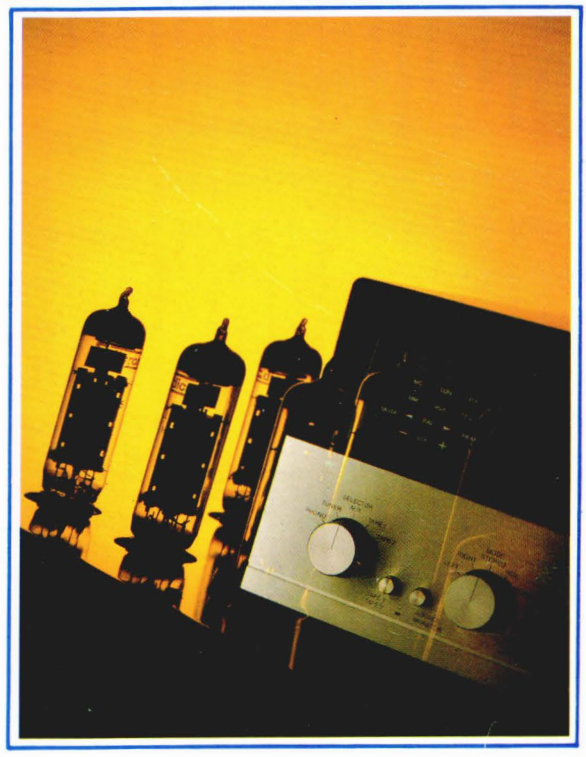
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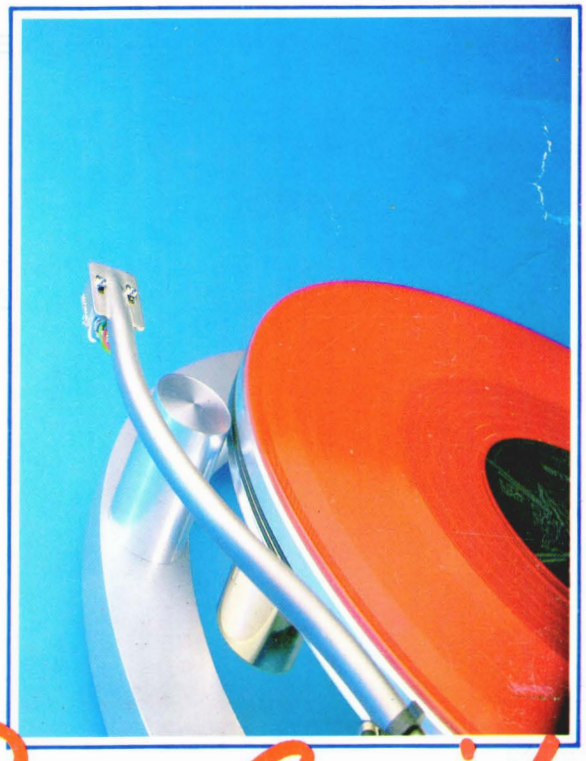
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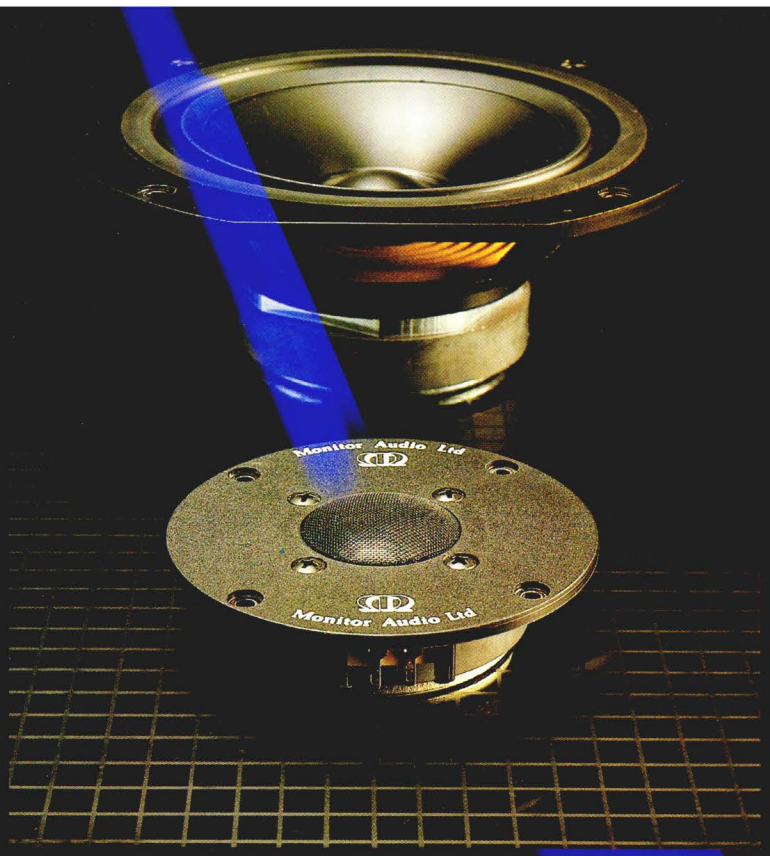


The Best Buy Guide

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EDITOR:
Paul Messenger
ASSISTANT EDITOR:
Jane Hadley
ART DIRECTOR:
Greg Brown
ADVERTISEMENT MANAGER:
David Williams
GROUP MANAGER:
Neil Dyson
PRODUCTION ASSISTANT:
Judith Middleton
PUBLISHER:
Marianne McNicholas
PHOTOGRAPHY:
Derek Gourd/Ian McKinnell

PUBLISHED
by Sportscene Publishers Ltd, 14 Rathbone Place, London W1P 1DE. Tel: 01-631 1433.
DISTRIBUTED
by Seymour Press Ltd, 334 Brixton Road, London SW9 7AG.
TYPESET
by Paragraphics, 2-4 Rufus Street, London N1 6PE.
PRINTED
by Imperial Printers, London.

Enquiries regarding the content of this book should be made in writing to Hi-Fi Choice Editorial, 14 Rathbone Place, London W1P 1DE. We regret 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 herein, or any consequence arising from them. Readers should note that all judgements have been made in the context of equipment available to Hi-Fi Choice at the time of review, and that 'value for money' comments are based on UK prices at the time of review, which are subject to fluctuation and are only applicable to the UK market. This edition © 1986, Felden Productions.

This 1986 *Best Buy Guide* is the ultimate survey on all that's best in popularly priced separate hi-fi components, based on the top models from a year's specialist editions of the uniquely respected *Hi-Fi Choice* buyers' guides, up to August 1986. The more expensive hi-fi equipment is now brought together in *The Collection*, first published April '86 and due for revision April '87, leaving the *Best Buy Guide* to concentrate on the keen value for money end of the market, which now includes CD players in addition to the traditional hi-fi hardware. For full background and context on any of the products, the reader should consult the original specific volume referred to in the text, which is available via our mail order service (see page 126).



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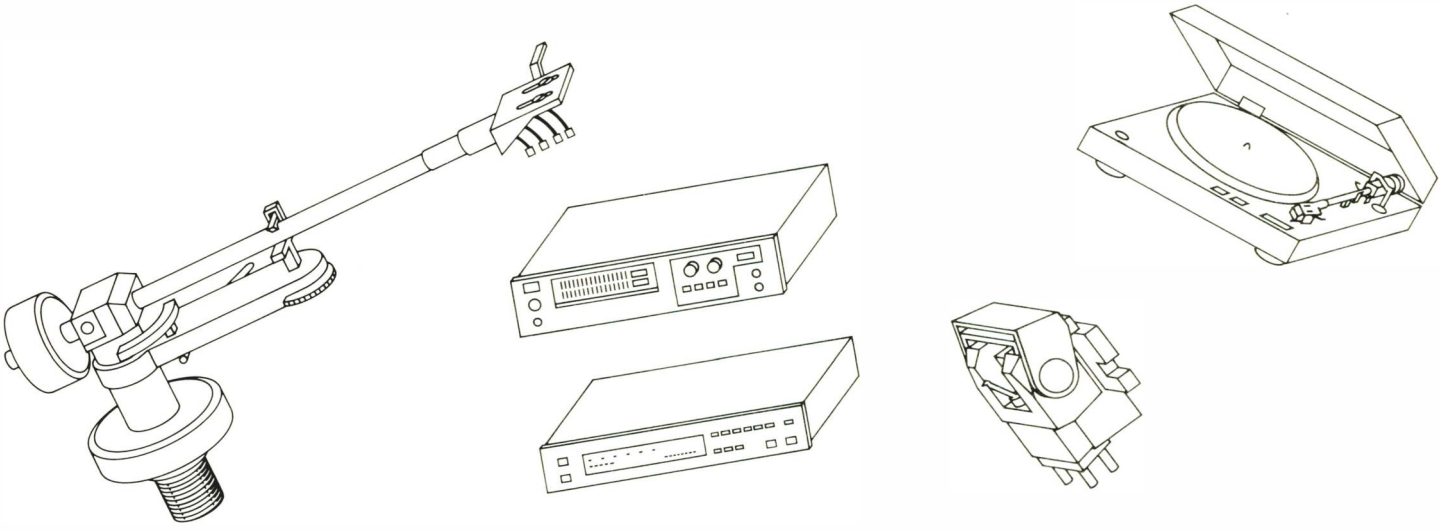
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GETTING IT ALL



Pre-packaged one-make systems have been commercially very successful, with advantages like cosmetic consistency, competitive pricing, and (assumed) technical compatibilty. however, despite the mass market clout of the consumer electronic giants, the hi-fi tradition of specialised separate components seems as strong as ever, and certainly represents the route taken by those who place sound quality ahead of other criteria.

Yet those who choose the separates route still have lingering doubts — usually completely unjustified — over the compatibility of components from different manufacturers. Gross incompatibilities are very rare nowdays, only likely to rear their heads amongst the most exotic components such as valve gear or secondhand items, and unusual even here. Meanwhile the subtle 'fine-tuning' of component matching is almost exclusively the preserve of the specialist, and a major reason for the superior sound of the well chosen separates system. Indeed, the delicate art of 'supercompatibility' really takes over the major role at a 'super-fi' level, and might be regarded as the key to 'real' hi-fi.

Superficially the pre-packaged system offers better value, purely in terms of the features available for the price. But the buyer who takes the trouble to analyse his or her needs and preferences will often come to the conclusion that step-by-step building of a separates system will provide greater long-term satisfaction, giving flexibility for future upgrading if so desired, and a chance to optimise total system performance towards personal taste.

A Question Of Priorities

The key advantage of choosing separates is the opportunity to choose one's own preferences as priorities. Taking the trouble to try and establish these leads most people to give up, assuming that they don't know enough even to start. But the process needn't be that difficult.

Begin by establishing whether you like to choose your own music, or have it chosen by someone else. This helps sort out what priority should be given to radio, but bear in mind that the best radio music is live radio music, which is very rare and often quite esoteric: when radio is merely an alternative source of pre-recorded material, the results will inevitably be inferior to those obtainable directly from the same source in the home, given a reasonably decent hi-fi.

There are now three different pre-recorded music media competing for the attention of the hi-fi user, and to go for all three will either cost a lot of money or involve substantial compromises in the sound quality of each. For this reason many separates purchasers may start with just one source, adding others or a radio tuner when funds permit.

There will always be controversy over the relative qualities of LP, CD and cassette, with earnest protagonists often trying to advance their prejudices by rubbishing rivals. LP is still the choice for ultimate sound quality — particularly for those prepared to spend a substantial sum on a good quality turntable system. Furthermore the vinyl repertoire is still the cheapest, largest and most varied, especially if one acknowledges a secondhand market extending back 30 years. However, LPs remain tied to the home, are prey to warps and surface noise even when purchased new, and do not survive rigorous physical abuse at all happily. Though bulky and heavy to store, the 12-inch cover has been turned to good use for artwork and liner notes, creating a pride of ownership somehow unmatched by CD or musicassette.

Cassette has never really challenged vinyl's potentially superior quality, but it is a multiple role format, offering 'go anywhere' flexibility, a uniquely useful recording capability, plus a broad catalogue of pre-recorded musicassette material. Although there are several potential rivals for recording from radio or pirating copyright material, the cassette still wins on convenience and compactness, though the sudden rise in popularity of double mechanism 'dubbing' decks remains mysterious. As hi-fi medium cassette suffers from pre-recorded material which has been improving but is still patchy in quality, and can often be bettered by a home recording, while any such home recording is inevitably poorer than the original. There is also the worry that a tape made on a specific machine usually replays best on that machine, which may cause aggravation when upgrading a few years hence. Though such opportunities are rarely possible or practical, a live recording on to cassette using good quality microphones can be the hi-fi equal of any other source.

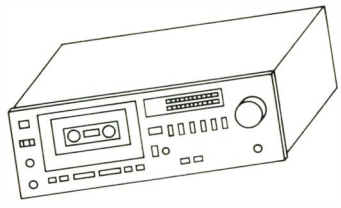
CD is the new challenger to these two established media, using a digital instead of analogue storage format. The sound quality remains controversial, hailed as near perfect by its fans but derided by vinyl freaks, so it is probaly fairest to say that CD is fine for most listeners, but may not suit everyone; certainly the lack of background noise, defects and deterioration over time are major strengths. Player prices are still on the high side (typically £200-350), but dropping quite rapidly as production capacity increases. However, disc prices are still more than twice those of LP and cassette, which is a significant disincentive for the music lover who is effectively starting from scratch. A major influence over signal source priority will be how many LPs, tapes and CDs a person already owns. To replace even the key items of a large LP collection with CDs will cost a great deal of money, and probably pose problems of availability besides.

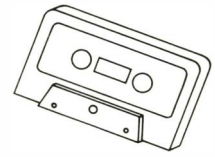
A Matter Of Precedence

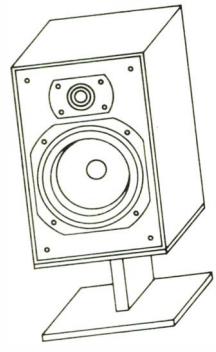
While there will always be arguments about the different music storage and transmission formats available to the hi-fi listener, there is also controversy over the relative importance of the different components which make up the system chain — by which is meant the source, the amplification, and the loudspeakers (and for the pedantic the room itself, though there's often little that can be done).

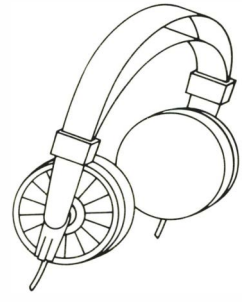
For many years the 'weakest link' theory proposed that the loudspeakers needed the most attention, that amplifiers merely had to have sufficient power, and that turntables were pretty well perfect. Recently, however, this perspective has become steadily discredited by an alternative 'theory of precedence', which stresses that no subsequent component can make up for the inadequacies of its predecessors — all it can do is supply its own additional degradations. In such a context it is not uncommon to find more than half the system budget allocated to the record player, with scrimping and saving made on amplifiers and loudspeakers, even though

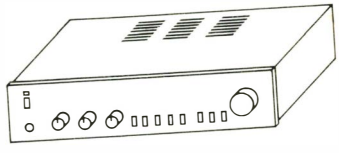
TOGETHER











these are used all the time whatever the source. And such an argument applies just as strongly to those who wish to record their LP records on to cassette, for convenience and use elsewhere.

MAXIMISING POTENTIALS

Choosing the components of a system is only part of the task of getting the system as a whole working as well as possible. Good turntables and loudspeakers both benefit to a surprising degree from proper support — from stands that enable them to give their best performance, whether floor-standing or wall-mounted. Just lining the components up along a shelf or sideboard is a recipe for mediocrity, however much has been spent on the individual components themselves.

Siting of components within a room can play a significant role, as can the room itself. Some people may prefer an acoustically more 'live' room than others, but most will agree that the larger it is the better, because this tends to provide smoother and better extended bass reproduction. All rooms create reflections and standing waves, and the effects of these are more severe if all opposing walls are parallel, similar distances apart, and with hard reflective surfaces. Provided that the loudspeakers can be placed fairly symmetrically, slight asymmetry elsewhere in the room is usually helpful. Though it is not really practical to move the walls around (and stud type walls behave differently from brick ones in any case), the odd strategically placed wall-hanging, say above a fireplace, can work wonders in removing an unpleasant 'flutter echo' effect, while a decent carpet is almost mandatory. 'Live' rooms are usually those that are sparsely furnished with hard wall coverings, so the overall live/dead acoustic balance can often be modified according to the furniture (or even the number of people) present.

The loudspeakers are most critical of placement, because it is their job to create the stereo image, and it will be impossible to do this if the sound from each is not roughly similar at the listening position. Each loudspeaker should operate in a similar immediate acoustic environment, unencumbered by other furnishings and structure, and a similar distance from listener, nearby walls, and corners. Some loudspeakers will be designed to operate close to a rear wall, others a metre or so out into the room, but all loudspeakers seem to benefit from being closely mechanically coupled *via* proper stands to the floor.

There is some debate about the best form of fixing, and in some instances the floor resonances themselves can become excited, particularly if a single concrete casting, and this may cause undesirable side-effects. However, adjustable spikes through to the floor proper or seated into the tops of cross-head screws are generally regarded as the best solution in most circumstances, and seem to give the best rigidity. Some speakers will work best with another set of spikes operating upwards into the loudspeaker itself, but small pieces of Blu-tack are a popular alternative. There is no need for paranoia about using spikes through normal pile carpets because the holes will be almost impossible to find when the stands are removed, but polished wooden floors do present a problem here, and hard plastic studs may be the only satisfactory solution.

Most decent quality turntables are fairly immune from feedback from loudspeakers, so it should not matter too much if these items are sited fairly close to each other. Indeed it is debateable whether any advantages gained from keeping the turntable well away are not lost through the need to use longer connecting cables. Turntables are usually susceptible to footfall shock, even on properly designed tables if the floor is springy, and the ideal solution here may be to use a wall bracket. It may sound unlikely, but amplifiers and CD players (and presumably cassette decks too) can also benefit sonically from carefully stand- or bracket-mounting in a high quality system.

Mixing and matching the components of a record player to get optimum results can be something of a black art, over and beyond the fairly simple business of choosing a cartridge of roughly the right compliance to suit the arm effective mass. Certainly the combining of turntables and tonearms is not a simple matter, and this is where a good specialist dealer will come into his own, both in terms of recommending good combinations from the models he holds in stock, and then in correctly carrying out the sometimes tricky set up procedures which are often required to get the best results.

Getting the best from a cassette deck is usually a question of making sure first of all that your deck does a decent job of replaying a good quality musicassette, and then finding out which tapes in the different price groupings give the best record/replay performance. The most common problem with cassette decks is in their alignment: matters are much better than they used to be a few years ago, but both dealer and customer still need to be on their guard against poorly aligned machines. Tuners can occasionally suffer similar problems, though this is even more unusual: most radio difficulties are likely to come from an inadequate or inappropriate aerial, after skimping on the less glamorous part of the budget. CD players are almost immune from the consistency problems of analogue systems, though it is mildly ironic that they too seem to derive some sonic benefit from spiked stands or tables in a high quality system.

THE FINAL LINK

The key to getting the best results from a separates system lies in finding an experienced and skilled dealer in the first place. One who takes the trouble to find out what you really want and then demonstrate some likely alternatives, without trying to cram his own particular prejudice's down your throat. To some extent the customer's task must be to discover for himself whether the dealer in question is competent or not. Membership of trade organisations like BADA can be a worthwhile pointer to a degree of professionalism, but the bottom line is whether the dealer in question can create a good sound in his own shop. If he can't, there is precious little chance of him doing so in your home. The best dealers should lay on demonstrations so you can hear the differences between components for yourself, and hear the sort of improvements which can be had at different price strata. You can then establish the sort of performance you are prepared to accept within whatever budgetary constraints you have set.

Paul Messenger

CDP502ES. "A beautifully designed and made machine with the precision of a Swiss watch... it has quality charisma that grows on you the more you use it." *Which Compact Disc – September 1985*

CDP552ES/DAS702ES. "I must start this review with an apology, for there is no way on earth to do justice to this the Rolls-Royce of CD players." *Which Compact Disc – September 1985*

YOU CAN HEAR HOW GOOD SONY ES SEPARATES ARE WITHOUT EVEN TURNING THEM ON.

