputs were very sensitive and quiet, whilst the DIN inputs were also very quiet, and various input switching options allowed great versatility of input level/impedance matching, the record levels being separate faders for left and right channels. Output levels are adjustable, and if these are set too high, clipping might result, but set to 500mV the replay clipping margin was really excellent, distortion in the electronics being generally low.

Replay azimuth was very accurately set and in any case, B & O supply an azimuth tape. Head heights were also accurately set.

The latest BASF Ferro Super LH I ferric gave excellent low frequency MOLs, but high frequency saturation was good rather than outstanding — although Dolby C improved it to excellent. Overall noise measurements were average without Dolby, and showed very good Dolby improvement. Frequency responses were very good throughout, with only minor deviations (some cheap tapes also gave amazing charts). Modulation noise was quite reasonable, and sound quality throughout

superb, provided one watched the meters GENERAL DATA Replay azimutho Lipe input sensit

BASF Superchrome CRS II gave excellent MOLs and a good high frequency saturation particularly with Dolby C, but 3.15kHz MOL' was poor due to the tape's characteristic. As expected, this tape produced an amazingly low overall noise, with good Dolby improvement, and thus high recording levels are totally unnecessary. Responses showed a slight presence valley with extremely high frequencies marginally up, although the sound quality seemed very open, smooth and generally excellent modulation noise being just average.

TDK MA metal gave fairly good MOLs, but was very good at high frequency, and outstanding with Dolby C. Overall noise measurements were all good, and responses excellent with just a slight rise at extremely high frequencies. Sound quality was superb throughout, very open and clean. The Dolby C circuits gave an average dynamic distortion performance. Replay amp noise measurements were all good, but mysteriously the right channel was even quieter than the left on two different samples.

Wow and flutter measured very well indeed, none being heard on the programme, whilst speed was as accurate as we could check! Spooling time was slightly faster than average and no tension problems were noted.

The original sample delivered to me for review had given an even better performance throughout, but a problem developed in the record feed circuitry, and at very short notice a B & O dealer helped out with the second sample used for many of the measurements (thanks to Rex Radio). Their sample had been well used, and yet gave the good overall main measurements and charts shown here, which in a way is a useful test. The early sample fault caused all MOLs and saturation results to degrade by over 3dB throughout, but we could not find the cause.

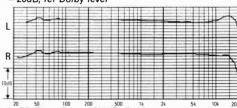
It is a pity that the UK model totally excludes phono sockets, whereas the US one has these. But the US version is of course only for 110V mains, so you can't win. I am full of praise for this deck, and whilst basic instructions are actually written under the hinged lid of the cassette compartment you will need to study the manual for some time with much concentration to gain the full benefits of operation.

Though at the price we can no longer list this model as one of the best buys it is still highly recommended. It employs some extremely advanced technology, and is superb to use once you understand it. Very much a 'B & O person's machine', a model which further enhances the Danish company's prestige.

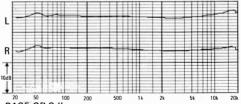
t	Replay azimuth deviation from average
1	Replay noise chrome position CCIR/ARM weighted (NR out)
.'	weighted (NR out)
ò	Replay amp clipping ref DL+ 15.5dB (see review)
,	Max replay level for DLup to 1.85V (see review) Wow and flutter average (peak weighted DIN)0.07%
	Speed average
,	Meters under-read
/	Overall 10kHz sat ferric L/R ref DL
t	Overall Dolby C 10kHz sat ferric L/R ref DL 3.5/ - 3.5dB
-	Overall distortion ferric L/R for 5% dist
,	@ 315 Hz ref DL+7.4/ + 7.6dB Overall 10kHz sat chrome position L/R ref DL6/ $-$ 5.5dB
'.	Overall Dolby C 10kHz sat chrome position L/R
/	ref DL
	Overall dist chrome position L/R for 5% dist
t	@ 315Hz ref DL+ 7.6/+ 6.6dB
	Overall 10kHz sat metal L/R ref DL
	Overall Dolby C 10kHz sat metal L/R ref DL + 2.5/ + 2.5dB
,	Overall distortion metal L/R for 5% dist @ 315Hz ref DL
3	Overall noise ferric NR out (CCIR/ARM) ref DL – 50.0dB
/	NR improvement Dolby B/C10/19.0dB
)	Overall noise chrome NR out (CCIR/ARM) ref DL 57.0dB
	NR improvement Dolby B/C
•	Overall noise metal NR out (CCIR/ARM) ref DL – 51.8dB
1	NR improvement Dolby B/C
-	Modulation noise chrome broad/close ref
t	3kHz tone - 35/ - 32dB
)	3KHz tone
•	Spooling time (C90)
	Dynamic range ferric/chrome/metal77.5/83/78dB
,	Noise reduction systemDolby B/C/HX Professional Tapes usedBASF FSLH1/BASF CRSII/TDK MA
t	Typical retail price£675 when reviewed, now £650
1	.,p.ca

#### **OVERALL FREQUENCY RESPONSES**

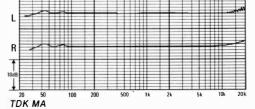
- 20dB, ref Dolby level



BASF Ferro Super LH1, Dolby C in



BASF CR-S II



Denon DR-M2

Hayden Laboratories Ltd, Churchfield Road, Chalfont St Peter, Bucks SL9 9EW Tel (0753) 888447



The Denon DR-M2 is clearly a 'budget' threehead deck, as it offers off-tape monitoring but is not cluttered with relatively rarely-used additional facilities. Encased partly in metal, partly in plastic, it is handsomely styled with almost all the tape deck functions behind a plastic membrane on the front panel.

Record level faders are sideways-acting long-throw types, acting independently and very smoothly for left and right. They are complemented by a ganged short-throw replay gain fader which also controls headphone volume, a ¼in jack giving plenty of volume into all normal headphone types. Line in/out phonos are neatly countersunk on the back panel which also incorporates a remote control socket, the mains lead being a captive two-core type.

Front panel buttons select MPX filter, Dolby B and C noise reduction, tape/source monitoring, cassette tape length (for operating the real-time tape counter) and switching for the counter to indicate remaining time or normal numbers. The fluorescent bargraphtype meters read transients very accurately and they had a useful hold time allowing you to see peaks properly with average discrimination. The deck will not drop into record from playback, and the pause control cannot re-start a function, although you can consistent all the way through, with excellent transfer from play into spooling and back.

Microphone inputs feed input amplifiers

with acceptable sensitivity and with reasonably quiet circuitry. The line inputs were reasonably sensitive and no clipping problem was encountered, distortion being particularly low through to the monitoring circuits. Input noise was slightly higher than average. particularly with the faders well up.

Replay azimuth was not very accurately set, which is a pity. Replay amp hiss levels measured very well, and hum levels were amazingly low although we noted a 24Hz component of noise at -65.5dB which was odd. Replay responses were well in accordance with the new IEC curves and the clipping margin was excellent, the available maximum output levels being slightly higher than usual. Meter indication was marginally too high on the right channel.

Maxell XLIS penned very good charts with iust a slight boost at extreme HF — we were asked by the importers too use this tape rather than UD. Subjective quality throughout was excellent and well above average. LF MOL measured extremely well but the bias compromise was slightly on the high side, and so HF saturation was good rather than exceptional, unless Dolby C was switched in. Modulation noise was poorer than average, but background noise measurements were very noise reduction on Dolby C.

BASF Chrome II worked particularly well

with this deck giving some superb sound GENERAL DATA quality provided the peak levels were watched carefully. Distortion was normal for the tape type and background noise measurements were all excellent. Maxell XLIIS generally sounded a little bright but the sound was exciting, and quality throughout was excellent. Responses on chrome and pseudochrome were all very good, chrome actually measuring a little better, particularly with noise reduction switched in.

Maxell MX metal produced a slight positive Dolby error, so, whilst Dolby-out pen charts were very flat, some bass and EHF loss was seen. Distortion measurements were very good across the board, HF saturation results being incredible. Overall quality was superb and background noise measurements were all excellent. This machine was quite well aligned throughout and is clearly a credit to Denon, although we might ourselves have chosen to have slightly more bias for metal.

Although wow and flutter measurements were all excellent, we thought we could hear slight flutter on piano once. Speed was superbly accurate and spooling time just marginally slow. Torque was slightly high and some juddering was noted, which could cause occasional momentary flutter.

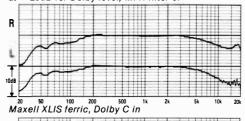
This deck has done remarkably well for an inexpensive three-head model, and Hayden Laboratories, now the importers of Denon, are to be congratulated. The DR-M2 has to be a R Best Buy in its class, and is warmly recommended. We must particularly commend good metering and good sound quality with excellent ergonomics.

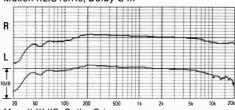
GENERAL DATA		
Replay azimuth deviation from average	+	40
Line input sensitivity	68	3m
Worst audible replay hum component 72.2d	B(100	H
Replay noise ferric CCIR/ARM weighted (NR out)	- 56.	3ď
Replay noise chrome position CCIR/ARM		
weighted (NR out)	- 59.2	2d
weighted (NR out)	+ 15.5	5d
Max replay level for DL		8.0
Max réplay level for DL	0.0	6%
Speed average	no e	rrc
Speed average	B on 8	3m
Overall 10kHz sat ferric L/R ref DI = 4.7	1 - A :	ในโ
Overall Dolby C 10kHz sat ferric L/R ref DL 1	.1/ - 1	1d
315Hz ref DL+8.4 Overall 10kHz sat, chrome position L/R ref DL5.0	1 + 7.6	6dl
Overall 10kHz sat, chrome position L/R ref DL, 5.0	l - 5.0	Dα
Overall 10kHz sat, Dolby C, chrome, L/R ref DL 1.7	7 - 1.8	Bdl
Overall MOL chrome L/P for 5% diet @		
315Hz ref DL+ 5.2	1 + 4.5	5dl
Overall 10kHz sat metal L/R ref DL+ 2.8	1 + 2.2	2d
315Hz ref DL	/ + 6.0	Dd
315Hz ref DL+ 8.4	1 + 7.9	9dI
Overall noise ferric NR out (CCIR/ARM) ref DL	- 49.7	7dl
NR improvement Dolby B/C10.	3/19.5	5dl
Overall noise chrome NR out (CCIR/ARM) ref DL	- 54.2	2dl
NR improvement Dolby B/C	0/18.2	2dE
Overal i MOL metal L/H for 5% dist @ 315Hz ref DL	- 50.4	ldE
NR improvement Dolby B/C	3/19.5	5d E
Modulation noise ferric broad/close ref 3kHz tone 34.5/ Line input noise floor, gain min ref DL (CCIR/ARM)		
ref 3kHz tone	- 32.1	ldE
Line input noise floor, gain min ref DL (CCIR/ARM)	- 75.7	ď
Line input noise floor ref 160mV/DL (CCIR/ARM)	- 72.5	odl
Spooling time (C90)	in 00 s	se
Spooling time (C90)	177178	BdE
Noise reduction systemD	olby I	B/C
Noise reduction system	axell	M)

#### **OVERALL FREQUENCY RESPONSES**

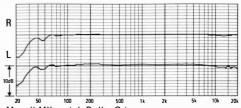
Typical retail price..

at - 20dB ref Dolby level, MPX filter of





Maxell XLIIS, Dolby C in



Maxell MX metal, Dolby C in

a

Dual C844

Hayden Laboratories Ltd., Hayden House, Chiltern Hill, Chalfont St Peter, Bucks. Tel. 0953 888447



This top-of-the-range deck from Dual has both Dolby *B* and *C* noise reductions systems, offers two tape speeds and incorporates a combination head which allows off-tape monitoring. Phono line inputs and outputs on the rear panel are complemented by a five-pole DIN socket to normal DIN specification, with an additional DIN socket giving an off-tape monitoring signal. Separate friction-locked rotary record level controls are provided for line/DIN and mic inputs, thus allowing mixing if required.

A series of push buttons select tape or source monitoring, 9.5 or 4.8 cm/sec tape speed, repeat function, auto-space (assisting music search), fade edit (switching on, and level up and down, allowing re-recording over an existing one with fade), counter set, memory and reset (digital counter). Rotary switches select tape type (medium/high bias ferric, chrome/pseudochrome, ferrichrome and metal), Dolby off/B/C, and remote mains timer play/record.

The deck itself is open at the front, a cover coming over the heads to protect them when the mains is off. Cassette loading is both simple and rather cunning. Metering is provided with two VU meters which under read badly, but are complemented by four mono LED peak indicators. These peak LEDs are fast, but indicate the equalised head signal. The first review sample was so badly aligned

that we requested a second one, properly set up — the original sample had grotesque Dolby errors of up to 4dB!

Deck functions allow you to move straight from play into wind and back, pause stopped but did not restart. It is also possible to go from play into rewind, starting programme search, but with much clanking, all operations being fairly slow and noisy. To enable source monitoring, record and pause also have to be selected, which is annoying.

The microphone inputs (¼" mono jacks) were rather insensitive, and slightly noisy, whilst the DIN input was a little noisy too, and a little insensitive. (The effective input impedance was too low, thus attenuating the DIN source level too much). The line inputs were fairly sensitive, but slightly hissier than average for a Dolby C deck, no clipping problem being noted though. Output levels were average and not adjustable, headphones being driven from a 1/4" stereo jack. All headphone types were on the loud side using this output. Replay azimuth was very accurately set, head and guide heights being fairly accurate. Very slight hum was noted on the right channel on replay, but hiss levels were low. Replay amp distortion was reasonable at all normal levels, but increased over quite a range up to the clipping point, which was at a very high level.

Maxell UDXL I ferric produced excellent

MOLs, but poor saturation results, although Dolby *C* improved the latter to acceptability. Overall noise was slightly high, but both Dolby *B* and *C* gave good improvements. Modulation noise was minimal, and frequency responses without Dolby very good, although Dolby *C* caused a slight high frequency loss on the left, and a marked one on the right. Subjective quality was very good indeed throughout the test programme, *XL IS* showing a slight high frequency lift, whilst *UDXL I* did produce a predictable HF loss.

Maxell XL IIS pseudochrome gave acceptable MOLs and high frequency saturation, the saturation results improving to good with Dolby C. Overall noise measurements were all quite satisfactory, modulation noise being low. Frequency responses measured well throughout. Although the slight very low frequency loss was mildly criticised subjectively, quality throughout was thought excellent and well above average up to moderate peak levels, higher ones probably being restricted by the MOL capability of the tape.

Fuji Metal gave good MOLs and very good high frequency saturation levels, overall noise measurements being average throughout. Responses were smooth but a little up at high frequencies. Tape-to-head stability was criticised, on the metal tape, but was acceptable on the other types. The chrome II position Dolby calibration was clearly optimised between chrome II and pseudochrome cassettes, which might be useful. The Dolby C circuits gave no dynamic distortion problems on speech, but French horn showed up some distortion here, the circuits being considered slightly better than average.

Wow and flutter measured reasonably well at normal speed, and superbly well at double speed (performance at 9.5 cm/sec being very good throughout). Speed was marginally slow and spooling times very slow, with back tension slightly high, but otherwise tensions were satisfactory.

I liked this machine very much, and it offers some excellent facilities and sound quality for its price, but whilst I am delighted to give a European machine a best buy, I must advise extreme caution in purchase, and you should check your sample for Dolby record calibration accuracy.

Replay azimutii deviation from average4
Line input sensitivity
Worst audible replay hum component – 64dB (150Hz
Replay noise ferric CCIR/ARM weighted (NR out) – 58.8dE
Replay noise chrome position CCIR/ARM
weighted (NR out) 62.0dE
Replay amp clipping ref DL + 13.0/ + 17.0 (see review
Max replay level for DL515m\
Wow and flutter average (peak weighted DIN)0.1%
Speed average pour weighted bitty
Speed average         - 0.5%           Meters under-read         7dB on 64ms 25dB on 8ms
Overall 10kHz sat ferric L/R ref DL 8.5/ - 9dB
Overall Dolby C 10kHz sat ferric L/R ref DL 6.5/ - 7dB
Overall distortion ferric L/R for 5% dist
@ 215 Harrof DI
@ 315 Hz ref DL+7.6/+7.6dE Overall 10kHz sat chrome position L/R ref DL6.5/-6.5dE
Overall Dolby C 10kHz and abroma position L/D
Overall Dolby C 10kHz sat chrome position L/R ref DL
Out of the state o
Overall dist chrome position L/R for 5% dist
@ 315Hz ref DL+5.0/+4.6dB
Overall 10kHz sat metal L/R ref DL0/0d8
Overall Dolby C 10kHz sat metal L/R ref DL + 2/ + 2dE
Overall distortion metal ∠R for 5% dist
@ 315Hz ref DL
Overall noise ferric NR out (CCIR/ARM) ref DL – 50.0df
NR improvement Dolby B/C
Overall noise chrome NR out (CCIR/ARM) ref DL 53.2d8
NR improvement Dolby B/C9.8/17.2df
NR improvement Dolby B/C
NR improvement Dolby B/C
Modulation noise ferric broad/close ref 3kHz tone - 43/ - 35dl
Modulation noise chrome broad/close ref
3kHz tone       - 42/ - 38dl         Line input noise floor ref 160mV/DL (CCIR/ARM)       - 76.8dl         Spooling time (C90)       2m 35
Line input noise floor ref 160mV/DL (CCIR/ARM) 76.8d8
Spooling time (C90)
Dynamic range ferric/chrome/metal76/76/78df
Noise reduction system Dolby B/0
Noise reduction systemDolby B/C Tapes used Maxell UDXL1/Maxell UDXL IIS/Fuji Meta
Typical retail price £280 when reviewed, now £325
Typical rotal price

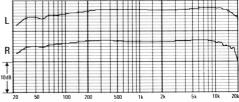
Replay azimuth deviation from average.....

#### **OVERALL FREQUENCY RESPONSES**

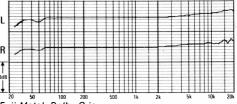
GENERAL DATA

- 20dB, ref Dolby level

Maxell UDXL I, Dolby C in



Maxell UDXL IIS, Dolby C in



Fuji Metal, Dolby C in

## Hitachi DE-44

Hitachi Sales (UK) Ltd. Hitachi House, Station Road, Hayes, Middlesex UB3 4DR Tel 01-848 8787



This front loading deck incorporates both indicated levels unfortunately. The microphone Dolby B and Dolby C noise reduction making use of Hitachi's combined new B/C micro chip. Having just basic functions, the *D-E44* is fairly compact. But as well as the usual pairs of phono sockets for line input and output, the rear panel also carries a ganged output level

The 1/4" stereo headphone jack delivers a impedance headphone models, but high impedance ones will be too quiet.

A large friction-locked rotary control is fitted for record level, along with switching for line/mic inputs. Pushbuttons select cassette tape types 1, 2 and 4 (well labelled), Dolby on/off, Dolby B or C, and tape counter reset. A three-position switch selects remote play/record start.

Deck functions all worked well, being solonoid operated, and permit transfer from play into wind and back, dropping into record but not out. The pause control can be used for stopping but not for restarting a function, and a record mute button is provided. Whilst the machine is extremely well laid out and presented, it is obviously made to a price — for example the phonos and replay presets are really severe. Overall noise was good without board-mounted, and thus rather floppy.

Metering is by extremely fast acting LED bargraph indicators, but these offer only 12

inputs (1/4" mono jacks) did not have sufficient gain, and input noise was only fair, and in using Dolby C slight transient distortion was noted in the crosstalk. The line inputs were fairly sensitive and no clipping problem was noted, although the input circuitry was slightly preset, and a DIN remote-control socket is noisier than usual, thus limiting the Dolby C noise improvement.

Replay azimuth was extremely accurate, but fixed level, about the right volume for low the replay tape guide was set a little high. Head penetration into the tape was perhaps slightly insufficient, being at the extreme of its tolerance. Replay noise without Dolby measured very well, but Dolby C improvement was not quite sufficient. Replay distortion and clipping margins were excellent, showing the new Hitachi chip to be very good here. Output level for Dolby level was average and from a fairly low source impedance. A non-switchable MPX filter is built in, incidentially.

> Hitachi ER ferric tape gave good MOLs at low frequencies and acceptable high frequency saturations for the tape type. Overall, the pen charts showed a very smooth HF response throughout, but low frequency variations (including bass 'woodles') were slightly more noticeable than usual, but not Dolby, the noise reduction improvement also being good. Subjective quality was very good indeed up to a fairly high recorded level, above

which distortion set in rather rapidly. But this is not a problem with Dolby C, since you needn't record at a very high level for good dynamic range. Modulation noise was low, but stability was only fairly good.

Hitachi EX (pseudochrome) penned extremely good charts without Dolby, and only a slight presence droop was noted with Dolby C, which is a good result. Low frequency MOLs measured badly, but high frequency saturation results were good. Some head saturation was noted on the lab charts, and the reproduced quality of loud levels was severely criticised. Overall noise was very good without noise reduction, but the input noise clearly affected the maximum improvement with Dolby C, which was only averaging 17dB. Modulation noise however was low. Dolby C action in general showed far less transient problems than usual, so Dolby have clearly fixed some of the early troubles.

Maxell MX metal gave acceptable MOLs and good saturations for a two head deck. The pen charts showed a slight drop at high frequencies which was a little emphasised with noise reduction. But this was not disturbing subjectively, a slight presence droop receiving only very mild comment. Overall noise was average, with 18dB improvement given by Dolby C.

Wow and flutter measured well, and was not a problem subjectively. Speed was just over 1% fast, whilst spooling was slightly faster than average. Play tensions were slightly jerky. This machine can give some very good overall quality if the recording levels are watched carefully particularly on ferric and metal, but could not find out why pseudochrome required a low level. This is not too serious though with Dolby C. The meters were very fast and this helps matters.

The machine was liked ergonomically and considering that the Dolby C circuits worked well, this model seems a reasonably good buy, but Hitachi really must look into their record electronics/record head saturation problems. A recommendable Dolby C budget model.

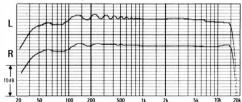
#### GENERAL DATA Replay azimuth deviation from average

neplay azillutli deviation from average
Line input sensitivity90mV
Worst audible replay hum/component 63dB (50Hz
Replay noise ferric CCIR/ARM weighted (NR out) 59.6dB
Replay noise chrome position CCIR/ARM
weighted (NR out)62.6dE
Replay amp clipping ref DL+ 16.5dB
Max replay level for DL500mV
Wow and flutter average (peak weighted DIN)0.10%
Speed average+1.2%
Meters under-read
Overall 10kHz sat ferric L/R ref DL
Overall Dolby C 10kHz sat ferric L/R ref DL
Overall distortion ferric L/R for 5% dist
@ 315 Hz ref DL+ 6.4/ + 5.6dB
Overall 10kHz sat chrome position L/R ref DL – 5/ – 5.5dB
Overall Dolby C 10kHz sat chrome position L/R
ref DL
Overall dist chrome position L/R for 5% dist
@ 315Hz ref DL
Overall 10kHz sat metal L/H ref DL+ 0.5/+ 00B
Overall Dolby C 10kHz sat metal L/R ref DL + 4/ + 3.5dB
Overall distortion metal L/R for 5% dist
@ 315Hz ref DL+ 5.4/ + 4.2dB
Overall noise ferric NR out (CCIR/ARM) ref DL 51.0dB
NR improvement Dolby B/C
Overall noise chrome NR out (CCIR/ARM) ref DL 54.8dB
NR improvement Dolby B/C9.8/17.0dB
NR improvement Dolby B/C
NR improvement Dolby B/C10.0/18.2dB
Modulation noise ferric broad/close ref 3kHz tone
Modulation noise chrome broad/close ref
3kHz tone
Line input noise floor ref 160mV/DL (CCIR/ARM) 74.8dB
Spooling time (C90)
Dynamic range ferric/chrome/metal76.5/77/dB
Noise reduction system Dolby R/C
Noise reduction system
Typical retail price C135 when reviewed now C125

### **OVERALL FREQUENCY RESPONSES**

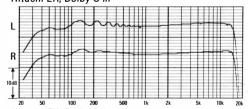
- 20dB, ref Dolby level

Typical retail price ......

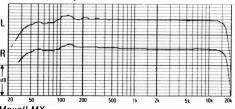


......£135 when reviewed, now £125

Hitachi ER, Dolby C in



Hitachi EX, Dolby C in



Maxell MX

REVISED AND REPRINTED

## Hitachi D-2200M

Hitachi Sales (UK) Ltd, Hitachi House, Station Road, Hayes, Middlesex UB3 4DR Tel 01-848 8787



Hitachi have had considerable success with their Automatic Tape Response System ('ATRS') in previous models, and this time they again have a winner. A three head (combination head) deck, the D2200M includes Dolby B and C noise reduction, and has just line in/out phonos and a remote control socket on the rear panel, with all operating controls on the front. Metering employs a fluorescent bargraph display which indicates peaks very accurately with good discrimination, and up to +8dB. High frequency peak lights are also included, which is excellent.

A friction-locked rotary record level control is complemented by a ganged replay gain control, which affects headphones level. The 1/4" stereo jack provides ample volume for all normal headphone types. Two counters provide indications of tape position (with reset), and of elapsed time. Pushbuttons select Dolby on/off, B/C, MPX on on/off, tape/source monitoring line/mic input, tape types 1 to 4 (well labelled), 'ATRS' tuning and fixed pre-set calibration. A three-position switch selects remote timer play/record. Auto memory rewind switching is also useful.

Tape deck functions are slightly slow in action but smooth (the controls are of the finger-touch type), and allow direct transfer from play into wind and back, and dropping into record. The pause stops tape movement but does not restart it. Cassette insertion was simple and the ergonomics liked. Lights indicate each main function as it is selected.

The microphone inputs (1/4" mono jacks) have insufficient gain, and are slightly noisy. although otherwise satisfactory. The line inputs have average sensitivity, no clipping problems, and a low input noise level. Output levels were just a little lower than usual, but the source impedance was also low, which is good.

Replay azimuth was in error (which will be noticeable on pre-recorded cassettes). Head/guide heights were reasonably accurate though. Replay amplifier noise measured very well, but marginal hum was noted at 150Hz with replay gain well up. Replay amp distortion and clipping performances were excellent.

'ATRS' calibration was used for setting all tape types in the tests. Hitachi SR ferric gave phenomenal low frequency MOLs and high frequency saturations, and whilst overall noise was a little hissier than usual, noise reductions achieved were good. Responses without Dolby were excellent, although with Dolby C, the right channel was slightly up at high frequencies, and some bass 'woodles' were noted throughout. Modulation noise measured extremely well, and sound quality was rated superb virtually throughout, the Dolby C circuits also being better than usual.

Hitachi SX pseudochrome gave good MOLs and saturation results, but was clearly not up to the fantastic ferric performance. Overall noise measured well with very good noise reduction on B. and fair with C. Responses were very good, but again showing bass 'woodles', and the right track slightly up at high frequencies. Modulation noise was good. Subjective quality was excellent, but the tape could not stand the highest levels as well as the ferric could. Stereo positioning was excellent throughout.

Maxell MX metal gave good low frequency MOLs, and phenomenal high frequency saturations! Pen charts were very good throughout, but showed the same bass 'woodles' again. Overall sound quality was rated superb throughout, and clearly better than metal on most decks. Whilst low frequency performance was bettered by the astonishing ferric, the high frequency end was fantastic - very open and clean. Overall noise was average, with reasonable Dolby improvement.

The wow and flutter performance was again phenomenal, one of the finest ever. Actual speed was only marginally fast, and spooling was reasonably fast. Tensions were wellcontrolled, being retained in the stop mode.

We all liked this machine very much indeed since it not only worked extremely well, but produced some phenomenally good sound quality. Its price is very reasonable indeed for its performance, and it is very strongly recommended as a best buy.