CDP502ES. "Sony's most prestigious integrated CD player oozes class from the moment you start using it." *New Hi-Fi Sound – May 1986*

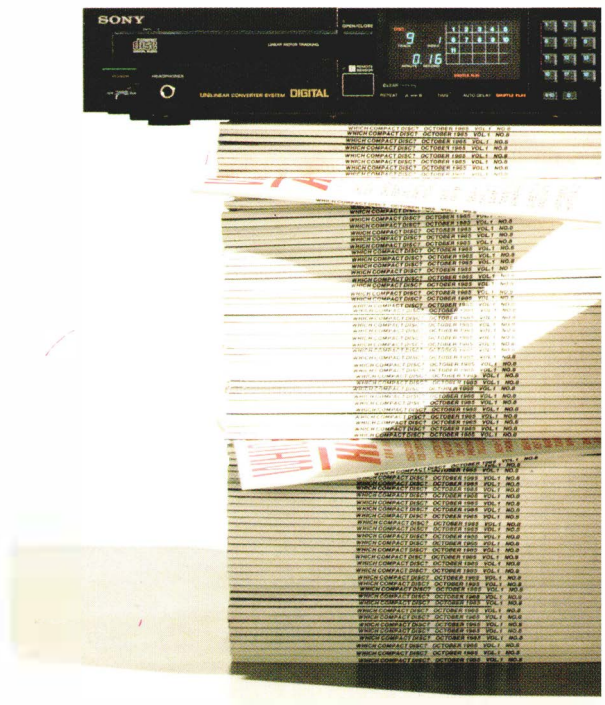
CDP552ES/DAS702ES. "Oh! The sound. Magnificent. The 552/702 combination has a clarity and definition unsurpassed by any current player." *Which Compact Disc – September 1985*

APM22ES. "Here is the classic 'Best Buy' loudspeaker. Well engineered, it offers an essentially neutral, open, transparent sound, full of detail and life." *Hi-Fi Choice. Loudspeakers*

STS222ES. "This is the best Sony non-video product I've tested in a long, long time... The STS222ES has a clean, natural, quality that marks it out from its peers." *Hi-Fi Answers – June 1986*

STS444ESII. "It was obvious when listening to the STS444ESII that it really is a very fine tuner." *New Hi-Fi Sound – May 1986*

**CDP502ES.
Compact Disc
Player of The
Year 'What Hi-Fi?'
Awards '86 Winner.
Hi-Fi Choice
'Recommended'.**



**TCK444ESII.
3 Head Stereo
Cassette Deck.**



The Dark Fantastic.



Philips are stepping out in style with their new CD104-B compact disc player, a smart new version of the much acclaimed CD104.

Under that handsome black exterior it's still the same CD player that the critics love to love and the competition have been forced to aspire to.

The CD104-B is fully featured with everything that makes CD listening such a unique pleasure, including of course the original Philips' compact disc sound.

What Hi-fi? Awards winner 1985

In fact, Philips compact disc players are widely regarded as having the best error correction and sound quality available.

It can be programmed to play tracks in any order with repeat, and at all times a 6-digit display provides track and time information.

Which makes it, overall, a very sound choice for anyone who's really serious about CD. You'll find the CD104-B is part of the new generation of Philips CD players, some of which offer every feature from music scan to remote control.

Isn't it time you saw the dark?

PHILIPS

PHILIPS

TURNTABLES, ARMS AND CARTRIDGES

Despite the claims of more recent rivals, the LP disc has remained the prime source for music lovers for over 30 years, building a vast historical repertoire which will ensure it continues to have a future for present and future generations. The format has not been without its ups and downs (remember quadraphony), but the last ten years have seen continual and substantial improvements, not so much in the discs themselves, but in the quality obtainable on replay.

The current situation is ideal. LP discs are comparatively cheap to manufacture and purchase, while the quality obtainable by the user depends largely on the amount of money invested in the replay equipment. As an added bonus, upgrading the equipment produces improved sound quality from all the discs in the collection, while the buoyant secondhand LP market shows that repertoire will continue to be available whatever the future development of rival media.

During the 'bad old days' of the 1970s, the LP came under strong attack as a result of indifferent manufacturing quality control. The lack of surface noise allowed the Musicassette to make a strong challenge, but with hindsight it may be seen that much of the problem with LPs came from poorly designed and matched replay equipment. This is not to say that a good quality record player can overcome all the inherent problems of the vinyl disc, but it is certainly true to say that a carefully chosen specialist player can emphasise the musical values and go some way towards avoiding the engineering limitations.

Such a claim may sound a little far-fetched, particularly to those who suffered the worst excesses of the direct drive period of turntable design. But the marketplace itself provides the justification: ten years ago the UK specialist turntable barely existed, and now a dozen or more manufacturers are competing fiercely to provide a sound quality alternative to the superficially flashy but sonically inadequate products which are typical of much of Far Eastern production.

The Vinyl Problem

One trouble with vinyl is that it is too effective a music storage system. The wide dynamic and frequency range of the signals which end up embedded in the plastic are a mechanical engineering nightmare to recover properly, because they are microscopically tiny — smaller, indeed, than the stylus which is trying to 'read' them. And to make matters worse, the turntable/disc is massively heavier than the stylus which is resting on it.

The cheap record player merely recovers the top few layers of information, the loud bits and the bass bits in particular. It can handle the quiet and trebly bits too, but if a loud bit comes along it is apt to 'swamp' the mechanics of the system, creating unwanted vibrations within the arm, cartridge or turntable which are much larger than the delicate subtleties of the record groove that the cartridge is trying to read. It is therefore hardly surprising that all record players are inadequate. It's just that some are much less inadequate than others.

The Turntable

While the rest of the world blithely assumed that if a turntable measured well on simple but artificial tests, it must be sounding good on music too, it was left to a handful of bright Scotsmen to literally rediscover the wheel, and its importance in the hi-fi system. That is history, but the turntable is now taken very seriously indeed, as possibly the most important single hi-fi component.

Some of the reasons behind this remain obscure, and speculation is beyond the scope of this brief introduction, but any hi-fi dealer worth patronage should be able to demonstrate the substantial difference that the turntable alone can make. And a very good case can be made for devoting a substantial part of the total budget to this one fundamental component. Exactly what percentage will depend on the individual's personal likes and dislikes, how important turntable sonic differences are to him or her, and the personal tolerance of limitations elsewhere in the chain. Spending more money on a turntable may mean spending less on arm, cartridge, amplifier and loudspeakers. Each component has its own influence on the final sound, but such qualitative differences are hard to quantify, and to some degree come down to personal taste.

There is no single right approach to building a turntable, because the end result comes from the skillful balancing of different compromises, including manufacturing costs. Belt drive and suspended subchassis designs tend to sound good, sometimes at the expense of ease of operation and the need for careful setting up. Yet some 'solid' designs have been appearing recently which can give them a run for their money, and only go to emphasise the fact that there are no rules.

The Tonearm

Whether you call it a pickup arm or a tonearm, there is absolutely no doubt that this item, whether part of an integrated player or as a separate item, plays a major part in determining the character of the sound. That said, the arm needs a good turntable to provide the proper foundation, and the proper matching of turntable and arm is one of the more obscure areas of the hi-fi art.

More straightforward is the matching of arm and cartridge, based on a simple mathematical formula which places the main mechanical resonance in the range of frequencies where it will do least harm. The fundamental performance of the tonearms is also laid bare by the unique *Choice* accelerometer sweep test, though again listening tests provide the final arbiter, and turntable termination plays a crucial role.

The Cartridge

No less complicated than turntables and tonearms, the cartridge is the 'business end' of the record, but is also a slave to the bigger mechanical components. There are two common kinds of cartridge, moving magnet and moving-coil: the former tend to be cheaper but the latter better. All amplifiers cope with moving magnets, but some of the cheaper amps don't handle moving-coils — and some that try don't succeed very well.

Most of the cost of a cartridge goes into the stylus and cantilever, so a range may share the same body while spanning a price difference of 5X, with differing standards of cantilever, stylus and quality control. It is worth spending a little more than rock bottom price for a cartridge if only to ensure the stylus is delicate and accurate enough to preserve the record collection.

A cartridge is a transducer, changing the mechanical stylus/groove energy into electrical energy. It therefore has a specific tonal balance, which is largely determined by the frequency response, and this key measurement also provides information on mechanical integrity, and for moving magnet cartridges shows the effect of different amplifier loading characteristics.

Ensemble

The extensive measurements carried out in the *Choice* review programme helps weed out the 'wallies,' and suggests the combinations which are most likely to perform well together. Measurement also often provides the backup evidence for listening findings, but the auditioning remains the final arbiter.

However, individual tests cannot cover all the bases. They cannot cope with every combination, nor can they take account of the quality of the setting up. Finding a competent and conscientious dealer, committed enough to get a good sound yet sensitive to an individual's own preference, can be the most important task facing the prospective purchaser.

Reviews reprinted from issue Nos 40 & 43 by Martin Colloms and Paul Messenger

WHEN YOU LISTEN TO THE SL6S, YOU'LL NOTICE SOMETHING MISSING

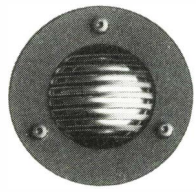
What you see here, or rather what you don't see here, is every loudspeaker designer's dream.

For it is well known that every cabinet loudspeaker has one major problem to overcome: the cabinet.

Because it vibrates over such a large area it doesn't take much movement to create unwanted noise, colouring and distorting the overall sound.

The loudspeaker SHOULD be a transparent link between the sound source and the listener's ears, adding nothing to the original performance and certainly taking nothing away.

The SL6S comes the closest yet to this ideal using conventional materials. By reducing the panel thickness we were able to reduce energy storage. A new, vertical, figure-of-eight brace tightly supports the cabinet, pushing up the frequency of the panel resonances.





SL6S CELESTION

The combined effect is just what we wanted. Less colouration, less muddle, better stereo imaging, allowing your ears to hear images in space so much more clearly – as they do in real life.

We could have stopped there, but, using laser interferometry, we also discovered how drive units make their own unwanted contributions. By scanning the vibrating diaphragm with a laser beam and using computer analysis, we can create a 3-D model and actually watch its behaviour.

We saw how poor connections between speaker diaphragms and their surrounds, dust caps and lead out wires were spoiling the picture, and of course the sound. It also made obvious the advantages of the metal dome tweeter.

Our latest research has shown how the aluminium dome tweeter improves both sensitivity and clarity at the highest audible frequencies.

At the other end of the spectrum we saw that the speed and articulation of the bass could be improved by increasing the flexibility of the roll surround. To do this without compromising mid range clarity in any way needed a unique solution: the bonding together of two materials of different flexibilities.

All this has made the SL6S an extraordinary loudspeaker by any standards.

Hi-Fi Answers wrote: "The SL6S is capable of higher levels, is more articulate in mid range, images better, and has a more open, spacious presentation."

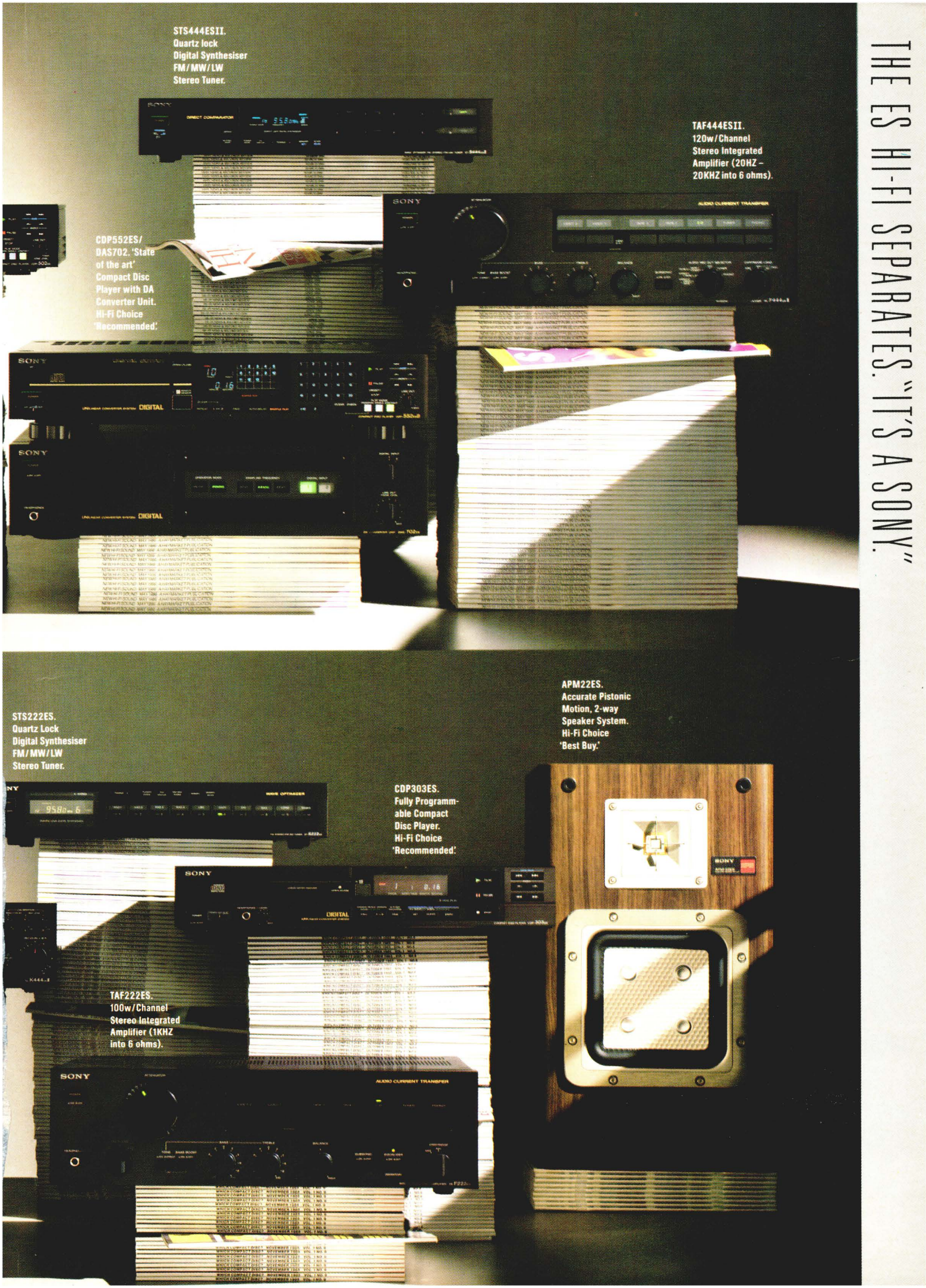
But we leave the final word to Gramophone who concluded by saying: "It has been a pleasure listening to and writing about this fine loudspeaker."

The SL6S. For those who want to listen to music, not loudspeakers.

Celestion International, Ditton Works, Foxhall Road, Ipswich, Suffolk, England.

CELESTION LOUDSPEAKERS

THE ES HI-FI SEPARATES. "IT'S A SONY."



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Following the successful relaunch of the classic AR deck (now the *Legend*), Acoustic Research UK developed this further model, the *EB-101*, with a vinyl 'black ash' finish and a steel girder subchassis substituting for the aluminium original. A new arm commissioned from Japan is factory fitted to provide a complete integrated player. For the review, a modest cartridge was also included, the whole selling for around £190, a considerable saving over the original model, equivalent to throwing in the arm and cartridge free.

This deck has rather a dark appearance, and comes with a low resonance tinted PVC cover on sprung hinges. The two-piece alloy platter has been retained while tolerances have been improved on the bearing, as well as in other areas. The robust arm has a firmly clamped headshell using a locking sleeve; its bearings proved free from play, an important aspect. Fully suspended, the chassis moved very freely and promised good acoustic and vibration isolation.

LAB REPORT

The total platter mass was close to 2kg, healthy for the price category, with the two part construction offering good mutual damping. Tested for disc impulse, the initial transient was quick with a fast decay and no low frequency hangover.

Speed change is manual, on lifting the outer platter. At 33⅓ the deck ran nearly 0.5% fast, which was satisfactory, while slowing under load was held to a fine 0.25%. Long term drift was negligible with the synchronous motor employed. DIN peak weighted, the overall wow and flutter was a fine 0.09%, with similarly low individual contributions from the wow and flutter components. Start up was a fairly rapid 3.5 seconds, and the player clearly had healthy torque. DIN B rumble measured very well, at −77dB. Little breakthrough was evident since the electrical and mechanical spectra matched well; just a hint of motor vibration was evident at 200Hz. The high quality suspension was demonstrated by the excellent breakthrough responses for both acoustic and vibration excitation; here the unit was clearly up with the best modern examples.

Turning to the arm, the robust headshell was nominally detachable but did not come with a plug and socket. Rotational adjustment is allowed, as well as overhang and lateral tracking angle. Effective mass was in the medium to high range at 13.5g including hardware, and consequently suited to fairly low compliance cartridges.

Charted for arm resonances with the Shure moving magnet cartridge the first break appeared around 700Hz, with the overall behaviour looking quite tidy, particularly at higher frequencies. Bearing friction was quite low, at 40mg lateral and 20mg vertical, while sensible bias levels were also established. Downforce calibration was accurate while the arm cue device operated well.

SOUND QUALITY

There was no doubt concerning the high subjective merit of this player. The sound was notably well-focused, with good stereo stage width and depth. Transients were reproduced with good speed and attack, while the overall effect was lively, with well differentiated dynamics. The bass was quite good, articulate as well as extended, with considerable detail apparent. Overall the tonal balance seemed well proportioned while the supplied cartridge was quite tidy itself and did not let the deck down; a sort of 'AR *Basik*', I suppose!

CONCLUSIONS

This belt-driven turntable offers a remarkable package. A genuine high fidelity product, it had no significant subjective or lab-tested weaknesses. Its rigid arm, good platter and drive, with a fine, effective subchassis, are complemented by a workable cartridge, which will happily benefit from upgrading at some future date if so desired. Pricing is also very competitive, and a Best Buy rating the logical outcome.

TEST RESULTS

Motor section	Integrated player
Type	belt-drive, subchassis
Platter mass/damping	2.0kg/good
Finish and engineering	very good, very good
Type of mains connecting leads	3 core/phonos plus earth
Speed options	manual change, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.4%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.1%/0.07%
Absolute speed error	+0.45%
Speed drift, 1 hour/load variation	negligible/−0.25%
Start-up time to audible stabilisation	3.5 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−77dB
Arm section	
Approximate effective mass, inc screws, excl cartridge	13.5g
Type/mass of headshell	special/9.8g
Geometric accuracy	very good
Adjustments provided	tilt/overhang/offset
Finish and engineering	very good/very good
Ease of assembly/set-up/use	very good/very good/very good
Friction, typical lateral vertical	40mg/20mg
Bias compensation method	internal spring
Bias force, rim/centre (set to 1.5g elliptical)	225mg/275mg
Downforce calibration error, 1g/2g	−0.05g/−0.1g
Cue drift, 8mm ascent/descent	negligible, 1.0 secs/2.5 secs
Arm resonances	fairly good
Subjective sound quality	see system result
Arm damping	decoupled counterweight
System as a whole	
Size (w×d×h)/clearance for lid rear	44×38.5×16cm/7cm
Ease of use	good
Typical acoustic breakthrough and resonances	very good
Subjective sound quality of complete system	very good
Hum level/acoustic feedback	low/very good
Vibration sensitivity/shock resistance	excellent/fairly good
Estimated typical purchase price	£190 inc cartridge

For graph references see issue No 43

ALPHASON OPAL and XENON

ALPHASON, 190-192 WIGAN ROAD, EUXTON, NEAR CHORLEY, LANCS PR7 6JW
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Alphason Xenon

This review covers two Alphason models, which, along with the *Delta*, extends the company's range of arms to cover a wide price spectrum.

ALPHASON XENON

Selling at around £196 this is the most expensive new Alphason tonearm, filling a gap in the market between budget models and the higher class £300 group which includes models such as the Alphason *HR10S* and the Linn *Ittok*.

The *Xenon* owes much to the well established *HR100S*, using the same good-sounding one-piece arm/shell, a large diameter 'S'-shaped titanium tube, now filled with a damping material to control higher mode vibrations. Some savings have been made in the cue mechanism, the bias compensator and the exterior finish of the bearing assembly, but these do not significantly prejudice the performance. The concentric bearing gimbal design is retained and was well aligned, offering negligible play plus very low levels of friction and stiction.

LAB REPORT

Slightly on the high side of the medium mass range, effective mass with fixing hardware approached 13g. Cartridges in the range 8-20cu are most appropriate. Rated highly for geometric accuracy, the arm proved easy to set up and use, coming as it does with Linn-compatible baseplate mounting hardware.

Bias correction erred on the high side for the disc rim, but not unduly so. Resonances were few, as the structural resonance graph shows, and in any case were of moderate degree — rather better than the *Opal* and closely resembling the *HR100S*.

SOUND QUALITY

At first it proved hard to separate this model from the well-rated *HR100*. The *Xenon* showed solid overall control with a firm sense of image focus over a wide frequency range. The treble was clear and finely detailed; the mid undoubtedly low in coloration with minimal 'clang' or hardness; bass was free from boom or emphasis. Open and clean stereo depth was respectably portrayed.

CONCLUSIONS

With Alphason's high standard of engineering, a basically good finish and a fine lab and sonic performance, the *Xenon* comes strongly recommended. The price was very fair for an arm which is essentially well balanced in all respects.

ALPHASON OPAL

Comfortably under £100, the *Opal* nonetheless manages to maintain Alphason's high standards for solid engineering and low friction, with bearings free from play or looseness. It may be fitted *via* a single hole in an arm board, but compatibility with the popular Linn mounting is also provided.

This fixed head arm has a strong main beam fitted with a properly clamped counterweight supported on a concentric gimbal bearing. Appropriate calibrations are given for bias and downforce, and the arm falls into the medium-mass category; an effective mass of 10g was recorded.

LAB REPORT

Performing well on lab tests, this was a well aligned and set up arm. The various facilities worked well, while the bearing friction was held to excellently low levels. Bias compensation was very satisfactory though downforce calibration erred on the high side. Rated above average for arm resonances, several audible range modes were distinguishable; for example, the counterweight at 250Hz and first beam modes at 675 and 950Hz.

SOUND QUALITY

The *Opal* gave a good acount of itself on audition, happily meeting other rated £90 tonearms in their own territory. In tonal balance it appeared lightweight and 'airy' with some 'zinginess' in the high treble — less well suited to moving coils in this respect. The bass was dry and firm, while mid focus and stereo depth were both pretty good. A particular attribute was the smooth uncoloured midrange, an Alphason hallmark.

CONCLUSIONS

With its individual interpretation of good sound, the *Opal* proved to be a well designed and constructed British tonearm. There are no problems in recommending this one — so let's give it a Best Buy!

TEST RESULTS

Opal tonearm

Approximate effective mass, inc screws, excl cartridge	10.0g
Type/mass of headshell	fixed
Geometric accuracy	very good
Adjustments provided	height/overhang/lateral
Finish and engineering	very good/very good
Ease of assembly/set-up/use	very good/good/good
Friction, typical lateral vertical	<20mg/<20mg
Bias compensation method	thread and weight
Bias force, rim/centre (set to 1.5g ellipical)	240mg/220mg
Downforce calibration error, 1g/2g	+0.15g/+0.30g
Cue drift, 8mm ascent/descent	negligible, 2.0 secs/4.5 secs
Arm resonances	good+
Subjective sound quality	good
Arm damping	none
Estimated typical purchase price	£95

Xenon tonearm

Approximate effective mass, inc screws, excl cartridge	12.75g
Type/mass of headshell	fixed
Geometric accuracy	very good
Adjustments provided	height/overhang/lateral
Finish and engineering	excellent/excellent
Ease of assembly/set-up/use	very good/good/good
Friction, typical lateral vertical	<20mg/<20mg
Bias compensation method	thread and weight
Bias force, rim/centre (set to 1.5g ellipical)	275mg/200mg
Downforce calibration error, 1g/2g	+0.25g/+0.25g
Cue drift, 8mm ascent/descent	negligible, 2.0 secs/5.0 secs
Arm resonances	very good
Subjective sound quality	very good
Arm damping	none
Estimated typical purchase price	£196

For graph references see issue No 43

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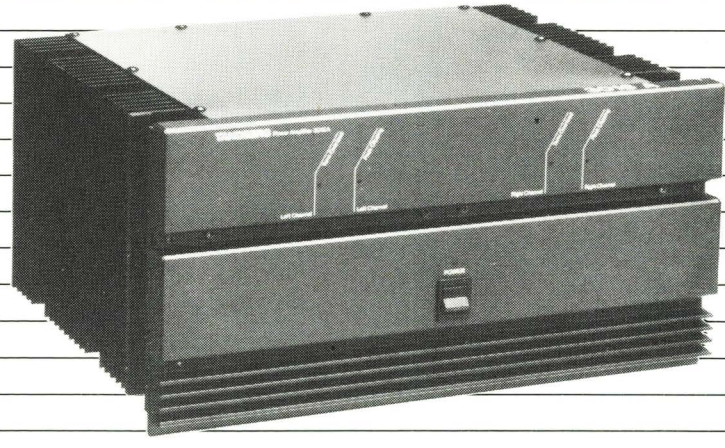
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Conceived as a complete range of turntables available with and without Ariston tonearms, the *RD40* series starts with the basic *RD40AC*, a two speed ac synchronous motor powered deck. Speed changeover is by hand, via access holes in the platter.

The design is founded on a circular subchassis in a cast aluminium alloy. this suspended from three sprung towers at the periphery. These are fixed to the baseplate, which itself follows the form of the open, skeletal style subchassis. The arm is mounted on an accessible outrigger platform, while a skeletal perspex awning may be fitted to the rear to help keep the dust off; this is the 'pop on' cover.

Drive is via a square section belt from the inboard mounted motor. In the case of the electric *'DC* version, a dc motor is substituted, this provided with front panel speed change and independent variable controls. An outboard power supply is also used with an extended low voltage cable allowing its convenient remote location. These models all have a striking 'engineered' look reminiscent of the large Oracle, and currently Ariston's finish is very good.

Two platter mass options are available, while all versions are equipped with a concave, acoustically absorbent mat working in conjunction with a threaded centre spindle and Artison's screw-down record clamp. Good record/mat contact is thereby assured. An internal hub is integral with the platter, this forming the drive belt hub, with the belt loaded via one of the access holes.

Easily adjusted from above, the suspension springs are foam damped to improve the shock resistance, this an intentional compromise with respect to ultimate vibration isolation.

LAB REPORT

Slight play and some noise were noted from the main bearing; the latter improved on running in. Rumble levels were fairly good at typically −72dB. But combined wow and flutter for the *'AC* was poorer than average at 0.19%, this mainly wow, but proved not to be too serious subjectively. The *'DC* version gave slightly better rumble results and noticeably better wow and flutter down to an excellent 0.04%. However the *'DC* was well off speed as delivered, and was also difficult to set owing to the excessive range of variable speed control ±15%, with no 'correct speed' detent. A stroboscope card is included to help reset the speed — an awkward procedure involving a mains powered lamp.

While the *'AC* version was good with respect to load tolerence, the *'DC* proved rather disappointing, slowing 0.7% on test which is likely to produce audible pitch instability.

The platter clamp system provided very good control of the initial leading edge impulse with only moderate platter ringing observed thereafter. From the graphs, the acoustic isolation can be seen to be pretty good, and vibration was quite well rejected, but was compromised at low frequencies by the fairly solid foam cores to the springs. In compensation, the player resisted shock better than the usual subchassis type.

SOUND QUALITY

The *'DC* came fitted with a *BX-150* cartridge which was rather unsatisfactory and was replaced by an alternative. On audition, the general character was considered pretty good, with firm bass, good stereo and pleasing depth, these the hallmarks of a subchassis design. It sounded clear and open, but was not particularly 'tuneful' and doubts were expressed concerning the pitch stability (the listening was done prior to the lab tests).

Turning to the *'AC* version, the good points were maintained, and the pitch query resolved with notably better timing and tunefulness. Wow and rumble proved inaudible, and good feedback margins were also demonstrated.

CONCLUSIONS

The *'DC* version, despite a higher specification, cannot be recommended at present. The poor torque and crude variable speed setting were weak points. However, the standard *'AC* synchronous motor version performed well, and is attractively priced in view of its high engineering content this priced in view of its high engineering content this including the effective record clamp system. Purchasers should remember to account for the options such as the add-on cover, but in basic form the *RD40AC* is a recommended model.

TEST RESULTS

Motor section	RD40AC Motor Unit*
Type	belt-drive, subchassis
Platter mass/damping	1.8kg/very good
Finish and engineering	very good, very good
Type of mains connecting leads	2 core
Speed options	manual change, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.19%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.18%/0.09%
Absolute speed error	<0.1%
Speed drift, 1 hour/load variation	negligible/−0.1%
Start-up time to audible stabilisation	2.2 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−72dB
System as a whole	
Size (w×d×h)/clearance for lid rear	45×38×17cm/4cm
Ease of use	fairly good
Typical acoustic breakthrough and resonances	very good
Subjective sound quality of complete system	good
Hum level/acoustic feedback	very good/very good
Vibration sensitivity/shock resistance	good/good
Estimated typical purchase price	£190/£250

**arm and other options available*

For graph references see issue No 40

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In production now for a number of years, the 505 design has undergone a continuing series of minor improvements which have helped maintain its competitive position, while the price has also been kept in check. The player is based on an old-style steel deck plate, supported on four foam-damped coil springs. This deck plate is heavily flanged to increase rigidity, and the modest platter is equipped with a fairly heavy rubber mat.

Belt driven by a 16-pole synchronous motor, the 505 is fitted with a unique variable pitch control, achieved by the use of a multi-lobed variable diameter motor pulley. Correct speed setting is achieved *via* stroboscope markings on the platter rim, though these were found none too easy to use.

The tonearm has been revised for the latest 505-2 version and is now fitted with a special detachable headshell with quite a firm fixing. The *Deluxe* has better looks and a lower resonance construction, with a substantial wooden plinth finished in 'black ash' vinyl. Both versions come complete with a compatible Ortofon cartridge.

Lab Report

A notable feature of the latest 505 is the significant reduction in rumble, which has improved from 67dB to 73dB. Spectrum analysis showed the usual contribution of motor vibration components, but these were not considered very serious. Speed characteristics were much as before with good wow and flutter, while good torque was also demonstrated, the mild 0.2% slowing under load being up with some of the best, helping to offset the low inertia of the platter. Vibration and acoustic isolation factors remain unchanged, and well above average for the price.

The arm now has a moderate effective mass, 10g, including mounting hardware, the headshell itself weighing a modest 4g. The arm was well aligned and the pivots were reasonable, proving moderate in friction but subject to a rather small pre-load; more than a gentle twist to the arm resulted in audible bearing 'clicking'. Biasing was accurate and downforce calibration acceptable. Arm structural resonances were charted with the cartridge supplied; the first weakness appeared at 90Hz, while the main problems occurred at 220 and 400Hz, not a great improvement on the previous design. Above 600Hz, however, the resonances were pretty well behaved.

Sound Quality

The 505s sound was tuneful, lively, punchy and somewhat 'forward' in presentation. Pitch and timing were good, the bass fairly good, and the stereo image had quite respectable depth and above-average focus. The sound could become a little muddled in the mid and treble but not seriously so, and the cartridge suited it well — we would not change it. The 'S' version showed a small improvement in clarity and definition, attributable to the improved plinth.

Conclusions

The 505 has managed to maintain its competitive position and provides a competent hi-fi sound. In our view it is the clear £120 group leader, so much so that the less expensive players, including Dual's own *514*, do not really stand much of a chance. Strongly recommended as a complete package with the *OM10* cartridge, the *505-2* merits Best Buy status; the *Deluxe* is Recommended..

Test Results

Motor section

Type	semi auto, belt-drive, subchassis
Platter mass/damping	0.85kg/good
Finish and engineering	very good/good
Type of mains connecting leads	2 core/phonos and earth
Speed options	variable, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.075%
Wow and flutter (Im peak wtd 0.2-6Hz/6-300Hz)	0.95%/0.08%
Absolute speed error	−0.1%
Speed drift, 1 hour/load variation	+0.065%/−0.2%
Start-up time to audible stabilisation	2.4 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−72/−74dB

Arm section

Approximate effective mass, inc screws, excl cartridge	10g
Type/mass of headshell	special detachable/40g
Geometric accuracy	good
Adjustments provided	overhang/offset
Finish and engineering	very good/good
Ease of assembly/set-up/use	very good/very good/very good
Friction, typical lateral vertical	40mg/20mg
Bias compensation method	spring
Bias force, rim/centre (set to 1.5g ellipical)	225mg/225mg
Downforce calibration error, 1g/2g	−0.12g/−0.2g
Cue drift, 8mm ascent/descent	very slight, 3.5 secs/3.0 secs
Arm resonances	average+
Subjective sound quality	average+
Arm damping	decoupled counterweight

System as a whole

Size (w×d×h)/clearance for lid rear	43.5×37×14cm/7cm
Ease of use	good
Typical acoustic breakthrough and resonances	average+
Subjective sound quality of complete system	good
Hum level/acoustic feedback	good/good
Vibration sensitivity/shock resistance	good/good
Estimated typical purchase price	£120 (*Deluxe*, £140)

For graph references see issue No 43

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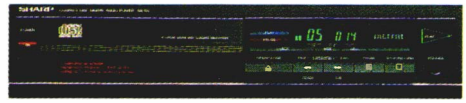
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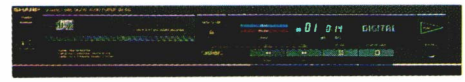
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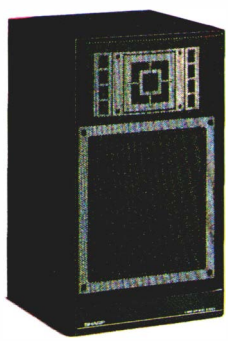


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This Elite turntable is designated *Rock II* to distinguish it from the original design developed at Cranfield Institute of Technology. The latter was only built in very small and highly expensive quantities. But lessons learned from its development have been applied to this cheaper model, which sells typically at £299 plus around £65 for the cover and platform if required.

The original *Rock* made much use of a mineral-filled resin for mass and damping, but the *Rock II* employs gypsum to the same end, for example in the solid platter and the weighty plinth/chassis, both of which use a fabricated metal skin to contain their mineral castings.

The *Rock II* is a solid-plinth model with a synchronus motor firmly bolted in place, and a rubber cord drive belt linking the motor to the inner hub of the two-piece platter. The unit achieves substantial environmental isolation through suspension of three air filled rubber balls (squash balls, I believe). The lid is attached to the base plate and hence remains isolated. Speed change is done by hand.

One unique feature is a large silicone fluid damper mounted on the plinth and operating at the headshell end of the arm. This is designed to help control both the audio band tonearm structural resonances and the arm cartridge subsonic resonances, without imposing excessive forces on the cantilever in the record warp frequency range. Shock resistance and record 'rumble' are said to be improved in this manner.

No special set up of alignment is required, and apart from the necessarily limited cartridge access the turntable was easy to use, with arm lead dressing uncritical.

LAB REPORT

The loaded platter weighed a notable 2.9kg with its plastic enamelled surface forming the disc support. It showed good damping of the disc impulse, which showed an even characteristic. Tonally the platter should sound neutral, and no platter ringing was observed.

No speed stability problems were experienced with DIN peak weighted wow and flutter a fine. 0.1% was satisfactory, while flutter looked very good at less than 0.05%.

Absolute speed accuracy was fine within 0.1%, while more than satisfactory table torque was confirmed by the modest 0.25% slowing under load; no over shoot was observed. Start-up time with our sample was slow 6.8 seconds, but this improved to 4.8 seconds with a new pulley. The DIN B rumble figures were a fine −77dB, given the unpromising motor location; spectral analysis did show some mild motor vibration breakthrough but at a pretty inaudible level.

The simple design proved remarkably effective in suppressing airborne acoustic feedback and vibration shock immunity was also well above average when using the damper, and the system was uncritical of location.

SOUND QUALITY

The *Rock II* did well on audition, demonstrating a good stability of pitch, with a neutral, even handed tonal balance. It performed competently throughout the frequency range, with firm clean bass, good perspectives in the mid range, and an unexaggerated treble. In fact, the treble seemed 'cooler' and less exuberent than usual when used with an *Ittok* arm. Stereo focus was good, and cartridges tracked well with reduced low frequency noise. A pleasing level of stereo depth was available.

CONCLUSIONS

I would hesitate to place this model in the highest sonic category, but it nonetheless has a lot going for it. The damper does the job it is claimed to do, particularly with good cartridge combinations, and the deck needs no setting up — a plus point for many purchasers. It offers a performance near to that available from a true subchassis turntable, doing so with a high level of neutrality (or, if you like, a low level of coloration). As such it represents an interesting proposition and the standard attained merits recommendation.

Note: Considerable improvements have been made since we last reviewed the Rock II *and these have yet to be evaluated in* Choice.

TEST RESULTS

Motor section

Type	belt-drive, rigid plinth
Platter mass/damping	2.9kg/very good
Finish and engineering	very good/very good
Type of mains connecting leads	3 core/-
Speed options	manual change, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.1%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.21%/0.05%
Absolute speed error	+0.1%
Speed drift, 1 hour/load variation	synchronous/−0.25%
Start-up time to audible stabilisation	6.8 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−77/−78dB
Size (w×d×h)/clearance for lid rear	40×33×11.5cm/none
Ease of use	good
Typical acoustic breakthrough and resonances	excellent
Subjective sound quality of complete system	very good
Hum level/acoustic feedback	very good/good
Vibration sensitivity/shock resistance	good/very good
Estimated typical purchase price	£299

For graph references see issue No 40

HEYBROOK TT2

MECOM ACOUSTICS, KNIGHTON HILL, WEMBURY, PLYMOUTH, DEVON.
TEL: (0752) 863188



With a reputation resting primarily on their highly successful loudspeaker designs, Heybrook now offer an upmarket pre- and power amplifier combination as well as the turntable reviewed here.

The *TT2* looks superficially similar to the Linn *Sondek*, but closer examination reveals that Heybrook have used a rather different set of solutions which do not appear to compromise engineering quality or finish. At the same time, the *TT2* is quite competitively priced.

The very strongly constructed plinth is essentially of 45mm composite, only cut away where space is required for the arm leads, motor and associated wiring. Suspended on three multi-turn coil springs, the subchassis can be aligned from above, *via* three socket-head bolts fixed by an ingenious locking system. The earliest models used a box-section welded steel subchassis which had rather a high mass, and was soon replaced by a cast aluminium design, with reinforcing flanges around the cruciform shape.

The closely-toleranced main bearing consists of a steel shaft supported on a hardened thrust ball, running in plain bronze sleeves. The alloy two-piece platter weighs 2.8kg, and the inner section forms the drum on which the belt runs. A felt mat is standard.

Currently, the *TT2* suspension is set on the firm side, to provide better control, while a fairly stiff short belt has been chosen as likely to minimise wow effects. The main subchassis modes are in the 4.5 to 5Hz range, and correct arm lead dressing offers good control of higher frequency rotational modes.

Arms tried with the *TT2* included the Linn *LVX* and the Alphason, but perhaps the most obvious choice was the Rega *RB300*, the two products complementing each other in fine engineering and value.

Lab Report

The well-constructed main bearing exhibited negligible play, while the subchassis was well adjusted. A fine weighted wow and flutter figure of 0.065% was recorded, with equally good results for the flutter and wow when separately weighted, at 0.08% and 0.07% respectively. The deck ran fast by an acceptable 0.5%, while high torque was shown by the excellent 0.18% slowing under test loading. Dynamic wow will not be a problem here.

DIN B weighted rumble was very low at almost −80db, but spectrum analysis did show some moderate motor-related mechanical frequency components, specifically at 100Hz and 200Hz. The latter measured −78dB and consequently should be quite harmless.

Sound Quality

On audition the latest *TT2* offered an improvement over the earlier version, notably in better exposition of the dynamic contrasts in the music. Pitch stability, rhythm and timing were all very good, while the bass was a strong point, with welcome firmness coupled with good extension to lower-bass frequencies.

Solo singing focused well in the stereo sound stage, the latter exhibiting good space and depth. The *TT2* compared well with far more expensive designs, making only slight concessions in areas of detail and dynamics on the most complex material.

Conclusions

One cannot help but be impressed by the fine finish and construction of this durable subchassis design, as well as by its competitive pricing and good performance both in the laboratory and in the listening room.

Strong points included very low wow and fine bass. It was easy to set up, remaining stably aligned, and merits a firm recommendation.

Test Results

	Motor unit
Type	belt-drive, subchassis
Platter mass/damping	2.6kg/average+
Finish and engineering	very good/excellent
Type of mains connecting leads	3 core
Speed options	manual change, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.065%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.07%/0.08%
Absolute speed error	+0.5%
Speed drift, 1 hour/load variation	<0.1%/−0.18%
Start-up time to audible stabilisation	3.8 secs
Rumble, DIN B wtd, L/R average	−80/−78dB
Size (w×d×h)/clearance for lid rear	44×37×15.5cm/6cm
Ease of use	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	£259

For graph references see issue No 43

RECOMMENDED

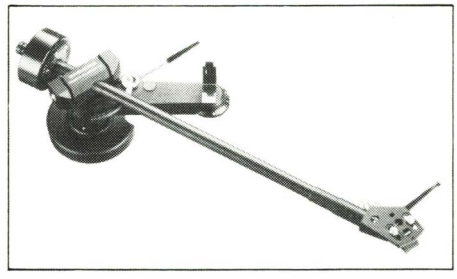
LINN BASIK PLUS

LINN PRODUCTS LTD, 257 DRAKEMIRE DRIVE, CASTLEMILK, GLASGOW G45 9SZ.
TEL: (041) 634 0371

Linn felt that the detatchable headshell fitting on their *LVX* represented a weakness, so decided to produce the *Plus*. Here the headshell has been factory fitted and is rigidly as well as permanently fixed. A feature of this relatively inexpensive Japanese-made product is the inclusion of the current *Basik* cartridge, a competent performer which retails at £15 when purchased as a separate item. Furthermore, the arm is assembled with bearings set to be free from play, essential if a satisfactory performance is to obtained when using a moving-coil cartridge. However, on some samples this practice can result in higher friction than usual — as indeed was the case with our arm. (A reasonable test to check this is to free balance the arm and set it near to the record centre. Dial a small amount of bias and observe if the arm swings slowly and smoothly. If so, the lateral friction is satisfactory.) Our sample did have low enough friction to give good tracking at a 1.8g downforce, but we would nonetheless have preferred less!

LAB REPORT

Effective mass with hardware was around 13g,



balancing a typical cartridge and suited to low or medium compliance. The geometry was fine, and it proved easy to set up. Vertical friction was fine at 50mg, but rose to 150mg laterally. The bias correction was estimated at an appropriate 230mg rim and 260mg centre.

Downforce calibration was fine, though cue descent a trifle slow. Measured with the *Basik* cartridge installed, the cartridge-coupled arm resonances were charted. The result was notably smooth, showing a good resonance behaviour and with the first mode at 620Hz.

SOUND QUALITY

Comparative listing tests showed an improvement over the *LVX*. Midrange coloration was reduced, with an improvement in clarity, detail and punch. Upper bass transients were more articulate, while the treble sounded better integrated as well as more incisive. The arm attained a fine standard for the price.