#### **GENERAL DATA** ine input concitivity

Line input sensitivityiumv
Worst audible replay hum component65dB (150Hz)
Replay noise ferric CCIR/ARM weighted (NR out) 61.2dB
Replay noise chrome position CCIR/ARM
weighted (NR out)64.2dB
Replay amp clipping ref DL+ 15.5dB
Max replay level for DL475mV
Wow and flutter average (peak weighted DIN)0.04%
Speed average+0.5%
Meters under-read
Overall 10kHz sat ferric L/R ref DL 1.5/ - 0.5dB
Overall Dolby C 10kHz sat ferric L/R ref DL+ 2/+ 3.5dB
Overall distortion ferric L/R for 5% dist
@ 315 Hz ref DL
Overall 10kHz sat chrome position L/R ref DL 3/ - 2dB
Overall Dolby C 10kHz sat chrome position L/R
ref DL+ 1/+ 2dB
Overall dist chrome position L/R for 5% dist
@ 315Hz ref DL+6.6/ + 5.8dB
Overall 10kHz sat metal L/R ref DL+2/+3dB
Overall Dolby C 10kHz sat metal L/R ref DL+6.5/+7dB
Overall distortion metal L/R for 5% dist
@ 315Hz ref DL+ 7.6/7.4dB
Overall noise ferric NR out (CCIR/ARM) ref DL 48.4dB NR improvement Dolby B/C
NR improvement Dolby B/C
OveralInoise chrome NR out (CCIR/ARM) ref DL – 52.4dB
NR improvement Dolby B/C10.8/17.4dB
Overall noise metal NR out (CCIR/ARM) ref DL 50.6dB
NR improvement Dolby B/C10.8/17.8dB
Modulation noise ferric broad/close ref 3kHz tone - 41/ - 37dB

Replay azimuth deviation from average.....

### 3kHz tone..... Line input noise floor ref 160mV/DL (CCIR/ARM).... - 81.2dB Spooling time (C90)..... Dynamic range ferric/chrome/metal.....77/77.5/77.5dB

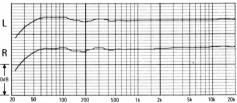
£330 when reviewed, now £350 Typical retail price ...

**OVERALL FREQUENCY RESPONSES** - 20dB, ref Dolby level

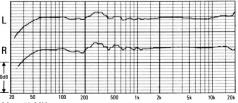
Modulation noise chrome broad/close ref



Hitachi SR, Dolby C in



Hitachi SX



Maxell MX

## VC KD-V22

JVC (UK) Ltd. 6-8 Priestley way, Eldonwall Trading Estate, Staples Corner, London NW2 7AF Tel 01-450 2621



Very modestly priced, the JVC KV-22B does incorporate both B and C Dolby noise reduction systems and is completely encased in metal. In other respects, this two-head deck is very basic. Line in/out phono sockets are clusted together on the rear, and the mains lead is, as usual, a two-core captive one. Two separate rotary record-level controls are provided for left and right inputs, and as these are spaced apart horizontally, they were easy to use, but difficult to bring up precisely together.

Lever switches are provided to select ferric. chrome and metal cassette tape types and noise reduction.

Meters consist of two rows of only five indicators per channel, thus having very poor discrimination, although peak levels were very accurately indicated if they fell within a segment. The only other front panel control. apart from deck functions, is the mechanical counter reset button. Despite JVC's description 'logic control', it was not possible to transfer from play into wind, although you could go from wind to play. However, the pause control does stop and restart play or record. Deck controls were found slightly clunky in operation.

Microphone inputs (1/4 in mono jacks) were reasonably sensitive and were quite quiet, although the response was slightly muffled from medium impedance microphones. The

line inputs were slightly less sensitive than average, but no clipping problem was noted, the input noise floor being very low, most commendable for a budget deck. The 1/4 in headphone socket gave too much level for low impedance headphones and high impedance types were still slightly too loud. A Dolby-level test tape lit up the +3dB segment on the meters but there is only one indicator step above this (3dB higher) and so the meter encourages you to under-record, unfortunately. I would have liked at least one more segment, perhaps 3dB higher still.

Replay azimuth was extremely accurately set, and head heights and penetration were all good, but one guide was slightly low. The replay amplifier clipping margin was poor. clipping occurring at only 9dB above Dolby level. Replay amplifier hiss levels were all very good indeed. A very slight hum on the right channel might just be noticed under some circumstances, but is not serious. The available audio output level was marginally on the low side, which is puzzling because of the poor clipping point. Replay responses were quite satisfactory.

Maxell UD gave very good LF and midfrequency MOLs, but HF saturations were perhaps a little poorer than they should have been. Overall noise measurements were all very good indeed, nearly 20dB noise reduction being given with Dolby C. The responses show

HF to be 2dB down at 10kHz without Dolby, an GENERAL DATA error which is considerably exaggerated with Dolby, showing the bias to be set rather too high. Overall subjective quality was liked throughout, although the lack of HF, and tendency to HF compression, were criticised Quite obviously, a very small adjustment of bias could have improved matters considerably. However, modulation noise was very poor.

BASF Chrome II gave a very marked negative Dolby error and produced a very muffled sound quality. Maxell XLII gave guite good MOLs, and HF saturations were reasonable. Responses were much better, but the extreme HF was still slightly down, especially on the right channel. Background noise measurements were all excellent, and overall quality was quite reasonable throughout, although the highest levels were just slightly gritty, so you should lower the recording level a little here.

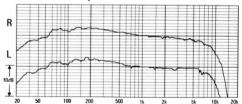
Maxell MX metal gave very good LF MOLs, especially for a two head deck, and 3.15kHz performance was also good. HF saturations were excellent, thus showing a good bias and equalisation compromise. It is ironical that the LF performance is actally limited by replay clipping! Overall noise measurements were excellent, as were responses to 15kHz. The subjective quality was also described as excellent and no problem was noted at all, which is amazing for a budget deck.

Wow and flutter performance measured a R little worse than average, but still good for the price - slight wow was heard once or twice on piano, but this was marginal. Speed was L slightly fast but spooling time rather slow. The torque was about right and there was only mild iudderina.

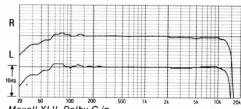
This deck was capable of giving some excellent overall sound quality and after much thought and discussion I think it well deserves a 'Best Buy' as it is such remarkable value for money. JVC need to pay a little more attention. though, to bias setting, particularly on the ferric position, but expensive ferrics including BASF LH Super I. Maxell XLIS. or TDK AD-X. together with, say, Maxell XLIIS for the chrome position, would have given a better performance. But these are all rather expensive, and this is a budget deck, so you may want to ask your dealer to tweak the bias for you. I rather liked this little workhorse, and it should do extremely well. Strongly recommended.

Boolay azimuth deviation from sucreas	
Replay azimuth deviation from average	0
Line input sensitivity	Jam.
Worst audible replay num component	50Hz
Replay noise ferric CCIR/ARM weighted (NR out) 5	7.6dB
Replay noise chrome position CCIR/ARM	
weighted (NR out) 6	1.6dB
Replay amp clipping ref DL	+9dB
Max replay level for Di	$\cap A_{V}$
Wow and flutter average (peak weighted DIN)0	.13%
Speed average+	0.5%
Meters under-read3dB on	8ms
Overall 10kHz sat ferric L/R ref DL = 7.6/ = 6	S 3dR
Overall Dolby C 10kHz sat ferric L/R ref DL	.0dB
Overall MOL ferric L/R for 5% dist @	
315Hz ref DL + 7.0/ + 7 Overall 10kHz sat, chrome position L/R ref DL 4.7/ - 4	.0dR
Overall 10kHz sat, chrome position L/R ref DL 4.7/ - 4	.5dB
Overall 10kHz sat, Dolby C, chrome, L/R ref DL – 2.0/ – 1	.4dB
Overall MOL chrome LIR for 5% dist @	
315Hz ref DI + 5 3/ + 5	9dR
Overall 10kHz sat metal L/R ref DL	8dB
Overall 10kHz sat, Dolby C, metal L/R ref DL + 3.9/ + 4	OdB
Overall MOL metal L/R for 5% dist @	.oub
315Hz ref DI + 8.7/+8	AP8
315Hz ref DL	DAB.
NR improvement Dolby B/C	5dB
Overall noise chrome NR out (CCIR/ARM) ref DI 53	740
NR improvement Dolby B/C 10 3/10	348
Overall noise metal NR out (CCIR/ARM) ref DL 52	648
NR improvement Dolby B/C10.0/18	540
Modulation noise ferric broad/close	.Jub
Modulation noise ferric broad/close ref 3kHz tone	640
Line input noise floor, gain min ref DL (CCIR/ARM) – 81	OUB.
Line input noise floor ref 160mV/DL (CCID/ADM)	./08
Line input noise floor ref 160mV/DL (CCIR/ARM) 78 Spooling time (C90)2 min 25	.208
Dynamic range ferric/ohra	sec
Dynamic range ferric/chrome/metal	9uB
Topog used Dolby B(ANH	5)/C
Tapes usedMaxell UD/Maxell XLII/Maxel	IMX
Typical retail price	£80

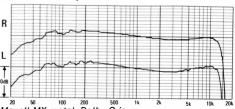
#### **OVERALL FREQUENCY RESPONSES** at - 20dB ref Dolby level



Maxell UD ferric, Dolby off



Maxell XLII. Dolby C in



Maxell MX metal, Dolby C in

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Marantz SD-320

Marantz Audio (UK) Ltd, 15-16 Saxon Way Industrial Estate, Harmondsworth, Middlesex UB7 0LW Tel 01-879 6633



Marantz's latest budget deck, the metal-cased SD-320 includes Dolby B and C noise reduction, but otherwise is fairly basic. Line in/out phonos are on the rear panel as usual. The two-core mains lead is separate, mating with a standard miniature IEC socket.

On the front, two vertical-acting record-level faders are provided for left and right channels. These worked smoothly, although tracking between the two channels was not good. Push buttons or switches select mic or line input, Dolby B,C or off, and normal, chrome or metal tape types (no IEC numbers). Deck function buttons were found very 'clanky', but do permit dropping into record from playback. 'Pause' stops and re-starts play or record. A record mute button is provided, a considerable distance away from the deck controls.

It is possible to use this deck with an external timer by depressing record and play when mains is off, so that when mains comes through again the deck goes to record. However, when the mains is cut off, the machine stops leaving the idler and capstan in contact with the tape, which is very bad, unless the tape has already reached its end stop.

Metering is by LED bargraphs with limited resolution, but reading very accurately, a commendable feature.

Microphone inputs, on ¼ in jacks, had plenty of gain, but were hissier than average, although sound quality was good. The line

inputs were quite sensitive, and no clipping problem was noted. The input circuits were very quiet, even with the volume control up.

Replay azimuth was quite badly mis-set, although head and guide heights were reasonable. Replay amplifier hiss measured well throughout, but hum levels were poor, particularly on the right channel. The clipping margin was quite reasonable and output levels were normal. Replay responses were quite accurate.

TDK D was supplied by Marantz and was found a little up at HF. The left channel HF saturations were average for the tape type, whilst LF MOL was slightly worse on the left than on the right. Both channels seemed normal for the tape type, overall noise levels being quite good throughout, the response extending particularly on the right. Sound quality was reasonable, but HF compression was heard. Modulation noise was fairly poor.

BASF Chrome II penned acceptable response charts throughout and gave some reasonable overall sound quality, provided we were careful with recording level, background noise levels always being very good. The left channel LF MOL and HF saturation measurements were a little poor, but the right was consistantly better, and acceptable. The usual nagative Dolby error was noted. TDK SA gave very good overall sound quality throughout, with less distortion, other than HF compression again being noted on the left. Responses

were quite reasonable on the right channel.

TDK MA metal was a little underbiased, and the MOLs were slightly disappointing, and HF saturations were superb, particularly on the right. With Dolby C in the right channel HF saturation remarkably reached +5dB, which just about hit the gong (this probably would break a wine glass — Memorex please note!). Overall sound quality was thought very good, although LF MOL was queried. Tape/head contact was also queried on pink noise.

Wow and flutter measured acceptably well by today's standards, but some wow was noted on piano. Speed was a little on the fast side, which could annoy musicians, whilst spooling time was slightly slow. Torque was average, but quite a lot of juddering was noted, which would explain the audible wow.

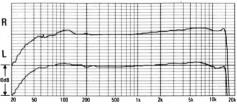
Although this machine is very inexpensive, I feel that the hum levels and wow performance should have been better. Overall performance on ferric and metal was very good for a budget deck, but the chrome position was only adequate. The ergonomics were good and the machine is a good buy, provided that you are not worried about the hum, and it most certainly deserves a recommendation.

#### GENERAL DATA

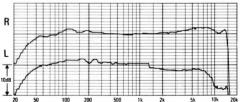
GENERAL DATA		
Replay azimuth deviation from average	+	- 45
Line input sensitivity	80	٥m١
Worst audible replay hum component 60	.8dB (5	0Hz
Replay noise ferric CCIR/ARM weighted (NR out)	- 5	7dl
Poplay poins observe position CCID/ADM		
weighted (NR out)	- 61	8dF
weighted (NR out)	+ 1	3dl
Max replay level for DL		0.5
Wow and flutter average (peak weighted DIN)	0	119
Speed average	0	79
Meters under-read	nd Abn	8m
Overall 10kHz sat ferric L/R ref DL	5 8/ - 5	5dF
Overall Dolby C 10kHz sat ferric L/R ref DL 3	3.0/ - 2.	7d1
Overall MOL ferric L/R for 5% dist @		
315Hz ref DL + 4	4.3/ + 4.	7dE
315Hz ref DL	5.6/ - 4	1dl
Overall 10kHz sat, Dolby C, chrome, L/R ref DL 2	2.4/ - 1	3dl
Overall MOL chrome L/R for 5% dist @		
315Hz ref DI + 3	3.1/+4.	.1dl
Overall 10kHz sat metal L/R ref DI + + + +	14/+2	1dF
Overall 10kHz sat, Dolby C, metal L/R ref DL + 4	4.5/ + 5	.0dl
Overall 10kHz sat, Dolby C, metal L/R ref DL		
315Hz ref DL+5	5.9/ + 6.	.7dE
Overall noise ferric NR out (CCIR/ARM) ref DL.  NR improvement Dolby B/C.  Overall noise chrome NR out (CCIR/ARM) ref DL.  NR improvement Dolby B/C.  Overall noise metal NR out (CCIR/ARM) ref DL.  NR improvement Dolby B/C.	48.	5dE
NR improvement Dolby B/C	10.4/19.	1dl
Overall noise chrome NR out (CCIR/ARM) ref DL	54.	.3dE
NR improvement Dolby B/C	10.4/19.	3dl
Overall noise metal NR out (CCIR/ARM) ref DL	51.	.6dI
NR improvement Dolby B/C	.9.5/18.	.5dl
Modulation noise ferric broad/close ref 3kHz tone		
ref 3kHz tone 37.	7/ - 30.	5dl
Line input noise floor, gain min ref DL (CCIR/ARM)	83.	4dE
Line input noise floor ref 160mV/DL (CCIR/ARM)	72.	.5dE
Line input noise floor ref 160mV/DL (CCIR/ARM)	min 15	se
Dynamic range ferric/chrome/metal	71/76/7	6dE
Noise reduction system	.Dolby	B/C
Noise reduction systemTDK D/BASF CR	II/TDK	M
Typical retail price		.£9

#### **OVERALL FREQUENCY RESPONSES**

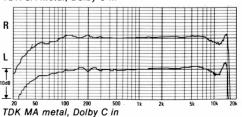
at - 20dB ref Dolby level



TDK D ferric, Dolby off

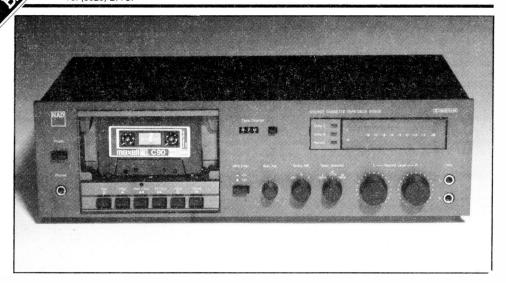


TDK SA metal, Dolby C in



## NAD 6050C

NAD Ltd, Cousteau House, Greycaine Road, Watford WD2 4SB Tel (0923) 27737



porates both Dolby B and Dolby C noise reduction systems. Both phono line input and output sockets and a five-pole DIN input/ output socket are fitted on the rear panel. Separate rotary record level controls are fitted for left and right channels — a concentric one would have been preferred. A three-positioned tape selector switches ferric/chrome/metal, the positions also being marked with IEC numbering — an excellent point — with another switch selecting Dolby off, B and C. A pushbutton switches the MPX filter on or off and a centre-indented rotary control adjusts bias. The tape counter is a mechanical type with zeroing button.

Metering is with a row of miniature lamps in a bargraph display, having only fair discrimination, but reading transients very accurately. The maximum level that can be indicated is rather low though.

Deck functions include transfer from play into wind and back. Holding the 'wind' key depressed gives cueing, which is excellent. The pause control stops and re-starts tape movement. Only the record button need be pressed to start recording. This deck was much liked ergonomically, being very simple. throughout. The cassette compartment is open, with a cover supplied.

The microphone inputs (1/4" mono jacks) had adequate gain and the amplifiers were

This reasonably priced deck from NAD incor- extremely guiet (excellent). The DIN input circuitry was superbly designed with almost no trace of noise, even when Dolby C was used. The line inputs had average sensitivity (impedance being 40kohms), and were very guiet indeed also having no clipping problem. Output levels were average, from a fairly low impedance. Headphones are driven from a 1/4" stereo jack, with fixed output - but low impedance headphones were too loud, while high impedance ones were too guiet.

Replay azimuth was fairly accurate, but head height was very slightly out. Replay hum was only very slightly noted on the right channel, whilst hiss levels were lower than average. Replay amplifier distortion and clipping measurements were excellent.

Maxell UDXL I ferric gave excellent MOLs and adequate high frequency saturation results, improving with Dolby C. Overall noise was average with good Dolby improvement, modulation noise being adequate. Overall responses were very good on the right, but the left channel showed a slight high frequency droop, worsening with Dolby C. Subjectively, the left channel response droop was heard, but other than this quality was thought excellent

Maxell *UDXL II* pseudochrome gave poor low frequency MOLs, but good high frequency saturations, with background noise good throughout. Modulation noise was average.

Frequency responses this time were very good on the left, but high frequencies were up on the right, showing poor internal bias balance setting. The sound quality was liked throughout, if the recording level was held back, but high levels distorted noticeably. Dolby C helps so much here and if levels do not exceed full scale deflection on the meters. overall distortion should be low.

Maxell MX metal gave only fair low frequency MOLs, but phenomenally good high frequency saturation, thus showing considerable under-biasing, and insufficient record equalisation. Overall responses were very good at mid and high frequencies on the right channel but the left was down at high frequencies. Low frequencies drooped down surprisingly with Dolby C in. Noise throughout was very good. A positive overall Dolby calibration error was noted. Responses seemed reasonable though, and distortion only came in with high recording levels, so if the meters are watched carefully distortion will be avoided. Slight record current limiting was noted at very high 10kHz levels.

Whilst wow and flutter DIN measurements were all very good, continuous judders were audible which were very disturbing. A second sample seemed very much better though. Speed was rather fast (the second sample being just slightly fast) and spooling time rather slow. Forward tensions were slightly high, but steady on the second sample. The Dolby C circuits had a slightly better dynamic distortion performance than average and were thus good.

I particularly admire much of the electronic design in this deck and provided recording levels were watched carefully, the overall sound quality was sufficiently good for this model to be warmly recommended. NAD haved promised to check the left-to-right bias balance and deck clutch mechanism much more carefully, and perhaps the record head could have been slightly down in left channel high-frequency output on the sample we tested. So I can just place this machine in the best buy class since its price is reasonable. Check however the various points that have I criticised on any deck offered to you.

#### **GENERAL DATA** Replay azimuth deviation from average.....

Tieplay azimati deviation nom average
Line input sensitivity100mV
Worst audible replay hum component – 66dB (150Hz)
Replay noise ferric CCIR/ARM weighted (NR out) – 60.0dB
Replay noise chrome position CCIR/ARM
weighted (NR out)63.8dB
Replay amp clipping ref DL
Max replay level for DL
Wow and flutter average (peak weighted DIN)0.06%
Speed average
Meters under-read
Overall 10kHz sat ferric L/R ref DL 6.5/ - 7dB
Overall Dolby C 10kHz sat ferric L/R ref DL 5/ - 6dB
Overall distortion ferric L/R for 5% dist
@ 315 Hz ref DL+ 7.6/ + 8dB
Overall 10kHz sat chrome position L/R ref DL 4/ - 4dB
Overall Dolby C 10kHz sat chrome position L/R
ref DL
Overall dist chrome position L/R for 5% dist
@ 315Hz ref DL+ 3.8/+ 3.4dB
@ 313HZ IEI DL
Overall 10kHz sat metal L/R ref DL + 2.5/ + 1.5dB
Overall Dolby C 10kHz sat metal L/R ref DL + 4.5/ + 3.5dB
Overall distortion metal L/R for 5% dist
@ 315Hz ref DL+ 5.2/ + 4.8dB
Overall noise ferric NR out (CCIR/ARM) ref DL – 50.4dB
NR improvement Dolby B/C
Overall noise chrome NR out (CCIR/ARM) ref DL – 53.6dB
N.B.:

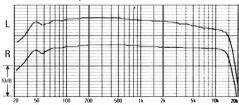
NR improvement Dolby B/C..... .... 10.0/18.4dB Modulation noise ferric broad/close ref 3kHz tone – 36/ – 29dB Modulation noise chrome broad/close ref 3kHz tone Line input noise floor ref 160mV/DL (CCIR/ARM). Noise reduction system. Noise reduction system......Dolby B/C Tapes used.....Maxell UDXL I/Maxell UDXL II/Maxell Metal Typical retail price

Overall noise metal NR out (CCIR/ARM) ref DL..... – 51.6dB

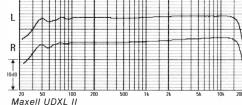
**OVERALL FREQUENCY RESPONSES** 

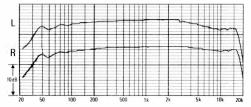
- 20dB, ref Dolby level

NR improvement Dolby B/C.



Maxell UDXL I, Dolby C in





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REVISED AND REPRINTED

Nakamichi ZX7

Nakamichi B&W UK Ltd, Meadow Road, Worthing, West Sussex Tel (0903) 205303



Senior member of the latest Nakamichi series, the ZX7 incorporates three heads (discrete) allowing off tape monitoring, together with Dolby B and C noise reduction. Separate left and right recording level controls are fitted, whilst a ganged rocker master gain control is provided, similar to that on the LX5. Phono line input and output sockets are provided on the rear panel, together with a DC output socket for Nakamichi 'black boxes', and a remotecontrol socket.

Meters are LED bargraph type, with very good discrimination and excellent peakreading capabilities, and with a slow fall-back time making peaks easier to see. Rotary switches select tape/source monitoring, MPX on/off, Dolby off or B or C in, 70 or 120 $\mu$ S equalisation, and memory/timer function. A ganged output gain control also adjusts headphone levels — output from the ½" stereo jack providing reasonable levels with all normal headphone types.

Pushbuttons select ferric/chrome/metal (these positions being confusingly labelled), built-in calibration tones (400Hz and 15kHz), and manual azimuth enable (recording azimuth can be adjusted). Rotary controls are provided for record calibrate and bias adjustment for all three tape types, and these can be used for setting up almost any tape optimally with the internal tones.

Deck functions operate very smoothly, and

provide the ability to go from play into wind and back (cueing is by pushing pause while winding), and dropping into record, with record mute available. The counter is digital. Overall responses, when Dolby C was in use, always seemed better when aligned with Dolby C selected, but azimuth indications were rather slow and a little irritating. Cassette loading was simple, but the compartment rather unusual.

The line inputs were very sensitive, and no clipping or noise problems were noted. Maximum output levels were quite high, and from a reasonable impedance. The replay azimuth was fairly inaccurate, but heads and guide heights quite well set. Replay amplifier hiss and hum levels were commendably low, whilst distortion and clipping performance was excellent. A slight lift though seemed to be present at extremely high frequencies.

Maxell *UD* ferric tape gave excellent low frequency and 3.15kHz MOLs, with an astonishing high frequency saturation performance for the tape type. Overall noise was average with good Dolby improvements, whilst frequency responses throughout were excellent and well extended (note that the deck was aligned with Dolby *C* in when *C* was in use). Modulation noise was minimal, which is excellent. Overall quality was considered superb, and this is amazing for a medium quality tape, putting to shame metal tape on

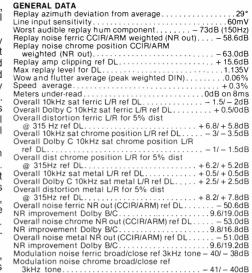
many other decks. The Dolby *C* circuits, however, did introduce slight high-level transition distortion on French horn.

Maxell *UDXL II* penned good charts, but they would have been better if we had fiddled a bit with external tones. Low frequency MOLs and high frequency saturations measured well, and overall noise was average, but with slightly below optimum Dolby *C* noise reduction. Modulation noise was again excellent, as was high frequency stability throughout. Overall sound quality was again excellent at all normal levels.

Maxell MX metal gave good MOLs and high frequency saturations were very good. Responses were excellent with Dolby out, but with Dolby C in, the use of the internal tones for calibration resulted in a slight 10kHz dip, 15kHz being flat. Overall noise levels were average, with a good Dolby improvement. Sound quality was considered superb throughout.

Wow and flutter measured superbly well, and absolutely none was audible. Speed was very accurate, and spooling fast, with play tensions stable. One of the record gain controls went faulty during tests, but the importers quickly put this right for us.

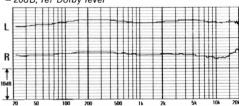
This deck allows a wide variety of tape types to be used, and whilst the internal calibration tones are useful, the 15kHz one should perhaps have been at a slightly lower frequency, which would have allowed a better control of Dolby C responses. A slight tweak, though, put matters right subjectively, and since this deck produced some superb overall quality, and was liked ergonomically, it was considered a best buy when first reviewed. However, in the light of recent developments, and particularly digital recording, it is now hard to justify this rating at the price. But the ZX7 is still strongly recommended, although its price is high.



#### **OVERALL FREQUENCY RESPONSES**

- 20dB, ref Dolby level

Typical retail price ...

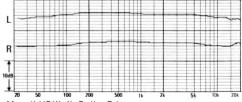


Dynamic range ferric/chrome/metal.....77.5/77/79.5dB

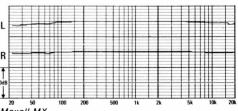
Noise reduction system......Dolby B/C
Tapes used.....Maxell UD/Maxell UDXL/Maxell Metal

£675 when reviewed, now £660

Maxell New UD, Dolby C in



Maxell UDXL II, Dolby C in



Maxell MX

Nakamichi ZX9

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Nakamichi have a number of decks senior to the ZX-9, but this one is designed to be the tape fiddler's paradise! It has one of the busiest front panels I have ever encountered. six pull-off plastic covers exposing bias and level control knobs for each channel and tape type. In addition to a separate mono rotary record level controls, there is a rocker push switch for master gain up and down which, however, cannot be set at an intermediate gain postion, and so you have to use the separate mono controls, which is annoying.

Of the many other facilities, one of the most interesting is the easy mechanical azimuth adjustment, calibration tones being 400Hz at 0dB, and 15kHz at -20dB, the meter sensitivity being adjusted appropriately during alignment. Other facilities include memory and timer record, 70/120µS equalisation, Dolby B, C or off, MPX filter on/off, tape/source monitoring, ferric/chrome/metal tape type switching and record mute.

Tape transport controls allow for cueing in either direction, although you cannot drop into record from play, and the pause only stops the tape motion. A ganged stereo rotary control adjusts output and headphone levels there is plenty of volume with low impedance headphone models but only just enough with high

Finish is really superb, with gold plated phono sockets mounted on the rear along with

sockets for a remote control and the Nakamichi accessory 'black box' mic adaptor. The machine is very robust and encased in metal. The LED bargraph metering had average resolution, and read transients extremely accurately. Dolby level on the left channel reading + 1dB, though, whilst the channel was correct.

There are no mic inputs, the line inputs were very sensitive, and no clipping problem was encountered. Noise floor around the record level circuitry was always at a low level. Replay azimuth was again rather badly out, although head and guide heights were reasonably accurately set, and head penetration was good. Replay amplifier hiss levels were stunningly good throughout. Hum levels were all low, but we detected a lurking 18Hz particularly on the left at -65dB (totally irrelevant, but mentioned for the log book!) The clipping margin was excellent, output level potential much higher than usual, which could be useful. Replay responses, though being excellent on chrome, were considerably up at 10kHz and above on ferric, which will make all pre-recorded cassettes sound quite toppy.