CONCLUSIONS

A worthwhile revision, the *Plus* was a fine tonearm, which in its latest form, and taking into account the inclusion of the *Basik* cartridge, earns a warm recommendation,albeit with slight reservation concerning lateral friction levels.

TEST RESULTS

Arm section

Approximate effective mass, inc screws, excl cartridge	13g
Type/mass of headshell	fixed
Geometric accuracy	very good
Adjustments provided	hieght/overhang/offset
Finish and engineering	excellent/very good
Ease of assembly/set-up/use	good/good/good
Friction, typical lateral/vertical	150mg/50mg
Bias compensation method	/internal spring
Bias force, rim/centre (set to 1.5g elliptical)	230mg/260mg
Downforce calibration error, 1g/2g	+0.1g/+0.15g
Cue drift, 8mm asce[illegible]t/des[illegible]	1.0 secs/3.5 secs
Arm resonances	good
Subjective sound quality	good
Arm damping	decoupled counterweight
Estimated typical purchase price	£112

For graph references see issue No 40

RECOMMENDED

MICHELL SYNCHRO

J.A. MICHELL ENGINEERING LTD, 2 THEOBALD STREET, BOREHAMWOOD, HERTS.
TEL: 01-993 0771

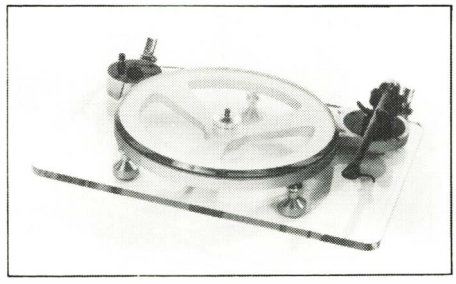
This middle-rank Michell *Synchro* is a true subchassis design, and has a striking, 'engineered' appearance, with all the working parts exposed and fully finished.

The cast subchassis has strong outrigger platform for arm mounting and a three point coil spring suspension. The assembly is mounted on a pale green, tinted, acrylic base with matching, round cornered lid and thick plate glass platter. A thin felt mat is in a darker shade of green. The synchronous motor feeds power *via* a rubber cord to the periphery of the platter. Speed change is effected by manual changeover on the two pulley diameters. The screw-in feet give a choice of rubber-faced or hard alloy spikes, the latter proving popular at present.

LAB REPORT

The platter had good self-damping; while the initial disc impulse transient was considerable, it decayed quickly, with minimal subsequent resonance. The suspension system was highly effective in blocking both airborne energy and vibration through the feet. What breakthrough was present proved even in character. The suspension did prove rather 'whippy' in the lateral and rotational planes, which unfortunately resulted in poor shock resistance.

The combined DIN peak weighted wow and



flutter measurement gave a fine 0.05%, with low individual contributions of flutter and wow, helped by the generous platter mass and fine tolerencing here, a absolute speed ran a little slow −0.06% but drift was negligible and slowing under load held to a fine −0.22%. Start-up was comparatively rapid 2.5 seconds, indicating healthy torque. DIN B weighted rumble was a very fine −77dB, the spectrogram showing low levels of electrical and mechanical noise.

SOUND QUALITY

Our initial sample disappointed with poor subjective pitch stability, the cause being an almost imperceptible mechanical interference between the close fitting platter and chassis. When solved, the player provided a very good standard of sound reproduction with firm bass and an articulate, detailed stereo presentation with good stage width and depth. Coloration was low while pitch and timing were to a high standard. Feed-back effects were negligible.

CONCLUSIONS

The *Synchro* offers an appealing combination of finish, engineered style, good lab performance, plus fine sound quality for the price. Versatile with respect to arm fitting it complemented the Rega *RB300* well and comfortably achieved recommendation.

TEST RESULTS

Motor section

Type	manual, belt-drive, subchassis
Platter mass/damping	see text/good
Finish and engineering	excellent/excellent
Type of mains connecting leads	2 core
Speed options	manual, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.05%
Wow and flutter (Im peak wtd 0.2-6Hz/6-300Hz)	0.08%/0.06%
Absolute speed error	−0.6%
Speed drift, 1 hour/load variation	negligible/−0.22%
Start-up time to audible stabilisation	2.5 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−77dB

System as a whole

Size (w×d×h)/clearance for lid rear	46×33.5×13cm/8.5cm
Ease of use	fairly good
Typical acoustic breakthrough and resonances	excellent
Subjective sound quality of complete system	very good
Hum level/acoustic feedback	very good/very good
Vibration sensitivity/shock resistance	very good/poor
Estimated typical purchase price	£235

For graph references see issue No 40

ENTER THE SONY/HI-FI CHOICE



Sony's *CDP 303ES* Compact Disc player; *TA-F222ES* amplifier; *ST-S222ES* tuner and *TC-R502ES* cassette deck are four top performance hi-fi components, when joined by Sony's exceptional *APM22ES* loudspeakers (shown on opposite page) they make up a remarkably fine hi-fi system that combines superb audio performance with the unmistakable Sony hallmarks of quality, reliability and stylish design.

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Choose A, B or C

1 Sony describe the D/A converter circuitry of their *CDP103* CD player as (A) ultralinear (B) ortholinear (C) unilinear. ☐

2 The remote control of the *CDP103* CD player offers a facility not on the machine itself, which (A) turns over the discs (B) disables the fluorescent displays (C) allows numeric index location. ☐

3 The bass/midrange driver of the *APM20ESII* loudspeaker uses a frame made of (A) pressed steel (B) injection moulded plastics (C) aluminium honeycomb. ☐

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MISSION CAMBRIDGE 775LCT

MISSION CAMBRIDGE LTD, STONEHILL, HUNTINGDON, CAMBRIDGE PE18 6ED.
TEL: (0480) 57477



This deck fitted as standard with a Mission *774LC* tonearm and *Solitaire* cartridge, it also has Linn-style arm mounting arrangements, so alternatives are possible. A solid plinth construction is adopted, made from a very thick and highly rigid composition board. Mission aim to 'close the loop' between arm and platter and thus exclude external interference. For isolation the plinth has three non-adjustable sponge feet in high-loss Sorbothane, capped by load-spreading cups.

A fairly resonant polystyrene lid is fitted while the two piece platter has an alloy outer disc weighing about 1.5kg resting on an inner plastic hub. The 500rpm synchronus motor is virtually rigidly mounted on the plinth which could give rise to breakthrough problems. This is linked to the platter via a neoprene cord running on a 'V' groove pulley. Speed change is manual, effected by flicking the cord from one step in the pulley to the other. No special alignment or adjustment is required, so the *775* should work properly straight away, immediately after it is unpacked and the platter put in position.

LAB REPORT

The limited shelf or support isolation was shown, with around 10dB of vibration rejection in the 30-500Hz range (as compared with 20-30dB for the subchassis designs). Acoustic energy was handled better if still below average, but both breakthrough curves were of an even and non-resonant character.

The disc impulse response was fairly typical of this type of thin felt mat, but the subsequent decay was rather quicker than usual. A slight 'ring' was evident at 180Hz, probably a platter rocking mode. Wow and flutter were only just satisfactory on an early sample, but improved with a second one. Rumble was certainly poorer than average but not unacceptable at around −70dB, analysis showing the predicted motor — related components at a satisfactory level. Torque was good with minimum slowing under load, and the other speed characteristics were fine.

SOUND QUALITY

Assessed with the *774LC* tonearm, this turntable confounded some of our prejudices concerning solid plinth designs. It gave a tidy, coherent and well integrated sound. Dynamics were good, with almost tactile percussive impact. Pitch and rhythm were also good, lending an almost 'boppy' effect with the help of an above average bass quality which was a bit lightweight but tuneful.

Stereo focus was impressive though the mid-range was a trifle 'up front' with some loss of depth. The sound was distinctly improved when the lid was removed, and this is our recommendation for serious listening.. Both deck and arm appeared well matched.

CONCLUSIONS

Supplied complete with cartridge at around £199, this turntable continued to do well despite a noticeable increase in motor noise with recent samples. Its musical drive and integrity remains, allowing us to continue our recommendation. It still sounded a little better with the lid removed despite lid improvements, and performed optimally on a proper wall-mounted shelf.

TEST RESULTS

Motor section	
Type	belt-drive, subchassis
Platter mass/damping	2.15kg/fairly good
Finish and engineering	very good/good
Type of mains connecting leads	2 core/phonos and earth
Speed options	manual change, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.1%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.18%/0.07%
Absolute speed error	+0.1%
Speed drift, 1 hour/load variation	+0.09%/−0.21%
Start-up time to audible stabilisation	1.8 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−77/−75dB
Arm section(Mission 774LC)	
Approximate effective mass, inc screws, excl cartridge	12g
Type/mass of headshell	non-detachable
Geometric accuracy	very good
Adjustments provided	height/overhang/offset
Finish and engineering	excellent/very good
Ease of assembly/set-up/use	very good
Friction, typical lateral vertical	30mg/30mg
Bias compensation method	spring
Bias force, nm/centre (set to 1.5g elliptical)	120mg/120mg
Downforce calibration error, 1g/2g	−0.08g/−0.2g
Cue drift, 8mm ascent/descent	very good, 0.5 secs/4.0 secs
Arm resonances	average+
Subjective sound quality	good
Arm damping	none
System as a whole	
Size (w×d×h)/clearance for lid rear	43×33×12.5cm/4cm
Ease of use	good
Typical acoustic breakthrough and resonances	fair
Subjective sound quality of complete system	good
Hum level/acoustic feedback	average/fair
Vibration sensitivity/shock resistance	average —/fairly good
Estimated typical purchase price	£199

For graph references see issue No 40

BEST BUY

NAD 5120

NAD Sales, Cousteau House, Greycaine Road, Watford, Herts WD2 4SB
Tel: (0923) 26499



Now significantly revised, the NAD *5120* remains a boldly unusual design. The earlier version's floppy, printed circuit tonearm has been replaced by a conventional tubular type, and the price cut to a competitive £109 including the worthwhile Ortofon *OM10* cartridge.

Amazing considering the price, this Czech built turntable has a true floating subchassis. The suspension needs no alignment, employing B&O style leaf springing. The lightweight pressed alloy platter is beefed up by a substantial hard mat insert, bringing total mass to a still-modest 1.15kg. The moulded plastic inner platter drum is belt-driven from a slow speed synchronous motor of the usual type. One control actuates the speed change and another cueing automatic stop and lift-off are automatic. The non-resonant lid is acrylic the plastic plinth is supported on hard rubber feet.

Lab Report

This player achieved presentable wow and flutter results 0.1%, DIN peak weighted, while the separate flutter and wow contributions were well balanced. Absolute speed was acceptably close and showing under load satisfactory −0.28%. Rumble was poorer than expected at −68/−64dB, DIN B weighted; spectral analysis showed some motor harmonics at 100 and 200Hz, sufficient to affect the DIN reading.

Vibration isolation was pretty good, but the light platter did not provide very strong acoustic breakthrough rejection, which peaked at 360Hz. The disc impulse response was also unpromising; the initial transient was handled well, but the platter continued ringing at several frequencies thereafter. Suspension dynamics were fairly good, if a touch 'whippy' in rotation.

Arm effective mass was 9.0g suiting the supplied cartridge, while lateral friction measured rather high 0.3g; as a result the bias compensation value had to go unrecorded. Downforce calibration was on the low side, which is not the best direction in which to err. The arm's resonant behaviour was considered poor, the graph being charted with the supplied Ortofon cartridge and hence representative of typical use conditions. The major break at 350Hz was particularly severe, but there were no problems over the rest of the range. When used as instructed the damper proved effective and was a useful extra in improving tracking and stability.

Sound Quality

For a budget model, this NAD did pretty well and with 2.0g downforce arm friction did not appear to pose any problem. The turntable exhibited some lower midrange coloration although this was not too serious.

Stereo images were stable and showed some sense of depth and scale, while the bass was satisfactory, possesing a fairly tuneful quality, better than usual for the price.

Conclusions

This player was quite close to our Best Buy classification, but was held back by doubts concerning sample quality. The review model was an early one, but still should have exhibited better arm friction.

(Note: a later sample showed further improvements to the arm, so this deck is now rated a 'Best Buy').

Test Results

Motor section

Type	semi auto, belt-drive, subchassis
Platter mass/damping	1.15kg/average
Finish and engineering	very good/good
Type of mains connecting leads	2 core/phonos and earth
Speed options	33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.1%
Wow and flutter (Im peak wtd 0.2-6Hz/6-300Hz)	0.12%/0.12%
Absolute speed error	+0.25%
Speed drift, 1 hour/load variation	synchronous/−0.28%
Start-up time to audible stabilisation	2.5 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−68/−64dB

Arm section

Approximate effective mass, inc screws, excl cartridge	9.0g
Type/mass of headshell	non-detachable/-
Geometric accuracy	good
Adjustments provided	overhang/offset
Finish and engineering	good/fairly good
Ease of assembly/set-up/use	very good
Friction, typical lateral vertical	320mg/<20mg
Bias compensation method	spring
Bias force, rim/centre (set to 1.5g elliptical)	see text
Downforce calibration error, 1g/2g	−0.15g/−0.3g
Cue drift, 8mm ascent/descent	<0.5 secs/2.5 secs
Arm resonances	poor
Subjective sound quality	average−
Arm damping	effective silicone dashpot

System as a whole

Size (w×d×h)/clearance for lid rear	42×35.5×11cm/3cm
Ease of use	very good
Typical acoustic breakthrough and resonances	average+
Subjective sound quality of complete system	average+
Hum level/acoustic feedback	good/good
Vibration sensitivity/shock resistance	good/fairly good
Estimated typical purchase price	£109

For graph references see issue No 40

THE OAK/ZETA JUNIOR ARM

MOTH MARKETING, 47 ARMSTRONG CLOSE, WILSTEAD, BEDFORD.
TEL: (0234) 741152



The Oak budget turntable can now be supplied fitted with the Zeta *Junior*, a newly-commissioned Japanese-built arm, effectively replacing the now discontinued ADC arm which was supplied with the earlier model some years ago. Considerable improvements have been made over the original version, the current turntable having a well-toleranced inverted main bearing and a well-centred wood composition (MDF) platter, driven by a distinctive bright red synthetic rubber cord. Manual speed change is accomplished by flicking the cord from one pulley stop to the other, and a powerful synchronous motor is fitted.

The arm is reminiscent of the old ADC *LM-F1*, with a detachable, lightweight reinforced plastic headshell (interchangeable with the metal one used in the original Linn *Basik LVX*). A rotating counterweight is used, and overall finish is excellent, but this arm is too inexpensive to offer bearings free of play.

LAB REPORT

Virtually in the low-mass category, the arm's effective mass is 8.3g including mounting hardware; substitution of an *LVX* headshell would increase this to 12g or so, to suit low compliance cartridges better. Geometry was fine, the arm was easy to set up and use, and friction was low. Bias correction tended to the low side at the rim — solved by dialling a slightly higher indicated value. Downforce was well calibrated, and the cue operated satisfactorily. Structural resonances were quite numerous and the arm scored a straight 'average' here.

The disc rests directly on the plain finished platter, resulting in fairly good disc damping; a platter rocking mode was evident at around 35Hz. Wow and flutter was a satisfactory 0.25%, with similar unweighted contributions of flutter and wow. Speed error was all right at 1%, while start-up was rapid; the player had good torque characteristics. DIN B weighted, the rumble levels were unexceptional with figures reminiscent of the mid 'sixties, and not really to hi-fi standards. Analysis showed motor vibration breakthrough at 100 and 200Hz, audible as a slight low level 'drone' on very quiet sections of a record. Acoustic breakthrough was fairly well controlled by the structural solidity, but the stiff plastic feet afforded little vibration rejection from the mounting surface. Variations in performance with different tables, platforms etc were expected and indeed found. Conversely, the rigid construction did afford good shock immunity.

SOUND QUALITY

The arm gave a satisfactory performance, reasonably clean and well balanced but not in the class of the Rega *RB250* with its play-free bearings. Some 'clutter' at high frequencies was associated with certain mid colorations, and lack of stereo depth was noted.

The Oak motor unit gave above-average performance for the type, with good clarity in the mid and treble ranges. The sound depended strongly on location and sounded rather lightweight on the test coffee table, lacking spaciousness with the bass distinctly curtailed.

CONCLUSIONS

Despite the above comments, the Zeta *Junior* is the only well-finished and competent tonearm available at the price, and should be welcomed for its contribution to the costing of budget turntable systems. The Oak deck is now presented in a refined form with a superior finish in real wood (black oak!), and it would be hard to deny that it represents fair value for money. Presentable results are possible from the package if appropriately sited.

TEST RESULTS

Motor section	
Type	belt-drive, synchronous (manual)
Platter mass/damping	1.5kg/fairly good
Finish and engineering	very good/good
Type of mains connecting leads	2 core/phonos and earth
Speed options	33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.26%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.27%/0.20%
Absolute speed error	1.0%
Speed drift, 1 hour/load variation	negligible/−0.15%
Start-up time to audible stabilisation	1.5 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−64/−68dB
Arm section	
Approximate effective mass, inc screws, excl cartridge	8.3g
Type/mass of headshell	ADC detachable/3.0g
Geometric accuracy	very good
Adjustments provided	height/overhang/lateral
Finish and engineering	very good/good
Ease of assembly/set-up/use	very good/very good/very good
Friction, typical lateral vertical	30mg/<20mg
Bias compensation method	internal spring
Bias force, rim/centre (set to 1.5g elliptical)	120mg/200mg
Downforce calibration error, 1g/2g	−0.05g/−0.05g
Cue drift, 8mm ascent/descent	slight, 1.5 secs/3.5 secs
Arm resonances	average
Subjective sound quality	average+
Arm damping	decoupling counterweight
System as a whole	
Size (w×d×h)/clearance for lid rear	46×35×14.5cm/7cm
Ease of use	very good
Typical acoustic breakthrough and resonances	average+
Subjective sound quality of complete system	average+
Hum level/acoustic feedback	average/average−
Vibration sensitivity/shock resistance	average−/good
Estimated typical purchase price	£139 (without arm £99)

For graph references see issue No 43



JUST FOR THE RECORD

It's been some years since we turned high fidelity thinking round by introducing the Sondek LP-12 turntable. Till then – just in case you're too young to remember – most folk thought the loudspeaker was the most important component. With the LP-12, we demonstrated that the turntable was the first, all-important link in the chain of sound reproduction. Pretty controversial stuff in its day – but as people stopped talking and started listening, the LP-12 became known as the finest turntable in the world. And all these years later, if you love music more than gadgetry, it's still the best source available.

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QED R232EN

QED AUDIO PRODUCTS LTD, 12 ASHFORD INDUSTRIAL ESTATE, SHIELD ROAD, ASHFORD, MIDDLESEX TW15 1AU. TEL: ASHFORD 46236



Some time ago, QED successfully completed their all-British budget audio system with the introduction of the *232* turntable. That model has since been joined by the *232EN*, a more advanced design incorporating an upgraded cartridge with elliptical stylus, and an electronic quartz-controlled motor power supply of unusually high quality for the price.

Like the *232*, the *'EN* is founded on a substantial solid plinth supported on resilient vibration-absorbing feet. A glass platter is used with a belt-driven inner hub. The main bearing is well toleranced while the popular black felt mat provides disc support. The overall finish — satin black with gold lettering — is very good, while operating speeds are conveniently set by front panel push buttons.

The tonearm is a modern design and now has slotted headshell fixings for more accurate alignment. It comes fitted with a moving magnet cartridge custom-built by Goldring. The strongly-constructed and rigid headshell is permanently fixed to the main arm beam, the latter supported on strong gimbal bearings adjusted to be free from play.

The design objective was to offer a complete and foolproof integrated player with all components properly fitted, aligned and sonically balanced.

Lab Report

While the cartridge was not subjected to full test it was found to give a more than satisfactory frequency response with worthwhile separation, plus good trackability at the chosen downforce; it also matched the arm well. The latter proved to be more than competent with regard to arm resonances, showing good control with mild resonances at 500, 950 and 1600Hz. Effective mass lay in the medium category at approximately 12g, including hardware. Well-aligned, the arm showed moderate friction levels, sensible degrees of downforce and bias correction, and the cue operated well.

The resilient feet of the motor unit provided good isolation at low mid frequencies, while the impaired bass isolation was nearer the norm for the type. Acoustic breakthrough was well handled though not to subchassis standards (note that the graph was taken with lid detached).

Speed measurements showed marginally better results than those of the non-electronic version. Wow and flutter, DIN-weighted, was fine at 0.12%, with the linear wow result predominant at a moderate 0.2%. Given the quartz motor reference, the absolute speed was a somewhat low −1.6%. Slowing under load was a moderate 0.3%, and the DIN-weighted rumble levels were rather better than for the non-electronic version, improving to a good −70dB with the main rumble components at 100Hz and 200Hz. Start-up to audible speed stabilisation was also quite rapid.

Sound Quality

The standard was improved over the already pleasing *'232*. In context, the *'EN* provided a feeling of greater stability and quieter backgrounds, allowing finer musical detail to be resolved. Rhythm and timing were better, while piano reproduction was also rather above average. Clarity was most presentable throughout the range, with moderate stereo depth, but full weight and attack was somewhat diluted in the bass.

Conclusions

QED now provide a trim, well styled integrated player in attractive satin black. The electronic speed switching is a worthwhile addition, while the player, arm and cartridge ensemble reaches a worthy standard. Not in the Best Buy category, general competence nonetheless ensures firm recommendation.

Test Results

Motor section	Integrated turntable
Type	belt-drive, electronic
Platter mass/damping	1.0kg/fair
Finish and engineering	fairly good/fairly good
Type of mains connecting leads	3 core/phonos
Speed options	33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.12%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.20%/0.10%
Absolute speed error	−1.6%
Speed drift, 1 hour/load variation	−1.0%/−0.3%
Start-up time to audible stabilisation	3.0 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−70.5/−69.5dB
Arm section	
Approximate effective mass, inc screws, excl cartridge	12g
Type/mass of headshell	fixed
Geometric accuracy	very good
Adjustments provided	none
Finish and engineering	good/good
Ease of assembly/set-up/use	excellent/excellent/very good
Friction, typical lateral vertical	30mg/<20mg
Bias compensation method	thread and lever
Bias force, rim/centre (set to 1.5g elliptical)	100mg/180mg
Downforce calibration error, 1g/2g	uncalibrated
Cue drift, 8mm ascent/descent	negligible, 1.5 secs/4.0 secs
Arm resonances	average+
Subjective sound quality	good
Arm damping	decoupled counterweight
System as a whole	
Size (w×d×h)/clearance for lid rear	40×30×11cm/6cm
Ease of use	very good
Typical acoustic breakthrough and resonances	fairly good
Subjective sound quality of complete system	above average
Hum level/acoustic feedback	good/average+
Vibration sensitivity/shock resistance	average+/average
Estimated typical purchase price	inc cartridge £199

For graph references see issue No 43

BEST BUY

REGA RB300

REGA RESEARCH LTD, 119 PARK STREET, WESTCLIFFE-ON-SEA SS0 7PD
TEL: (0702) 33071



For most of the tests here, the Rega *RB300* tonearm was fitted to a current-production *Planar 3* turntable, which is in fact the most usual combination, selling for just under £190. The arm can also be bought as a separate component (£90) and proved to be one of the most exciting introductions in the 1984 issue.

The *RB250* arm is a simplified version of the '300 and is currently fitted to the *Planar 2*, the combination selling for around £125. We also subjected the *Planar 3* to a full retest, and comments on its sonic performance are included with this arm review. Very little change was recorded in the '3 performance, though the drive components did demonstrate some engineering improvement in terms of both quality and tolerances.

Getting back to the *RB300*, this Rega-made product uses a very rigid one-piece arm beam/headshell, which unusually is constructed from a hollow aluminium casting. No joins are present between cartridge platform and pivot. The bearings themselves are highly pre-loaded and yet mounted to such a high tolerance that friction is negligible while play is physically undetectable.

Rega's traditional magnetic frictionless bias compensator is employed, with a novel touch present in the design of the downforce mechanism. When set to zero, the carefully designed coil spring mechanism exerts a minus force of 3g, so reducing the counterbalance requirements. Designer Roy Gandy has aimed for the smallest possible counterweight in order to reduce its moment of inertia and consequently its effect on the dynamics of the rear section of the arm. To this end the counterweight is machined from a very dense tungsten alloy, permitting a still smaller counterweight diameter.

The bearing gimbal is itself a substantial casting and the usual adjustable vertical pillar design has been omitted, being regarded as a structural weakness. The alternative is a threaded stem and large locknut; vertical height adjustment is only possible using various washers, assuming that the arm/cartridge combination will fit the chosen turntable. For example, the arm was a mite too high for an EMT cartridge, though fine for an *Asak*, when mounted on a Linn deck; on the Lux 300, the height was right for the EMT. It is also slightly longer than the majority of tonearms, so less suitable for very compact turntables.

LAB REPORT

Tests showed the *RB300* to have some of the finest bearings in the business; furthermore it was very competent in the important area of beam/headshell rigidity. Friction was very low in both planes, without a trace of play, and while biasing worked well, the calibrated figures were a little on the high side (by about 25%). Downforce calibration was accurate and cue operation fine. Geometric accuracy was to a high standard, while the effective mass was a moderate 10.5g, including the good-quality steel mounting hardware. A wide range of moving magnet and moving coil cartridges are judged suitable in the 8-22cu range.

Looking at the structural resonance response, the picture suggested good control and excellent rigidity. The 400Hz mode was probably the counterweight and was mild, while the first bending or torsional mode was deferred until a remarkably high 1.5kHz — an outstanding result. The treble was also remarkable for its absence of resonances after 4kHz.

SOUND QUALITY

It was clear after only a few minutes audition, that the *RB300* was a top flight performer. Depending on the chosen player, it proved quite comfortable in the company of other reference tonearms in the £250-£400 range.

The sound was notably dry and neutral with excellent control throughout the range. It proved capable of making one 'reference' arm sound dull and another hard and brash; and while the latter comparison could be interpreted by some as a lack of 'life' in the *RB300*, personally, I do not believe this. Transients were judged excellent, while it offered a very well-focused sound stage with first rate depth. Cartridges up to £800 were tried without any embarrassment. Its only significant failing was a slight muddling of detail on complex musical passages.

CONCLUSIONS

The *RB300* is an excellent product of which Rega can be justly proud. Despite its modest price it sets new standards in performance, and a Best Buy rating is obviously appropriate. In conjunction with the turntable it forms the new *Planar 3* combination, and its benefits were clearly also apparent in the *Planar*.

TEST RESULTS

Tonearm

Approximate effective mass, inc screws, excl cartridge	10-11g
Type/mass of headshell	non-detachable
Geometric accuracy	very good
Adjustments provided	overhang/offset
Finish and engineering	very good/excellent
Ease of assembly/set-up/use	very good/excellent/very good
Friction, typical lateral vertical	150mg/15mg
Bias compensation method	magnetic
Bias force, rim/centre (set to 1.5g elliptical)	340mg/330mg
Downforce calibration error, 1g/2g	+0.05g/+0.03g
Cue drift, 8mm ascent/descent	negligible, 0.5 secs/3.0 secs
Arm resonances	see graph
Subjective sound quality	very good
Arm damping	none
Estimated typical purchase price	£90

For graph references see issue No 43

REGA PLANAR 2 and 3

REGA RESEARCH LTD, 119 PARK STREET, WESTCLIFFE-ON-SEA SS0 7PD.
TEL: (0702) 333071



Since 1984 the *RB300* arm has been a standard fitting on the *Planar 3* deck. The performance of this new combination is discussed fully in the *RB300* review. The *Planar 2* now comes with a simplified version of the new *RB300* arm, called the *RB250*.

This simple turntable design 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 thrust ball showed close tolerances, 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 heavy plate glass (less thick in the *Planar 2*, 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 supress vibrations coupling to the platter.

The *Planar 2 RB250* arm has the same excellent bearings and one-piece cast arm tube as the *RB300* but has been simplified by a conventional rotating/sliding scale counterweight which is partly decoupled. The leadout cable is fixed and the chassis earth combined with one of the signal grounds; phono plugs are fitted.

Effective mass is around 11.5g including the supplied stainless steel mounting hardware, suitable for moderate compliance cartridges or even modest moving coils.

Rega recommend that the deck should be placed on a light shelf, wall mounted rather than '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 showed. 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. Consequently hum levels were poorer than average and the choice of cartridge will need a little 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 with the motor off, however. Acoustic breakthrough was about average and the lid was found to be influential here, and results were better when it 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.

SOUND QUALITY

Belying traditional assumed relationships between a number of technical parameters and sound quality, the Rega proves that a well-developed, 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.

With the latest arm the *Planar 2* sounded more confident. In the upper bass it was surprisingly articulate while mid and treble were notably smooth and sweet with better detail than before. Presentation of detail was considered well above average and little inferior to 'super-fi' models.

CONCLUSIONS

The *Planar 2* offers a fine subjective performance and is both very well made and finished, which places it firmly in the Best Buy category. The *Planar 3* is also good, but does not offer quite the same value, so a standard recommendation is appropriate here, especially with the excellent *RB300* arm.

TEST RESULTS

Motor section	Integrated turntable
Type	manual, belt-drive
Platter mass/damping	2.2kg/good
Finish and engineering	very good/very good
Type of mains connecting leads	2 core phones
Speed options	33/45 rpm
Wow and flutter (DIN peak wtd sigma 2)	0.09%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	*0.21%/0.45%
Absolute speed error	+0.4%
Speed drift, 1 hour/load variation	synchronous/−0.4%
Start-up time to audible stabilisation	4.5 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−72/−70dB
Arm section	
Approximate effective mass, inc screws, excl cartridge	11.5g
Type/mass of headshell	universal detachable/8.0g
Geometric accuracy	very good
Adjustments provided	overhang/lateral angle
Finish and engineering	excellent/very good
Ease of assembly/set-up/use	very good/very good/very good
Friction, typical lateral vertical	less than 25mg/15mg
Bias compensation method	internal magnet
Bias force, rim/centre (set to 1.5g elliptical)	300mg/310mg
Downforce calibration error, 1g/2g	−0.1g/−0.07g
Cue drift, 8mm ascent/descent	negligible 0.5 secs/1.5 secs
Arm resonances	very good
Subjective sound quality	very good
Lead capacitance/damping method	70pF/counterweight decoupling
System as a whole	
Size (w×d×h)/clearance for lid rear	45×36×12.3cm/7cm
Ease of use	fairly good
Typical acoustic breakthrough and resonances	average
Subjective sound quality of complete system	good
Hum level/acoustic feedback	average−/fairly good
Vibration sensitivity/shock resistance	average−/good
Estimated typical purchase price	Rega 2 £125; Rega 3 £188

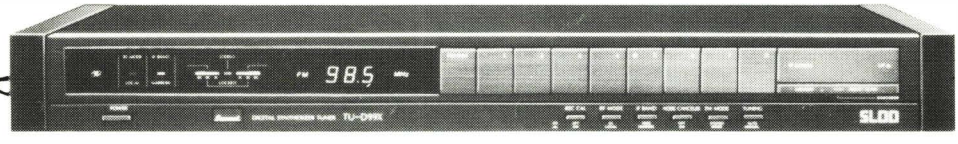
**worsened by unevenness of thick felt mat*

For graph references see issue No 43

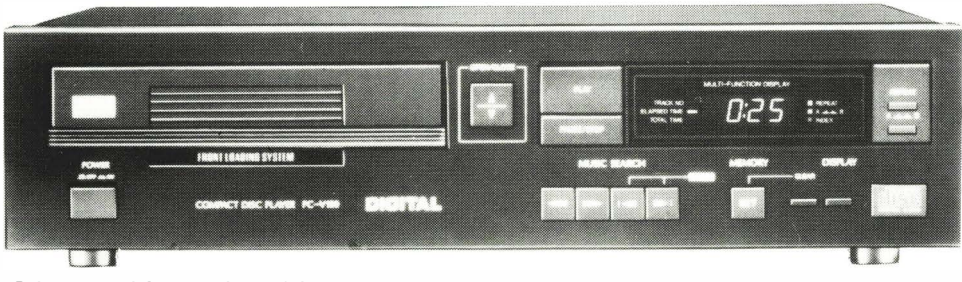
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Ian Kuah. Which Compact Disc. April 1986.

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ROTEL RP850

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Outwardly quite conventional, the Rotel *RP850* in fact shows much evidence of careful design, and attains correspondingly fine results. Priced at £180, it is a very different kind of product from the visually similar but much less competent *RP830*.

The heavy, solid plinth makes a good foundation for arm and platter, and is supported on moderately compliant feet. The deck is fitted with a rather resonant polystyrene lid, but Rotel were quick to pont out that they recommend critical listeners should remove it during play. A fairly generous die cast aluminium platter weighs 1.8kg, and the main bearing was well toleranced with negligible slack. A thick rubber mat covers the platter, helping to mask any effects of the two apertures provided in the platter surface for drive belt access. The player is powered by a large synchronous motor with double crowned pulley. Speed changeover is by hand, only requiring the mat to be lifted.

The arm is rather better than those usually encountered on integrated players, having well adjusted slack-free bearings. The light alloy tube has an adjustable die-cast metal headshell which is clamped in position using a proper sleeve clamp with socket-head bolt tightening. This arm is in the medium-to-high effective mass range, so cartridges with compliances of the order of 8-20cu should prove suitable.

LAB REPORT

The motor proved well isolated from vital vibration-sensitive points, as shown by the fine −80dB DIN B-weighted rumble. Spectral analysis revealed a couple of harmless motor harmonics at 25Hz, and 200Hz, but electrical hum was fairly low.

A high-powered motor enables this player to reach rated speed in a fast 1.7 seconds, and its good torque was confirmed by very mild slowing under test loading, measuring 0.2%. Consequently pitch stability was very good, while DIN peak wow and flutter was a fine 0.07% with equally promising flutter and wow when separately assessed.

The *RP850* did fairly well on acoustic breakthrough which was noticeably improved by removing the lid. The feet afforded some vibration isolation — poorer than most subchassis types, but beneficially even. Shock resistance was better than average. The disc impulse response showed good initial damping followed by some low frequency platter ringing at 40Hz; this is likely to be a rocking mode.

Arm performance was above average showing good alignment and adjustments. Minor/modes at 100 and 280Hz were probably due to the counterweight, but the main break at a commendably high 1kHz was rather severe. Arm adjustments included level, angle overhang and rotation. Friction was a low 25/10mg lateral/vertical, while the bias compensator offered appropriate values. Downforce error was minor, and the cue worked well.

SOUND QUALITY

The sound was more than satisfactory with the lid on and improved still further when it was removed, gaining an above average rating.

Pitch was secure and stable with inaudible wow or rumble, and the sound seemed tonally well balanced, with a clean detailed midrange plus good treble and only slight imprecision heard as a touch of fizz. Bass was reasonably defined, albeit with some loss of attack noted as a 'rubbery' quality. However, it did at least show reasonable tune playing abilities. Stereo was to a good standard with solid focusing and fair depth.

CONCLUSIONS

This surprising player offered a good all-round performance at a competitive price. The above average tonearm complemented the motor well and was good enough for some modest moving-coil cartridges. Enthusiasts may run the deck with the lid off for the very best results, but at £180, the *RP850* is clearly a strong contender, comfortably gaining our recommendation.

TEST RESULTS

Motor section

Type	manual, belt-drive
Platter mass/damping	1.8kg/fairly good
Finish and engineering	very good
Type of mains connecting leads	2 core/phonos and earth
Speed options	33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.07%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.05%/0.08%
Absolute speed error	+0.25%
Speed drift, 1 hour/load variation	<0.06%/−0.2%
Start-up time to audible stabilisation	1.7 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−79/−81dB

Arm section

Approximate effective mass, inc screws, excl cartridge	13g
Type/mass of headshell	special detachable/9.5g
Geometric accuracy	very good
Adjustments provided	tilt/overhang/offset
Finish and engineering	good/very good
Ease of assembly/set-up/use	very good
Friction, typical lateral/vertical	25mg/10mg
Bias compensation method	internal spring
Bias force, rim/centre (set to 1.5g elliptical)	190mg/225mg
Downforce calibration error, 1g/2g	−0.05g/−0.04g
Cue drift, 8mm ascent/descent	negligible, 0.8 secs/1.8 secs
Arm resonances	see graph
Subjective sound quality	good
Arm damping	none

System as a whole

Size (w×d×h)/clearance for lid rear	43.5×37×14.5cm/6cm
Ease of use	good
Typical acoustic breakthrough and resonances	fairly good
Subjective sound quality of complete system	good(lid off)
Hum level/acoustic feedback	very good/fairly good
Vibration sensitivity/shock resistance	fair/good
Estimated typical purcahse price	£180

For graph references see issue No 40

RECOMMENDED

SEE REVOLVER

SEE LTD, 49 FOLLY LANE, WARRINGTON WA5 5ND.
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Now a well-established and popular model, the *Revolver* is a British designed and built motor unit, which can be supplied factory-fitted with the *Revolver* arm, or (at slightly higher cost) the Linn *LVX*.

Essentially a solid-plinth design, the *Revolver* is founded on a substantial Medite (MDF) board. This in turn is mounted on three rubber feet, one at the rear and two at the front, looking rather similar to those used by Rega.

A secondary plinth element, namely the top plate on which the arm and platter are mounted, provides some decoupling from the plinth-mounted motor and lid. This plate is marginally isolated with stiff foam rubber strips joining it to the plinth proper. A hidden feature of the top plate is the rumble vibration canceller, which comprises a pair of lead weights mounted under the rear corners to avoid a coincident resonance and hence improve the signal-to-noise ratio.

The platter is rather light in weight and is cut from MDF. It is driven at its periphery by a long endless belt, power being provided by the usual double-pulley synchronous motor. The main bearing is a simple design with a steel shaft and brass sleeve, run 'wet' with a charge of oil supplied. The main bearing tolerance on our samples was very good, with no significant slack.

From its introduction, the *Revolver* featured a striking finish in first-class red or grey hammer paintwork — it is now additionally available in black ash. SEE also supply the 'PIG' rubber record clamp, along with their Starmat impregnated felt platter mat.

Lab Report

The *Revolver* ran slightly fast, on the 1984 sample by an acceptable 0.4%. Wow and flutter was a little below par at 0.18%, with both wow and flutter components in evidence. Slowing under load was, however, negligible. Platter mass was quite low and the disc damping result fairly typical for the type. On an early sample, rumble was also below par at −62/65dB, with 200Hz motor rumble apparent. Acoustic and isolation breakthrough were not particularly good, though shock resistance was quite good. Unfortunately it was not possible to carry out full measurements on the current sample; while the graphs related to the latest production, the tabulated results are from an earlier sample.

Sound Quality

On listening tests the *Revolver* scored 'average plus', and clearly benefitted from the competent performance of the chosen tonearm. The overall sound was nicely balanced, though mild wow was occasionally heard, while neither pitch nor timing in music seemed too secure. The bass was free of boom or emphasis, but also lacked attack and weight and consequently sounded a bit 'soft'. Stereo depth was good, however, and had pleasant perspectives.

Conclusions

The current *Revolver* features a thicker top deck, and build quality is much improved compared with the earliest examples. The main bearing still needs a period of running in. Priced at a little over £200 with Linn *LVX* arm, this model provides a decent sound quality and our recommendation continues.

Test Results

Motor unit/integrated player

Motor section	
Type	plinth, belt-drive, synchronous
Platter mass/damping	1.0kg/fair
Finish and engineering	good
Type of mains connecting leads	3-core
Speed options	manual change, 33⅓/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.18%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.15%/0.14%
Absolute speed error	+0.4%
Speed drift, 1 hour/load variation	negligible/−0.12%
Start-up time to audible stabilisation	2.0 secs
Rumble, DIN B wtd, L/R average (see spectrum)	62/65dB
Size (w×d×h)/clearance for lid rear	42×36×13cm/8.5cm
Ease of use	average
Typical acoustic breakthrough and resonances	average−
Subjective sound quality of complete system	average+
Hum level/acoustic feedback	fairly good/average
Vibration sensitivity/shock resistance	fair/good
Estimated typical purchase price £123; with Revolver tonearm £180; with LVX £220	

(Note: measurements relate to an earlier sample)

For graph references see issue No 43

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Floating subchassis models are rare at the £144 level, and the *Systemdek* IIX is one of a select few. Its suspension resembles the Pink Triangle, the subchassis hanging on fairly small diameter coil springs adjustable from above. Good chassis dynamics are ensured, with free swing in the required planes of motion. The standard Dunlop oil-feed bearing is used and all vital parts are well engineered.

The subchassis is reinforced by an aluminium girder extrusion linking main bearing tonearm mount. A plate glass platter plus felt mat rests on the inner platter drive hub, and a standard synchronus motor (with two-speed pulley) powers the deck *via* a precision rubber belt.

The well finished plinth has a decent lid mounted on good hinges. Arm mounting is straightforward and cable dressing no problem; for testing we fitted a Mission *774LC*, together costing about £180. However, we have been informed by Dunlop that in future they may be able to offer their own Japanese-sourced 'LC' arm.

LAB REPORT

Founded on the good results of the earlier *II*, the *IIX* performed well on test. Platter mass was a realistic 1.8kg with average disc damping provided by the felt mat. Some improvement occurred when the Dunlop disc clamp was used.

Weighted wow and flutter was a moderate 0.09%, unweighted flutter was fine at 0.1% likewise wow/at 0.12%. The deck did run a little fast but showed excellent torque, the 0.13% slowing under load a fine result indicating a complete absence of subjective program dynamic wow. DIN B rumble was very good −80/82dB, spectral analysis showing some 100Hz motor harmonics at a harmless level.

This front-rank performer on vibration and acoustic isolation allowed very little energy in above 30Hz.

SOUND QUALITY

Fine results were obtained on audition. Stereo images were well focused, while good depth and midrange detail were evident. The bass was notable for its clean, even quality, showing good attack and tunefulness.

Tonally, the deck sounded a little bright and forward with a hint of 'echo' in the mid, and it could also sound a trifle 'louder' than the best of its competitors. Rumble and wow were inaudible.

CONCLUSIONS

Unfortunately we did not recieve a current version of this deck for retest, but understand that some small improvements have taken place. Given Dunlop's consistent standing over the years, we have decided to maintain the Best Buy rating for this deck. An 'electronic' version is also available.