For each tape type, we set the deck up exactly according to the instructions. Maxell UD measured superbly, with excellent HF saturation, and vet excellent MOLs, all overall noise levels being very good. Modulation noise was average, and the reponses were fantastic!

The subjective sound quality was superb GENERAL DATA throughout, and, remarkable for a medium cost tape, with absolutely no reservations.

BASF Chrome II also measured well for a chrome tape, the responses being almost ironed flat! Overall noise measurements were amazingly low, subjective quality was superb throughout, provided the levels were held down just slightly, and dynamic range was incredible. Maxell XLII was also superb.

TDK MA metal gave excellent MOLs at 315Hz and at 3.15kHz, and HF saturations were very good. Responses again were amazing. Overall noise levels were amazing again. Subjective sound quality was excellent throughout, but we did detect a 10kHz valley with noise reduction on, although the responses were very smooth indeed. Stability on pink noise was excellent, which shows a very good tape transport.

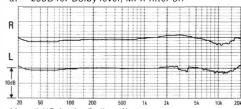
Wow and flutter measured phenomenally well, being almost as good as the very best ever on cassette. Speed was remarkably accurate, and spooling time slightly faster than average. Torque was quite reasonable. but some juddering was noticed, which might explain one or two judders that were actually heard on piano.

Before spending the considerable amount of money that is required for this machine, you will have to think about your priorities, because now digital is getting cheaper and cheaper. This is more a machine for the R professional studio, or semi-professional making up masters for small-scale duplication, or for making superb prestige cassette L recordings. It can be recommended as it gives magnificent quality, but note that there are 10d8 many decks costing a third of the price, which will also give very good quality, but omit all the 'fiddling' functions. A wonderful deck though, of which its owner can be very proud.

GENERAL DATA	
Replay azimuth deviation from average+	40
Line input sensitivity57	m
Line input sensitivity	H.
Replay noise ferric CCIR/ARM weighted (NR out), – 61.7	7d
Replay noise chrome position CCIR/ARM	
weighted (NR out) 67.8	Зd
Replay amp clipping ref DL + 15	id
Max replay level for DL	1 1
Wow and flutter average (peak weighted DIN)0.0	40
Speed average	10
Meters under-read0dB on 8	lm
Overall 10kHz sat ferric L/R ref DL – 1.5/ – 1.1	14
Overall Dolby C 10kHz sat ferric L/R ref DL+ 0.6/ + 1.0	141
Overall MOL forsign L/D for 50/ dish o	Jui
Overall MOL ferric L/R for 5% dist @ 315Hz ref DL+ 6.8/ + 6.0	
313072 (e) DL	וטי
Overall 10kHz sat, chrome position L/R ref DL 5.4/ - 4.9	ioi
Overall 10kHz sat, Dolby C, chrome, L/R ref DL 3.4/ - 2.8	sa
Overall MOL chrome L/R for 5% dist @	
315Hz ref DL+ 5.6/ + 4.7	d
Overall 10kHz sat metal L/R ref DL 1.0/ - 0.4	łdΙ
Overall 10kHz sat, Dolby C, metal L/R ref DL + 1.2/ + 1.8	3d
Overall MOL metal L/R for 5% dist @	
315Hz ref DL+ 8.8/ + 8.5	idl
Overall molt inetal L/H 101 5% dist @ 15Hz for DL +8.8/ +8.5  Overall noise ferric NR out (CCIR/ARM) ref DL	)dI
NR improvement Dolby B/C10.0/19.5	id
Overall noise chrome NR out (CCIR/ARM) ref DL, 56.3	di
NR improvement Dolby B/C9.6/18.5	idl
Overall noise metal NR out (CCIR/ARM) ref DL 53.4	dl
NR improvement Dolby B/C9.7/19.1	d
Modulation noise ferric broad/close	
ref 3kHz tone	di
Line input noise floor, gain min ref DL (CCIR/ARM) = 81.3	M
Line input noise floor ref 160mV/DL (CCIR/ARM) – 78.1	di
Specifications (C90)	201
Spooling time (C90)	141
Noise reduction eyetem	2/0
Noise reduction systemDolby E Tapes usedMaxell UD/BASF CR II/TDK I	)/C
Typical retail price	
Typical retail price£8	יטכ

#### **OVERALL FREQUENCY RESPONSES**

at - 20dB ref Dolby level, MPX filter off



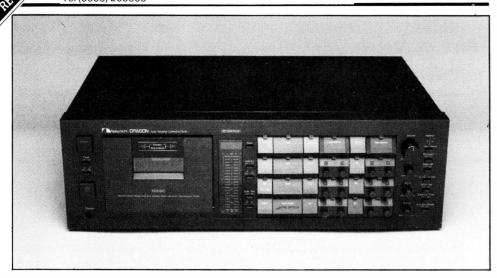
Maxell UD ferric, Dolby off



TDK MA metal, Dolby C in

Nakamichi Dragon

Nakamichi B&W UK Ltd. Meadow Road, Worthing, West Sussex Tel (0903) 205303



in this new deck, the *Dragon*, comes a crowning achievement — the replay head has an amazing automatic azimuthing circuit which works superbly, and allows you to get the best out of pre-recorded cassettes. Similar in styling to the ZX9, it is metal-encased with a smart black finish. It has virtually identical facilities with bias and sensitivity pre-set knobs (no covers this time), for both channels ZX9. and all three tape types, and built in switchable tones and so on, for alignment.

Just as much a knob-twiddler's paradise as the ZX9, it also sports dual direction capability on replay only, together with continuous play and reverse functions which are quite complex. The deck allows cueing in either direction and also has memory rewind/play. On the back panel are mounted gold plated phono sockets for line in/out, a Nakamichi 'black box' accessory socket, a remote control socket and a captive two core mains lead.

When in play or record, the tape path is very tightly controlled, small shrouds coming forward and pushing the pressure pad assembly away whilst screening the head, to the guietest. reduce scrape flutter and friction.

Metering is by two vertical columns of LEDs, which give average discrimination. They read long transients correctly but under-read short ones rather badly, which is a pity — these meters were not liked. A stereo ganged rotary

Nakamichi have always been innovators, and record level control is complemented by two small mono ones for left and right, but there is an additional fade up/down assembly with a choice of two fading speeds.

> Buttons select tape/source monitoring. 120/70uS equalisation, Dolby B.C on/off, MPX filter, subsonic filter, and auto-pause on/off. Remote timer on/off for record/play is also provided. Other functions are similar to the

> Ergonomics were thought superb, the addition of the stereo ganged master fader being very sensible. Replay level is adjustable. the control setting headphone level as well. There is ample volume for all normal headphone types.

> There are no mic inputs, though Nakamichi mic pre-amps are available as accessories. Line inputs were very sensitive, with no clipping problem noted; but when the machine is switched off and the volume controls are left well up, the diode action of the input circuits can cause distortion to a source signal feeding other devices (I learned this the hard way)! The noise floor around the gain controls was not

> Replay azimuth set itself up very accurately in both directions of the transport (well within 10 degrees phase at 3kHz) and this is just amazing. It was able to correct many prerecorded cassettes which were themselves badly out, in just a few seconds. Head heights

were reasonably accurate, penetration was GENERAL DATA good, and guide heights excellent. Replay hiss levels were excellent, and replay hum measured quite well but was not quite good enough for very critical listening. The clipping margin was good, output levels well above normal, which may be useful. Replay responses were accurate up to 10kHz, but with too much HF boost above 15kHz (around + 3dB at 18kHz)!

Maxell UD ferric gave excellentlycompromised LF MOLs and HF saturation measurements, overall noise measuring very well. Modulation noise was also very good and responses excellent, with and without noise reduction. The audio quality was superb throughout, many words of praise being noted.

BASF Chrome II gave good measurements and extremely low background noise. Because of the 3kHz distortion being worse on chrome than on pseudochrome, there was slight criticism of distortion in the presence region. This completely dissappeared, though, at a slightly lower recording level, such lower levels being acceptable because of the tape's very low inherent noise. Responses were all excellent, but the slight valley between 3kHz and 12kHz, because equalisation is at 15kHz. TDK SA-X sounded superb throughout. especially with Dolby C.

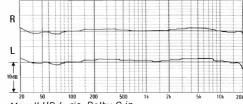
TDK MA metal gave excellent LF and MF MOLs, and HF saturation measured very well indeed, but should have been slightly better! The audio quality is best described by quoting the panel's words 'superb', 'fantastic'. Responses were excellent. We adjusted response exactly according to the book, but I would prefer a lower bias setting tone at 12kHz, which would improve the linearity of the sensitive area below 10kHz.

Originally, the wow and flutter sounded disappointing. We found that the entire transport needed very thorough running in followed by cleaning after which it gave dramatically improved measurements, the best we ever measured on cassette — amazing in both directions. Speed was extremely accurate in both directions, wind time was very fast and torque around average with only slight juddering.

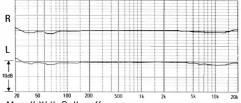
This really is a fantastic machine which has given us much pleasure, probably the last word in aetting the best from pre-recorded cassettes, but also in extracting superb performance from any respectable cassette tape type. Strongly recommended if you can afford and justify it. Finally, how marvellous it is to have the dual direction capability which worked so well, and which measured well in both directions!

GENERAL DATA		
Replay azimuth deviation from average	+	10°
Line input sensitivity	66	V m6
Worst audible replay hum component 68.6	dB(150	)Hz)
Replay noise ferric CCIR/ARM weighted (NR out)	– 57.	4dB
Replay noise chrome position CCIR/ARM		
weighted (NR out)	62.	0dB
Replay amp clipping ref DL	+ 16.	5dB
Max replay level for DL		1 2v
Wow and flutter average (peak weighted DIN)	0.0	14%
Speed average		
Meters under-read15		
Overall 10kHz sat ferric L/R ref DL 3	3.07 - 3	0dB
Overall Dolby C 10kHz sat ferric L/R ref DL 0	1/ - 0	4dB
Overall Dolby C 10kHz sat ferric L/R ref DL	0.	
315Hz ref DI	6.1/ + 6.	2dB
Overall 10kHz sat, chrome position L/R ref DL, 5	6.67 - 5.	7dB
Overall 10kHz sat, Dolby C, chrome, L/R ref DL 3	3.1/ - 3.	4dB
Overall MOL chrome L/R for 5% dist @		
315Hz ref DL+5	5.71 + 5.	4dB
Overall 10kHz sat metal L/R ref DL 2	2.1/ - 1.	4dB
Overall 10kHz sat, Dolby C, metal L/R ref DL + 1		
Overall MOL metal L/R for 5% dist @		
315Hz ref DL+ 8	3.6/ + 8.	6dB
315Hz ref DL+8 Overall noise ferric NR out (CCIR/ARM) ref DL+	– 50.	6dB
NR improvement Dolby B/C	0.3/19.	8dB
Overall noise chrome NR out (CCIR/ARM) ref DL	– 55.	6dB
NR improvement Dolby B/C	0.1/19.	2dB
NR improvement Dolby B/C	– 52.	6dB
NR improvement Dolby B/C	0.2/19.	4dB
Modulation noise terric broad/close		
ref 3kHz tone – 41. Line input noise floor, gain min ref DL (CCIR/ARM)	0/ - 37.	5dB
Line input noise floor, gain min ref DL (CCIR/ARM)	– 78.	5dB
Line input noise floor ref 160mV/DL (CCIR/ARM)	– 77.	5dB
Spooling time (C90)	min 12	sec
Dynamic range ferric/chrome/metal	76/79/8	0dB
Noise reduction system	.Dolby	B/C
Tapes usedMaxell UD/BASF CF	II/TDK	MA
Typical retail price	£1	1100
71		

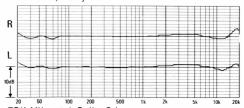
#### **OVERALL FREQUENCY RESPONSES** at - 20dB ref Dolby level



Maxell UD ferric, Dolby C in



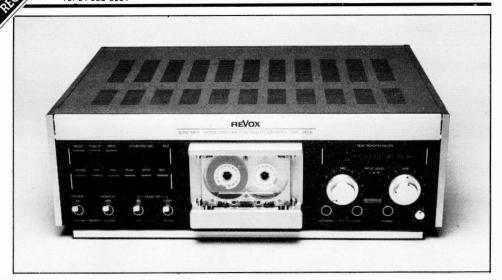
Maxell XLII, Dolby off



TDK MX metal, Dolby C in

## Revox B710 MkII

F.W.O. Bauch Ltd, 49 Theobald Road, Borehamwood, Herts WD2 4RZ Tel 01-953 0091



This MkII version of Revox's first cassette deck design, the B710, is similarly styled to their famous reel-to-reel models. It has three heads allowing off tape monitoring, and Dolby C noise reduction. The mechanical parts are superbly made, and designed with many unique features. The back panel incorporates the usual line in/out phono sockets, plus remote control sockets for interfacing with the Revox B251 amplifier, and a socket for the separate two-core mains lead. There is also a mains sensitive indeed, and very quiet. The phone adjustment panel and fuse and finally, separate pre-set pots for left and right outputs.

Separate friction-locked rotary record level controls are provided for mic and line inputs, a small ganged headphone level control providing adequate volume into all normal headphone types from the 1/4 in stereo jack.

Metering is with an LED bargraph display which gives good discrimination and reads fast transients very accurately. Under a hinged flap is tape type switching for IEC I. II. IV or auto. MPX on/off and remote timer off/play/ record, along with buttons for memory or cycling, 'set, start, stop and clear'. A push button sets the counter to read normal clock time or tape counting (four digits); run-up and zeroing buttons are also provided.

Deck function controls allow transfer straight from play into wind and back and dropping in and out of record. The pause control will restart tape motion only in the

record mode. All deck functions were very smooth in operation, and ergonomics were excellent although we thought the 'record on' indicator not clear enough. The auto leader 'jump' system of the MkI has been modified, and the mechanism no longer stops at the end of the leader when beginning playback of a pre-recorded cassette. The deck is supplied with a detachable lid.

Microphone inputs (1/4 in jacks) were very line inputs were also sensitive, and had no clipping problem. The input circuitry had an extremely quiet noise floor. The meters read Dolby level correctly, as marked. Replay azimuth was precise, head height accuracy good and guide heights and penetration very accurately set. Replay hiss levels were all excellent, but hum levels only fairly good with 20Hz being noticed at -60dB; a curious result. The replay clipping margin was just adequate. Replay responses showed LF to be slightly up and HF just slightly down on the latest IEC

Maxell UD gave very good LF MOLs, but HF saturation was just satisfactory, and uneven between channels. Overall responses measured well with and without Dolby, modulation noise measuring exceptionally well. Overall weighted noise was excellent throughout. Tape stability was superb throughout and subjective quality excellent and often superb.

BASF Chrome II gave acceptable LF MOLS GENERAL DATA and average HF saturations whilst background noise was amazingly low throughout. Responses were also good, and the subjective quality excellent when peak levels were carefully watched. Maxell XLII gave good charts without Dolby, but there was slight LF and HF loss with Dolby C. The deck had been aligned for IEC II, though, and responses would have been better if record sensitivity had been corrected for Maxell XLII.

TDK MA metal gave very good LF MOLS, and HF saturations, although excellent, should have been better. Overall weighted noise measurements were remarkably good for metal. Tape stability was again superb, all stereo images beign far clearer than usual. Quality was highly praised in the subjective tests.

On all tape types, despite the excellent overall sound, we felt performance slightly limited by the record head design, and we would have liked higher MOLs, together with better HF sats throughout, which would then have brought the measurements up to a Nakamichi standard. However, the superb transport seems somehow kinder to a broad selection of tape types, and less fussy about azimuth.

Wow and flutter measured well, and we were not disturbed by any wow problem in listening tests. Speed was accurate, spooling time very fast, and torque marginally high, but with only R slight juddering.

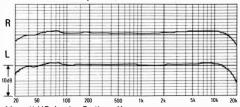
It should be borne in mind that all the measurements quoted are after this particular L sample has been very well used in my lab for over nine months, particularly for testing the mechanical properties of cassette mechanisms. We could leave a tape with 1½ minutes of 10kHz tone recorded on it to play back a chosen one minute section again and again automatically for half an hour, pencharting the R result. This was done to around 100 tapes, as well as numerous other trials, including playing back hundreds of pre-recorded L cassettes. The fact that it has lost only 1dB at 10kHz on replay shows remarkably good wear characteristics.

So many niggling points about the B710 MkI have been corrected in the MkII, including the addition of Dolby C, the removal of the DIN socket, and the correction of some Dolby tracking problems in the original design. Bias, equalisation and record cal can all be pre-set. these controls beign easy to reach under the top cover. The price, though, is very high, and will rule the machine out of court for many, but if you want these facilities I can definitely recommend it. An extremely good workhorse and very reliable, but expensive.

GENERAL DATA	
Replay azimuth deviation from average,	0
Replay azimuth deviation from average Line input sensitivity	75.8m\
Worst audible replay hum component – 67.70	dB (100Hz
Replay noise ferric CCIR/ARM weighted (NR out)	– 60.0dE
Replay noise chrome position CCIR/ARM	
weighted (NR out)	63.7dE
Replay amp clipping ref DL	+ 12dE
Max replay level for DL	0.85
Wow and flutter average (peak weighted DIN)	0.08%
Speed average	+ 0.2%
Meters under-read00	B on 8ms
Overall 10kHz sat ferric L/R ref DL	.0/ — 5.3dE
Overall Dolby C 10kHz sat ferric L/R ref DL 4.	8/ - 2.8dE
Overall MOL ferric L/R for 5% dist @	
315Hz ref DL+ 6.	2/ + 6.2dE
315Hz ref DL+ 6. Overall 10kHz sat, chrome position L/R ref DL 6.	2l - 5.7dE
Overall 10kHz sat, Dolby C, chrome, L/R ref DL 3.	5/ - 3.0 dE
Overall MOL chrome L/R for 5% dist @	
315Hz ref DL	2/ + 4.8 dE
Overall 10kHz sat metal L/R ref DL, 2.	0/ - 2.0 dE
Overall 10kHz sat, Dolby C, metal L/R ref DL + 1.	0/ + 1.0dE
Overall MOL metal L/R for 5% dist @	
315Hz ref DI + 7	0/ + 7.7 dE
Overall noise ferric NR out (CCIR/ARM) ref DL	52.9dE
Overall noise ferric NR out (CCIR/ARM) ref DLNR improvement Dolby B/C10	0.4/18.9dE
Overall noise chrome NR out (CCIR/ARM) ref DL	56.5dE
NR improvement Dolby B/C	9.9/18.6aE
Overall noise metal NR out (CCIR/ARM) ref DL	54.0dE
NR improvement Dolby B/C10	0.2/18.8dE
Modulation noise ferric broad/close	
ref 3kHz tone – 42.6	I = 38.7 dE
Line input noise floor, gain min ref DL (CCIR/ARM),	81.8dE
Line input noise floor ref 160mV/DL (CCIR/ARM),	
Spooling time (C90)	min 9 sed
Dynamic range ferric/chrome/metal7	7/77/79dE

#### OVERALL FREQUENCY RESPONSES

at - 20dB ref Dolby level. MPX filter off



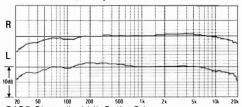
Maxell UD/BASF CR II/TDK MA

Maxell UD ferric, Dolby off

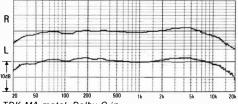
Noise reduction system.

Tapes used.

Typical retail price.



BASF Chromdioxid II, Dolby C in

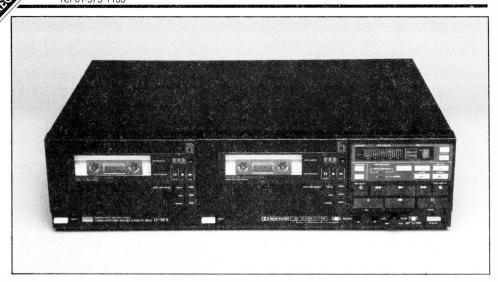


TDK MA metal, Dolby C in

200

Sansui D-W9

Sansui (UK) Ltd, Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford Middlesex Tel 01-575 1133



For the first time in *Hi-Fi Choice* we have looked here at a double deck incorporating two cassette deck mechanisms, plus controlling functions. The Sansui *D-W9* is encased in a combination of metal and plastic in a black finish. The back panel is fitted with line in/out phone sockets and a 'Compu-Edit' socket for controlling the appropriate Sansui turntable when recording.

The two transports are mounted side-by-side with the controls to the right. These allow recording or playback to either deck from a single stereo source or mono microphone, or copying from deck 'A' to deck 'B'. It is also possible to record on both decks at the same time. Although there is a microphone gain control, the single line-in pair has no manual gain control at all, which is very bad — the internal automatic limiting control (ALC) deciding the dynamic range of the music rather than the composer or recording engineer! Tape type selection is automatic, but there is a switch for Dolby B, C or off.

Push buttons control the complex programme-search and copy facilities, allowing tracks to be copied in any order automatically, as well as all the normal deck functions. The pause control stops and re-starts play or record, and touching one button causes the appropriate deck to go into record — users must watch out! There is also a tape lead-in facility which when selected jumps the first

few seconds of tape.

The mono microphone input (a single ¼in jack socket) had plenty of gain and was also subjected to the automatic limiting control. I found that when I raised my voice while recording it, the system gain went down and did not recover for over one minute, thus showing an attempt at recording dynamic range. But one cough accidentally near the mic could write off that important piece of bugging! Line inputs were very insensitive, a minimum of around 240mV being required to give Dolby level. This sensitivity whops down after a big peak, so it is constantly varying.

Record level indication is in mono with five LEDs showing green or red. They did read transients correctly, surprisingly. The limiting comes in at around 300mV, giving just over Dolby level on tape, which is under-recording on many tapes. This is not good enough when using Dolby B, but is quite acceptable with Dolby C. When we copied from 'A' to 'B', record level was increased by 1dB, and ALC is inoperative here. Copying has to be done with the same noise reduction system — you cannot make a Dolby C copy of a Dolby B tape.

Both decks were well in azimuth on replay. Head heights on 'A' were poor, but 'B' was OK. All guide heights were slightly high, but head penetration was good. The input noise floor measured very well, as did replay amp hiss levels. Deck 'A' had very slight 50Hz hum, but

deck 'B' was much worse here, also having bad hum at 150Hz (the mains transformer is nearer to deck 'B'!). The replay clipping margin was excellent and output levels normal. The  $70\mu S$  ('chrome' position) replay response was reasonably accurate, although LF fell down a bit. But the ferric replay response ( $120\mu S$ ) showed around 1.5dB loss at 10kHz on both decks, deck 'A' being slightly worse.

Maxell *UD* gave a maximum level of +2.5dB at around 3.5% distortion. HF saturation was good and background noise levels measured well. Modulation was only fair on 'A', but good on 'B'. Responses were thought good and programme quality, a pleasant surprise, was rated excellent throughout, although dynamic range was only adequate.

BASF Chrome II was limited at around Dolby level, with response sounding slightly bright but acceptable, and distortion rated excellent to superb. Dynamic range was slightly limited with Dolby B because of the low recording level. Maxell XLII also sounded excellent throughout.

TDK MA metal gave much more distortion than it should have done at peak levels not much above Dolby level, although HF saturations were good. Responses were slightly bright, and well up at extreme HF with Dolby C. The programme sounded reasonable because the limiter stopped the tape being driven too hard, although its action was audible, of course. Overall noise was a bit hissy subjectively because of the reduced recording level.

We also made a frequency response test recording on deck 'A', copying from 'A' to 'B' and then replaying from 'B', all on Maxell *UD*, and the result really was not bad.

Wow and flutter measured very well indeed on deck 'A' and was not much inferior on 'B'; subjectively, with only slight flutter occasionally noted on piano. Speed was just slightly fast, and spooling time a little slow. Torque on both decks was rather high and definitely a little jerky — one of the worst here.

The convenience of having two decks in one cabinet with all the facilities worked out for easy copying is a strong point in this unit's favour, if you regularly want to make copies. We were all surprised that so much of the recorded sound quality was excellent despite the very modest facilities.

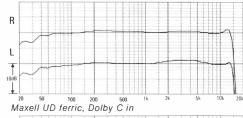
This double deck can, therefore, be strongly recommended, and we feel that it is very reasonably priced. If it had had a manual record level control and one could switch out the limiter, it might even have verged on a 'best buy'. A very useful little workhorse which i guess will be quite popular with the younger members of the family.

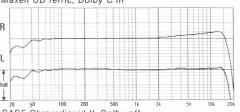
#### GENERAL DATA

Replay azimuth deviation from average – 15°	
Line input sensitivity243mV Worst audible replay hum component – 61.5dB (150Hz)	
Worst audible replay hum component – 61.5dB (150Hz)	
Replay noise ferric CCIR/ARM weighted (NR out), 57.8dB	
Replay noise chrome position CCIR/ARM	
weighted (NR out)	
Replay amp clipping ref DL+ 17dB	
Max replay level for DL	
Wow and flutter average (peak weighted DIN),0.08%	
wow and flutter average (peak weighted DiN),	
Speed average	
Meters under-readUdB on 8ms	
Overall 10kHz sat ferric L/R ref DL 3.4/ - 4.5dB	
Overall Dolby C 10kHz sat ferric L/R ref DL – 0.7/ – 1.6dB	
Overall MOL ferric L/R @ 315Hz ref DL + 2.4/ + 2.6dB*	
Overall 10kHz sat, chrome position L/R ref DL 4.7/ - 5.2dB	
Overall 10kHz sat, Dolby C, chrome, L/R ref DL – 1.9/ – 2.7dB	
Overall MOL chrome L/R @ 315Hz ref DL 0.1/ + 0.6dB*	
Overall 10kHz sat metal L/R ref DL	
Overall 10kHz sat, Dolby C, metal L/R ref DL+ 1/ + 0.6dB	
Overall MOL metal L/R @ 315Hz ref Dl $+ 1.8/ + 1.6$ dR*	
Overall noise ferric NR out (CCIR/ARM) ref DL 50.6dB	
NR improvement Dolby B/C	
Overall noise ferric NR out (CCIR/ARM) ref DL.         - 50.6dB           NR improvement Dolby B/C.         10.4/19.4dB           Overall noise chrome NR out (CCIR/ARM) ref DL.         - 54.1dB           NR improvement Dolby B/C.         10.1/18.4dB	
NR improvement Dolby B/C 10 1/18 4dB	
Overall noise metal NR out (CCIR/ARM) ref DL 52.1dB	
ND improvement Dolby BIC 10 2/19 0dB	
Modulation noise ferric broad/close	
ref 3kHz tone _ 31 3/_ 38 5dB	
ref 3kHz tone	
Line input noise floor ref 160mV/DL (CCIR/ARM) – 85.2dB	
Checking time (C00)	
Spooling time (C90)	
Naise radication aviation	
Noise reduction systemDolby B/C Tapes usedMaxell UD/BASF CR II/TDK MA	
Tapes usedMaxell UD/BASF CH II/TUK MA	
Typical retail price£219	
*see text	

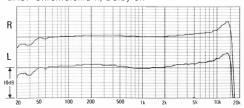
#### OVERALL FREQUENCY RESPONSES

at - 20dB ref Dolby level





BASF Chromdioxid II, Dolby off



TDK MA metal, Dolby C in

Sony TC-FX44

Sony (UK) Ltd. Sony House, South Street, Staines, Middx TW18 4PF Tel 0784 61688



Well-styled but very basic in facilities, the Sony TC-FX44 does have Dolby C noise reduction. It is completely encased in metal, and on the back panel are the usual two pairs of phonos for line in/out interconnections. The captive two-core mains lead, about one metre long. carries a moulded IEC male connector to plug into either an IEC chassis mounted female flying lead supplied, which is very long.

The record-level faders on the front panel run together in parallel horizontally, and have a very long throw. This makes level setting simple — it's very easy to bring them up and down separately, or together. A music search facility is provided by pressing 'play' and 'wind' simultaneously.

Deck function controls allow transfer straight from play to wind and back, the pause control stopping and re-starting record/play. Push buttons select MPX filter on/off, Dolby B. C or off and auto-ferrichrome tape switching (one of the few machines that have not abandoned ferrichrome!). The counter is a simple mechanical type with reset. There is a remote timer play/record/start switch. Level indication is with two separate rows of eight LEDs, thus having rather modest discrimin ation, but allowing all transients to be read very accurately. A record mute facility is also provided.

Microphone inputs on 1/4 in jack sockets

were fairly sensitive and very quiet, but the deck monitor made a quiet whirring noise, which microphones would possibly pick up. Line inputs were reasonably sensitive, and we had no clipping problem at all. The noise floor was guite low, but noisier than many other

Replay azimuth was extremely accurately socket on another component or the female set. Head heights were adequate, replay guide height slightly high, but head penetration good. Replay amplifier hiss levels were marginally worse than usual, but satisfactory, whilst hum did not measure too well, but was acceptable in the subjective tests. The replay clipping margin was amazingly good, whilst output levels were average.

> There is no replay gain control, and headphones were driven from 1/4 in stereo jack socket at slightly too loud a level for both low and high impedance models. Replay response was a litle disappointing, averaging around 1.4dB down at 10kHz the bass end being fairly extended, though.

> Sony BHF was chosen for ferric and gave very good LF and MF MOLs, but HF satur ations were slightly disappointing though not poor. Overall noise measurements were reasonable throughout but quite a few machines were slightly better. Modulation was not too good, but overall responses measured well to 10kHz, dropping off noticeably above this. Responses sounded reasonable through

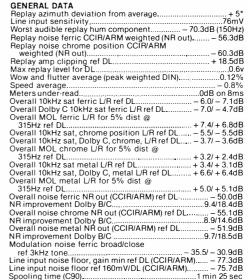
out, but we felt there was a loss of 'air' because of the fall-off at extreme HF. Distortion was thought very good, and we only commented mildly about the HF compression. Tape stability was excellent and the sound was thought very good indeed for a budget deck.

BASF Chrome II gave poor LF MOLs, but HF saturations were average for the tape. Overall noise levels were reasonable without Dolby. fairly good with Dolby B; but Dolby C noise reduction fell short of its potential by around 4dB, showing some of the electronic circuits to be slightly nosier than optimum. Responses were quite reasonable up to 13kHz without Dolby, but a little uneven with Dolby C. Overall distortion was worse than usual, so you would have to take the volume down on recording by several dBs. Since overall noise was criticised slightly, dynamic range is a little limited. Sony UCX-S Pseudochrome gave slightly better sound quality, but odd response variations gave a slight colouration, although distortion was a little better.

Sony *Metallic* gave disappointing LF and MF MOLs, but stunningly good HF saturations, Dolby C HF saturation hitting the gong and breaking it with +6.6dB! Overall noise levels were all around 1½dB worse than average, but acceptable. Responses showed slight bass loss and EHF boost, exaggerated with Dolby C in. If the replay response had been correct and bias increased on record, the metal performance would have been far better, and more R balanced. The programme would have been far better, and more balanced. The programme was heard to be slightly bright, but 'exciting' throughout. The lower frequency peaks were a little dirtier than usual, especially in the Shostakovich, but HF was very transparent.

Wow and flutter measured acceptably well for a budget deck, but some was noted on piano, but was not too poor. Speed was a little on the slow side, which might depress those R with perfect pitch. Spooling time was marginally faster than usual and torque very slightly high, but there was some juddering noticed which would explain the piano wow.

This deck most certainly is worthy of a good recommendation, and it is fair to include it in the 'Best Buys' - my main reservation being the very slight wow. For its price it did give some good overall sound quality at best, but pre-recorded cassettes might sound just a wee bit muffled. Reasonable metering, Dolby C noise reduction and programme search are all useful facilities, and we liked the ergonomics.



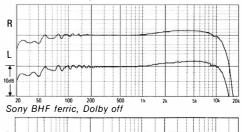
#### **OVERALL FREQUENCY RESPONSES**

at - 20dB ref Dolby level

Dynamic range ferric/chrome/metal

Noise reduction system

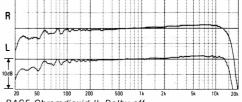
Typical retail price.



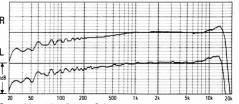
.73/72/79dB

.Dolby B/C

Sony BHF/BASF CR II/Sony Metallic



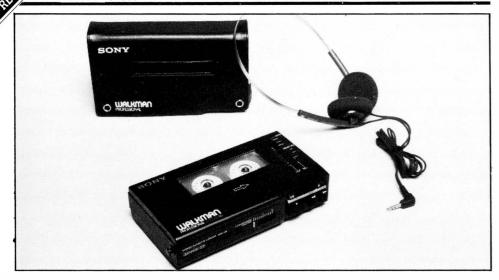
BASF Chromdioxid II, Dolby off



Sony Metallic, Dolby C in

Sony (UK) Ltd, Son

Sony (UK) Ltd, Sony House, South Street, Staines, Middx TW18 4PF Tel 0784 61688



At a price higher than many very respectable mains-operated recorders, Sony's Walkman Professional we felt, deserved inclusion here. It certainly is a cut above all their cheaper models and incorporates stereo record functions as well as replay. Alas, only Dolby B noise reduction is fitted, and the machine has only two heads. But the remarkable compactness of the WM-D6 will be very useful indeed for many serious recording applications. It weighs a mere 640gms, including leather case and average batteries.

The main inputs and outputs are on 3.5mm stereo jacks and are on the right and back of the deck. A switch selects mic or line input for one of the jacks. Ample levels for both high and low impedance headphones are available from two stereo jacks so two pairs can be used at once. The deck requires four AA cells internally, or 6V external supply via a socket on the rear. Current drawn varied from 140mA to just over 200mA, so typical battery life on recording (without spooling) could be around 3½ hours from a set of AA cells.

A miniature ganged rotary record level control is fitted, together with a large record button near it. The stop button is on the front panel with the other controls, including pause (able to stop and re-start the tape), fast forward, rewind, and play. Also on the front is the ganged slider for headphone level. A very small switch for ferric, chrome, or metal tape

types (not ferrichrome) is on the side panel along with a Dolby B on/off switch. It is particularly fascinating that the deck controls allow cueing in either direction.

A hinged lid on the top panel opens a very neat and small cassette compartment. A tape counter with re-set is to the right and metering is with five LED segments, whichever is the higher of left and right channels being indicated. Fast transients were read very accurately, although level discrimination was, of course, very poor and this was annoying. The bottom LED can be switched to read battery state. The speed can be varied  $\pm\,5\%$  from nominal with a control on the back, a switch selecting nominal or variable speed.

Two strap hooks are mounted on the deck which fit neatly into a leather case, the straps also allowing for shoulder suspension. Sony MDR 50 headphones are supplied, and these are lightweight and sound very good.

Pre-recorded cassettes at best sounded excellent, both on the Sony headphones and through an external system, but slight flutter and tape/head contact problems were occasionally noted. Replay azimuth was a little inaccurate, but replay response was at least 3dB down at 10kHz on both ferric and chrome positions. Replay hiss measurements were reasonable. Output levels are about 4dB lower than usual.

The microphone input sensitivities were

quite reasonable, and the circuitry was fairly quiet, quality with our two Beyers being throught very good. The line inputs (3.5mm stereo jack) were reasonably sensitive and there was no clipping problem. In the context of just Dolby  ${\it B}$  the record amp noise floor was reasonable.

Maxell *UD* gave good LF and MF MOLs, but HF saturations were only adequate. Overall noise measured well but Dolby *B* gave just 9dB improvement. Responses were very flat up to 13kHz. Modulation noise was poor, though. Overall sound quality was very good throughout. Sony *UCX-S* pseudochrome did not have very good MOLs and saturation was just adequate, but noise measured quite well with Dolby out, Dolby only giving 8.5dB improvement, though. Sound quality was good, but frankly, should have been better.

TDK MA metal gave very poor LF MOLs, and even at 3.15kHz MOLs were poor. HF saturations were average for the tape type, so quite clearly the results show that this deck is not really metal capable, there obviously being considerable record head saturation. Overall noise measurements were acceptable. Responses were quite reasonable up to 13kHz. All responses rolled off steeply below 50Hz. Sound quality was said to be gritty at LF, although HF was very clear and clean. Quite frankly, I do not really think it's worth while attempting to use metal on this deck.

Wow and flutter measured moderately well in comparison with other 'Walkmans', but not compared with a mains-operated deck. Wow was just noticeable on some types of music. Nominal speed was extremely accurate, but spooling time very slow. Torque was slightly on the low side. Head and guide heights were excellent and head penetration was good, although the erase head was a little low.

I wish we could have got away from 3.5mm stereo jacks, since phonos make interfacings so much easier. Even so, the machine did interface quite well with a normal system, so that the deck was a perfectly reasonable one for many uses in a mini installation.

This is probably the best recording personal cassette recorder available, but surely it should be replaced soon by one with Dolby C. It is beautifully constructed and designed and seemed very reliable, so it can be recommended highly as it will undoubtedly be a lot of fun to use. The rather high price for it is the main reason for it not achieving a 'best buy' rating here.

as fairly s being (3.5mm ive and context	GENERAL DATA Replay azimuth d Line input sensiti Replay noise ferr Replay noise chr weighted (NR o Replay amp clipp
loor was	Replay amp clipp Max replay level f

Line input sensitivity	77mV
Replay noise ferric CCIR/ARM weighted (NR out	) 58.3dB
Replay noise chrome position CCIR/ARM	,
weighted (NR out)	61.2dB
Replay amp clipping ref DL	+ 18dB
Max replay level for DL	
Wow and flutter average (peak weighted DIN)	0.15%
Speed average	
Meters under-read	0dB on 8ms
Overall 10kHz sat ferric L/R ref DL	- 6.2/ - 6.6dB
Overall MOL ferric L/R for 5% dist @	
315Hz ref DL,	+ 5.8/ + 6.5dB
Overall 10kHz sat, chrome position L/R ref DL,	6.0/ - 6.4dE
Overall MOL chrome L/R for 5% dist @	
315Hz ref DL	+ 4.2/ + 5.2dE
Overall 10kHz sat metal L/R ref DL	0.1/ + 0.2dE
Overall MOL metal L/R for 5% dist @	
315Hz ref DL	+ 3.2/ + 4.7dE
Overall noise ferric NR out (CCIR/ARM) ref DL	– 51.2dE
NR improvement Dolby B	9.0dE
Overall noise chrome NR out (CCIR/ARM) ref DL	
NR improvement Dolby B Overall noise metal NR out (CCIR/ARM) ref DL	8.4dE
Overall noise metal NR out (CCIR/ARM) ref DL	– 52.6dB
NR improvement Dolby B	9.0dE
Modulation noise ferric broad/close	
ref 3kHz tone	- 35.9/ <b>–</b> 26.7dE
Line input noise floor, gain min ref DL (CCIR/ARI	
Line input noise floor ref 160mV/DL (CCIR/ARM).	
Spooling time (C90)	2 min 45 sec
Dynamic range ferric/chrome/metal	65/66/64dE

azimuth deviation from average.

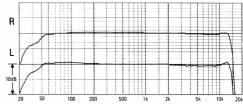
#### **OVERALL FREQUENCY RESPONSES**

at - 20dB ref Dolby level

Noise reduction system

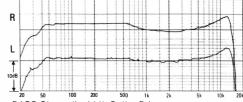
Typical retail price.

Tapes used..

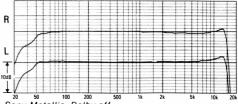


Maxell UD/SonyUCX-2/TDK MA

Maxell BHF ferric, Dolby off



BASF Chromdioxid II, Dolby B in



Sony Metallic, Dolby off

Sony TC-K555

Sony (UK) Ltd. Sony House, South Street, Staines, Middx TW18 4PF Tel 0784 61688



This well laid-out new deck from Sony incorporates a combination head allowing off tape monitoring. Dolby B and C noise reduction is included, together with an excellent tape counter, which indicates time elapsed from a zero point in minutes and seconds, working even during spooling. If zero is at the end of a tape then all readings are 'minutes and seconds to go'. Phono line input and output sockets are mounted on the rear panel. The record level control is a frictionlocked rotary, which felt particularly smooth. and this is complemented by a ganged replay gain control for headphones only. The 1/4" stereo jack provides ample volume.

Metering is with a fluorescent bargraph display, reading from -40dB to +8dB with reasonable discrimination. This display gives a very fast attack time and is excellent. A centre indented preset adjusts bias on ferric only, and pushbuttons select ferric/chrome/ferricchrome/metal (IEC numbers are marked as well). Dolby on or off. B or C, MPX filter on or off, tape or source monitoring, counter reset and memory. A switch selects remote timer start (play or record). A remote control socket is fitted on the front panel. Deck functions allow direct transfer play into wind and back, with auto rewind and play and dropping into record. The pause control stops and restarts tape movement. Deck functions were much liked, and cassette insertion was very simple.

No microphone inputs are provided. The line inputs have good sensitivity, and the input circuits add only very slight noise. The output impedance from the deck is a little high. although levels are average.

Replay azimuth was extremely accurate, but the head was marginally out of true vertically. Very slight 50Hz hum was just noted on the left replay channel, whilst hiss levels were around average. Replay amplifier distortion and clipping performances were excellent.

Sony AHF ferric produced quite good low frequency MOLs and excellent high frequency saturation, showing a good compromise of overall adjustment. Responses with bias nominal showed very sight high frequency droops, but with bias at -1 responses sounded very smooth indeed, rated superb, as was sound quality up to moderately high levels, distortion setting in rapidly above these. Noise measured reasonably with good Dolby improvements, modulation noise being fairly low.

Sony UCXS pseudochrome also gave guite good low frequency MOLs, and very good high frequency saturation — but 3.15kHz MOLs were only adequate. Noise was reasonable throughout, modulation noise being rated very low, which is good. Responses showed high frequency lift, though this was not disliked. Distortion seemed quite low up to fairly high levels, the sound being very open and much liked, although high levels were distorted.

Sony *Metal* gave reasonable low frequency MOLs, and excellent high frequency saturations. Responses sounded quite flat, although the lower presence region did show a slight valley on the charts. Noise measurements were all reasonable, whilst the subjective quality throughout was much liked, showing metal tape to work well.

Although wow and flutter measured well, the clutch mechanism was slightly jerky causing the odd judder (this was not serious though).

Speed was accurate, and spooling time average. Forward tension was rather jerky, but back tension showed only small cyclic variations. Dolby calibrations throughout were reasonably accurate. The Dolby C circuits were better than average, showing that Sony have dramatically improved upon their earlier Dolby C designs.

We all liked this machine very much, for not only were many points of the ergonomics excellent, including a superb counter, good metering and good facilities, but the overall sound quality was often rated superb on all types - though levels will need watching slightly on ferric and chrome. Highly recommended as an obvious best buy.

#### GENERAL DATA

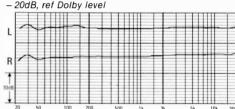
Line input sensitivity	90 m
Worst audible replay hum component 61dB (	50H
Replay noise ferric CCIR/ARM weighted (NR out) 5	6.8d
Replay noise chrome position CCIR/ARM	
weighted (NR out)6	0.2d
Replay amp clipping ref DL+1	7.8d
Max replay level for DL	
Wow and flutter average (peak weighted DIN)	.089
Speed average+	
Meters under-read	
Overall 10kHz sat ferric L/R ref DL	- 4d
Overall Dolby C 10kHz sat ferric L/R ref DL 1/-	- 1d
Overall distortion ferric L/R for 5% dist	
@ 315 Hz ref DL+ 5.8/+	5.6d
Overall 10kHz sat chrome position L/R ref DL.,,,,, - 4/-	<ul><li>4d</li></ul>
Overall Dolby C 10kHz sat chrome position L/R	
ref DL – 1.5/-	– 1d
Overall dist chrome position L/R for 5% dist	
@ 315Hz ref DL+6.0/+	5.6d
Overall 10kHz sat metal L/R ref DL+ 0.5/+	
Overall Dolby C 10kHz sat metal L/R ref DL+ 4/-	+ 4d
Overall distortion metal L/R for 5% dist	
@ 315Hz ref DL+ 7.6/+	
Overall noise ferric NR out (CCIR/ARM) ref DL., 50	).4dl
NR improvement Dolby B/C9.8/18	3.6d
Overall noise chrome NR out (CCIR/ARM) ref DL 53	
NR improvement Dolby B/C9.4/18	3.0d
Overall noise metal NR out (CCIR/ARM) ref DL 52	
NR improvement Dolby B/C	
Modulation noise ferric broad/close ref 3kHz tone - 40/ -	34d

Replay azimuth deviation from average.....

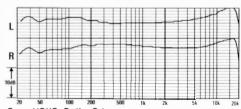
Modulation noise chrome broad/close ref 3kHz tone..... .. - 41/ - 34dB Line input noise floor ref 160mV/DL (CCIR/ARM).... - 78.4dB Spooling time (C90)..... Dynamic range ferric/chrome/metal......76/79/79.5dB 

. £225 when reviewed, now £249

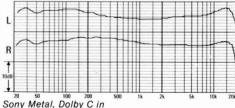
**OVERALL FREQUENCY RESPONSES** 



Sony AHF



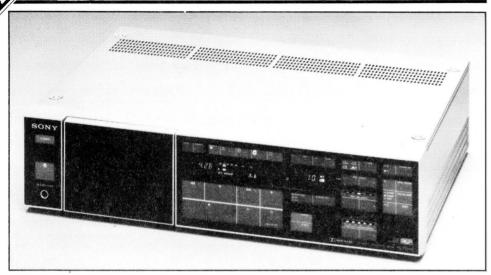
Sonv UCXS. Dolby C in



REVISED AND REPRINTED

## Sonv TC-FX1010

Sony (UK) Ltd. Sony House, South Street, Staines, Middx. TW18 4PF Tel 0784 61688



This new Sony deck is unusual in that despite its three heads, off tape monitoring is not possible, although the automatic tape settingup function and auto peak level attenuator do use all three heads for their operation. All controls on the front panel are touch sensitive types, including the record level (which can go from -56dB to 0dB in five seconds), and a balance control allowing four steps to swing to left or right. Phono line input and output sockets are provided on the rear panel, whilst a 1/4" stereo jack is provided for headphones on the front. There is a touch-operated stepped ganged level attenuator which affects line output levels (average at maximum but from a fairly high impedance) and headphone level (plenty of volume available). A pip tone button allows a pip to be heard whenever a function control is touched, so one can count pips to check on the degree of gain change for example.

Touch sensitive functions also include: Dolby off, B or C: MPX filter on/off; tape type (IEC types 1 to 4, with partly auto switching); auto tape calibration; auto attenuation (programme levels monitored by special replay head circuit which controls record level steps): status memory for four settings; write and check functions; timer record or play; counter reset and memory (the counter is superb, as on the TCK 555); eject, and deck transport functions. The deck allows direct play into

wind and back, pause stopping and re-starting, and record muting. An MOL balance facility allows the overall response to be varied from +1 to -1 dB at 10 kHz after tape calibration. No microphone inputs are provided.

Metering is with fluorescent bargraph display, which indicates transients very accurately. If the pip tones are selected, the meters indicate over-recording with a pip and, if auto attenuate is also selected, will step down the record level appropriately. An indicator tells you if the replay level is nonlinear with record. Input attenuation is indicated in dBs digitally. All functions are indicated by LED displays. This deck has a very high audiophile quotient, even switching itself off when it gets bored with waiting!

The line inputs had average sensitivity, but input noise was only adequate for Dolby C. Replay azimuth was fairly accurate, head and guide heights reasonable. Replay amplifier distortion was satisfactory, but the clipping margin excellent. No replay hum was noted. but the 50Hz measurement was only fairly good, hum components probably being masked subjectively by the higher than average replay hiss which also added to the overall tape noise. Some of the hiss was probably microprocessor noise breakthrough.

Sony AHF ferric produced good low frequency MOLs but just adequate high frequency saturation, responses being much

flatter than average, and well extended (all charts are with MPX in). Overall noise was not too good, but Dolby improvements were good fortunately. Modulation noise charts were reasonable. With auto attenuation switched in. the entire programme sounded well, except for high frequency compression being slightly criticised. The auto-attenuation circuits coped with the high levels very well by attenuating them guite subtly, this action being barely audible. The Dolby C circuits were better than average.

Sony UCXS pseudochrome gave reasonable MOLs and saturations throughout, background noise being adequate, with good noise reduction improvements. Responses measured well, and modulation noise was low. The subjective sound quality was rated superb and very much liked.

Sony Metal gave very good MOLs and reasonable high frequency saturations. Responses were excellent without Dolby, but showed a slight presence hump with Dolby in. Overall noise was average here, with good Dolby improvements, whilst the subjective quality was again much liked throughout. showing metal performance to be very good but not quite superb.

Wow and flutter measured very well and none was heard on the normal programme material. Speed was extremely accurate but spooling slightly slow. Tensions were surprisingly steady.

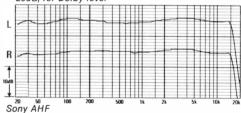
This deck was very difficult to assess in the lab since the microprocessor operation of gain steps caused it to argue with our computer but it should not argue with you! It is so unconventional in ergonomics, that whilst we all liked it, you might not, so you must check this before you order one. I warmly recommend it as a best buy, but to sum up its remarkable features in this short review has been unusually difficult. Its overall sound quality was marvellous, and the microprocessor operations all worked well and reliably, particularly the auto attenuator/pip functions and excellent meters. A remote control socket and an AC mains outlet are included on the back panel. The review sample was an early 110V one: 240V models are usually better on noise performance and I hope this applies here.

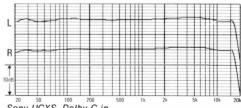
#### GENERAL DATA

neplay azimutii deviation nom average
Line input sensitivity110mV
Worst audible replay hum component – 68dB (150Hz)
Replay noise ferric CCIR/ARM weighted (NR out) 52.8dB
Replay noise chrome position CCIR/ARM
weighted (NR out)
Professional Control of Control o
Replay amp clipping ref DL+ 17.1dB
Max replay level for DL610mV
Wow and flutter average (peak weighted DIN)0.08%
Speed average 0.1%
Meters under-read
Overall 10kHz sat ferric L/R ref DL 8.5/ - 7.5dB
Overall Dolby C 10kHz sat ferric L/R ref DL6/ – 5.5dB
Overall distortion ferric L/R for 5% dist
@ 315 Hz ref DL
@ 313 HZ TET DL
Overall 10kHz sat chrome position L/R ref DL – 6.5/ – 6dB
Overall Dolby C 10kHz sat chrome position L/R
ref DL
Overall dist chrome position L/R for 5% dist
@ 315Hz ref DL+ 6.4/ + 6.4dB
Overall 10kHz sat metal L/R ref DL 1.5/ - 0dB
Overall Dolby C 10kHz sat metal L/R ref DL+ 2/+ 3dB
Overall distortion metal L/R for 5% dist
@ 315Hz ref DL+8.0/+8.0dB
Overall noise ferric NR out (CCIR/ARM) ref DL 48.0dB
NR improvement Dolby B/C9.8/18.6dB Overall noise chrome NR out (CCIR/ARM) ref DL – 51.6dB
NR improvement Dolby B/C9.6/18.2dB
Overall noise metal NR out (CCIR/ARM) ref DL – 51.2dB
NR improvement Dolby B/C9.6/18.0dB
Modulation noise ferric broad/close ref 3kHz tone – 40/ – 34dB
Modulation noise chrome broad/close ref
3kHz tone
3kHz tone
Spooling time (C90)
Dynamic range ferric/chrome/metal74/77/79dB
Noise reduction system Dolby B/C

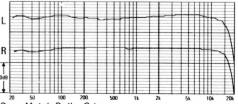
#### Typical retail price.....£360 **OVERALL FREQUENCY RESPONSES**

- 20dB, ref Dolby level





Sony UCXS, Dolby C in



Sony Metal, Dolby C in

## ESEC T

## Technics RS-M216

National Panasonic (UK) Ltd, 300-318 Bath Road, Slough, Berks Tel Slough 34522



This budget two-head deck incorporates just simple facilities, with only Dolby B noise reduction. But it offers very good deck controls (solonoid operated) and is encased in metal. The rear panel has phonos for line input and output, the mains being lead is two-core attached. Metering is with moderately fast peak-reading fluorescent bargraph displays for each channel, with reasonable discrimination. The record level control is a large splitconcentric rotary, switchable to mic or line inputs. No replay gain control is provided, the 1/4" stereo headphone jack giving greatly excessive volume into low impedance headphones and too much even into high impedance ones.

Deck controls permit transfer from play into wind, with cueing, and the pause control stops and restarts both on playback and record. For recording, only the record button need be pressed which is unusual. The tape counter was rather crude and jammed several times during the tests. Cassette loading was simple and effective. The front panel also includes a normal, chrome and metal tape selector, which was poorly labelled, and a Dolby on/off switch.

Two ¼ " mono jack sockets are provided on the front panel for microphone inputs, and these proved reasonably sensitive and surprisingly quiet, the audio quality also being excellent here. The line inputs were slightly insensitive but input noise was minimal and no

clipping problem was noted. Input and output impedances should present no problems and output levels were reasonable.

Replay head azimuth was fairly accurately set, but the head was slightly off its correct height and guides were also marginally in error. Replay amplifier noise measured adequately, with hum levels well down. Replay amplifier distortion and clipping margins were good and no problems were experienced in playing back pre-recorded cassettes.

TDK D tape was originally recommended by Technics for the ferric position, but proved to be over-biased and well down at high frequencies, so Maxell New UD was substituted. The 315Hz and 3.15kHz distortion plots were very good for the tape type, but 10kHz saturation measurement was poor showing the machine to be over-biased and over-equalised here. Overall noise measured extremely well with and without Dolby and modulation noise was adequate. The A/B levels were reasonably accurate and responses showed around a 1dB shelf up at high frequencies, with response curtailing rapidly above 15kHz (built in MPX filter). Low frequencies rolled off rapidly from 50Hz unfortunately. Stability was very good.

TDK SA pseudochrome was found rather muffled and so we substituted SA-X which showed a marginal drop in response around 2kHz, but otherwise was very flat, other than

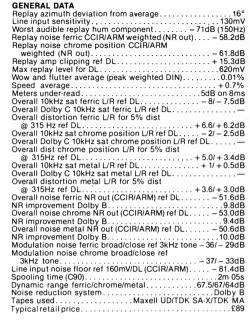
some bass loss, again with Dolby in or out. The 315Hz MOL was frankly very poor, although high frequency saturation was amazingly good — showing that the chrome position was under-biased and under-equalised. Overall noise and Dolby improvement were average. A/B sensitivity was again correct for SA-X. High frequency stability was slightly poorer than average because of the under-biasing. Modulation noise was better than average on SA-X.

TDK MA metal proved to have very poor MOLs at 315Hz, but very good high frequency saturations, and so we suspect some slight head saturation as well as the tape being under-biased. Ironically, 3.15kHz MOLs were actually better than the 315Hz ones, thus proving our criticisms. Overall results on metal tape were audibly excellent provided a rather low recording levels were not exceeded — but dynamic range was thus only good rather than very good. Overall noise on metal was inherently only adequate anyway, but with good Dolby noise reduction, A/B saturation sensitivity being well matched. Responses with Dolby out were excellent and only a marginal presence valley was noted with Dolby in, apart from the same very low frequency loss as before.

Wow and flutter measured very well indeed, especially for a budget deck, and speed was only marginally slow. Spooling times were average. Forward tension was slightly jerky and back tension a little variable but no actual problems were encountered in operation. No problems were noted with erasure or crosstalk.

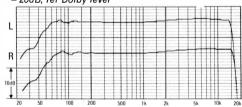
Whilst either low or high frequencies on the various tape types were not too well optimised for distortion, this machine can give some surprisingly good flat responses overall and with the mechanics being basically good, this model is of reasonable value for money although it only includes Dolby B noise reduction. Helped by good meters and deck functions, it can be recommended in the budget class, but I do not really consider it as metal compatible because of its very poor low frequency MOL performance. What a pity that it misses Dolby C though, and the meters do encourage users to keep peak levels down.