TEST RESULTS

Motor section

Type	belt-drive, subchassis
Platter mass/damping	4.75kg/good
Finish and engineering	very good/very good
Type of mains lead/connecting lead	3 core/–
Speed options	manual, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.08%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.14%/<0.05%
Absolute speed error	+0.05%
Speed drift, 1 hour/load variation	synchronous/−0.16%
Start-up time to audible stabilisation	4.3 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−76/−78dB
Size (w×d×h)/clearance for lid rear	41×34×16.5cm/6.5cm
Ease of use	good
Typical acoustic breakthrough and resonances	very good
Subjective sound quality of complete system	very good
Hum level/acoustic feedback	very good/excellent
Vibration sensitivity/shock resistance	excellent/fairly good
Estimated typical purchase price	£144

For graph references see issue No 40

THORENS TD320-316 SERIES

PORTFOLIO MARKETING LTD, RIVER WALK, TONBRIDGE, KENT TN9 1DT.
TEL: (0732) 365071



After a relatively quiet period, Thorens last year launched a new range of turntables called the *320* series, and these were followed by the inexpensive *316* and *318* models. Essentially this provides replacements for the long established *160* range, and a new wood subchassis design has been employed. Following in the footsteps of B&O and Philips, Thorens have chosen to replace their usual coil spring suspension with one using flat leaf springs, these hung or cantilevered from the chassis allowing free movement. Centration and consistency are thus improved and the springs are easy to adjust from above.

The massive plinth is of solid MDF, 40mm thick. The section of material cut out for the arm mounting is used to construct a wood-based high-mass subchassis of low resonance properties. Arm mounting boards are interchangeable. Thorens' existing two-part Mazak platter and belt-drive has been retained, but a new low voltage synchronous motor has been fitted, fed by an electronically synthesised two phase power supply with the two speeds directly switched. In *320* form, this deck comes with a factory, or fitted Thorens *TP16* tonearm complete with a stable arm lift control fitted with a Linn *LVX* as an option, if so desired. Many other arms can also be fitted — our sample had a Mission *774LC*.

The *320* is engineered to a high standard with excellently toleranced main bearing and particularly good finish. The lid now sports spring loaded hinges. It proved easy to set up except for the restricted clearance available for dressing the arm cable inside the deck.

LAB REPORT

The clutch provided a judder-free start up at a slow 8.7 seconds. Rumble was a very low −76dB with no supply harmonics visible on the spectrogram. The new flat mat offered quite good platter damping with good termination of disc impulse energy. The suspension offered very good levels of vibration isolation while acoustic energy was also well rejected. No particular emphases were detected in the frequency range.

Wow and flutter was a very low 0.06%. The separate figures for wow and flutter were well balanced, while speed accuracy was good, and slowing under load a mild 0.25%. This player also provided quite good resistance to shock though the chassis proved to be a trifle 'whippy' in the rotational mode.

SOUND QUALITY

Performing very well in the listening tests, the *320* provided a stable, focused sound, with a feeling of substantial weight and solidity. Stereo images revealed fine depth and space while the pitch and rhythm were well maintained. Acoustic feedback was very low, while the player was also not too critical of siting, a good sign.

THORENS TD316

This new turntable is a higher-quality replacement for the old *TD166*, a deck which offered excellent value. The *316* carries forward the established *166* arm, now fitted to the latest subchassis and drive system of the *320* series. One cost concession is seen in the change to black ash vinyl for the plinth exterior, a substitute for the real veneer of the *320*; while the inner platter hub is now made from reinforced plastic, the outer ring is still Mazak.

Features include an electronic motor control with convenient two-speed switching on the plinth, plus the comparative luxury of a plinth-mounted cue control which allows jiggle-free operation despite the suspended subchassis. The arm has been improved by replacing the old headshell with a new cast metal design, offering sensible cartridge fitting and a firm locking collar. Bias compensation is by thread and weight, with downforce set by a calibrated dial and rotating counterweight.

SOUND QUALITY

Good points included a strong stable sound with good pitch and speed stability. The bass was weighty and extended with the mid moderate in coloration and good on detail. The treble was a touch exuberant but quite well focused. Stereo images were well presented in the width dimension but lacked some measure of depth transparency; overall it sounded a little less dynamic than top rated alternatives.

CONCLUSION

Undoubtedly competitive, the lower cost *316* integrated player offers traditionally good Thorens engineering. Arm mass is on the low side, suited to some of the more delicate moving magnet cartridges, and is also well calibrated and convenient. In contrast to some of the competition, this player also offers a good lab performance and two-speed electronic motor drive.

In a slightly higher price bracket, the *320* series improves on the traditional strengths of the *TD160* and offers a welcome advance in engineering, performance and finish. Fully competitive in their price category, this range of models is firmly recommended.

TEST RESULTS

TD320/321	Motor unit/integrated player*
Type	electronic, belt-drive, subchassis
Platter mass/damping	3.7kg/good
Finish and engineering	excellent/very good
Type of mains connecting leads	2 core
Speed options	33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.06%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)	0.1%/0.1%
Absolute speed error	−0.16%
Speed drift, 1 hour/load variation	<0.1%/−0.25%
Start-up time to audible stabilisation	8.7 secs
Rumble, DIN B wtd, L/R average	−76dB
Size (w×d×h)/clearance for lid rear	44×37×16cm/6.5cm
Ease of use	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
Typical price	321Bc, £249; 321, £349; 320, £299; 316, £179

**supplied without arm (TD321BC) with factory-fitted Linn LVX arm (TD321) or Thorens arm (TD320)*

For graph references see issue No 43

RECOMMENDED

WALKER CJ58/AR ARM

CW&J WALKER LTD, BRENTWOOD, RED LANE, FRODSHAM, CHESHIRE WA6 6RA.
·———TEL: (0928) 33326———·

This recent turntable is now in full production form, with a fine wood veneer plinth plus improved support feet. Available as an integrated player with the AR tonearm and factory-aligned suspension, it was supplied for an updated report in 1986. Distinguished by a heavy, inert two-piece Tufnol platter, fitted with a high density bonded felt mat, the deck has a fabricated wood-composition subchassis, which is easily levelled from above by means of three socket-head screws.

LAB REPORT

In most respects the *CJ58* performed well — better than the earlier pre-production model tested in *Choice* No. 40. Wow and flutter met a satisfactory 0.22% standard, while slowing under load was very good. Start-up time was a typical 4 seconds, and good rumble results were also obtained. The low metal content results in higher than usual levels of electrically-induced hum, though this was still satisfactory. Shock resistance was average with some 'whippiness' in the rotational mode. Vibration and acoustic breakthroughs were well controlled while the disc impulse response gave a generally tidy result.



SOUND QUALITY

Auditioned with the AR tonearm, this player gave a well balanced sound with a surprising level of detail and depth for the price category. (This good rating includes the inexpensive Glanz cartridge supplied with the arm). The mid/treble region was tidy, pleasantly focused and in musical harmony. At low frequencies some loss of 'attack' and speed was noted, though this was not considered very serious or upsetting to the overall standard of performance, nor a very fair criticism at the price.

CONCLUSIONS

This new integrated player combination presents a notably musical result in a competitive price area. Supplied complete with cartridge, few could argue with the price given the overall standard of finish and performance. The *CJ58* is therefore recommended once again.

TEST RESULTS

Motor unit	Motor unit plus AR arm
Type	belt-drive (manual)
Platter mass/damping	1.9kg/good
Finish and engineering	good/good
Type of mains connecting leads	2 core/phonos
Speed options	33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.22%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.28%/0.08%
Absolute speed error	−1.23%
Speed drift, 1 hour/load variation	0.1%/−0.15%
Start-up time to audible stabilisation	4.0 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−75/−76dB
System as a whole	
Size (w×d×h)/clearance for lid rear	48×38.5×14cm/5cm
Ease of use	fairly good
Typical acoustic breakthrough and resonances	very good
Subjective sound quality of complete system	good+
Hum level/acoustic feedback	good/very good
Vibration sensitivity/shock resistance	very good/average
Estimated typical purchase price	£200 (£130 without arm)

For graph references see issue No 43

BEST BUY

WALKER CJ61

CW&J WALKER LTD, BRENTWOOD, RED LANE, FRODSHAM, WARRINGTON WA6 6RA.
·———TEL: (0928) 33326———·

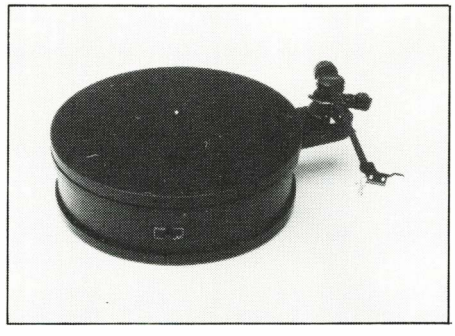
Possibly inspired by the drum-plinth *Systemdek*, Colin Walker has come up with a quite remarkable new turntable. If the purchaser is prepared to forego a cover, this model can offer a true floating subchassis with a good-quality synchronous motor driving a substantial two part platter via a precision ground drive belt — all for under £90. It is likely that the factory-assembled package of a *CJ61* plus Mission *774LC* arm will retail in the region of £145, a price territory where a proper subchassis, with its attendant performance benefits, is still commonly omitted; only the B&O and NAD have it in the £100 price range.

The *61*'s subchassis is of wood composition as in the *CJ58*' and the properly-designed three-spring suspension can be easily aligned from below via the accessible bolts. Two speeds are provided, manually changed by lifting the belt, while the established Walker Tufnol platter has been retained, this a further major asset at this price level. A new thin felt mat is bonded to the platter. Finish is in satin black, practical and workmanlike.

Our pre-production sample came supplied with a rubber drive cord and gave just audible wow and flutter. During the project, it was however replaced by a full production model which was fitted with a trusty conventional belt drive.

LAB REPORT

The first sample gave high wow and flutter results and this was queried with the designer. The other characteristics were however fine, and



start-up was particularly quick. Torque was fine and rumble satisfactory, though affected by the presence of the high flutter, the spectrogram lowered by 20dB to allow recording of this trace. Note that the final sample gave rather better wow and flutter readings than those here, plus reduced rumble; clearly there are no problems on this score now.

Fine results were obtained for vibration isolation and acoustic energy was particularly well rejected. The disc impulse response was above average the initial transient being well handled with a low incidence of secondary ringing. A trace of low frequency resonance may also be seen towards the end of the pulse recording.

SOUND QUALITY

Final auditioning on the second sample provided very good results, these in no way related to the low price! Sound quality was fully equal to that of a medium-range subchassis model and the *774* arm complemented it well. Bass was pretty clean with surprising 'speed' and articulation. The midrange was free of hardness and yet was explicit with good resolution of detail, while the treble register remained in good tonal balance.

Stereo images were well focused, stable and exhibited good depth, while dynamics were well portrayed without undue forwardness.

CONCLUSIONS

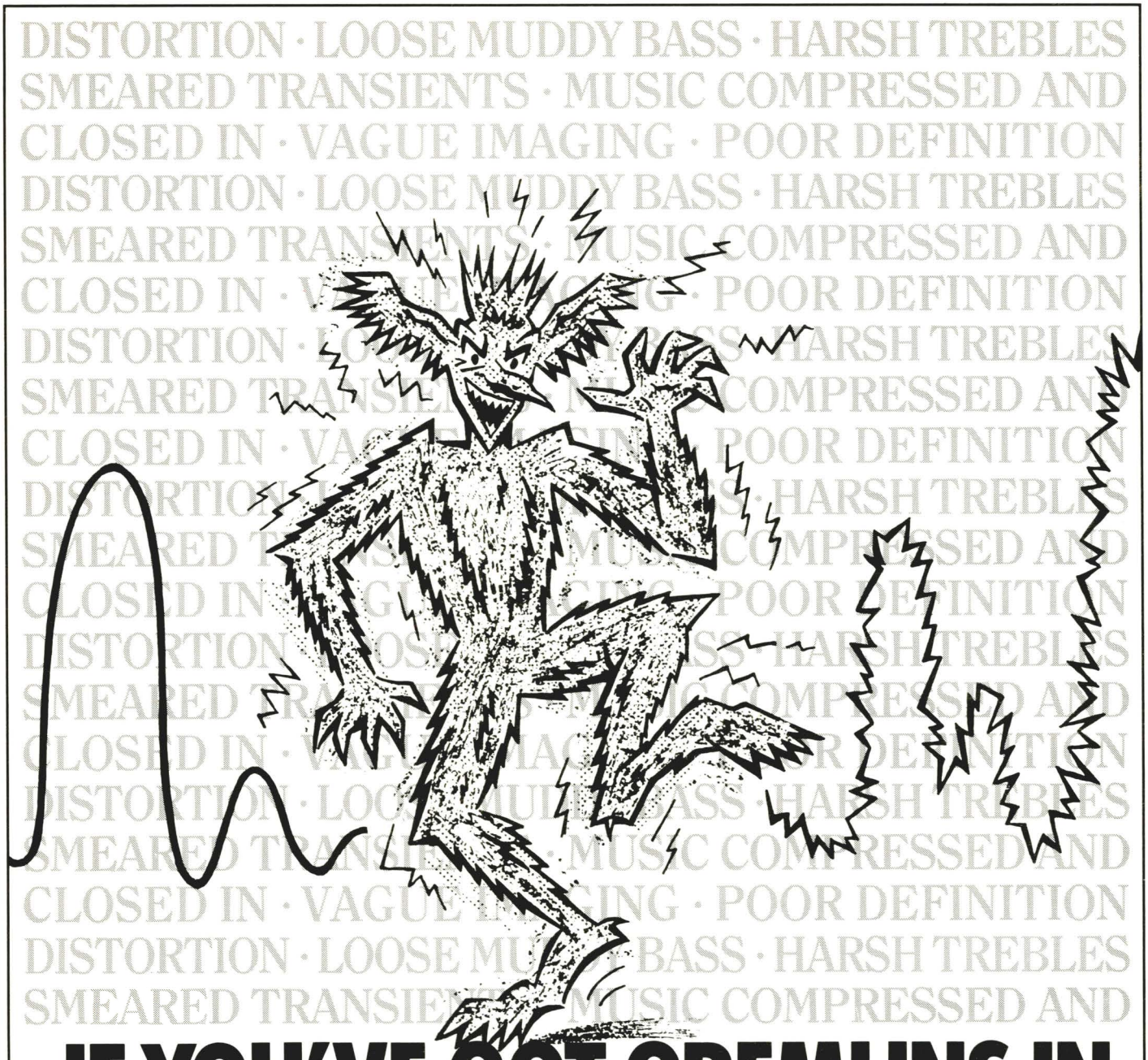
In its production form, this new Walker model has broken a price barrier for good subchassis motor units. Compatible with the Mission *774LC* tonearm, and arguably, with even better models as well, it offers a very good sound at a very modest price. Its fine value for money ensures it Best Buy status in this edition.

TEST RESULTS

Motor section	
Type	belt-drive, subchassis
Platter mass/damping	1.9kg/average+
Finish and engineering	adequate*/very good
Type of mains lead/connecting lead	2 core/−
Speed options	manual change, 33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.3g
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.25%/0.2%
Absolute speed error	−0.25%
Speed drift, 1 hour/load variation	synchronous/−0.25%
Start-up time to audible stabilisation	1.5 secs
Rumble, DIN B wtd, L/R average (see spectrum)	−74/−72dB
Size (w×d×h)/clearance for lid rear	41×31×14cm/none
Ease of use	fairly good
Typical acoustic breakthrough and resonances	very good
Subjective sound quality of complete system	good+
Hum level/acoustic feedback	fair/very good
Vibration sensitivity/shock resistance	good/fair
Estimated typical purchase price	£80

**Prototype review sample not typical production*

For graph references see issue No 40



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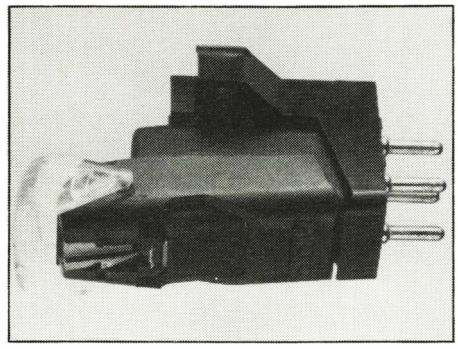
RECOMMENDED

ADC PHASE IV

HARMAN (AUDIO) UK LTD, MILL STREET, SLOUGH, BERKS SL2 5DD.
TEL: (0753) 76911

This £41 model is the top of the traditional Phase range of ADC induced magnet cartridges. The body construction seems sound, with sensible mounting lugs for firm headshell fixing, though removing or fitting the stylus assembly — in this instance carbon fibre instead of ordinary plastic — was a bit fiddly.

A nude elliptical stylus is specified, and this was confirmed on inspection. Tracking weight is a lowish 1.2g, and the compliance and damping are moderate enough to suit a wide range of low-to-medium mass arms.



LAB REPORT

Output level and capacitance loading requirement are entirely average, which should ensure good amplifier compatibility. Capacitance adjustment does change response slightly, though not to the extent of being subjectively too distracting.

Frequency response showed a very smooth and gently falling treble range with low loading; treble was rather better maintained but then rolled more sharply with increased capacitance. Channel balance was only fair, with some variation particularly at low frequencies. Interestingly, due either to the carbon fibre or the higher compliance, the midrange resonances noted with the *'1* were virtually absent.

Channel separation was a touch disappointing considering the price level, being poorest at low frequencies, with some asymmetry. Tracking ability, on the other hand, was fine.

SOUND QUALITY

The improvement of high frequency output over the cheaper *Phase* models was immediately obvious, though perhaps a trifle too much so. There is a family resemblance about the sound which preseves fine integrity through the upper bass and lower mid, but in the case of the *IV* the treble seemed a trifle 'detached'. The bass was rather lacking in 'weight' and 'power', though it was quite tuneful and uncoloured.

Stereo imaging was quite nicely focused with reasonable depth, if a trifle 'narrow'. Though not the most dynamic of cartridges, it sounded pretty consistent throughout the range and seemed well-suited to all types of music. The cartridge sat reasonably securely in the groove despite the lowish tracking weight though surface noise seemed a touch emphasised.

CONCLUSIONS

This is a pretty well-balanced design, as the *Phase* series generally seem to be. It suits the lower mass arms best, and can sound a touch 'bright', but detail and integrity are pretty good, and the sound betters many at its price.

TEST RESULTS

Type, mass	moving magnet 5.8g
Stylus type	elliptical
Stylus inspection result	adequate nude
Output Level (1kHz, 5cm/s)	3.48mV
Relative output (0dB = 1mV/cm/s)	−1.5dB
Channel balance	1.03dB
Channel separation (L,R)	24.6, 30dB
Tracking ability (L,R)	80, 80µm
Frequency response limits 100Hz-5Hz	+0.5, −2dB
Frequency response limits 30Hz-20kHz	+0.5, −4.5dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	28, 31, 26dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	30, 30, 25dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0, 0.5, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+0, −2dB
Response limits ref computer mean, 1kHz-20kHz	+0, −3dB
Test tracking weight, loading	1.5g, 275pF
LF resonance frequency, 12.5g arm (vert, lat)	9.5, 8Hz
Estimated compliance (vert, lat)	16, 22cu
Recommended arm effective mass	5-14g
LF resonance rise, 12.5g arm (vert, lat)	13.5, 13.5dB
Typical selling price	£41

For graph reference see issue No 43

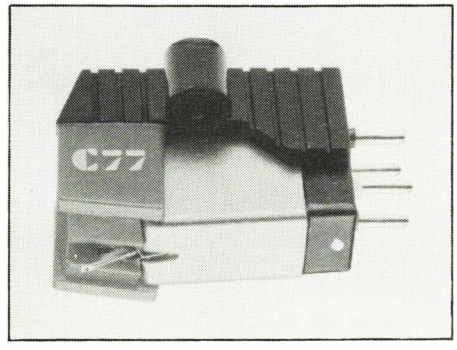
BEST BUY

A&R C77

A&R CAMBRIDGE LTD, DENNY INDUSTRIAL CENTRE, WATERBEACH, CAMBRIDGE CB5 9PB.
TEL: (0223) 861550

A&R are best known for their A60 amplifier, but in recent years have expanded their activities into the loudspeaker and cartridge markets. Their original cartridge policy was to take a fairly conventional moving magnet design and specify a very high quality stylus (Weinz Paroc on the original *P77*), while keeping the price quite modest.

The unassuming *C77* moving magnet model shows good mechanical integrity in body and stylus assembly. The latter has a spherical tip which was small, neat and well-mounted. Compliance is moderate with little damping, suited to the many arms in the effective mass range 7-15g. Tracking weight for this model is a sensible 1.8g, a figure which confers reasonable groove security.



LAB REPORT

Output is conveniently average, and amplifier input capacitance is quite uncritical (250pF increase adding 1dB to treble level).

Frequency response showed a fairly obvious broad 3dB suckout in the mid treble, followed by a mild rise to the 16/17kHz resonance. Channel balance improved steadily towards high frequencies, and the overall trace did in fact manage to look quite 'clean' even at high writing speeds.

The separation analysis showed decent enough figures which were generally pretty consistent down to low frequencies, though reducing somewhat at HF. Tracking abilities were fine.

SOUND QUALITY

The measured frequency balance was quite obvious in the sound quality, but this is something of a compliment to an inherently very clear and clean sounding cartridge, which in many respects sounds most impressive considering its price.