(Note: Technics have since introduced a Dolby C version of the 216 designated the RS-M226, which sells for £110).

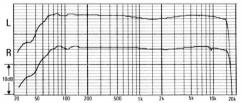


#### **OVERALL FREQUENCY RESPONSES**

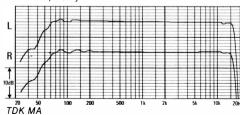
- 20dB, ref Dolby level



Maxell New UD



TDK SA-X. Dolby B in



Technics M245X

National Panasonic (UK) Ltd, 300-318 Bath Road, Slough, Berks Tel Slough 34522



Fairly compact in its metal case, the 245X is a two-head deck and so does not allow off-tape monitoring while recording. Unusually, it has its 1/4 in mic input lacks on the back panel accompanying the phono line in/out sockets. remote control socket, and two-core captive mains lead. Record level is adjusted by a single stereo-ganged medium-throw horizontal fader, with a centre-indented balance fader alongside it. Replay gain is variable via a rather stiff ganged fader of shorter throw. Fader controls were found not too easy to adjust as average European thumbs.

Push buttons select counter mode (three digit display or tape time remaining, pseudoreal-time) along with the necessary tape length setting for the counter (this cycles five time settings from 15 minutes to 60 minutes per side): 'music select' for use with music search. 'music repeat' for block cycling: noise reduction buttons for off, Dolby B, dbx, and dbx disc: counter reset and remote timer start record or playback.

Tape transport functions are conventional, and allow transfer straight from play into wind and back with excellent cueing. The pause control stops but does not re-start tape movement and there is a record mute facility. All the main transport controls are built into a panel which is flush mounted, nice to use for most people though very awkward for the blind

or partially sighted. Tape type selection is automatic.

Behind a glass panel are the fluorescent bargraph meters, reading transients very accurately, but with the scale changing if you choose dbx. The meters, unusually, are unequalised, with bass cut and top boost. They had fair discrimination and read Dolby level at + 3dB approximately, on the mark. The front panel on our review sample felt slightly loose and had a slight sharp edge at a corner.

Microphone inputs were moderately the finger grip was not large enough for sensitive, but slightly hissy. Much hiss pumping was heard when speech was recorded with dbx, Dolby C being much better. The line inputs were slightly insensitive but had no clipping problem. The background noise floor was at a very low level indeed, which should be a lesson to Teac.

Replay azimuth was accurate, and head and quide heights acceptable, with head penetration good. Replay ampifier hiss measurements were excellent, slightly better than usual. Some hum was measured in the lab at 50, 100 and 150Hz, and this needs improvement. The clipping margin was excellent, and output levels were average. Replay responses were also excellent and amongest the flattest. Low and high impedance headphones of normal types could be driven loud enough for almost anyone, the 1/4 in stereo jack having its delivered volume

adjustable with the replay gain control.

Maxell UD gave good LF and MF MOLs, but HF saturations were slightly disappointing. Overall noise levels were all excellent. Dolby C giving virtually a 20dB improvement. Reponses were very good, but showed a gentle EHF lift. Modulation noise was average. The programme sounded very slightly 'up' and bright, but this was not disliked. Slight HF compression was noted throughout the programme, so the tape was just a little overbiased. Background noise with dbx was phenomenally low in the absence of programme, but much programme material caused continual noise modulation, which was strongly disliked. Even so, dbx sounded better than it used to, but Dolby C was so much better, we felt, as to make dbx redundant.

BASF Chrome II gave only fair LF MOLs, but HF saturations were average for the tape, background noise measurements being superb throughout. Responses again showed a slight lift at extremely high frequencies. which was exaggerated a bit with Dolby C, also giving a presence valley. Quality was generally very good indeed with a comment of 'exciting' but we preferred to lower the recording level slightly. TDK SA was generally muffled and was disappointing, but Maxell XLII was much better. Responses with XLII were exellent.

TDK MA metal gave only rather mediocre LF and MF MOLs, but HF sats were excellent. We suggest that the tape was under biased, and R also there must have been slight record head saturation. Overall noise measurements were good. Responses were again slightly up at L EHF. Sound quality was excellent throughout and much liked, despite the disappointing LF MOLs.

Wow and flutter measured well, none being heard on the programme after the machine had warmed up a bit. Speed, unfortunately, was rather too fast, and this was noticed by the R panel. Spooling was slightly slow and torque normal, but some juddering was noticed.

There will be some users who will want dbx. which has the uncanny ability to reproduce silence at appropriate moments. As the price of the machine is very reasonable, then why not try it so that you can play back dbx discs. which can be fun. We liked the ergonomics (not so much the faders), and the overall performance was quite reasonable R throughout. Clearly the best machine with three noise reduction systems among those tested, it must be warmly recommended, but L just misses a 'best buy' because of the replay hum and a few minor points.

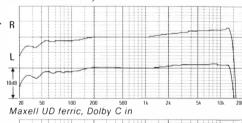
#### GENERAL DATA

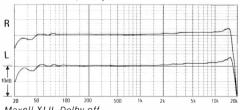
Replay azimuth deviation from average		+	10°
Line input sensitivity		.106	m۷
Worst audible replay hum component 6	6.1dB	(150)	Hz)
Replay noise ferric CCIR/ARM weighted (NR out)-	_	60.3	3dB
Replay noise chrome position CCIR/ARM		00.0	
weighted (NR out)	_	63 (	adB
Replay amp clipping ref DL		1 1	740
Max replay level for DL		+ 17	) E
Wow and flutter average (peak weighted DIN)		۰	0.07
vvow and nutter average (peak weighted DIN)		.0.0	60/
Speed average	0.40	+ 1.	0%
Meters under-read	0aB	on 8	sms
Overall 10kHz sat ferric L/R ref DL	- b.// -	– b.,	30B
Overall Dolby C 10kHz sat ferric L/R ref DL	- 4.6/	- 3.8	RaR
Overall MOL ferric L/R for 5% dist @			
315Hz ref DL	+ 6.8/	+ 6.5	5dB
Overall 10kHz sat, chrome position L/R ref DL	– 5.8/ -	- 5.5	5dB
Overall 10kHz sat, Dolby C, chrome, L/R ref DL	– 3.6/ -	– 2.8	8dB
Overall MOL chrome L/R for 5% dist @			
315Hz ref DL	+ 3.71 -	+ 3.8	BdB
Overall 10kHz sat metal L/R ref DL	+ 0.8	8/0.0	OdB
Overall 10kHz sat, Dolby C, metal L/R ref DL	+ 3.7/	+ 3.0	0dB
Overall MOL metal L/R for 5% dist @			
315Hz rof DI	+ 5.9/	+ 5.6	6dB
Overall noise ferric NR out (CCIR/ARM) ref DL	_	51	4dB
NR improvement Dolby B/C	10. 1	/19.9	9dB
Overall noise chrome NR out (CCIR/ARM) ref DL	_	55 4	4dB
NR improvement Dolby B/C			
Overall noise metal NR out (CCIR/ARM) ref DL		526	Ah?
NR improvement Dolby B/C	10.0	/16	9dR
Modulation noise ferric broad/close	10.0	10.	Jub
ref 3kHz tone	37 71 _	35	1dR
ref 3kHz tone	) )	83	148
Line input noise floor ref 160mV/DL (CCIR/ARM)	) —	00.	940
Specifications (COO)	2 min	100.1	000
Spooling time (C90)	76/7	1 10	260
Dynamic range terric/chrome/metal	/0//	1111	חמק
Noise reduction system	CDUIT	2/0/(	JRX
Tapes usedMaxell UD/BASF	CH II/I	υK	MA

#### OVERALL FREQUENCY RESPONSES

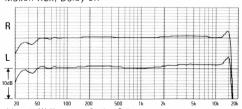
at - 20dB ref Dolby level

Typical retail price...



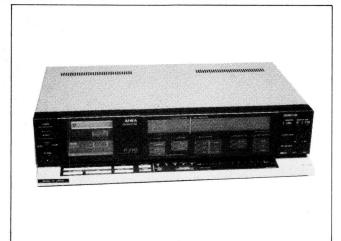


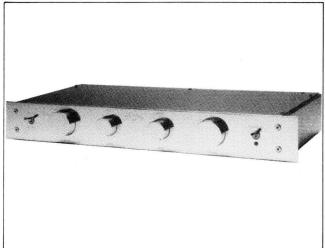
Maxell XLII, Dolby off

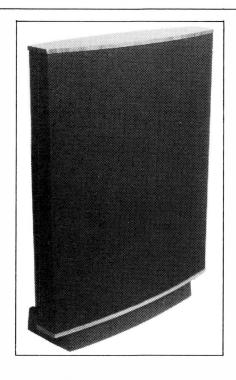


Maxell XLII metal, Dolby C in

# RECOMMENDED BY THIS MAGAZINE









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GRADO — GOLDRING — KOETSU — SUPEX — K.M.A.L. — SHURE —
A&R (CAMBRIDGE) — HAFLER — LENTEK — ONIX — QUAD — ROTEL —
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# CASSETTE TAPES

Hi-Fi Choice again assessed the cassette tape market as part of Issue 32, which gave a brand by brand run down on tape performance to provide the reader with some idea of which tape would best suit his/her machine and pocket. The summaries of Angus McKenzie's extensive computer testing programme, covering over 60 tapes, are compiled in the table opposite for quick reference.

Most cassette tape manufacturers have now adopted the standard IEC numbering scheme. Tapes are now grouped as follows. Group1 includes all tapes for use in the ferric (120us equalisation) position; Group 2 includes all chrome and pseudochrome formulations; Group 3 coversthe everdwindling population of dual-coating ferrichrome tapes; Group 4 covers the pure metal and metal alloy tape types. It may be that you know of cheaper tapes which are not included in this survey but our experience with many unbranded tapes has shown them to offer no economy and in most instances to be an expensive waste of time as they suffer from poor mechanics, which may cause jamming and from oxide shedding. These tapes should not be confused with the best 'own brand' tapes, which are often a repackaging exercise on the products of one of the major tape manufacturers.

Cassette tape types

The first cassette tapes used ferric oxide coating and were designed to be played back with an equalisation determined by the 120uS time constant; this was labelled on machines as 120, Ferric, Normal or I. Tapes coated with chromium dioxide were introduced ten years ago and offered improved high frequency performance; international agreement was reached that the equalisation curve should be changed for their playback and 70uS equalisation was adopted. But chrome tapes proved difficult to produce and had a poor maximum level potential at mid and low frequencies, not to mention the scare stories about tape head abrasion.

Improved chrome formulations have now been marketed by Dupont (Crolyn II) and BASF (Chromdioxid II and Super II, CRII and CRSII). Though these tapes are a definite improvement over the old their sensitivities at middle frequencies are not always compatible with decks being made and aligned in Japan. They often are quieter than pseudochromes but their maximum operating level (MOL) is usually less good, often in the presence region.

Experiments were made with ferric tapes for use in the chrome position to match the ease of ferric tape manufacture with the best of chrome per-

formance. These pseudochromes can be more sensitive in the mid frequencies than chrome and have a high frequency response at least equal to the superchromes. All modern decks are now aligned for these tapes during manufacture but many very old machines cannot supply the extra bias required or else their tape heads saturate.

Group 3 dual-layer ferrichromes havealmost completely disappeared from the market, while decks haven't featured a position III at all for some time how. Many maufacturers claimed that ferric bias and chrome equalisation would work for these tapes but results were usually very unsatisfactory without the true position III bias.

Group 4 Metal tapes made from pure or alloyed metals were first introduced onto the UK market in 1979 but were only available in small quantities and at high prices. There are still many modern decks which claim metal compatibility but nevertheless turn in better performance with good pseudochrome formulations simply because they are incapable of recording the very high levels necessary to benefit from the metal formulation. An improved high-frequency response from your machine with metal may yet be compromised by worse low-frequency performance.

Dolby C has now in effect improved the high frequency performance of normal tapes and has dropped hiss levels well below those achievable with Dolby B, so that the necessity for metal tape formulations has been reduced. Though the most up-to-date metal compatible machines do give excellent results with suitable Group 4 tapes, if it has Dolby C noise reduction then the expense on metal tape will not be worthwhile. At the time of writing, TDK are planning the introduction of a new metal tape compatible with the IEC II standard, which may be a significant development.

What is bias?

The audio signal exists in a record tape head as a modulated current. Forthis current to magnetise the tape with minimum distortion it is necessary to pass a supersonic current through the head at between 75 and 150kHz; this is known as RF (radio frequency) bias, or more simply as bias.

As bias is increased an optimum setting is reached for low distortion, first at high frequencies then, as bias is further increased, at lower frequencies. If the tape is optimised for quite lowfrequencies (333Hz standard frequency) then the high frequencies (typically measured at 10kHz) become degraded. Immediately you can see that setting bias is a compromise between acceptable low and mid frequency performance and low dis-

tortion and making sure that a good response is maintained at high frequencies.

Equalisation

Equalisation refers to the cutting or boosting of certain frequencies by the amplifier circuits in the cassette deck both during record and replay. This is done to obtain a flat frequency response from the tape in use. For reasons of technical convenience the replay equalisation curve is referred to by a time constant (ferric tape EQ is standardised at 120uS).

Variable bias and EQ can be used further to optimise the tape's response, though most decks are fitted with switchable fixed-value bias and

Notes on the comparison table

equalisation.

For ferric tapes, Group 1, IEC I reference tape is regarded as standard throughout and performance generally relating to the comparison with IEC I. Thus 'std' (standard) refers to a tape which is basically IEC I compatible in the relevant parameter. Many words are used to describe degrees of quality, the basic order being superb, excellent, very good, good, fairly poor, poor, very poor and bad. It will be seen that several tapes from the last edition have different adjectives this time. Although this is sometime due to product changes, it may also be due to a stricter appraisal of mechanics. Modern cassette decks are usually biased near the relevant IEC standard. Tapes having a bias requirement called 'low' will usually show a muffled quality on modern decks, although they may be satisfatory an older may be satisfatory and older may be satisfatory an

Maxell UDXII used to be used as a reference for Group 2, for all parameters. This now been changed to the new IEC II reference tape type from BASF. This tape has a lower sensitivity than almost all pseudochromes but is nevertheless used as reference also for 315Hz sensitivity. Noise levels are quoted to the same relative standard as Group 1. Please note that Group 3 (ferrichrome) tapes are omitted from these tables, since they are not recommended for one reason or another, as an entire group, and also omitted are several older and unsatisfactory tape types from other groups.

fatory on older models, particularly

those of European manufacture.

Group 4 metal tapes are all judged against the latest samples of TDK MA, chosen recently as IEC IV reference but with the noise columns assessed in comparison with Groups 1 and 2. 315Hz MOL, 3.15kHZ MOL and HF saturation have now been made relative also to groups 1 and 2, whereas bias, sensitivty and response are referred to TDK MA. All mechanical properties mentioned througout the tables are relative and may be compared directly.

## OVERALL COMPARISON CHART: CASSETTE TAPES

		Bias	MF sensitivity	HF response (ref.bias)	315Hz MOL	3.15kHz MOL	10kHz saturation	Stability dropouts	Wow and flutter	Back- ground noise	Print- through	Mod. noise	Mechan- ical quality	Recom- mendation*	Typical price* (C90)
GROUP 1															
Agfa Fe I	C60	low	standard	down	f. good	good	good	fair	fair	average	excellent	f. poor	-	_	95p
Agfa Fe IS	C60	sl. high	low	up	good	v. good	v. good	poor	poor	low	v. poor	average	-	_	£1.15
BASFLH-EI		sl.low	standard	sl. down	v. good	fair	good	average	excellent	f. high	-	average	good	_	£1.35
BASF LH-Super I		sl. high	standard	up	excellent	excellent	v. good	v. good	fair	high	poor	f. good	good	Rec.	£1.15
Denon DX1		low	sl. low	v. down	good	v. good	f. good	-	-	f. low	-	-	-	-	-
Denon DX3		sl. low	standard	sl. down	good	good	f. good	_	_	f. low	-	-	_	_	
Fuji DR		sl.low	low	sl. down	fair	good	f. good	average	v. good	f. low	good	f. good	good		
Fuji ER		sl. low	standard	sl. down	v. good	v. good	good	good	excellent	low	fair	f. good	v. good	_	
Fuji FR-I		IEC	standard	sl. up	v. good	excellent	excellent	good	excellent	f. low	fair	good	v. good	Rec.	_
Hitachi DL		sl. low	low	down	fair	good	fair	good	excellent	f. high	good	average	v. good	-	_
Hitach i UD		IEC	standard	flat	v. good	v. good	excellent	good	excellent	f. low	fair	average	v. good	-	-
Hitachi ER		IEC	standard	flat	excellent	excellent	excellent	v. good	excellent	average	fair	average	v. good	_	_
Hitachi SR		sl. high	sl. high	sl. up	excellent	good	excll. +	v. good	excellent	f. low	f. good	f. good	v. good	_	_
Marantz MF1		low	standard	v. down	good+	good	good	good	f. poor	f. high	v. good	fair	_	_	_
Maxell UL		sl. low	low	down	fair	good	fair	good	excellent	f. high	good	average	v. good	_	£1.12
Maxell UD		IEC	standard	flat	v. good	v. good	excellent	good	excellent	f. low	fair	average	v. good	Best Buy	£1.54
Maxell XL-I		IEC	standard	flat	excellent	excellent	excellent	v. good	excellent	average	fair	average	v. good	Best Buy	£1.90
Maxell XL-IS		sl. high	sl. high	sl. up	excellent	good	excll. +	v. good	excellent	f. low	f. good	f. good	v. good	Rec.	£2.35
Memorex MRXI		sl. low	standard	down	v. good	good	good +	average	fair	average	v. good	f. poor	fair	_	_
Philips UFI		IEC	standard	flat	excellent	excellent	excellent	v. good	v. good	high	fair	f. good	good	Rec.	
Philips Fel		v. low	v. low	v. down	f. poor	good	fair	fair	v. good	f. high	f. good	fair	good	_	
Pioneer N1		IEC	v. low	flat	fair	good	good	good	v. good	average	v. good +	fair	good	_	
Pioneer N2		sl. low	low	sl. down	good	v. good	good	good	excellent	f. low	fair	fair	v. good	_	_
Scotch Master I		IEC	standard	flat	excellent	v. good +	v. good	good	good	high	fair		fair	_	-
Sony BHF		IEC	standard	flat	excellent	excellent	excellent	v. good	excellent	f. high	excellent	f. good	good	Best Buy	
Sony AHF		sl. low	sl. low	up	v. good	excellent	excll. +	v. good	excellent	low	v. good	f. good	goood	Rec.	
TDK D		IEC	sl. down	flat	good	v. good	v. good	good	excellent	f. high	v. good	f. good	v. good	Rec.**	85p
TDK AD		IEC	sl. down	flat	good	excellent	excellent	good	excellent	low	f. good	fair	v. good	Best Buy	_
TDK AD-X		sl. high	standard	sl. up	excellent	excll. +	excellent	good	v. good	f. low	fair	fair	v. good	Best Buy	£1.15

GROUP 2															
Agfa Crll		IEC	sl. low	flat	good	fair	fair	fair	v. good	ex. low	poor	f. good	-	-	_
Agfa Crll-S		high	sl. high	up	v. good	fair	f. good	poor	good +	ex. low	poor	good+	_	-	_
BASF Crll		IEC	standard	flat	good	f. good	good	v. good	excellent	v. low	f. good	good	good	_	£1.50
BASF Cr Super II		IEC	high	sl. up	excellent	fair	good	good	excellent	ex. low	poor	good	good	Rec.	£2.00
Denon DX7		IEC	high	flat	good	f. good	good	_	_	low		_	-	•_	_
Fuji FRII		low	sl. low	down	good	good	f. good	good	excellent	low	good	f. good	good	_	_
Hitachi EX		IEC	sl. high	flat	v. good	good	v. good	v. good	excellent	low	f. good	average	v. good	-	_
Hitachi SX		sl. low	v. high	sl. down	excellent	f. good	good	v. good	excellent	v. low	good	f. good	v. good		_
Marantz MC2		low	sl. high	down	v. good	fair	f. good	average	_	v. low	poor	average	_	_	_
Maxell XLII		IEC	sl. high	flat	v. good	good	v. good	v. good	excellent	low	f. good	average	v. good	Best Buy	_
Maxell XLIIS		sl. low	v. high	sl. down	excellent	f. good	good	v. good	excellent	v. low	good	f. good	v. good	Best Buy	£2.00
Memorex High Bias II		IEC	standard	flat	fair	f. good	good +	good	_	v. low	f. poor	fair	_	_	£1.80
Philips UC II		high	standard	up	v. good	fair	fair	average	v. good	v. low	poor	average	good	_	_
Pioneer C1		IEC	sl. high	flat	good	f. good +	good	v. good	v. good	v. low	f. poor	average	v. good	_	_
Scotch Master II		sl. low	high	down	v. good	f. good	good	v. good	_	v. low	fair	-	_	- 1	- 1
Sony UCX		IEC	high	flat	excellent	good	good	v. good	excellent	v. low	good	f. good	good	Best Buy	-
Sony UCXS		IEC	v. high	flat	excellent	good	good	v. good	excellent	low	good	f. good	good	Rec.	£2.85
TDK SA		IEC	sl. high	sl. up	v. good	good	good	good	v. good	v. low	good	average	v. good	Best Buy	£1.60
TDK SA-X		IEC	v. high	flat	v. good	good	excll. +	good	v. good	low	fair	f. good	v. good	Best Buy	£2.10
GROUP 4										Se.					
Agfa Metal	C60	IEC	standard	flat	excellent	excellent	excll. +	poor	_	low	excellent	_	_	_	_
BASF Metal IV		low	standard	down	excellent	v. good	excll. +	fair	v. good	f. low	excellent	fair	good	_	£3.25
Denon DX-M		sl. low	standard	sl. down	excellent	v. good	excll. +	_	-	low	-	_	_	Rec.	_
Fuji FR Metal		sl. high	sl.high	sl. high	superb+	excellent	superb+	v. good	excellent	low	excellent	f. good	v. good	Best Buy	_
Hitachi ME		sl. low	sl. low	sl. down	superb+	excellent	superb	good	excellent	low	excellent	f. good	v. good	_	_
Maxell MX		sl. low	sl. low	sl. down	superb+	excellent	superb	good	excellent	low	excellent	f. good	v. good	Best Buy	_
Memorex Metal IV		IEC	standard	flat	superb	excellent	superb+	good	_	f. low	excellent	fair		_	_
Philips Metal		IEC	standard	flat	excellent	excellent	superb+	poor	_	low	excellent	-	good	_	_
Pioneer M1	C60	sl. low	standard	sl. down	excellent	v. good +	superb	average	v. good	f. low	excellent	fair	good	_	_
Scotch Metafine		low	high	down	superb	excll. +	superb+	good		low	excellent	-	_	_	-
Sony Metallic		sl. low	standard	flat	excellent	_	superb	good	good	low	excellent	_	good	_	_
TDK MA		IEC	standard	flat	superb+	excll. +	superb+	good	v. good	low	excellent	average	v. good	Best Buy	£2.90
TDK MA-R		IEC	standard	flat	superb+	excll. +	superb+	good	v. good	low	excellent	average	v. good	Rec.	£4.50

<sup>\*</sup>Recommendations must be taken in the context of the reviews, and as explained in the text other tapes may be worth considering. Prices are for C90s, quoted where obtainable as we went to press, and should be taken only as a rough guide. Multiple packs usually offer considerable savings. \*\*See text.

# **TUNERS**

Tuner models tend to be among the 'stayers' in a rapidly-changing hi-fi market. Though is has been a long time since *Hi-Fi Choice* has featured tuners in its reviewing schedule a representative cross section has now been reviewed and the 'Best Buy' and 'Recommended' products are presented here.

A tuner is simply a radio receiving device which presents its output at line level for connection to a suitable preamplifier or preamp section of an integrated amp. To transmit music or speech by radio the audio signal is made to ride 'piggy back' on the radio wave. There are two methods of 'encoding'; in one system the fre-quency of the radio wave is changed (modulated) according to the shape of the audio signal (frequency mod-ulation or FM). The other technique is to vary the strength or amplitude of the (fixed frequency) radio signal in time with the audio signal, which is known as amplitude modulation or simply AM.

FM has an inherent high performance capability with wide bandwidth, wide dynamic range and the possibility of stereo encoding. The audio signal is not affect either by changes in the radio signal strength and comes free of the background noise limitations and interference inherent with AM boradcasting. FM stereo is achieved by broadcasting the sum of the left and right channels (that, is a mono signal) but also at the same time broadcasting the difference signal between the two channels into a second band encoded above the audio band up to 38kHz. This ensures normal mono reception for the average 'tranny' but enables the decoder section of a hi-fi stereo tuner to do a bit of adding and subtracting to come up with the stereo

AM broadcasting in the UK uses two wavebands. Medium Wave (or MW) travels well but is prone to atmospheric and local electrical interference and overcrowding of the waveband. This quality of signal is also very limited. Long Wave (LW) travels better and has a less populated waveband so the incidence of foreign interference is lessened. Since the latest internationallyagreed wavelength changes, it has become essential to have Long Wave

to receive BBC Radio 4 UK feature programmes during the day when Radio 4's FM channels are devoted to Broadcasting for Schools.

#### **Features**

The major difference between tuners on sale today is between those with digital readout and the conventional scale tuner analogue types. The essential difference is in the 'front end' of the tuner. The conventional tuner uses an expensive variable capacitor to tune in stations; in contrast the true 'digital' tuner uses frequency synthesis techniques. There is a grey area between the two; some conventional tuners are provided with digital readouts of the received frequency, which is not the same thing as a true digital tuner. Look for the words Synthesis or Synthesiser in the maker's description and don't pay for something you're not getting

The digitally-synthesised tuner opens up many convenience-feature possibilities with scanning and automatic waveband switching being almost all too easy for the manufacturers to offer. Station presets are more easily designed into a digitally tuner.

Some aids are usually provided to improve tuning accuracy. A signal-strength meter and a centre-tune indicator are most helpful but too many manufacturers choose inappropriate meter calibration; all too manyofferfalse reassurance by lighting up fully with only a very weak aerial signal!

#### **Performance**

Tuner technical performance is one of the most complex areas of hi-fi measurement and of necessity we have to resort to technicalities to discuss how to interpret the results of our tests.

Sensitivity tells you how well the tuner will pick up weak stations. It is a measure of the aerial signal required to supress the background noise a certain way below the signal. Figures are quoted for mono and stereo performance at 50dB signal-to-noise. The lower the figure the better.

Signal-to-noise shows the ultimate dynamic range potential of the tuner. The bigger the better.

Muting threshold is the point at which the 'interstation' mute is

released. The threshold should be set to discriminate between plain weak stations and noisily weak stations.

Selectivity tells you how well the tuner can cope with two stations close together on the waveband. We have adopted the alternative channel measurement (400kHz away). 60dB is a good standard, 80dB excellent.

Pilot tone rejection shows how well the tuner ditches the stereo carrier tones which may be inaudible to many listeners but which can upset recordings on tape decks with whistles. Better than 55dB is good.

AM rejection measures the tuner's immunity to interference from electrical or other radio-borne noise. The bigger the number the better the rejection. 80dB is excellent; 50dB

Capture ratio shows how well a tuner would deal with two stations on the same frequency but at different strengths. The figure is for the smallest difference between the two signals that will result in the weaker of the two signals being rejected 30dB below the stronger one. The lower the figure the better the tuner will operate in areas where two transmitters are broadcasting on the same wavelength in fringe reception or overlap areas between transmitters. Ratios lower than 1.3dB are considered good; the range runs between 0.6 and 3.0dB. the latter being a figure which can be regarded as poor.

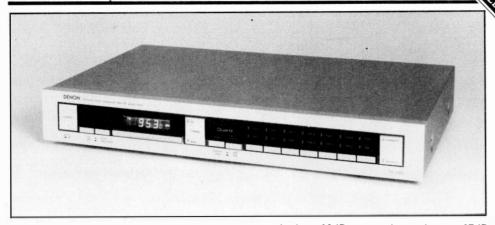
Frequency response was charted for all the tuners but as there were all so close it was considered that there would be little audible difference attributable to frequency response differences. Where response anolmalies do occur they have been mentioned in the review text.

### **Reception conditions**

When choosing a tuneryou must consider its ability to cope with the local reception conditions. Often this is of greater importance than the inherent sound quality of the tuner under reception conditions. If you wish to consider reception of long distance stations you will have to look more closely still at the tuner's technical radio frequency specification. Details of aerial choice are given in the section Choosing and Setting up a Hi-Fi System, at the front of the book.

## **TUNER BUYER'S CHECKLIST** Are the tuning aids suitable for the reception conditions? If you intend to receive anything other than locally boradcast FM you need a good centre tune and a signal strength meter. Is a stereo beacon Are there enough preset stations? Do they operate on all three wavebands or are AM Are the stereo/mono button and muting features combined as here? For the reception of distant stations it is often presets shared between MW helpful to have separate control. An FM hi-blend feature will mono the high frequencies on a stereo broadcast to and LW? If a digital readout is fitted is this merely a readout of the received frequency or evidence of a true digitally sythesised front end? Look on the fascia for word 'Synthesiser'. minimise noise on a weak Does the tuner provide both broadcast that you want to manual tuning and automatic hear in stereo. The AM aerial should be Is there a suitable input for the A variable level output can be a aerial you are using? This model features a 750hm big help in matching the turner steerable or detachable from volume to that from the stereo the tuner to enable it to be unbalanced coax male aerial socket which requires a female co-ax plug on the lead from the FM aerial. Bare wire positioned for hiss-free cartridge. reception. connectors are provided for 300ohm balanced aerial feed. The 300ohm wire dipoles Does the waveband selection supplied with many tuners are often unsuitable for hiss-free FM stereo reception. A baluns transformer will enable you to cover the broadcasts in which you are interested? Remember you may need long wave for Radio 4 reception. use a 75ohm imput with 300ohm feeder or vice versa. Professional aerial installation is inexpensive and is strongly recommended

Hayden Laboratories Ltd. Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG Tel (0753) 888447



The TU750 sells at a moderate £150, and is a slimline design with a silver fascia and a brown case. Denon have chosen the digitally-tuned route whereby all controls are push button and a fluorescent numeric display shows tuned frequency for both AM and FM wavebands. This tuner offers a number of additional features such as a record level calibration signal, as well as manual and automatic station-seeking tuning, and a memory section which will store the settings for seven FM and seven AM stations. The intensity of the display has two settings to help accommodate different lighting conditions.

Screw terminals provide for 300ohm and 750hm connection, while the AM loop aerial is demountable, on a short cable, and can be pinned up for the best reception. The fixed level output sockets are phono.

#### Sound quality

Clearly one of the better tuners in the group, the TU750 provided a pleasant sound. Subjectively stereo background noise was low. and it was also sensitive enough to attain good noise levels on quite low signal strengths.

Stereo images were fairly sharply-focused. and a fair impression of depth was also given. Well balanced tonally, the subjective distortion was fine with good clarity, and the AM sound quality was rather better than average.

#### Lab results

A 150µV input sufficed for a 50dB stereo signal to noise ratio with the mono result at 7µV (1kHz ref, CCIR ARM).

Ultimate stereo signal to noise ratio was

marginal at 63dB stereo improving to 67dB mono. Alternate channel selectivity was fairly good, while capture ratio and AM rejection levels were fine. Total harmonic distortion was satisfactory and did not deteriorate when the signal was overmodulated by a factor of 30%, while pilot tone rejection was just satisfactory at - 39dB. Output level was 500mV and stereo separation about average. Crosstalk intermodulation was unexceptional, while the frequency response showed a slightly rising level with increasing frequency, measuring 1dB up at 12kHz relative to 200Hz, and 2dB down at 20Hz.

#### Conclusion

Though the sensitivity is quite good, and the background noise subjectively fine, free of the common spurious whistles, the overall technical performance was quite unexceptional. However the unit did sound well for the price on both AM and FM, and was also well equipped. It deserves recommendation.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	7μV/150μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo,,,,	
Muting threshold	5.5μV
Alternate channel selectivity	– 61dB
Pilot tone rejection	– 39dB
AM rejection	
Capture ratio	1.0dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	
Stereo separation, 1kHz/5kHz/10kHz	9dB/34dB/28dB
Output level, 100% mod	
Dimensions (width, depth, height)	43 x 30 x 7cm
Typical price inc VAT	£150

## Fisher FM-275

Fisher Sales (UK) Ltd, 1-4 Walter Lawrence Estate, Otterspool Way, Watford, Herts Tel (0923) 31974



the 'super power' CA-275 amplifier also reviewed in this issue. Selling at a budget £130, the unit uses the currently-popular set of store up to eight stations on each band, which is a comprehensive selection. Manual and automatic station seeking are provided, entering stations to the memory store proving straightforward. On the rear panel a small switch adjusts the synthesiser steps from separation was average. '9kHz AM, 50kHz/FM' for the UK, to 10kHz/100kHz for other countries. Audio Conclusion output is in phono, while FM aerial input is Highly rated for its sound on strong FM stereo from this model.

#### Sound quality

This tuner proved insensitive, in that a high signal level, of over 10mV was required for a full subjective suppression of spurious whistles in the audio background. It was then pretty quiet however, and gave a good stereo performance. The depth and clarity were well above average and the bass was also favoured. while stereo focus was fine, and the tonal balance appeared neutral. The AM sound was judged poor though, appearing noisy as well as coloured and muffled.

#### Lab results

Rated sensitivity was in fact to a good -

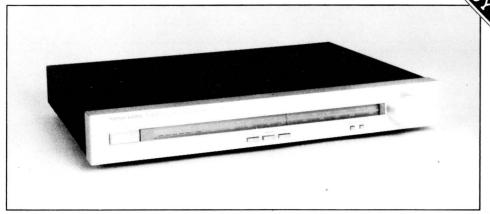
Built by Sanyo for their Fisher division, this standard, with the stereo (1kHz CCIR/ARM) low-profile unit is styled in satin black to suit signal to noise ratio satisfactory at 200µV. although full stereo quieting did not occur until 15mV was reached, this due to the presence of 'birdies' or low level whistles in the audio. The digital tuner electronics, including the RF parameters - capture ratio, selectivity and fluorescent numeric display of station carrier AM suppression - were pretty good, and pilot frequency. Three wave bands are provided - tone rejection was excellent. Output was a long, medium and FM - and the memories can healthy 925mV and distortion levels were guite low under all modulation conditions, including the severe crosstalk intermodulation tests. The frequency response was quite flat midband, but drooped slightly at the band edges, reaching - 1dB, 30Hz and 15kHz, Stereo

750hm (coax) only. AM reception is via a ferrite signals, which was good for the price, it was bar, with some limited adjustment. An external rather poorer on AM, and may also show slight AM aerial could be used to get the best results whistles from weaker FM stations on occasion. Fortunately, this tuner can produce a really competitive sound under good signalstrength conditions, and so is recommended.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise Mono/stereo	.6μV/200μV
Mono/stereo	.73dB/68dB
Muting threshold	– 70dB
Pilot tone rejection	– 83dB – 60dB
Capture ratio	
At 100% mod, 1kHz, mono/stereo	17%/0.25%
Stereo separation, 1kHz/5kHz/10kHz 43dB Outputlevel, 100% mod	925mV
Dimensions (width, depth, height)	x 2/ x 11cm £130

## Harman-Kardon TU-610

Harman (Audio) UK Ltd. Mill Street, Slough, Berks SL2 5DD Tel (0753) 76911



This low-profile tuner matches the Harman- reasonable depth, but on AM it was considered Kardon range of integrated amplifiers and sells for a modest £130. An analogue design, it is described as 'linear phase' on the panel which presumably refers to the type of pilot tone filtering. Off station, the long dial is illuminated in red, while accurate tuning causes a change to green. An LED bar type signal strength display is employed, and the tuning knob is well weighted, as well as smooth in action. FM and AM medium stereo/mono switching is separated. A hightreble separation.

The AM aerial is a large swivelling bar, and an external aerial may also be fitted. Three Conclusion inputs are provided for FM - 300ohm This neat tuner provided a good all round balanced, 750hm binding posts and a 750hm (male) coax connector. Audio outputs are quality was sufficient to bring it into the 'Best phono while an unshrouded US-type two-pin mains outlet was also fitted on our sample, this not strictly to the safety standard.

#### Sound quality

Subjectively, the TU-610 seemed fairly sensitive and offered good stereo background noise levels by 1mV input, and did not suffer from whistles etc. One listener commented that it possesed a touch of the 'HK sound' with an above average bass definition. Inevitably some loss of detail and clarity was noted when it was compared with the original sound, but this was considered moderate, and the HK achieved guite a good rating for sound quality. The stereo was fairly well focused with

to be a little below average.

#### Lab results

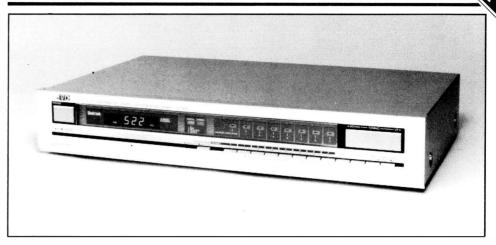
Sensitivity was moderate, with 100µV required for the 50dB stereo quieting level, though it quieted quickly above this input attaining a good 69dB stereo signal-to-noise ratio by 1mV aerial input. The front-end performance was quite reasonable with a 67dB selectivity 1.3dV capture ratio and 60dB AM rejection. wavebands are covered and the muting and Distortion levels were just satisfactory and it did not respond too well to overmodulation. blend function improves the signal to noise Output was guite healthy at 840mV and good ratio on weak transmissions at the expense of channel separation results were recorded. while pilot tone rejection was fine at 60dB.

performance at a competitive price. The sound Buy' category, and it can be warmly commended.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
	8µV/100µV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	.74dB/69dB
Muting threshold	5.1µV
Alternate channel selectivity	67dB
Pilot tone rejection	60dB
AM rejection	60dB
Capture ratio	1.3dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo 0	.44%/0.47%
Stereo separation, 1kHz/5kHz/10kHz 40d8	3/39dB/36dB
Output level, 100% mod	840mV
Typical price inc val	£ 139
	Sensitivity for 50dB signal-to-noise Mono/stereo Ultimate signal-to-noise (CCIR/ARM) Mono/stereo Muting threshold Alternate channel selectivity Pilot tone rejection AM rejection Capture ratio

## VC TX-22L

JVC (UK) Ltd, 6-8 Priestley Way, Eldonwall Trading Estate, Staples Corner, London NW2 7AF



Priced at just over £100, the JX22L tuner matches the correspondingly-priced JVC amplifiers. Styled in silver alloy with a blue fascia incorporating the usual fluorescent digital display, the tuner has no rotary controls, as it is digitally operated. It can store a total of 14 preset station frequencies three for long wave, four for medium and seven for FM. Manual as well as automatic scan tuning is provided, with a mono button to mute stereo operation on noisy signals.

Aerial connection is via binding posts for 75ohms and 300ohm termination on FM, and also for auxiliary AM aerial; a hinged box aerial is for AM fitted but it is not possible to rotate this for optimum reception. Signal outputs are in phono.

#### Sound quality

As has been noted with other inexpensive digital tuners in this survey, the JX22L showed some minor whistles in the audio output at around levels below 1mV. Above a 5mV input the stereo output was decently quiet, and overall this tuner sounded above average, with a lively, open character and good clarity. Detail loss was mild, with reasonable treble, and it also responded well to overmodulation. It gave quite good stereo depth, and the AM sound was also above average, showing good clarity.

#### Lab results

The JVC was quite sensitive particularly on stereo where it achieved a 50dB, 1kHz weighted signal to noise ratio for 100µV of aerial input. 4mV was required for full quieting reaching a good 70dB stereo, 74dB mono. Output level was just over 1 volt. The RF parameters were to the usual standard. alternate channel selectivity about average, with AM rejection and capture ratio both good.

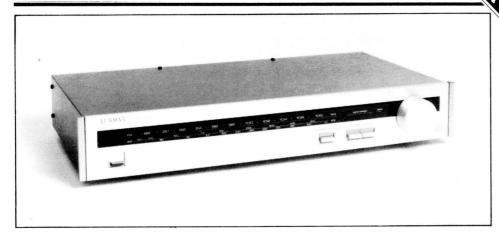
Total harmonic distortion was satisfactory on mono, but rather higher in stereo, reaching 0.85% on peak modulation. Stereo separation was better than average, with a good 34dB recorded at 10kHz.

#### Conclusion

On decent strength signals, this tuner provided a good sound quality on FM and to some extent, on AM as well. At lower FM signal strength levels it still worked well, but with some slight whistles, which may however not prove obtrusive in practice. This design offers good value for money and is rated as 'Best

GENERAL DATA	Tune
Sensitivity for 50dB signal-to-noise	
Mono/stereo	7μV/100μ\
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	74dB/70dE
Muting threshold	
Alternate channel selectivity	
Pilot tone rejection	
AM rejection	59dE
Capture ratio	1.2dE
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.21%/0.85%
Stereo separation, 1kHz/5kHz/10kHz	
Output level, 100% mod	
Dimensions (width, depth, height)	
Typical price inc VAT	
<b>7</b>	

HW International Ltd. 3-5 Eden Grove, London N7 8EQ Tel 01-609 0293



tuning dial and a nicely weighted, freewide range of stations must be set against the digital alternative, where manual tuning is

Finished to high Lux standards, the open dial covers three wavebands, namely long. medium and FM. The final detail is the stereo/mono button, with rear connections including 750hm coaxial (male) socket for FM. plus 300ohm balanced binding posts. A large open sound is to be expected. detachable loop aerial is provided on a short cable for AM, while an external aerial can be Conclusion connected if required. The standard of both This tuner, though without the convenience of finish and construction was high for the price.

#### Sound quality

This modest tuner gave a good account of itself. Good noise quieting was observed, with no spurious tones or whistles. The sound was guite 'open' with a decent quality shown in the bass and treble registers. The midrange was well balanced with reasonable stereo depth and focus, with only a slight hardness, while it was also reasonably good on AM and certainly above average in clarity on strong stations.

#### Lab results

The mono sensitivity was quite good at 6µV for our specially weighted result, and the 60µV for 50dB stereo was also OK. By 2mV input, a fine 70.5dB stereo quieting was attained. Its RF

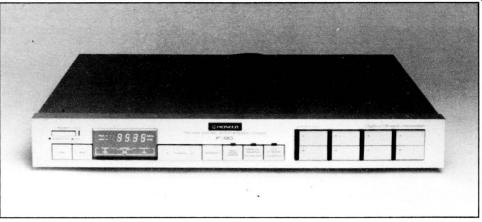
This is an 'old-fashioned' design in its use of a performance was also promising, with 67dB of conventional FM front end with a normal alternate channel selectivity and reasonable values for AM suppression as well as capture spinning rotary control. The fast and ratio. Muting was rather late at 2μV; 10μV is a convenient action of this system for seeking a more realistic muting threshold value. Output was normal at 700mV, while stereo separation was to the usual standard. Distortion was more awkward but pre-set station selection is suprisingly low, and well maintained over the range of tests including the overmodulation section. Pilot tone suppression was also fine at - 78dB. The frequency response showed some premature bass rolloff, measuring - 3dB at 50Hz, while the treble was slightly lifted, to + 1dB at 14kHz, but with no peaking. A dry

pre-set stations, offered a fine all-round performance at a very attractive price, and accordingly it happily qualifies for 'Best Buy'

	-
GENERAL DATA Tune	er
Sensitivity for 50dB signal-to-noise	
Mono/stereo	V
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	
Muting threshold	V
Alternate channel selectivity 67d	В
Pilot tone rejection	В
AM rejection	В
Capture ratio	В
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo0.11%/0.12%	6
Stereo separation, 1kHz/5kHz/10kHz42dB/38dB/28d	В
Output level, 100% mod	٧
Dimensions (width, depth, height) 45 x 24 x 8cr	
Typical price inc VAT £11	0

## Pioneer F90

Pioneer High Fidelity (GB) Ltd, Field Way, Greenford, Middlesex UB6 8UZ Tel 01-575 5757



An advanced digital tuner, this Pioneer design offers the usual microprocessor-aided facilities such as preset tuning, power scan and so on. Extra features include AM medium waveband coverage, a record level calibration output signal and variable IF bandwith narrow for congested reception with weaker signals and wide for clean well spaced stations to derive maximum sound quality. Eight preset buttons are provided, and the silver front panel is well laid out. Rear panel facilities include a 750hm coaxial socket (UK female) with 300ohm binding posts and an unattached AM loop aerial which can be freely placed to get the best reception. Outputs are phono.

#### Sound quality

This tuner was sensitive and it 'limited' quickly, providing excellently quiet stereo backgrounds from 600µV up. Only the merest trace of digital whistles was apparent. The sound was considered quite good, with a slight dulling in transient attack, and it appeared open and clear, with quite good stereo depth and focus. It sounded tidy in the bass and treble extremes, as well as fairly presentable on the AM bands, a bonus in some reception areas.

#### Lab results

Very sensitive on mono, it also achieved 50dB stereo quieting by 60 µV and an excellent 75dB stereo signal-to-noise figure by 2mV, reaching a subjectively good 65dB by 0.6mV. The RF performance was excellent (as we have come

to expect from Pioneer) with an 86dB selectivity complemented by a 1dB capture ratio and an astonishing 80dB AM rejection. It can cope with severe reception conditions, from fringe to over-congestion, while muting was sensible at 6<sub>u</sub>V. Audio output measured 730mV. Pilot rejection was good, and distortion satisfactorily low, even when overmodulated. The best figures were attained on wide IF, but narrow was also pretty good. for example note the excellent stereo separation results. The frequency response was extremely flat to -1dB, 15kHz, with accurate de-emphasis.

#### Conclusion

With a basically good, reliable, and accurate sound, the Pioneer also rewarded us with a superb lab performance and silent backgrounds. One of the best all round digital tuners at a realistic price, the F90 therefore qualifies for 'Best Buy' status.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	5μV/60μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	81dB/75dB
Muting threshold	6.0µV
Alternate channel selectivity	– 86 dB
Pilot tone rejection	– 58dB
AM rejection	– 80dB
Capture ratio	1.0dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.1%/0.15%
Stereo separation, 1kHz/5kHz/10kHz68	
Output level, 100% mod	
Dimensions (width, depth, height)	
Typical price inc VAT	£220
*'Narrow' IF bandwidth setting	

### Ouad FM4

Quad Electroacoustics Ltd, St Peters Road, Huntingdon PE18 7DB Tel (0480) 52561



A characteristically distinctive design from this famous British company, this middlepriced Quad tuner has been intelligently designed and works with a minimum of fuss. A large, well-weighted tuning knob gives manual station selection, the tuned frequency shown on the large digital display. A combined signalstrength/centre-tune bar graph is included in the display, and was found to work well. Seven pre-set stations may be automatically programmed, appropriately marked BBC 1 through 4; BBC LR (local radio); and ILR1/ILR2 for the local commercial stations.

Rear panel facilities include a three-pin IEC mains input, a shrouded IEC three-pin mains outlet, plus a 750hm (female) coaxial aerial socket and a DIN audio output. Both finish and constructional standard are very high.

#### Sound quality

Despite digital tuning, the FM4 had clean backgrounds free from the usual annoving whistles. By the time input reached 1mV, it showed decently quiet stereo backgrounds, and the sound quality was much favoured, scoring up with the best in this group. Stereo images were well focused, and pleasing depth was reproduced. Tonally it sounded quite neutral, and the treble was free of grain or harshness. Some mild loss of detail and bass attack was apparent when compared with the original sources, which was nonetheless a favourable result when the attainment of some of the other models is taken into account.

#### Lab results

The FM4 was quite sensitive, reaching the

50dB stereo quieting (1kHz ref, CCIR/ARM) by 70µV and ultimate stereo signal-to-noise ratio by 2mV with a 66dB recorded which is a satisfactory result, and slightly better than the broadcast chain. This tuner was not at its best separating a weak from a nearby strong station with a selectivity of around 50dB, which was rather below average. Conversely AM rejection and capture ratio were quite good. Output level was lower than usual at 300mV but good pilot tone rejection was shown. Total harmonic distortion was about average with 0.25% mono and 0.5% stereo (full modulation, left or right channel only). It also responded well to overmodulation, and attained good stereo separation.

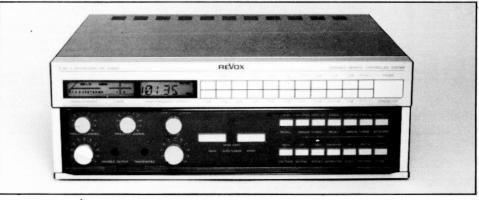
#### Conclusion

This tuner appeals on the grounds of its fine sound, excellent ease of use, good build, and finish and a more than satisfactory technical performance. Clearly a quality design, it justifies 'Best Buy' status.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	7μV/70μV
Ultimate signal-to-noise (CCIR/ARM)	301010010
Mono/stereo	
Muting threshold	4045
Alternate channel selectivity	– 490 E
Pilot tone rejection	
Capture ratio	1 8dF
Total harmonic distortion	
At 100% mod. 1kHz, mono/stereo	0.25%/0.35%
Stereo separation, 1kHz/5kHz/10kHz	
Output level, 100% mod	300m\
Dimensions (width, depth, height)	
Typical price inc VAT	£240

## Revox B261

F W O Bauch Ltd, 49 Theobald Road, Borehamwood, Herts WD2 4RZ Tel 01-953 0091



This is a remarkable FM tuner, closer to a aerial rotation facility is taken into account. professional rather than a domestic receiver in Alternate channel selectivity was very good terms of build quality. For FM only, it has a and capture ratio excellent, as was the AM host of facilities ranging from auto aerial suppression at no less than 77dB. Distortion rotation to twin volume-adjustable headphone was low, particularly when overmodulated. sockets. Digitally synthesised, the tuner has Pilot tone suppression was excellent and the space for 20 preset stations whose names may be entered on a keyboard and displayed on selection. The signal-strength meter is highly reaching 60dB mid band, while audio output accurate and all its many facilities worked well including the variable muting threshold and variable stereo threshold. Infra-red remote control is possible, and this model is also slight lift in the last two octaves at around compatible with the new line of Revox 0.6dB, the output still at full level at 15kHz. electronics. Variable and fixed output level phono sockets are provided, while the aerial input is 75ohm coaxial (male). A DIN audio This comprehensive tuner was a most socket is also included.

#### Sound quality

This tuner was superbly engineered, and felt 'right' when setting up for the auditioning. It proved to be sensitive, with good guieting by 50μV and almost silent at 500μV with no accessible. spurious tones or whistles. The sound quality rated as 'good', if slightly subdued and softened when compared to the original source, but very pleasant nonetheless, with a clean treble. The mid tonal balance appeared a little thin, but not seriously so, while the stereo focus was good and depth satisfactory.

#### Lab results

The IHF mono 50dB quieting figure was impressive at 1.6µV with our 50dB stereo (1kHz ref CCIR/ARM) figure sustained at a good 45μV. This is a sensitive tuner suited to a wide range of reception conditions, particularly if the

ultimate signal-to-noise ratios were also pretty good. Stereo separation rated as very good, was ample at 2.2 volts, this variable to suit the matching amplifiers. The treble response was very flat from 100Hz to 2kHz but showed a very

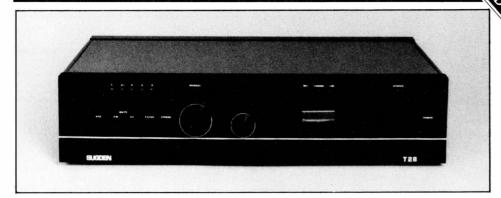
#### Conclusion

sophisticated and well executed example of modern broadcast design. For the FM enthusiast with a deep pocket it would be a logical choice, and can be expected to give years of service - on a hill site in southern England many of Europe's transmitters will be

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	4uV/45uV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	76dB/70dB
Muting threshold	variable
Alternate channel selectivity	82dB
Pilot tone rejection	– 82dB
AM rejection	77dB
Capture ratio	0.8dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	
Stereo separation, 1kHz/5kHz/10kHz	
Output level, 100% mod	
Dimensions (width, depth, height)	45 x 33 x 15cm
Typical price inc VAT	· · · · £897

## Sugden T28

J E Sugden & Co Ltd, Valley Works, Station Lane, Heckmondwike, West Yorks WF16 0NF Tel (0924) 404088



Two versions of this British-made tuner are available — the *T28* here reviewed and the *DT28*, which adds a digital tuning readout at some extra cost. The *T28* is in the traditional Sugden styling. The front panel is not properly labelled, and the designer has chosen to use a rotary switch for up to five pre-set stations, these adjusted via a set of screwdriver slots at the rear. No tuning meter is fitted; instead, there is a red-green-red lamp system, which can be confusing. A moving-coil meter gives a rough indication of tuned frequency. Manual tuning is by an unweighted knob coupled to a 10-turn potentiometer.

Signal output is via a permanentlyconnected phono lead, with aerial input via a 75ohm coax (female) with rather inaccessible screws provided for a 300ohm unbalanced connection.

#### Sound quality

While this tuner seemed quite sensitive and showed a rapid quieting, it was plagued by 'birdies' or whistles until a signal level as high as 5-10mV was reached. Stereo background was reasonably quiet at this level though this was still poorer than average. However, the sound was liked, and a reasonable impression of depth as well as a clean, lively character was noted. It also seemed capable of above average musical detail, sounding tonally neutral.

#### Lab results.

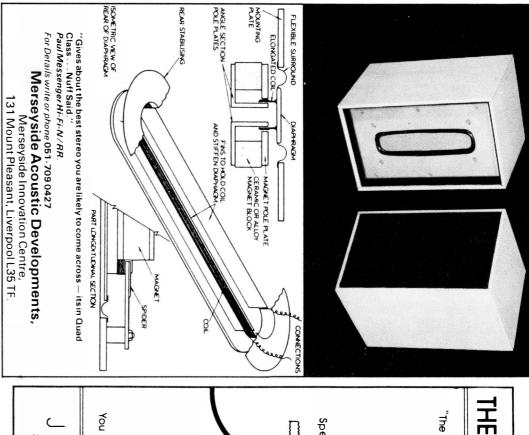
The *T28* was fairly sensitive, with  $60\mu V$  sufficient for 50dB stereo noise quieting (1kHz ref CCIR/ARM). 1mV input was required for full stereo quieting, this levelling out at 61dB, which is poorer than average. Normally

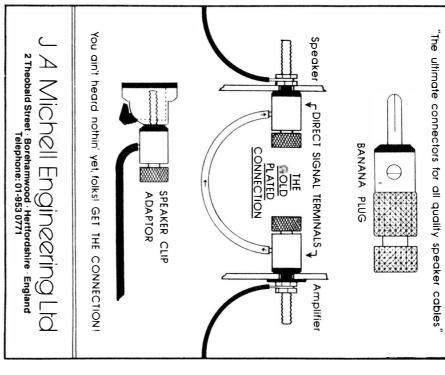
weighted, the mono sensitivity was  $3.5\mu V$ . The RF performance was not very strong, with a selectivity of 52dB, a 55dB AM suppression and a 2.1dB capture ratio. Total harmonic distortion was worse than average at up to 0.65% stereo, full modulation with a similar figure for mono overmodulation. Pilot tone rejection was fine however at -72dB. Stereo separation was good in the mid band but deteriorated at higher frequencies to 21dB at 10kHz. Output level was 620mV while the muting threshold was ridicuously low at  $2\mu V$ . Frequency response was quite uniform, with just a mild 1dB shelf down in the first half octave in the treble.

#### Conclusion

At £172 the *T28* could do with some refinements such as better RF performance, as well as better suppression of spurious tones at moderate signal levels. Conversely the sound quality was quite good, sufficient in fact for a cautious recommendation to be in order; but we hope that the company will improve overall product quality.