The treble peak was a trifle obvious and sounded a little 'detached', perhaps because the extreme HF was not particularly detailed. Elsewhere the balance and dynamics were thoroughly impressive, with plenty of 'bounce' and a genuine attempt to convey stereo depth. Surface noise was not exaggerated, midrange focus was pretty good, and the general integrity was good.

CONCLUSIONS

Belying its rather nondescript appearance, the *C77* is the sort of model that gives moving magnets a good name. It offers good compatibility and sound quality at a very sensible price. Clearly a Best Buy, the only question mark lies over the treble peak and how it might interact with a given system and pair of ears.

TEST RESULTS

Type, mass	moving magnet 6g
Stylus type	spherical
Stylus inspection result	confirmed, well mounted
Output Level (1kHz, 5cm/s)	3.75mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.85dB
Channel separation (L,R)	28.5, 28.8dB
Tracking ability (L,R)	80,80µm
Frequency response limits 100Hz-5Hz	+1, −2.5dB
Frequency response limits 30Hz-20kHz	+1, −9dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	22, 31, 22dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	28, 24, 22dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0.5, 1dB
Response limits ref computer mean, 1kHz-15kHz	+2.5, −1.5dB
Response limits ref computer mean, 1kHz-20kHz	+2.5, −2dB
Test tracking weight, loading	1.8g, 300pF
LF resonance frequency, 12.5g arm (vert, lat)	10, 10.3Hz
Estimated compliance (vert, lat)	16, 15cu
Recommended arm effective mass	6-16g
LF resonance rise, 12.5g arm (vert, lat)	14.5, 12dB
Typical selling price	£20

For graph reference see issue No 43

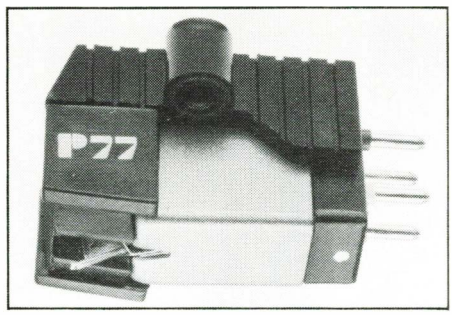
RECOMMENDED

A&R P77

A&R CAMBRIDGE LTD, DENNY INDUSTRIAL CENTRE, WATERBEACH, CAMBRIDGE CB5 9PB.
TEL: (0223) 861550

The original '77 started with a Weinz Paroc stylus profile on a conventional Japenese-sourced body/cantilever, chosen for good rigidity and sensible compliance. This stylus is now replaced by a special elliptical/line 'profiled' tip which is fitted in the UK.

The quality of this tiny nude tip was confirmed by inspection, and is fair justification for the moderate £45 asking price. This A&R stylus assembly may be purchased separately, to upgrade any of the other A&R cartridges when the time comes for stylus replacement. Compliance was a touch higher than the other *77s*' with rather greater damping, so low-medium effective mass arms are to be preferred.



Lab Report

Medium output and uncritical capacitance loading should avoid any compatibility problems with amplifiers. Adding capacitance in fact served merely to fill the upper-mid/treble suckout by less than 1dB.

Frequency response showed a remarkable similarity to the C*77*, though the extreme HF peak was a trifle more pronounced. Channel balance was much closer — width-of-the-pen trace stuff in fact — which confirms A&R's claim that they select the closest tolerance bodies for the *P* model. The trace itself was impressively smooth, with no obvious identifiable mechanical resonances midband.

Separation gave rather variable results, and it was difficult to determine a trend, but the figures were pretty reasonable nonetheless. Tracking abilities seemed fine.

Sound Quality

Though the response indicated a less promising result than the C*77*, in fact the reverse was true. Though still a slightly 'tizzy' cartridge, the definition and 'sweetness' at high frequencies was improved sufficiently to render the peak somehow less sonically 'isolated'.

In fact clarity, detail and control were impressive throughout, and quite good stereo images were produced, with reasonable depth albeit the occasional anomaly. The bass did sound a touch congested, perhaps the effect of increased damping which certainly made the cartridge very stable in the groove.

Conclusions

Another well balanced A&R cartridge, clearly meriting recommendation, the *P77* does a pretty good job of justifying its extra cost over the C. Despite the measured response, it is one of the more listenable moving magnet cartridges around, while offering sensible widespread compatibility.

Update

The *P77* is due to be upgraded by a new all-metal body in late 1986, made in aluminum or magnesium alloy in place of the current plastic. This ought to produce a further improvement in an already good design, though confirmation will have to wait for *Choice* Turntables & Cartridges, published December 1986.

Test Results

Type, mass	moving magnet 6g
Stylus type	'profiled' line contact
Stylus inspection result	fine nude line contact tip
Output Level (1kHz, 5cm/s)	3.4mV
Relative output (0dB = 1mV/cm/s)	−1.5dB
Channel balance	0.36dB
Channel separation (L,R)	25.8, 24dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5Hz	+1, −2.5dB
Frequency response limits 30Hz-20kHz	+1, −4dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	21, 30, 22dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	33, 26, 35dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0, 0, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+2, −1.5dB
Response limits ref computer mean, 1kHz-20kHz	+3.5, −1.5dB
Test tracking weight, loading	1.8g, 300pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 8.6Hz
Estimated compliance (vert, lat)	18, 19cu
Recommended arm effective mass	6-15g
LF resonance rise, 12.5g arm (vert, lat)	10.6, 10.6dB
Typical selling price	£45

For graph references see issue No 43

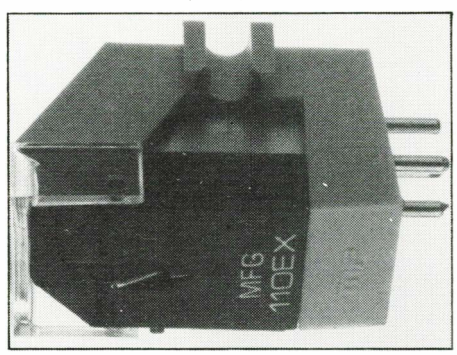
BEST BUY

AUDIO-TECHNICA AT110E

TECHNICA HOUSE, LOCKWOOD CLOSE, LEEDS, LS11 5UU.
TEL: (0532) 771441

This conventional low cost (£17) magnetic cartridge shares bodywork and the LC-OFC (linear crystal) wiring with the *105* and *115E*. The rigid body, mildly compromised by half-circle mounting lugs, accepts a firmly located stylus assembly. It tracks securely enough at a sensible 1.5-2g, though the specified mild-profile elliptical stylus looked suspiciously spherical under the 'scope — a curious juxtaposition with the test *'105*..

Compliance is pretty sensible, suiting a wide range of arms, though better class turntables are to be preferred as there is little damping of the resonance. The highish mass of the cartridge suggests that the lowest mass arms are better avoided.



Lab Report

Output level is about average, and although low capacitance is specified, a high capacitance load did flatten the response and extend the bandwidth, not to mention sounding slightly better. Most pre-amps should provide suitable loading, though experimentation with a little extra might pay off in some systems.

Frequency response downtilted quite noticeably until some capacitance was added, when a good overall response to 14kHz was obtained. Channel balance error was a less than impressive 1.1dB, though the match between channels was quite close. Even at the fast writing speed the response traces were pretty smooth, with only a couple of minor 'glitches'.

Separation was very good considering the modest price of this model, only mildly asymmetrical and showing a 5dB improvement at high frequencies over the cheaper *'105*.

Sound Quality

This extra treble was immediately apparent in the listening tests, providing a significantly 'livelier' sound than the *'105*. With high capacitance loading, the cartridge could sound rather brittle and aggressive, so the recommendation for low capacitance should be followed. The sound was quite 'fast', 'firm' and 'bouncy', with a good overall balance, but a mild 'steely' coloration was also described.

Conclusions

This exceedingly well balanced budget cartridge is a very capable performer, with few grounds for technical criticism, a sound quality that more than stands up to scrutiny, and performance more than able to do justice to better quality turntables. Whether the LC-OFC wire actually is a worthwhile 'magic ingredient' remains a moot point, but the *'110E* is clearly a very competitive package well deserving recommendation.

Test Results

Type, mass	moving magnet 7.2g
Stylus type	elliptical
Stylus inspection result	spherical!
Output Level (1kHz, 5cm/s)	4.0mV
Relative output (0dB = 1mV/cm/s)	0dB
Channel balance	1.1dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 78μm
Frequency response from graph 100Hz-5kHz	+1.5, −2dB
Frequency response from graph 30Hz-20kHz	+1.5, −7dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	33, 36, 32dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	36, 39, 33dB
Response limits ref computer mean, 1kHz-15kHz	+0, −2dB
Response limits ref computer mean, 1kHz-20kHz	+0, −5dB
Test tracking weight, loading	1.8g, 150pF
LF resonance frequency, 13.5g arm (vert, lat)	9, 9Hz
Estimated compliance (vert, lat)	15, 15cu
Recommended arm effective mass	5-16g
LF resonance rise, 13.5g arm (vert, lat)	14, 16dB
Typical selling price	£17

For graph reference see issue No 43

RECOMMENDED

AUDIO-TECHNICA AT3200XE II

AUDIO-TECHNICA (UK) LTD, TECHNICA HOUSE, LOCKWOOD CLOSE, LEEDS LS11 5UU.
TEL: (0532) 771441

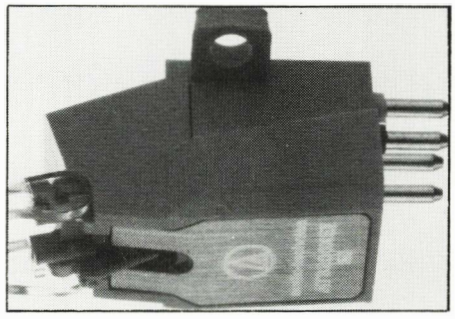
The *'3200XE II* is the latest model in Audio Technica's original series of modestly-priced moving-coil models, following the *'30* and *'31* but no relation to the pillbox-bodied *'32* or *'33*.

This is a high output model, the body is fashioned in a polystyrene regrettably redolent of the unpainted toys which fall out of cereal packets; the mounting lugs in particular did not feel particularly rigid. In fact the complete generator mechanism can be unplugged from the mounting section, a feature of dubious value which does nothing to preserve mechanical integrity. Furthermore, the mounting plate only contacts the headshell over a comparatively small area.

Sensible and symmetrical compliance ratings suit a wide range of tonearms, while the lack of significant low frequency damping suggests that best results will only be obtained when a respectable quality turntable is being used. Tracking was adequate at a reasonable down-force, though the stylus shape and alignment left something to be desired.

LAB REPORT

Moving coil cartridges, high or low output, are unaffected by pre-amplifier loading differences. The measured response of the *'3200* was promisingly even and extended, though significantly downtilted from bass to treble. Inadequate structural rigidity is indicated by the



'glitches' which may be seen at 800Hz and 1200Hz, though the high frequency region looks remarkably well controlled for such a modestly priced m-c design.

Promising results for stereo separation, with an even trend gently reducing either side of the midband, was marred by significant asymmetry between the channels.

SOUND QUALITY

Given that this is perhaps the cheapest movingcoil model generally available, it auditioned better than appearances might have suggested. Results were somewhat inconsistent, but the consensus was only a little below the overall average.

The 'laid back' balance is one notable characteristic, and the ability to convey convincing 'space' was praised. The bass gave good detail and articulation, but could also sound a little 'heavy' and 'detached'. The treble was well controlled, if lacking the fine resolution of some more exotic models.

CONCLUSIONS

Sonically the *3200* represents a valiant and at least partly successful attempt to present moving coil qualities at an affordable price and in a convenient high output form. The mechanical engineering and presentation let it down somewhat, but the generator has become impressively refined after a number of years' development. It faces stiff competition from the best moving magnet designs at the same sort of price, but manages to offer a very credible alternative.

TEST RESULTS

Type, mass	high output moving coil 4.3g
Stylus type	elliptical
Stylus inspection result	indifferent shape/alignment
Output Level (1kHz, 5cm/s)	0.9mV
Relative output (0dB = 1mV/cm/s)	−13dB
Channel balance	1.4dB
Channel separation (L,R)	30, 24.1dB
Tracking ability (L,R)	76, 73μm
Frequency response from graph 100Hz-5kHz	+1.5, −2dB
Frequency response from graph 30Hz-20kHz	+1.5, −2dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	32, 52, 38dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	28, 32, 27dB
Response limits ref computer mean, 1kHz-15kHz	+15, −1.5dB
Response limits ref computer mean, 1kHz-20kHz	+1.5, −1.5dB
Test tracking weight, loading	1.7g, n.a.pF
LF resonance frequency, 13.5g arm (vert, lat)	9, 9Hz
Estimated compliance (vert, lat)	18, 18cu
Recommended arm effective mass	6-18g
LF resonance rise, 13.5g arm (vert, lat)	16, 16dB
Typical selling price	£50

For graph reference see issue No 43

RECOMMENDED

BANG & OLUFSEN MMC4

BANG & OLUFSEN (UK) LTD, EASTBROOK ROAD, GLOUCESTER GL4 7DE.
TEL: (0452) 21591

Selected to represent the lower end of the B&O range, this cartridge slots neatly into the hierarchy of five models, which share a common adaptor to provide compatibility with B&O's turntables and their super-light arms.

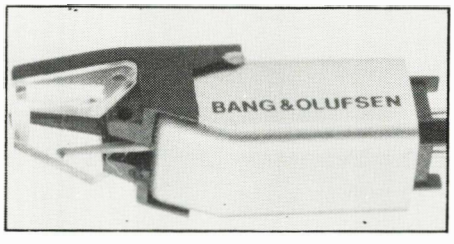
The cartridge itself is a little miracle of engineering miniaturisation, though the adaptor is slightly flexible and the connection only push-fit. The whole weighs a mere 3.3g, tracks at a low 1.2g, using a tapered aluminium canteliver fitted with a titanium-bonded elliptical tip.

Compliance needs to be high enough to match B&O's own arms, yet is still low enough (with the low cartridge mass) to allow a reasonable range of low-medium mass arms to be used.

LAB REPORT

Output level is rather below average, but this almost certainly only means that users will have the luxury of a wide volume control range! The change in measured response with increased capacitance was very marginal, but the sound was slightly preferred.

Response is most impressive, showing the usual gently falling trace, with a mild recovery to a well-damped resonance at around 10kHz. Channel balance was fine. Much of the class of this cartridge can be gleaned from the remarkably smooth trace even at high writing speed, but the Achilles heel of the adaptor resonance is shown clearly at 900Hz, similar to



though less severe (and at a higher frequency) than those encountered with P-mount cartridges, but subjectively significant nonetheless.

Despite the low cost of this model, fine results were obtained for separation, particularly in the midband, bettering 30dB over most of the range. Tracking was impressively secure throughout.

SOUND QUALITY

There is a close family resemblance throughout the B&O's range. All are handicapped by slight softening and blurring at low frequencies, which gives a relaxed rather than 'punchy' presentation, with fine control.

The'4 was picked out for its particular solidity and overall balance, which seemed remarkably 'seamless' for the price. Midrange clarity, dynamics and focus are excellent, giving fine stereo imaging. The treble is well balanced and controlled for the price, though a touch unrefined. Stability was impressive and surface noise was well under control.

CONCLUSIONS

The general standard attained by the B&Os transcend their modest price level, and do much to reinforce their claim that moving magnets sound as good as moving coils. The mounting bracket problem keeps them from the top class, but its sonic significance will depend on the relative importance the listener attaches to powerful integrated bass.

The level of engineering expertise demonstrated in other respects is mildly awe-inspiring, and an added bonus is the relatively easy time given to the tonearm by such light-tracking cartridges.

TEST RESULTS

Type, mass	moving magnet 3.3g
Stylus type	elliptical
Stylus inspection result	short squat brazed elliptical, little polish
Output Level (1kHz, 5cm/s)	2.55mV
Relative output (0dB = 1mV/cm/s)	−4dB
Channel balance	0.05dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5Hz	+1, −1.5dB
Frequency response limits 30Hz-20kHz	+1, −3dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	30, 38, 27dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	26, 39, 26dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 1, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+0, −1dB
Response limits ref computer mean, 1kHz-20kHz	+2, −1dB
Test tracking weight, loading	1.2g, 200pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 9Hz
Estimated compliance (vert, lat)	24, 24cu
Recommended arm effective mass	5-15g
LF resonance rise, 12.5g arm (vert, lat)	15, 12dB
Typical selling price	£36

For graph references see issue No 43

BEST BUY

DENON DL110

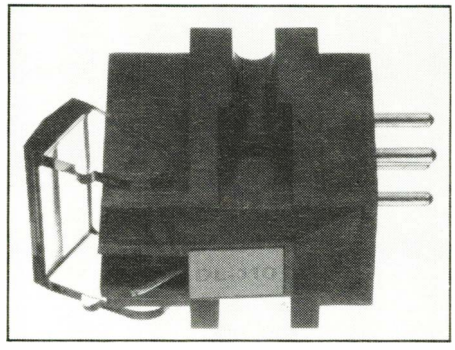
HAYDEN LABORATORIES LTD, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST PETER, BUCKS.
TEL: (0753) 888447

Denon were busying away making *'103* moving coil cartridges for Japanese domestic and broadcast customers while througout the rest of the world only Ortofon struck doggedly to the m-c principle. But more recent Denon models have been high priced items, not always brought into the UK; the very top model has achieved an enviable international reputation, but less exotic versions have had to struggle a bit to justify their extra cost over the *103*. Now we have two very competitively priced high(ish) output models which look more than capable. The £60 *DL110*, finished in an attractive maroon tortoishell effect, has a neat rigid four-square body with substantial though only semicircular mounting lugs and a reasonable area of headshell contact. A high quality advanced elliptical tip stylus of low mass was fitted.

Cartridge mass is quite low, so a medium compliance at a sensible 1.8g downforce provides good tracking capabilities in a package which is usefully compatible with a wide range of arms. The quite heavy internal generator damping should help it perform in inadequate turntable systems. Output level is significantly below normal, but most amplifiers will have sufficient reserve gain.

LAB REPORT

The frequency response trace is pretty remarkable by any standards, let alone those of £50 cartridges. Occasional minor uneveness can



be detected in the 1-2kHz region, but there is no other ground for criticism apart from noting the normal overall downtilt, held to a respectable 3dB.

Separation results were good too, mildly asymmetric but better than 30dB even at high frequencies, and with reasonable control of ultrasonic spuriae besides.

SOUND QUALITY

The listening panel seemed to be passing through a positive phase when the *'110* was presented and were generally enthusiastic, praising the clarity and dynamics, a generally neutral balance, and fine midrange projection. Minor concern was raised at the quality of the bass, which some felt sounded mildly dissociated and detatched.

The overall reaction seemed to be that this model offers a fine balance of strengths, while noting that it still falls short of the very highest standards.

CONCLUSIONS

To describe a cartridge as lacking character should be praise of a high order. The Denon *110* sailed through our subjective and objective test programme with consummate ease. It deserves firm recommendation as a fine all-rounder which is very likely to perform to a consistently high standard under nearly all circumstances. Provided the lowish output is no problem, our only minor reservation is that other less heavily damped models can sound rather more lively.

TEST RESULTS

Type, mass	high output moving coil 4.8g
Stylus type	advanced elliptical
Stylus inspection result	small nude stone, well aligned
Output Level (1kHz, 5cm/s)	1.5mV
Relative output (0dB = 1mV/cm/s)	−8dB
Channel balance	0.4dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 78μm
Frequency response limits 100Hz-5Hz	+1.5, −0.5dB
Frequency response limits 30Hz-20kHz	+1.5, −1.5dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	29, 38, 30dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	36, 47, 31dB
Response limits ref computer mean, 1kHz-15kHz	+0.5, −1dB
Response limits ref computer mean, 1kHz-20kHz	+2, −1dB
Test tracking weight, loading	1.8g, n/apF
LF resonance frequency, 12.5g arm (vert, lat)	10, 9Hz
Estimated compliance (vert, lat)	15, 19cu
Recommended arm effective mass	6 -16g
LF resonance rise, 13.5g arm (vert, lat)	11, 12dB
Typical selling price	£60

For graph references see issue No 43

RECOMMENDED

DENON DL103

HAYDEN LABORATORIES, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST PETER, BUCKS.
TEL: (0753) 888447

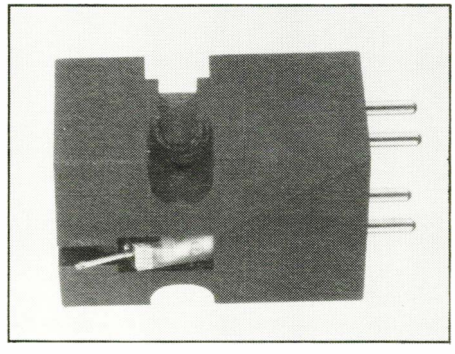
One of the oldest models still in current production, the *103* is the low output moving-coil model which Denon made originally for NHK, the Japanese equivalent of the BBC, and which definitely made a major contribution towards the revival of the genre. Other models in the *103* series have more sophisticated styli and cantilevers.

It is a large but quite solid and heavy cartridge, with large headshell contact area but half-circle retaining lugs. Spherical styli may lack status, but that fitted here was very neat. Compliance is quite low, allowing matching with a usefully comprehensive range of arms from 6-16g effective mass.