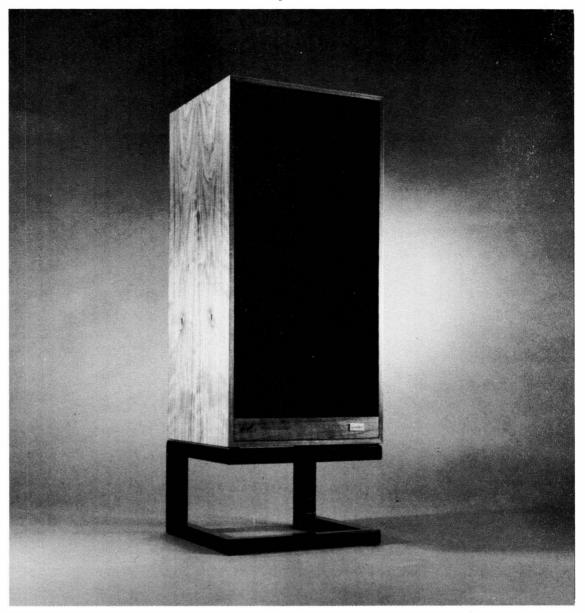
GENERAL DATA	Tune
Sensitivity for 50dB signal-to-noise Mono/stereo	
Mono/stereo	65dB/61dE
Alternate channel selectivity  Pilot tone rejection	
AM rejection	– 55dE
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	
Stereo separation, 1kHz/5kHz/10kHz	40dB/28dB/21dE
Output level, 100% mod	
Dimensions (width, depth, height)	43 x 23 x 9cm





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# **HEADPHONES**

Headphones, like loudspeaker, convert electrical energy into mechanical vibrations which couple to the ear through the air and which is perceived as sound. As headphones are the only item of consumer electronics worn about the person, comfort plays a large role in their choice!

#### On or around

There are two major types of headphone — those which rest on the ear and those which fit around ear. These are described as supra-aural (on top of the ear) and circumaural (around the ear). These descriptions generally correspond to the open-backed (or 'dynamic') and closed types of 'phone respectively. The circumaural 'phone has a 'closed-in' or isolated feel that endears it to some listeners but which others find oppressive. This is quite apart from the general comfort of the headband and padding.

#### Sealed or not

The open backed 'phone does not cut out sound from outside and sound will also spill over from these 'phones to the outside. The benefit of this type is the sharp transient sound and extension of the stereo image outside the head. Of course such 'phones are of little use when others in the same room want to watch TV for example.

Closed back 'phones both isolate you from the environment and the environment from you, which is a big point in favour of this type of 'phone for users who wish to use a headphone for hi-fi listening while other members of the family watch TV in the same room. The closed back 'phone does couple better to the ear and can reproduce low frequencies in some ways better than the open type.

#### **Drivers**

Manytransducerprinciples have been tried for headphones. The most common is the moving-coil driver which is similar to a loudspeaker drive unit. The signal passes through a coil of wire which moves in the gap of a magnet with the changing signal and vibrates the attached diaphragm.

Electrostatic headphones are the second most common type. These use a sheet of conductive material suspended between perforated electrodes charged at a high voltage; changes in the audio signal, applied over a biasing signal, cause the diaphragm to move backwards and forwards, quite linearly, between the electrodes. The electret'phone is the capacitor analogue of the electrostatic while thin-film magnet types copy the idea of a thin diaphragm driven over its entire surface. Electret and electrostatic'phones need driving from an energiser box which takes its power from the loudspeaker outlet of the amplifier rather than from the

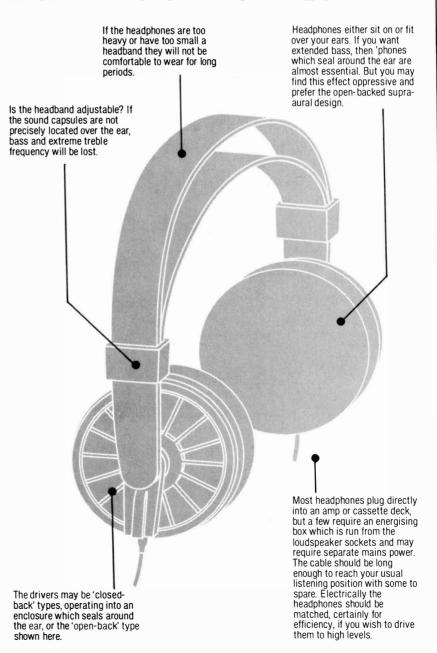
resistor attenuated headphone socket.

#### **Choosing headphones**

Taste is a bigger factor in headphone choice than with any other piece of hi-fi equipment. 'Hands on experience' and personal audition are essential to determine the volume, comfort and colouration levels of the models you've short-listed.

Our review measurements come from tests using two different dummy ears while later reviews used a tiny microphone right in the ear canal of the reviewer! Beware comparing results from these different types of test. What you should look for is a smooth and even trace falling close to the marked 'ideal' response. This will ensure a neutral, uncoloured sound.

## HEADPHONE BUYER'S CHECKLIST



### Audio-Technica 0.5

Audio-Technica (UK) Ltd. Hunslet Trading Estate, Low Road, Leeds



#### Audio-Technica 0.3

Next up in the AT 'Point' series is the 0.3. Here. sensitivity was rather better than for the 0.1 at a high 103dB, this achieved with a higher 43ohm impedance. Capable of decent midband sound levels the 0.3 nonetheless gave high distortion when driven hard at low frequencies. The bass rolloff meant that a 90dB level at 40Hz resulted in 12.0% distortion, though at 1kHz the 0.1% measured was fine. The frequency response was not unpromising above 600Hz, but it showed a prematurely humped lower midrange centred on 250Hz, falling off at 9db/octave below 200Hz. Consequently the 40Hz point was nearly 16dB below the reference level.

Placed 'below average' on audition, the sound was fairly good in absolute coloration terms, but was both dulled and mid-dominant. with a chesty, thickened effect. Real bass was notable by its absence, which was felt to be a serious problem. Taken overall, the 0.3 could not be recommended.

#### Audio-Technica 0.5

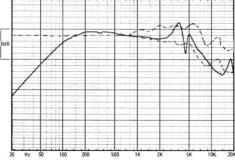
Finally we have the 0.5, the most expensive model. This offers the same sensitivity and impedance as the 0.3, and high sound levels were possible though with significant distortion at low frequencies - for example, 13% at 40Hz. However 0.1% measured at 1kHz distortion over the rest of the range was comparatively good. Frequency response was Frequency response, IEC artificial ear (AT 0.5)

notably improved compared to the 0.3, with more upper-midrange energy and minimal mid emphasis or 'humping', although it did roll off early at low frequencies - being, for example, - 12dB at 40Hz.

Auditioning placed the 0.5 in the 'average' class; in numerical terms it rated slightly above the 0.1. The sound was notably deficient in bass but at least it was free of chestiness or boom. Slight nasal coloration was heard, but otherwise the effect was open with good treble detail and clarity. A reasonably good headphone, but one which does not set any new standards for value.

GENERAL DATA: AT 0.3
Frequency response 100Hz-5kHz, rel. 500Hz
(deviation from mean curve) + 4dB, - 4dB
Frequency response overall within ± 5dB
(deviation from mean curve) , , , 90Hz to 9kH
Impedance
Sensitivity for 2.83V (via 330 ohms for jack) at
500Hz; (equivalent to 1 watt/8 ohms) 103dBlin/101dB/
Connection and lead length 6mm jack, 3n
Weight and comfort
Type moving coil, supra-aural, open
Sound insulation
Loudnessaverage
Subjective qualitybelow average
Price (typical, inc. VAT) £18 when reviewed, now £16.5

#### **GENERAL DATA: AT 0.5** Frequency response 100Hz-5kHz, rel. 500Hz (deviation from mean curve) . . . . . . . . + 3dB, - 3dB Frequency response overall within ± 5dB (deviation from mean curve) .......................70Hz to 10kHz 500Hz; (equivalent to 1 watt/8 ohms) . . . . . 103dBlin/102dBA Type ..... moving coil, supra-aural, open Subjective quality ......average .. £22 when reviewed, now £20 Price (typical, inc. VAT) ...



## Audio-Technica ATH7 and ATH8

Audio-Technica (UK) Ltd. Hunslet Trading Estate, Low Road, Leeds Tel (0532) 771441



These elegant electrostatic headphones are supplied with a drive box which needs connection to amplifier speaker terminals; bypass loudspeaker switching is also provided. Of moderate weight they nevertheless proved comfortable with extended use. while the quality of construction and finish was very high. Using electret film diaphragms, these 'phones were sensitive and could be driven to very high sound levels. The bass reproduction was particularly powerful, which is most unusual for an electrostatic design, as premature rattles are often encountered. An overload warning light was provided to prevent 'phone and listener ear damage. Of supraaural fit, they were open-backed and provided negligible sound isolation.

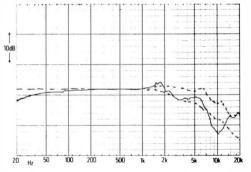
The frequency responses demonstrated exceptional correlation with the trend envelopes. The midrange was uniform with the bass well extended and free of the all too commonly encountered hump, while the high frequencies were smooth, well maintained and extended, with good ouput to 20kHz. Subjectively the ATH-7 did not do quite as well as these measurements might have indicated: for example, the sound was not as 'open' as for the Stax models. On the other hand, their smoothness, clarity and high resolution of detail were much appreciated as was the fine bass depth and power. Stereo imagery was also to a high standard.

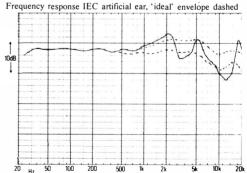
On the basis of its overall quality the ATH-

7 may be recommended. The slightly more expensive ATH-8 was also tested and found to be very similar if sounding a touch more 'open'. At some £60.00 extra, this comes with a more elaborate 'box' with power indicators, and can also be recommended.

#### **GENERAL DATA**

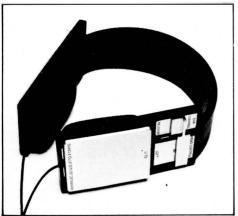
Frequency response 100Hz-5kHz, rel 500Hz (deviation from mean curve) ............+1dB, -1dB Frequency response overall within ±5dB (deviation from mean curve)........... 20Hz to 20kHz 500Hz;(equivalentto 1 watt/8 ohms) . . . 109dBlin/107dBA Connection and lead length ..... amplifier leads, 2.5m Weight and comfort. 210g, good
Type. electret, condenser, supra-aural, open
Sound insulation. none Loudness.....very good High/low switch: -6dB





Frequency response real ear, 'ideal' envelope dashed

Bang & Olufsen (UK) Ltd, Eastbrook Road, Gloucester GL4 7DE Tel (0452) 21591



These unusuallooking headphones employ the orthodynbamic principle of operation, a plastic film with lightweight surface coil and magnetic drive. The successful soft inner headband technique is used, together with rather stiff controls to permit locked adjustment of pad angles and axis. While they were pretty comfortable, the side pressure was judged too high and could not be reduced by prestressing (a useful dodge with steel sprung headbands).

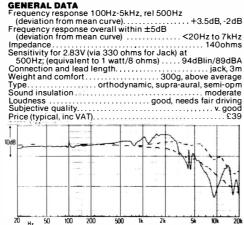
The lower than average impedance (a very uniform 140 ohms) meant that the sensitivity was lower than the voltage specifica- Frequency response IEC artificial ear, 'ideal' envelope dashed tion might indicate, and to produce a decent sound levbel using nominal 330ohm impedance amplifier sockets the volume setting needed to be well up. Consequently these 'phones are not suited to tape deck outputs. The low frequency range was excellent, exhibiting good power and a cutoff below 20Hz, with no audible distortion: the quality of ear seal did not affect this unduly.

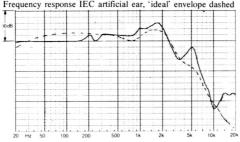
Lab measurement showed an interaction with the artificial ear at around 8kHz, which varied with position, but which would also seem present on the dummy head graph, relative to the 5 and 15kHz regions. This anomaly aside, an interestingly close correspondance to our 'ideal' was shown by the curves for this model, and the response was clearly very extended and generally well balanced and even.

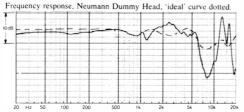
This character was confirmed by audition, the U70 proving to be quite clean and neutral with good extension at low and high fre-

quencies. However, the stereo effect was not quite as airy and ambient as for some of the 'open' phones, and some slight veiling of detail was occasionally noted.

Worthy of best buy status, these are fine headphones which excel on normal domestic program, and offer some useful acoustic isolation. For long term monitoring though they are probably a bit tight, and they also need a fair amount of driving.







Frequency response, B&K4153 Artificial Ear, 'ideal' curve dotted.

JVC (UK) Ltd, Eldonwall Trading Estate, 6-8 Priestley Way, London NW2



A conventional, moderately priced headphone, the 404 weighs approximately 120g excluding cord and is thus fairly lightweight. Head pressure was not too high and wearing comfort was satisfactory. Moving-coil diaphragms are used in the drive units, and the construction is semi-open, affording marginal exclusion of external sounds.

At 94dB these phones were not very sensitive and moreover possessed quite a low impedance of 14.5ohms — which could prove unsuitable for a number of tape decks and preamps which offer only restricted output. Distortion levels were satisfactory, especially considering the fact that these relatively insensitive phones needed more drive than usual to meet the test sound level. A distortion figure of 1.5% was recorded at 40Hz, with 0.2% at 1kHz. The frequency response met + 2dB limits from 45Hz to 600Hz, above which point the output decayed to a lower level, about 5dB down, the treble then being fairly well maintained at this level to 16kHz. Some peaks and troughs were however present in the treble range.

Probably the best of the JVC phones reviewed in this edition, the 404 scored an 'average' mark on audition. Bass was quite tight and extended, and the general balance fairly good. Some coloration was evident in the midrange — a degree of nasality and hardness with an 'enclosed' feeling. While the treble lacked detail, it was otherwise satisfactory.

Though unexceptional, these reasonably comfortable phones were at least not too far from the required standard and at the price merit recommendation.

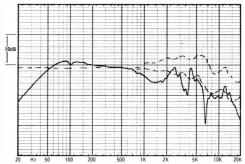
#### JVC HP707

We also tried the more expensive 707, a 'closed' design which was judged fairly comfortable. Sensitivity, was measured at 103dB, Impedance measured 54ohms, and the 707 proved capable of producing high sound levels. Distortion was much lower than for the open 'velocity' type headphones, measuring 0.33% at 40Hz and less than 0.1% at higher frequencies. Although the measured frequency response was erratic, it did correspond fairly well with the ideal envelope. The low frequency band was humped around 80Hz, with a peaky prominence around 2.0kHz.

Rated below average on audition the 707 was quite colored with a thick, 'shut-in' quality, The bass was quite deep and fairly uniform but bass output was found excessive to the point of boominess, while hardness was evident in the mid making the sound fatiguing at high levels. The treble lacked smoothness, sparkle or detail. Overall, the sound was clearly unnatural and did not rate a recommendation.

#### **GENERAL DATA: JVC HP404**

Frequency response 100Hz-5kHz, rel. 500Hz (deviation from mean curve) . . . . . . . . + 2dB, -8dB Frequency response overall within ± 5dB 500Hz; (equivalent to 1 watt/8 ohms) ......94dBlin/90dBA Connection and lead length . . . . . . . . . . . . . 6mm jack, 3m Sound insulation ......a little Loudness . . . . . . below average 



Frequency response, IEC artificial ear (HP404)

Senneiser
Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter Ruck Tel (0753) 888447



worthy of recommendation.

#### Update

The recommendation of the HD40 was based on incorrect price information, at its typical price of £12.95 the HD40 reaches Best Buy status.

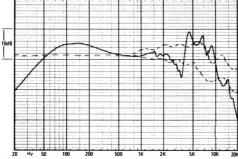
Following the success of their inexpensive HD400/410 models, this year Sennheiser have introduced an even less costly design called the HD40. Weighing around 25% less than the HD400, these phones were if anything even more comfortable. It does seem, in fact, that Sennheiser have succeeded in cutting both weight and cost of their headphones with each successive model, although at around 70g, even the HD40 does not quite come into the ultra lightweight class.

Another moving-coil supra-aural type, they offered negligible isolation of external sounds. Their sensitivity was average at 96dB, with a typically high Sennheiser impedance of 550ohms. Distortion was a little worse than for the 410; we recorded 10% at 40Hz and 1.3% at 200Hz, this reducing finally to a figure of 0.07% at 1kHz.

The frequency response was rather lumpy with a humped 150Hz range, and the linear open mid to presence region followed by a treble hump at 4-8kHz. The response fell off quickly outside the 50Hz-15kHz limits.

On audition this economy headphone scored an 'average' rating. Showing a touch of exaggerated 'loudness control', it was considered a trifle boomy and tizzy. Although quite good detail was present with moderate mid coloration, the treble sounded a bit forward and out of perspective. Nonetheless, at the price the performance was a commendable one, and makes the HD40 **GENERAL DATA** 

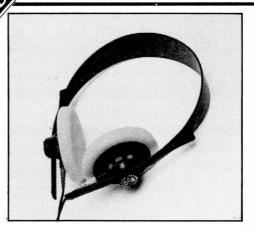
Frequency response 100Hz-5kHz, rel. 500Hz (deviation from mean curve) ......40Hz to 4kHz 500Hz; (equivalent to 1 watt/8 ohms) .......96dBlin/98dBA Connection and lead length . . . . . . . . . . . . . 6mm jack, 3m ..... moving coil, supra-aural, open Price (typical, inc. VAT) .



Frequency response, IEC artificial ear, 'ideal' envelope dashed

Sennheiser HD410

Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9HG Tel (0753) 888447



exchanged and all parts are readily removed for repair — many other headphones need to be scrapped if faulty or requiring repair.

#### Update

The model 400 is no longer available.

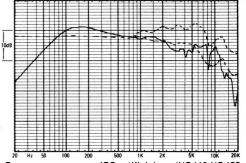
The '410 is yet another Sennheiser lightweight open air phone weighing 80g, and offering good wearer comfort. In fact the '410 is a version of the 400 with detachable leads, and costs only a couple of pounds more than that model. Sensitivity was better than average at 101dB linear and the impedance was also high at 540ohms, which will make it suited to a wide variety of source equipment. Capable of good sound levels, distortion was held to 2.0%, 40Hz reducing quickly with increasing frequency, and at 1kHz a fine 0.4% reading was obtained.

The frequency response was notable for its lack of peaks and dips if not for its accuracy. The output humped at 130Hz with an early bass rolloff measuring -6dB at 40Hz. The response also tilted downwards above 200Hz giving a slightly dull effect though, the general shape was not far from the ideal envelope dotted in on the graph.

On audition the 410 was placed in the 'average' category which was commendable at the price. The sound was considered slightly dull with a boxy tendency in the upper bass. but conversely it was also clear and sweet with a reasonably uncoloured mid range. It receives a strong recommendation as regards value for money and along with the still-current '400, it must qualify for a Best Buy rating. Here it is also perhaps worth mentioning Sennheiser serviceability — headphone cables are easily

#### **GENERAL DATA**

Frequency response 100Hz-5kHz, rel. 500Hz (deviation from mean curve).....+3dB, -5dB Frequency response overall within +5dB (deviation from mean curve) ......50Hz to 3kHz Impedance......540 ohms Sensitivity for 2.83V (via 330 ohms for jack) at 500Hz; (equivalent to 1 watt/8 ohms) . . . . . . 101dBlin/98dBA Connection and lead length . . . . . . . . . . . . . . . . 6mm jack, 3m Loudness......good Subjective quality .....



Frequency response, IEC artificial ear (HD410-HD400 should be identical)

## Sennheiser HD420

Hayden Laboratories Ltd. Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9, 9HG Tel (0753) 888447



Fully re-tested in this issue, the moderatelypriced moving-coil HD420 is a relatively lightweight model, at 140g. The usual Sennheiser foam-cushion ear pads are here replaced by a beige velour type fabric, and the use of a soft support headband separate from the tension band gave a high level of wearer comfort.

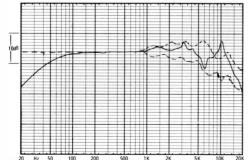
Specified at a nominal 600ohm impedance, the HD420 measured close to this spec at 530ohms, and the sensitivity was good at 99dB linear. Decent sound levels were possible, with satisfactory 3.0% distortion at 40Hz, and less than 0.1%, 1kHz.

The frequency response looked as if it were designed for the IEC jig — perhaps it was! More or less flat from 70Hz to 5kHz, with relatively minor deviations at higher frequencies, the frequency response extended to 17kHz, measuring - 14dB at 45Hz. In response terms at least the HD420 rated as one of the

Fortunately, the HD420 also received a high rating on audition, and was felt to be tonally well balanced, with a wide subjective frequency range and good stereo representation. Clarity was high and coloration reasonably low, the coloration effects noted mainly comprising a slight metallic effect with some treble uneveness and mild 'fizz.' We had no hesitation in awarding this model Best Buy rating for the second time around.

#### **GENERAL DATA** Frequency response 100Hz-5kHz, rel. 500Hz

(deviation from mean curve) . . . . . . . . + 2.5dB, - 2.5dB Frequency response overall within + 5dB Impedance......530 ohms Sensitivity for 2.83V (via 330 ohms for jack) at 500Hz; (equivalent to 1 watt/8 ohms) . . . . . . . 99dBlin/101dBA Connection and lead length . . . . . . . . . . . . . . 6mm jack, 3m Loudness.....good



Frequency response, IEC artificial ear, 'ideal' envelope dashed

## Sennheiser HD222

Hayden Laboratories Ltd. Hayden House, Chiltern Hill, Chalfont St. Peter, Bucks SL9, 9HG



These 'phones were design in response to strong public demand for a cirum-aural sealed-back enclosed model, giving good noise isolation. The HD222 is therefore intended as an alternative to the 'open' HD420, but unfortunately the Sennheiser trademark of an open and ambient sound quality has been sacrificed in the process. Still relatively lightweight, these movingcoil headphones were judged comfortable. as the head pads were quite soft and did not rely on excessive side pressure. As the low frequency performance was somewhat dependent on the quality of head sealing, the real-ear response proved better than the test rig, which in this instance must have been poorly sealed.

Capable of providing good volume, the low frequency range could be driven to Frequency response IEC artificial ear, 'ideal' envelope dashed slight distortion under heavy bass inputs. The design objective was achieved in that the sound insulation was good, but the sensitivity was fairly low and would be inadequate for some tape decks, though satisfactory for most amplifiers.

The response curves were none too promising, with lumpy characteristics on both curves, exhibiting prominence at 150Hz and 6kHz with the output proving deficient at 2-3kHz and above 12kHz. Fortunately the subjective results were rather better than these measurements might have suggested, and a slightly above average score was obtained. The sound proved unfatiguing, but with impaired stereo ambience and a

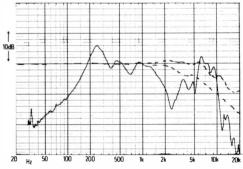
distant, almost 'hollow' quality in the midrange, while an uneven frequency response was also demonstrated.

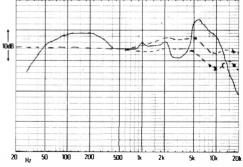
For a closed-back model the result was reasonable at the price, but fell below the open-back equivalent in terms of sound quality.

#### **GENERAL DATA**

Frequency response 100Hz-5kHz, rel 500Hz (deviation from mean curve) ...........+4dB, -4dB Frequency response overall within ±5dB (deviation from mean curve) ............ 60Hz to 6kHz Impedance..... essentially 550 ohms Sensitivity fpr 2.83V (via 330 ohms for Jack) at 500Hz; (equivalent to 1 watt/8 ohms).... 100dBlin/98dBA Connection and lead length. jack, 3m Weight and comfort. 290g, good

Type moving coil, circum-aural, closed Sound insulation. good Loudness. good Subjective quality....above average
Price (typical, inc VAT)....£33 when reviewed, now £42





Frequency response real ear, 'ideal' envelope dashed

224

Sony MDR4T

Sony (UK) Ltd, Sony House, South Street, Staines Middx TW18 4PF Tel (0784) 61688



#### Sony MDR4

Although the MDR3 is still available, it is in effect replaced by the new models in the range. The MDR4, is even lighter than the MDR1 — by some 5g. They also have reduced earpad pressure, offering well above average wearer comfort. Possessing a similar impedance to the MDR1 at 350hms, the '4 was a little more sensitive, measuring an average of 98dB. Interestingly, low frequency distortion was greater, with a potentially serious 30% at 40Hz. and still measuring 5.0%. 100Hz; clearly these phones could not be driven too hard on bassheavy material. However, midband distortion was fine. Frequency response was not dissimilar to the '1, but it differed in that the bass was a little more extended and the entire treble was reduced by several dB — whereas the '1 lay on the 'bright' side of the ideal envelope, clearly the '4 was on the dull side.

Excepting the low bass, auditioning placed the 4 in the 'above average' category. Tonally these phones were well balanced with a clean, open and highly-detailed midband plus fine treble articulation. The stereo effect was good, and although the bass was undeniably deficient and none too clean when driven hard, the MDR4 nonetheless merits recommendation.

#### Sonv MDR70

The MDR70 is one of the more luxurious phones in the range (the similar MRD50s are supplied as standard with the top line Execu-

tive Walkman). Higher compliance 30mm moving-coil dome units are used to provide an extended frequency response, the '70 using a higher efficiency samarium cobalt magnet to achieve greater sensitivity. The MDR70 in fact measured a high 105dB at a kind 53ohms, and would boost the sound level of a portable stereo many times, or make some low output headphone sockets capable of substantial sound levels. Distortion was under good control measuring 5.0% at 40Hz and reducing quickly at higher frequencies to less than 0.1% at 1kHz. Frequency response was very good, with a satisfactory bass extension and a central response tailored to lie quite closely within the ideal envelope, the output maintained smoothly to 16kHz.

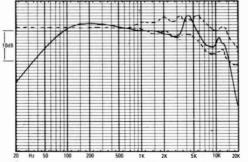
Rated good on audition mild criticisms were made of a 'pinched' effect in the mid with slight wiriness on strings and a 'shy' extreme bass, although in general, bass lines were satisfyingly clear. The balance was a touch dulled, and yet the treble was clean and well detailed — making the MDR70 a certain candidate for strong recommendation.

#### Update

The MDR70 is now replaced by the similarly priced MDR620.

#### **GENERAL DATA: SONY MDR 70**

Frequency response 100Hz-5kHz, rel, 500Hz
(deviation from mean curve) + 3dB, - 3dB
Frequency response overall within ± 5dB
(deviation from mean curve)60Hz to 15kHz
Impedance
Sensitivity for 2.83V (via 330 ohms for jack) at
500Hz; (equivalent to 1 watt/8 ohms) 105dBlin/104dBA
Connection and lead length 2.5/6mm jack, 3m
Weight and comfort
Type supra-aural, open
Sound insulation
Loudness
Subjective qualitygood
Price (typical, inc. VAT) MDR62
Price (typical, inc. VAT) MDR4T £17



Frequency response, IEC artificial ear, 'ideal' envelope dashed

Sonv MDR801

Sony (UK) Ltd, Sony House, South Street, Staines Middx TW18 4PF Tel (0784) 61688



#### Update

This model have been revised giving a slight performance improvement.

Finally we come to the top of the line '80 which differs in small details from the '70, weight being increased by 15g to 60g. In the drive unit a copper clad aluminium voice coil is employed, with a high-molecular-weight (12µm thick) 30mm diameter plastic-dome diaphragm. A stronger, angled capsule swivel system was used, and wearing comfort was undeniably good.

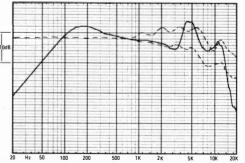
As with the '70, the sensitivity was high at 104dB, and not significantly compromised by the 43ohm impedance. Distortion was a little poorer, measuring 10.0% at 40Hz, and still 1.5% at 100Hz, but improving to less than 0.1% at 1kHz.

In our opinion the frequency response was poorer than for the '70, with a 4dB high bass hump appearing at 180Hz, while the bass roll-off was greater below 100Hz and the lower presence band depressed. Treble response was lumpy from 5kHz to 13kHz, and fell quickly away above 14kHz.

On audition the '80 scored below the '70 but still merited an 'above average' placing. Open and clean in the mid, the bass sounded reasonably good, its excess helping to counteract the 'forward' treble. Overall the '80 was slightly too bright in an unbalanced manner but it nonetheless possessed some subtle qualities, and is certainly well worth trying — the strength of our recommendation, though, is clearly moderated by price, which is high compared with others in the range.

#### GENERAL DATA

Frequency response 100Hz-5kHz, rel. 500Hz (deviation from mean curve). +5dB, -3dB Frequency response overall within±5dB (deviation from mean curve). 70Hz to 14kHz Impedance. 43 ohms Sensitivity for 2.83V (via 330 ohms for jack) at 500Hz; (equivalent to 1 watt/8 ohms). 104dBlin/106dBA Connection and lead length. 2.5/6mm jack, 3m Weight and comfort. 70g, good Type moving coil, supra-aural, open Sound insulation. little Loudness. very good Subjective quality. above average Price (typical, inc. VAT). 5240



Frequency response, IEC artificial ear, 'ideal' envelope dashed



Costing some £130.00, this large headphone of open frame construction is related in concept to the even larger Sigma. It sits almost flat on the head. whereas the Sigma directs the sound at a more natural forward angle towards the ear, and in consequence the Lambda should and does sound brighter by comparison. An electrostatic model, two drive boxes are available, namely the SRD-X (£70.00) and the *SRD-6* (£40.00). The 'X box may be powered by mains or battery (eight 'C' cells), being fed via a standard jack plug, so it can therefore be used with portable equipment. It does however suffer from a limited dynamic range particularly at low frequencies, and in my view this is a serious weakness, although its bandwidth and fidelity are superior to the '6 at modest sound levels. It is also very sensitive, but a volume control is provided to take account of this. The SRD-6 is the standard self-powered transformer box, possessing a fine performance and allowing as much volume level as you could wish for, but it does require power amplifier connection.

No sound insulation was provided, and the Lambda proved quite noisy for other room occupants. It was considered to be very comfortable, with the measured response curves exhibiting good correspondence with our targets, although the bass was not particularly extended, exhibiting a mild hump around 80-100Hz. The real-ear curve suggested extra energy in the last two treble octaves, and this was confirmed on the listening tests, with surface noise sounding prominent as a N tests,

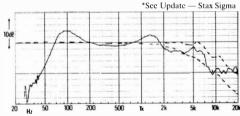
The bass reproduction was slightly 'thick' but superior to that of the Sigma, while the overall fidelity was very fine. The qualities of openness. freedom from mid coloration transparency, and high musical detail were present in full measure. while the stereo presentation was better than almost all the models in the review save the Sigma (whose more natural frontal presentation was judged to be superior).

Aside from the upper brightness which a tone control could easily correct, the sound was to such a good standard that recommendation was mandatory despite the price. Note that we preferred the cheaper SRD-6 adaptor box.

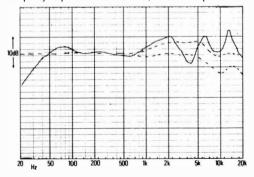
#### GENERAL DATA Frequency response 100Hz-5kHz rel 500Hz

(deviation from mean curve)
Frequency response overall within ±5dB
(deviation from mean curve)
Impedance
Sensitivity for 2.83V (via 330 ohms for Jack) at
500 Hz; (equivalent to 1 watt/8 ohms)
116dBlin/114dBA (SRDX); (102.5/100SRD-6)
Connection and lead length amplifier leads, 2.3m

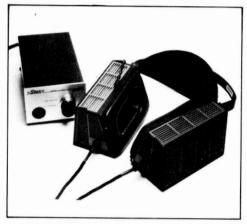
..... electrostatic, circum-aural, open . SRD-6 good (only fair SRDX) Price (typical, inc VAT) £175 when tested, now £224 with new SRD7\*



Frequency response IEC artificial ear, 'ideal' envelope dashed



Frequency response real ear, 'ideal' envelope dashed



This headphone has already received some mention in the technical introduction in connection with the forward off-axis placement of its large electrostatic diaphragms relative to the ear. Selfpowered via a SRD6 transformer unit, the Sigmas proved quite insensitive, although 15-30 watt rated amplifiers were nonetheless ample. Despite their visual bulk, these over-the-ear phones were quite comfortable and they truthfully approximated to the term 'ear speakers'.

Their unconventional acoustic loading (a sort of open baffle radiator) could have caused measurement problems, but in practice this did not seem to be the case. On the artificial ear the response to 1.5kHz was smooth and free of major deviation, with the low frequency limit set at about 30 Hz (this agrees with the subjective appraisal which also showed inaudible distortion at reasonable sound pressures.) However, the 2-5kHz band was clearly depressed by some 7dB or so, before recovering towards 10kHz, the latter part somewhat exposed relative to the adjacent areas. Reasonable correlation was obtained on the Neumann head, though a bass hump was indicated at 60 Hz and the shape was somewhat altered in the 750Hz to 8kHz

Auditioning ranked this model highly with some panelists putting it above all others by virtue of its spacious, coherent and ambient stereo, free of ear clamping mechanics. One or two other listeners however were aware of a tendency to bass lift and a mild fizz in the high treble, together with a trace of mid suckout.

significant advance in headphone design, and while they should be auditioned before purchase, they are nonetheless recommended.

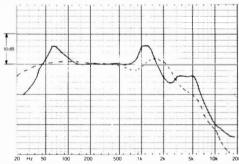
#### Update

A new energiser, the SRD7 at £69, is now recommended for both these 'phones and the Lambdas.

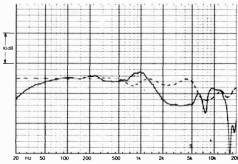
#### GENERAL DATA

Frequency response 100Hz-5kHz, rel, 500Hz

(deviation from mean curve) +4dB, -9dB
Frequency response overall within ±5dB,
(deviation from mean curve) 28Hz to 2kHz
Impedance
Sensitivity for 2.83V (via 330 ohms for Jack) at
500Hz; (equivalent to 1 watt/8 ohms) 85dBlin/79dBA
Connection and lead length power unit, 2.2m
Weight and comfort approx 400 g, above average
Type self-powered electrostatic, circum-aural, open
Sound insulation little
Loudnessgood
Subjective quality, very good
Price, (typical, inc. VAT) £250 when tested, now £281 with new SRD



Frequency response, Neumann Dummy Head, 'ideal' curve dotted



Overall it was felt that the Sigmas represented a Frequency response. B&K4153 Artificial Ear, 'ideal' curve dotted

REVISED AND REPRINTED

'amaha HP3

Natural Sound Systems Ltd, Greycaine Road, Watford, Herts WD2 4SB Tel (0923) 36740



This inexpensive headphone was heavier than it looked, and in comparison with the HP1/2, its headband resulted in greater ear pressure. Since the HP2 appears to employ the same innards, we feel that their improved wearer comfort could be worthwhile despite the slightly higher cost. The HP series of headphones are all well made and finished, and use flat film diaphragms with spiral coils of very low mass - a sort of magnetic film transducer. Of supra-aural design, the capsules are semi-open and provide only a little sound insulation. Their sensitivity was below average, and as a result some cassette decks may not drive these 'phones to high volume levels. At high levels the sound exhibits negligible low frequency distortion. with a smooth and comparatively well-extended bass register.

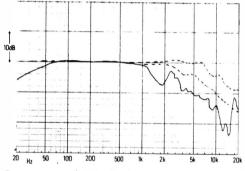
The frequency response of the HP3 showed some family resemblance to that of the previously reviewed HP1, notably in its flat bass and mid frequency range, with a suggestion of excess around 1kHz and then a smooth resonance-free but depressed treble. The result was equivalent to a '-3' or so of treble cut setting on an amplifier tone control, and may therefore be corrected if so desired.

The subjective performance resulted in an 'above average' rating, which is fine at the price. The stereo presentation was good with the overall character relatively uncoloured, but with some dulling and with an impression of mid prominence; the effect was smooth and slightly 'shut-in'. Compared with the HPI, the bass showed a little Frequency response real ear, 'ideal' envelope dashed

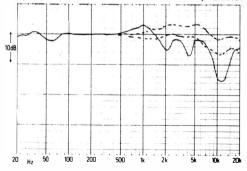
less extension while the treble was not quite so

The HP3s may be recommended, but we suspect that most purchasers would opt for the similar but more comfortable HP2 at ten pounds

GENERAL DATA
Frequency response 100Hz-5kHz, rel 500Hz
(deviation from mean curve)+2dB, -4dl
Frequency response overall within ±5dB
(deviation from mean curve)
Impedance
Sensitivity for 2.83 V (via 330 ohms for Jack) at
500 Hz; (equivalent to 1 watt/8 ohms)
Connection and lead length iack, 2.4n
Weight and comfort
Type magnetic film, supra-aural, semi-oper
Sound insulation fai
Loudness
Subjective quality , good
Subjective quality
Price (typical, inc VAT)



Frequency response IEC artificial ear, 'ideal' envelope dashed



Yamaha HP1
Natural Sound Systems Ltd, Greycaine Road, Watford, Herts WD2 4SB Tel (0923) 36740



designs. The characteristic was generally very smooth, the whole treble region 1.5-15kHz was depressed by up to 5-8dB.

On audition for this issue the HP1 nonetheless still managed to attain an 'above average' rating - sufficient to earn it a recommendation, but no longer meriting Best Buy status. The midrange could sound oppressive with a thickened quality, but the treble was smooth and detailed, if depressed. On the whole the HP1 provided good stereo, with the bass particularly clean and well extended.

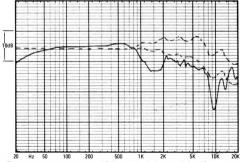
The HP1 headphones were introduced several vears ago now, guite some time before the success of the current breed of open lightweight models, and in their time they set a new standard for smoothness, bass coloration. comfort and visual design. Strongly recommended in previous issues, the HP1 has been fully re-tested this time round, for it is always instructive to re-evaluate earlier trend-setters in the light of new developments.

Still rated as 'fairly good' on comfort, the HP1's 250g weight nonetheless seemed a little heavy now. The drive unit principle used is orthodynamic — the magnetically-driven thinfilm diaphragm resembles that of an electrostatic although not driven by electrostatic forces. The earpads are supraaural and semi-open, with some isolation of external sounds and only moderate sound leakage from the capsules.

Easy to drive, and possessing a 140ohm impedance of great uniformity, the sensitivity was high at 102dB. These phones can be driven to even dangerously high levels without distortion, and low-frequency power handling was particularly good - this is shown by the 0.25% distortion recorded at 40Hz while by 1kHz the figure had fallen well below 0.1%.

The measured frequency response confirmed our developing awareness of the tonal balance of this model, namely that it possessed a rather dull and depressed treble noticeably so by comparison with the latest

**GENERAL DATA** Frequency response 100Hz-5kHz, rel. 500Hz (deviation from mean curve) . . . . . . . . + 2dB, -8dB Frequency response overall within +5dB (deviation from mean curve) ..............20Hz to 8kHz Sensitivity for 2.83V (via 330 ohms for jack) at 500Hz; (equivalent to 1 watt/8 ohms) ......102dBlin/98dBA Connection and lead length . . . . . . . . . . . 6mm jack, 2.5m Type . . . . . . orthodynamic, supra-aural, semi-open Loudness......good Subjective quality......above average Price (typical, inc. VAT)



Frequency response, IEC artificial ear, 'ideal envelope dashed

# **GLOSSARY**

ABR: Auxiliary bass radiator; a reflex type bass-loading for loudspeaker systems, which uses a speaker-like 'cone' without motor, instead of a port.

AM: Amplitude modulated; see 'Medium Wave'

Acoustic breakthrough: Sound that gets into the turntable and hence the cartridge from the air and thereby creates a risk of acoustic feedback (see separate entry).

Acoustic feedback: If any sound in the room can find its way through the body of the record deck to the cartridge stylus, then that sound will be reproduced from the loudspeakers, along with the wanted programme material. If too much of this sound from the loudspeakers is picked up by the cartridge in this way then a vicious circle of acoustic feedback will be created. Active: Speaker systems which contain electronic crossovers and where the drive units are connected directly to power amplifiers.

Alignment protractor: A device used to minimise the lateral tracking error of a cartridge/arm combination.

Amplitude: Size or magnitude; hence the amplitude/frequency response, known normally simply as the frequency response, which describes the relative loudness of the system at different frequencies with a constant input voltage. Anechoic: Without echo; a special room or 'chamber' with thick sound absorbing materials on all surfaces to prevent reflections.

Arm mass: More accurately called *effective* arm mass, because it is *not* the weight of the arm on a pair of scales. It is the mass of the arm and cartridge combination that appears to be concentrated at, and thus felt by, the stylus tip which is tracking a record groove. There is nothing inherently good or bad about arms with light or heavy effective mass; what matters is the manner and choice of their combination with cartridges of different compliance and the low frequency resonance produced by such combination.

Azimuth: With reference to tape and cassette recorders, the alignment of head gap to tape path.

**Balance:** 1) The overall relative loudness perceived at different frequencies (eg bass, treble) 2) the accuracy of the match between the two channels of a stereo transducer (eg cartridge or headphone).

Bandwidth: A range of frequencies with presumed defined upper and lower limits. Bass: Lower part of the frequency spectrum, typically below 150Hz.

Belt drive: The motor has its rotational speed geared down to the required platter speed (331/3 rpm for LP discs) by a rubber or similar resilient belt which runs round a small pulley on the motor shaft and a large pulley attached to or part of the platter.

**Bextrene:** A plastics material frequently used for bass and midrange cones.

Bias: (turntable/arms) Because the cartridge on a pivotal arm is being drawn across the record surface by the stylus tracking at an angle offset from the pivots, groove friction produces an imbalance of ateral force. Bias is the application of a compensatory lateral force acting in the opposite direction.

Bias: (tape) This refers to a high frequency current passing through the record head which allows the audio current also passing through the head to produce reasonably linear magnetisation of the tape at all levels permitted by the combination of each machine with the tape. The lowest level of bias is required for ferric cassettes, a slightly higher one for ferrichrome, an even higher one for chrome or pseudochrome, and the highest for metal

**Binaural:** Closed system recording/replay technique using headphones and 'dummy head' microphones.

**Bituminous damping:** A cabinet damping technique whereby heavy impregnated felt pads are attached to the internal cabinet surfaces.

**Bottoming:** The stylus scraping on the distorted rounded bottom of the groove due to incorrect stylus geometry.

Cantilever: The thin rod or tube that connects the stylus to the armature and hence that cartridge body.

Capacitance: An element of electrical impedance that is particularly important when matching pickup cartridge, arm leads and amplifier input characteristics to achieve a flat frequency response from discs

Clipping: This is reached when a circuit is overloaded and overdriven, resulting in bad waveform distortion and audibly unpleasant effects.

Coloration: A general term used to describe the audible effects of distortions, particularly in loudspeakers and record players. These are usually caused by frequency response irregularities and/or resonances.

Compatibility: The selection of interdependent components to achieve optimum system performance; notably arm/cartridge mass/compliance matching, cartridge electrical loading, or headphone compatibility with amplifiers.

**Compliance:** A measure of the springiness of the cantilever/armature seen from the stylus, expressed in compliance units (cu), where 1 cu =  $10^{-6}$  cm/dyne.

Crossover: An electrical circuit which uses combinations of inductors, capacitors and resistors to divide the signal from the power amp into the required frequency bands and with any necessary equalisation for feeding to the individual drive-units of the speaker system.

Crosstalk: The leakage from one channel to the other in a two channel stereo system. Cutter: Mechanism used to cut recorded signal onto lacquer master; consists of turntable, lathe, cutting head, cutting and servo amps.

**DIN:** German standards body, responsible amongst other things for a popular range of standard plugs and socket specifications.

**Damping:** A means of controlling resonances by means of a resistive medium (electrical, mechanical, or acoustic depending on situation).

**Decibel (dB):** A logarithmic unit that is convenient for expressing ratios that span a wide range on a linear scale. For simplicity it can be regarded as a measure of relative loudness.

**Direct drive:** This type of turntable motor has one moving part, the platter/centre spindle. The other part of the motor is fixed to the chassis or plinth.

**Distortion:** Literally this can mean any deviation from the original, but usually refers to harmonic rather than intermodulation distortions when not specified.

Dolby processing and deprocessing: This

refers to changes introduced in recording and playback in order to achieve noise reduction.

**Doping:** A techique involving the application of damping to a loudspeaker driver cone in order to assist in controlling resonances.

Downforce: The weight, measured at the stylus, which holds it down in the groove. Drive unit (Driver): The term used to distinguish the loudspeaker unit itself, be it bass, midrange, treble or fullrange in application, from the complete loudspeaker system which combines drive units, cabinet and crossover into a total design.

Dropouts: Momentary reductions of programme level due to inadequate head/tape contact caused by oxide particles shedding off the tape onto the head gap, or inadequacies in tape transport or tape

**Dynamic range:** The ratio in dBs between the quietest sound that can be successfully recorded and the loudest which can be accepted without serious distortion on an average programme.

Effective mass: The inertia, or masscontrolled resistance to movement, of a device, particularly important with regard to tonearms.

Efficiency: The amount of acoustic power delivered for a given electrical input power. Electret: Effectively a permanently charged capacitor, it is used as the transducing element in certain cartridges and headphones.

**Electrostatic:** A principle employed in some headphone transducers using static electricity effects to set up a polarising field within which the modulated transducer medium moves.

Elliptical stylus: A specially shaped stylus profile that makes the 'plan view' radius along the length of the groove smaller than the 'elevation view' contact radius viewed from the front.

Equalisation: (general) The deliberate modification of frequency response, usually in response to some engineering

limitation or deficiency. **Equalisation:** (tape) This refers to the necessary change in frequency response required of an amplifier so that an overall flat frequency response is obtained from a tape medium. Equalisation is required both on record and replay. Any tape recorded on a good cassette recorder should have the same inherent response when played back on another correctly set up machine, since all playback equalisations should have been standardised. These standards are normally specified by the time constants of the circuits involved, eg 70µs or 120µs (see 'Microseconds').

**FM:** Frequency modulated; often used to describe radio transmissions of high fidelity potential.

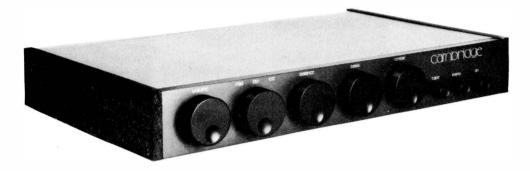
Farad: Measure of capacitance.

**Ferrite rod:** A short rod type aerial used for AM reception; may be fitted internally or externally to tuner or receiver.

Ferro-fluid: A magnetic fluid which is introduced into the voice-coil gap to provide damping and/or improved cooling. Filter: A circuit (normally) used to restrict the bandwidth of a system; may be fixed or switchable.

Frequency range or spectrum: Can refer to any particular group of frequencies, but commonly applied to the audible band from 20 to 20,000 cycles per second (Hz),

# The review is by Martin Colloms



This visually attractive amplifier, if well built and quality control tested in production, could be best buy material.

It offers a clean musical sound with a good performance standard, while the technical results were most promising. It was also generous as regards power and tolerant of adverse loading.

However, as the P35 was available only in prototype form at the time of writing, I must give it only a reserved recommendation.

NOTE: Fortunately, we were able to test a production sample just as we went to press and thus confirming the best buy rating for

# The choice is yours!

Γhe

this model.



amplifier, by Cambridge Audio.

Acoustic Research Ltd High Street, Houghton Regis, Bedfordshire LU5 5QJ.

# **GLOSSARY**

extending from the deepest bass to the highest audible harmonics.

Frequency response: The variation in output over a frequency range, particularly of a transducer; can be expressed as a range with decibel limits, or depicted

graphically. **Hz (Hertz):** 1 Hz = 1 cycle per second and is a measure of frequency which corresponds to musical pitch (the higher the frequency the higher the pitch.)

HF: High frequency.

Harmonic: Harmonics are the whole number multiples of a base frequency called the fundamental.

Harmonic distortion: The addition of unwanted harmonics to a signal.

Hum: A low frequency interfering sound produced by break-through or interference from mains wiring or circuitry

IHF: American Institute of High Fidelity, an

important standards body.

IEC: An international standards body. Impedance: Measure of resistance (and reactance) in alternating (ie audio) signals; this is of some importance in the compatibility of both cartridges and headphones with amplifiers. For convenience's sake is measured in ohms.

Integration: Used to describe the success with which the output from two drive units combine to give smooth output through the crossover region.

Intermodualtion (IM): A form of distortion arising from two or more signals producing non-harmonic signals that correspond to the sum or difference of the two frequencies.

Kilo (k): prefix meaning one thousand. LED: Light Emitting Diode; an indicator

light. LF: Low frequency.

Lateral friction: The resistance to movement of an arm and cartridge combination in the horizontal plane (ie across a record), caused by friction in its

Linear: A transducer that produces an output that exactly portrays its input over the required operating range is described as linear, and is hence distortion free. Hence also nonlinearities (distortions).

Line-contact: A special stylus profile that extends the ellipse, increasing contact length up and down the sides of the aroove.

Load or loading: The impedance (including resistive and reactive components, ie ohms, mH, pF) seen by one component looking back to its interconnected component; of importance in compatibility of cartridge/amp, and amp/headphone. 'Loudness': An equalisation circuit fre-

quency switchable on amplifiers which is designed to compensate for presumed hearing characteristics at low listening levels by boosting bass and treble.

**MOL:** Maximum operating level of tape normally referring to 5% distortion of 315Hz or 3.15kHz.

Medium wave: An AM transmission band incapable of high fidelity signals.

Micro· (μ): Prefix for units meaning one millionth of

Microseconds (µs): The time constant of a resistor capacitor combination involving a frequency reponse change (equalisation).

Midrange, Midband: The central part of the audible frequency range where the ear is most sensitive.

Milli- (m): Prefix for units meaning one thousandth of.

Modulation: The audio signal is 'stored' by means of modulations within a medium, eg the 'wiggles' in the groove of a plastic disc, or the magnetic coding on a tape.

Modulation noise: An additional noise added to tape noise, which increases with the degree of modulation of the tape, caused by the properties of the magnetic coating. This noise has most of its energy near the modulation frequency (causatory

**Moving-coil:** A transducer (eg cartridge or headphone) where the signal is generated by the movement of a coil within a magnetic field.

Moving magnet: The most common form of cartridge transduction, where the magnet moves while the coils are held relatively stationary.

Multiplex filter (MPX): A circuit which introduces severe attenuation at supersonic frequencies to decrease interference encountered with the output from some stereo FM tuners.

Nano (n): Prefix meaning a thousandth of a millionth of.

Noise: Random unwanted low level signals. Noise modulation: An unwelcome breathing effect that can be heard on some programme material, produced by poor noise reduction systems, or circuits.

Octave: Two-to-one ratio of pitch or frequency.

Offset angle: The angle measured between the centre line of the pickup cartridge and the line which joins stylus and arm pivot

point.

Ohm: Unit of electrical impedance (including reactance) or resistance; also kohm, where 1 kohm = 1,000 ohms.

Overhang: The extent to which the cartridge stylus extends beyond the centre of the platter is critical, and controlled by fore and aft adjustment of the cartridge on

Passive: The most common type of system, where drivers and crossover are driven from a single power amplifier.

Peak recording level: A level above which distortion becomes apparent. This distortion is introduced when the oxide particles almost reach magnetic saturation, and thus will accept no more

Phono: The most commonly used plug/socket combination in audio components.

Pico (p): Prefix meaning one millionth of a millionth of.

Port: An opening in a cabinet which is tuned to characteristics of the bass driver and the enclosure volume to provide reflex

type bass-loading.

Power amplifier: The part of an amplifier that provides power to drive the loudspeakers; usually integrated, it is sometimes a separate component.

Pre-amplifier: The part of an amplifier that accepts the input signals, sorts them, applies any necessary equalisation, and then passes the signal to the (normally integral) power amplifiers.

Presence: A quality of forwardness or immediacy in a sound balance, generally related to an upper-middle frequency response boost.

Print-through: A pre- or post-echo of a loud signal created by magnetisation occuring from one layer to adjacent layer after the tape has spooled or been recorded.

Q: A measure of the magnitude and shape of a resonance; the higher the Q, the sharper and more severe in amplitude the resonance.

Reflex: A system of bass loading (using port or ABR) which offers improved efficiency and bass power handling at the expense of subsonic control compared to a sealed box.

Rumble: The low or medium frequency sound produced mechanically by any moving parts in a turntable, mainly the motor and platter bearings.

Sensitivity: The volume of sound output for a specific electrical voltage input.

Separation: As between the two channels of a stereo pickup; see crosstalk.

Shibata: A special stylus extending the elliptical to a 'line-contact' type of profile. Side-thrust: A force acting on cartridges in pivoted (ie not parallel tracking) arms, due to the stylus/vinyl 'friction' acting along the line of the offset angle; hence bias or sidethrust compensation.

Signal-to-noise, signal/noise, S/N: The difference in total output when an applied signal is removed.

Stylus: The specially shaped piece of diamond in contact with the groove and connected to the cantilever.

Subsonic: Below the audible range, ie below 20Hz.

Square wave: A signal which consists of a fundamental plus a (theoretically infinite) series of odd (3rd, 5th etc) harmonics in a precise phase and amplitude relationship. It is useful for examining transient performance, symmetry, resonance control and 'ringing'.

THD: Total harmonic distortion.

Tracing: The following of the groove modulations by the stylus; hence for example tracing distortion, caused by the inability of a spherical stylus to trace the high frequency inner grooves on a disc.

Trackability: The ability of the cartridge to cope with large amplitude modulations (or of the arm and cartridge to follow the

groove itself properly).

Tracking error: The discrepancy between the truly tangential angle at which a record is cut and the slightly off-tangential angle at which it is tracked by a stylus on a pivoted arm during some parts of the arm's travel.

Transient: Signal of very short duration.

Transmission line: Complex construction and hence fairly uncommon, this bass-loading technique has much in common with reflexing.

Treble: Upper part of frequency spectrum, typically above about 3kHz.

Tweeter: A small drive unit designed to operate over the high frequency range. Ultrasonic: Frequencies above audibility, ie

greater than 20kHz; also supersonic.

Vertical tracking angle (VTA): The angle at which the plane of motion of the stylus is set with respect to the vertical when viewed from a side elevation of the Should match the 20° cutter cartridge. standard.

Weighting: A factor or function that is applied to a measurement to increase its relevance and usefulness; eg the weighting curves applied to headphone frequency response measurements to take account of head, ear, and other related effects.

Woofer: A drive unit that operates over the bass portion of the audio range.

Wow and Flutter: Low and high frequency pitch variations (from poor tape transport of turntable platters with speed drift).

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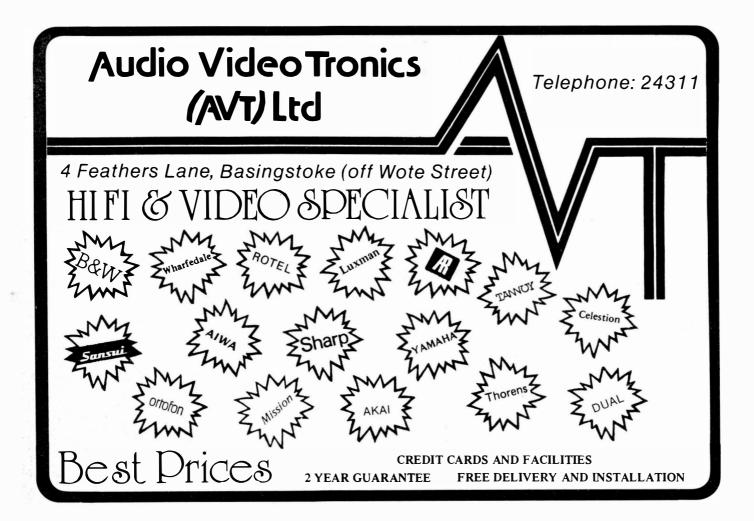
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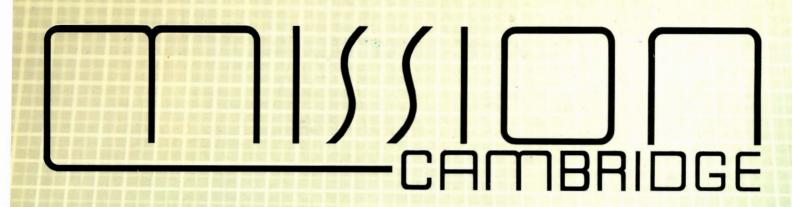
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