LAB REPORT

Some high-gain pre-amps (notably certain valve models) should be able to take the *103* directly into moving-magnet inputs, but most users will find it provides plenty of urge for m-c inputs.

Frequency response showed a fairly modest 2dB downtilt through the midrange, and a slight flattening out at 7-8kHz. In fact a straight line could be drawn through the response trace from 20-20kHz with deviations of less than 0.5dB, which is very impressive at this (or any) price level. However, the response was 2dB 'brighter' if taken at the outer grooves, a function of the



limited scanning radius of the spherical tip. Channel balance was pretty good, and the response was smooth, with just a tiny 900Hz 'glitch' and some bass unevenness.

Separation generally exceeded 30dB across the bulk of the band, reducing somewhat at the extremes, and 2.5g tracking weight (no problem with the large footprint area of a spherical tip) provides adequate tracking abilities and extraordinary groove stability — it is easy to understand its popularity in broadcast studios.

SOUND QUALITY

Very well received, the strength of the sound is its fine integration and great liveliness, coupled with a firm and powerful bass. Treble can be inconsistent, and generally sounded a little rolled off, while the midrange extended the good clarity established through the bass.

CONCLUSION

Spherical styli may be unfashionable, but they have always worked exceedingly well in the *103*. Once again this stalwart shines out from the pack, and furthermore offers fine value for money and general (moving-coil) compatibility.

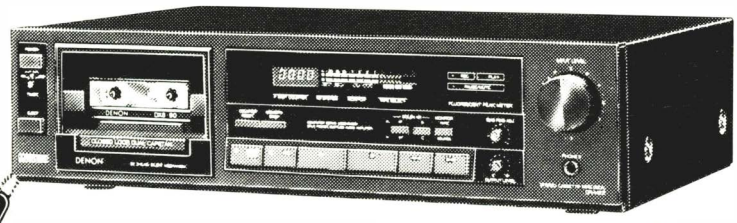
TEST RESULTS

DENON DL103

Type, mass	low output moving coil, 8.5g
Stylus type	spherical
Stylus inspection result	small v. short shank, diagonal set
Output Level (1kHz, 5cm/s)	0.44mV
Relative output (0dB=1mV/cm/s)	−19dB
Channel balance	1.0dB
Channel separation (L,R)	29.7, 28, 24dB
Tracking ability (L,R)	75, 80μm
Frequency response limits 100Hz-5kHz	+1, −1dB
Frequency response limits 30Hz-20kHz	+1.5, −3dB
Separation L on R 100Hz, 3kHz, 10kHz	32, 31, 26dB
Separation R on L 100Hz, 3kHz, 10kHz	25, 32, 26dB
Channel diff. 100Hz, 1kHz, 10kHz	0, 0, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+1, −0dB
Response limits ref computer mean, 1kHz-20kHz	+1.5, −0dB
Test tracking weight, loading	2.5g, n.a.
LF resonance frequency, 12.5g arm (vert, lat)	10, 10Hz
Estimated compliance (vert, lat)	13, 13cu
Recommended arm effective mass	6-16g
LF resonance rise, 12.5g arm (vert, lat)	15, 13dB
Typical selling price	£90

For graph references see issue No 43

DRM 22



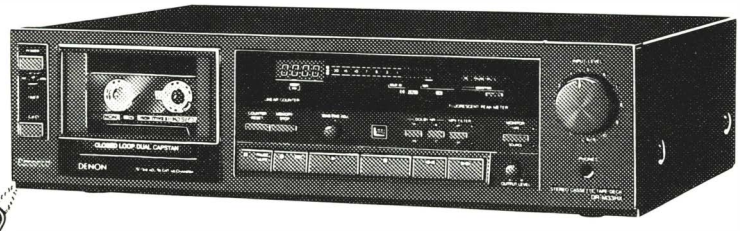
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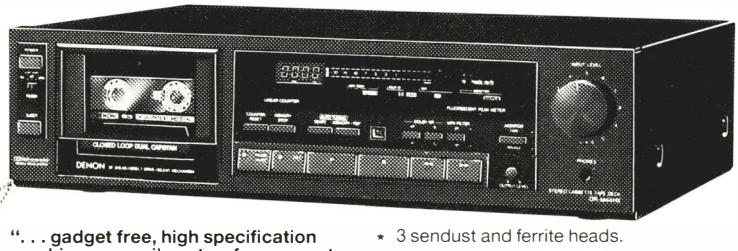
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DRM 44 HX



£399.95

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NOEL KEYWOOD. HI FI CHOICE CASSETTE DECKS

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- 3 sendust and ferrite heads.
- Double Dolby B/C and HX-Pro.
- Full auto bias.
- LC-OFC signal leads.
- Denon computer controlled 'silent mechanism'.

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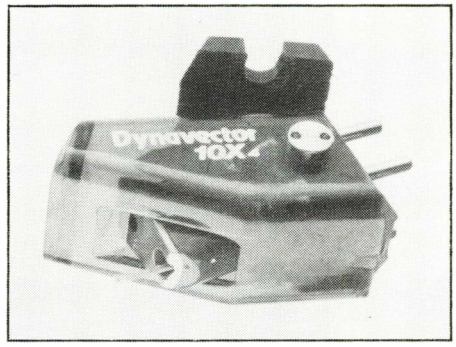
RECOMMENDED

DYNAVECTOR DV10X IV

DYNAVECTOR UK, 117 KINGS ROAD, LONG DITTON, SURBITON KT6 5JE.
TEL: 01-398 8710

This lightweight high output moving coil from Japanese specialist Dynavector is the latest in a long series of *10X* models, which are accustomed to high ratings in *Choice*. Though the transparent bodywork is cantilevered from a plastic mounting plate, rigidity is reasonable. The longish cantilever looks a little vulnerable to accidental damage, and the stylus is a fine quality nude elliptical on a rectangular shank.

Compliance is fairly low and pretty well damped, so medium-to-high mass arms are to be preferred. Tracking abilities fell slightly short of the target despite the reasonable 1.7g downforce.



LAB REPORT

Output level is lower than most models intended for moving magnet inputs, but was still high enough to be most unlikely to cause any difficulties. Capacitance matching is of course irrelevant in a low impedance moving coil design.

Frequency response followed the familiar downtilted pattern but only dropped some 3dB across the whole band. The high frequency resonance is quite well controlled, but at a lowish 7-8kHz, while there were also a couple of midrange 'glitches' to cope with at 600 and 800Hz. Channel balance showed some 0.5dB variation at different parts of the main frequency spectrum, but was held quite closely at high frequencies.

Separation figures were good for a cartridge at this price level (or any price level, for that matter), albeit with mild channel asymmetry.

SOUND QUALITY

In some respects this was the most balanced sounding of the Dynavectors, and certainly delivered a very decent level of quality. Bass was felt to be slightly overdamped, with mild upper bass richness combining to give an impression of slightly limited extension. The mild treble peak was audible as a slight 'brightness', and emphasised by 'smearing'. Midrange focusing was very good, and this tended to draw attention away from the limitations at the extremes. Stereo seemed a trifle lacking in depth, but was impressively solid and stable, as was the general behaviour of the cartridge in the groove.

CONCLUSIONS

This is a fine sounding cartridge at a realistic price, with the added convenience of driving moving magnet amplifier inputs directly. Tracking ability is less its forte than groove stability, yet damping should be sufficient to ensure successful widespread compatibility, so firm recommendation is clearly indicated.

TEST RESULTS

Type, mass	high output moving-coil 4.5g
Stvus type	nude elliptical
Stylus inspection result	good small rectangular section
Output Level (1kHz, 5cm/s)	2.35mV
Relative output (0dB = 1mV/cm/s)	−4dB
Channel balance	0.4dB
Channel separation (L,R)	26.1, 30dB
Tracking ability (L,R)	80, 77μm
Frequency response limits 100Hz-5Hz	+1.5, −1dB
Frequency response limits 30Hz-20kHz	+2, −2dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	23, 32, 23dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	35, 35, 30dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0.5, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+1, −1dB
Response limits ref computer mean, 1kHz-20kHz	+2, −1dB
Test tracking weight, loading	1.7g, n.a.
LF resonance frequency, 12.5g arm (vert, lat)	11, 12Hz
Estimated compliance (vert, lat)	12, 10cu
Recommended arm effective mass	8-18g
LF resonance rise, 12.5g arm (vert, lat)	well damped
Typical selling price	£60

For graph references see issue No 43

RECOMMENDED

EMPIRE MC-5M

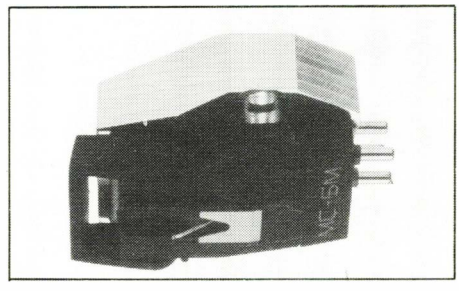
AUTOMATION SCIENCES COMPANY, 20 LITTLE GADDESDON, BERKHAMSTED, HERTS HP4 1PA.
TEL: (044284) 2786

Empire is one of the long established US cartridge manufacturers, though the company's European operation now appears to be autonomous, combining Japanese and European manufacturing with European design skills. Prominent among consultants has been AJ van de Hul, whose *MC10* is a refinement of Empire's *MC1000*.

The MC5M is an altogether more affordable item of quite different concept. Though a low-output moving-coil cartridge, this one is made in Japan is fitted with a detachable stylus assembly/generator, and costs a reasonable £89. The substantial metal frame with full circular fixing lugs looks a promising start mechanically, despite the minor weight penalty involved. But the headshell contact area is rather small, and a large area of purely decorative trim detatched itself rather readily.

Furthermore, all the business bits are fitted into additonal plastics mouldings (of admittedly very high quality), and there seems little rational justification for introducing electrical and mechanical interfaces in order to provide a detachable facility that has very little value. That said, the stylus assembly fit was excellent!

Mechanically the cartridge will match well with most arms, and shows a fair degree of internal damping.



LAB REPORT

Frequency balance of the MC-5M was a little unusual. Showing minimal droop through the 2-5kHz region and distinct recovery beyond, in some respects not unlike the balance shown by Decca cartridges. A minor 'glitch' at 1.2kHz is detatchable, and some high frequency uneasiness besides.

Separation was generally good though distinctly asymmetric between channels, showing the expected reduction towards the treble resonance (above the audible range) and good suppression of ultrasonic spuriae.

Output requires the extra boost of moving-coil pre-amplification circuitry, and a high quality advanced elliptical stylus tip provided secure tracking at a sensible 1.8g downforce.

SOUND QUALITY

On audition, the Decca analogy proved appropriate, for the MC-5M bounced along with lively dynamics and a bright, sometimes aggressive presentation. Providing an impressive sense of scale, some felt the presentation as a whole lacked subtlety, and could become wearing with prolonged listening.

Attempting to summarise varied reaction this cartridge's individual style is not easy, though the overall reaction was cautiously favourable, with averaged scores that more than justified its price.

CONCLUSIONS

Only the name remains the same, for this gutsy, almost fiery-sounding cartridge is quite unlike this author's recollection of the earlier American designs. It represents a new direction which clearly deserves success. The cartridge itself providing an exciting sound in a mechanically well controlled (if unnecessarily elaborate) package, and as such wins a recommendation though the recent price rise has reduced its competitiveness.

TEST RESULTS

Type, mass	low o/p (detachable) moving coil 6.2g
Stylus type	'paralinear'
Stylus inspection result	advanced high quality ellipse
Output Level (1kHz, 5cm/s)	0.31mV
Relative output (0dB = 1mV/cm/s)	−22dB
Channel balance	0.7dB
Channel separation (L,R)	30, 23dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5Hz	+1, −0.5dB
Frequency response limits 30Hz-20kHz	+2, −0.5dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	31, 45, 33dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	26, 33, 25dB
Response limits ref computer mean, 1kHz-15kHz	+2, −0dB
Response limits ref computer mean, 1kHz-20kHz	+5, −0dB
Test tracking weight, loading	1.8g, n/apF
LF resonance frequency, (13.5g arm) (vert, lat)	9, 8Hz
Estimated compliance (vert, lat)	16, 20cu
Recommended arm effective mass	6-15g
LF resonance rise, (13.5g arm) (vert, lat)	12, 12dB
Typical selling price	£89

For graph references see issue No 43

RECOMMENDED

GLANZ MFG 110EX

PRESENCE AUDIO, EASTLAND HOUSE, PLUMMERS PLAIN, HORSHAM, WEST SUSSEX RH13 6NY.
TEL: (044485) 333

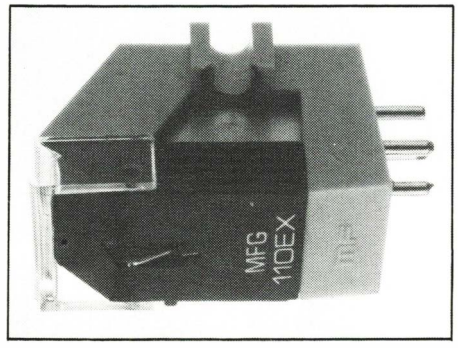
Perhaps less readily available than they were a few years ago, Japanese manufacturer Glanz make a comprehensive range of 'Moving Flux' (loosely moving magnet) and moving-coil cartridges in the low and medium price ranges. The *MFG 110EX* is a £22 moving magnet model, which as it happens is also the first Glanz model to come the way of the reviewer.

Substantial in size, construction seems well-founded, and the stylus assembly fixes in quite precisely. The stylus itself, a simple ellipitical, showed an indifferent standard of polish. The semi-circular lugs seem strong enough for rigid fixing, and a reasonable headshell contact can be made despite a superfluous centre trim piece.

Output level is sufficient for all moving magnet inputs, and different loadings have little effect upon response. Mechanically, the *110EX* should suit most tonearms, and gave good tracking ability at a sensible 1.75g downforce. The discrepancy between the size of horizontal and vertical resonances is curious as the frequency is identical, though it is impossible to predict cause or effect.

LAB REPORT

Frequency response was gently downtilted in the usual manner, generally very smooth and even though with some variation between channels at high frequencies. Adding capacitance produced a flatter total response at the expense of a slightly more exposed, but effectively ultrasonic, treble peak. The difference amounted to only about 1dB and may probably be safely ignored.



Separation was rather disappointing by the standards of most of today's cartridges, reaching only 24dB on one channel, 30dB on the other. Ultrasonic spuriae were reasonably well down.

SOUND QUALITY

Subjectivly marginally preferred with capacitance loading, the Glanz was warmly recieved by a panel who admittedly appeared to be in a generous mood at the time of its presentation. Tonally described as a little 'bright' not unlike CD, the midrange sounded lively if slightly coloured, the bass detailed if a little slow, and the treble clear with only slight over-emphasis at times.

The 'average' ratings were very good considering the modest enough price of this model.

CONCLUSIONS

The *MGF-110EX* doesn't define any new standards in technical performance, but nevertheless it delivers a very competitive sound deserving recommendation. If typical of Glanz cartridges in general, the rest of the range should also be worth exploring.

TEST RESULTS

Type, mass	moving flux (magnet) 5.5g
Stylus type	elliptical
Stylus inspection result	simple ellipse, indifferent polish
Output Level (1kHz, 5cm/s)	3.4mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.5dB
Channel separation (L,R)	20, 16dB
Tracking ability (L,R)	80, 80μm
Frequency response from graph 100Hz-5Hz	+1, −1dB
Frequency response from graph 30Hz-20kHz	+1, −4dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	24, 24, 22dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	32, 30, 25dB
Response limits ref computer mean, 1kHz-15kHz	+1.5, −1.5dB
Response limits ref computer mean, 1kHz-20kHz	+3.5, −1.5dB
Test tracking weight, loading	1.75g, 100pF
LF resonance frequency, (13.5g arm) (vert, lat)	9, 9Hz
Estimated compliance (vert, lat)	16, 16cu
Recommended arm effective mass	6-16g
LF resonance rise, (13.5g arm) (vert, lat)	9, 14dB
Typical selling price	£22

For graph references see issue No 43

BEST BUY

GRADO MT

MOTH MARKETING, 47 ARMSTRONG CLOSE, WILSTEAD, BEDFORD.
TEL: (0234) 741152

Like all Grado models, this is a simple design of unprepossessing appearance, sensibly constructed to couple well with the tonearm mechanically. The mounting lugs are a little flimsy and should not be over-tightened, but they at least provide circular contact with the bolts.

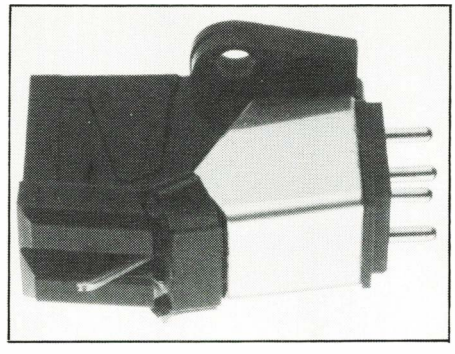
The stylus assembly fit is remarkably tight, with additional mastic-type damping. Indeed those foolhardy enough to attempt removal without the special tool provided risk terminal cantilever damage — as we discovered last time around!

A fairly stiff compliance means that medium and heavy mass arms are to be preferred, while the lack of any cantilever damping (a characteristic Grado trait) implies that tonearm damping could be beneficial if available, and that poorer quality turntables should be avoided. Tracking abilities should be adequate, but in an adequate player could be caught out on the more difficult material (opera, choral etc).

Output is fine for conventional moving magnet inputs, but the design of the generator means Grados, though entirely unaffected by input capcitance loading, may be somewhat susceptible to hum pickup in the 'wrong' system (glass turntable platters, for example).

LAB REPORT

Frequency response was certainly a little dramatic, suggesting a cartridge stronger on character than neutrality. Dropping a full 3dB through the midrange from 200Hz to 5kHz, there is evidence of slight recovery and then a sharp rise to a +2dB peak at 18kHz.



Separation showed good channel matching and impressive evenness, despite absolute values which were below average. Ultrasonic output was higher than usual, corroborating the high frequency response problem.

SOUND QUALITY

The frequency characteristic proved a major element in the subjective reaction, though 'listening through' the effect revealed a sound of rare quality considering the low price.

The balance was rich and slightly 'heavy', marred by some softness in bass definition and some sibilant and surface noise exaggeration. Inherent good clarity and 'speed', along with the balance, helped to convey impressive scale with good vocal projection and ambient detail.

CONCLUSIONS

Despite the odd frequency balance, this Grado produced sufficient of the sound quality goods to indicate recommendation at its very reasonable price. Other aspects of technical performance were decent enough in any case.

However, significant reservations remain regarding the suitability of such a lightly-damped model in the budget turntables it is likely to partner. Good performance in a high quality system does not necessarily imply that the quality will be maintained when the compromises get tough. A fine potential performer, it needs, more than most, to be checked out in the prospective system.

TEST RESULTS

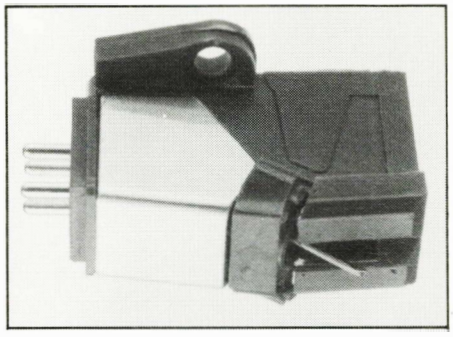
Type, mass	moving magnet 5.5g
Stylus type	not specified
Stylus inspection result	mild elliptical
Output Level (1kHz, 5cm/s)	3.5mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.6dB
Channel separation (L,R)	24, 25dB
Tracking ability (L,R)	80, 66μm
Frequency response from graph 100Hz-5Hz	+1.5, −1.5dB
Frequency response from graph 30Hz-20kHz	+2, −3dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	26, 31, 29dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	32, 34, 31dB
Response limits ref computer mean, 1kHz-15kHz	+2.5, −3dB
Response limits ref computer mean, 1kHz-20kHz	+4, −3dB
Test tracking weight, loading	1.5g, n/apF
LF resonance frequency, (13.5g arm) (vert, lat)	11, 11Hz
Estimated compliance (vert, lat)	12, 12cu
Recommended arm effective mass	8-18g
LF resonance rise, (13.5g arm) (vert, lat)	18, 21dB
Typical selling price	£20

For graph references see issue No 43

RECOMMENDED

GRADO M3

MOTH MARKETING, 47 ARMSTRONG CLOSE, WILSTEAD, BEDFORD.
TEL: (0234) 741152



Grado cartridges are unusual in several ways, the most obvious being the almost total lack of low frequency damping, which is not so much of a bad thing *per se*, but which does mean that the accompanying turntable needs to be pretty decent. The body is a rather soft blue plastic, and we frankly didn't dare try the recommended three-point mounting spacer for fear of tearing off the lugs, which showed signs of straining when tightened. Stylus was a nicely shaped and mounted special elliptical.

The compliance is beautifully chosen for the test arm, and perfectly symmetrical, so a fair range of arm effective masses should be useable despite the high resonance rise.

LAB REPORT

Output level is round about average and Grados are unaffected by capacitance changes, so there are no amplifier matching problems. Hum susceptibility is a known Grado trait, and will depend upon the turntable, so should be checked out if proposing purchase.

Frequency responce sorted out the cheaper *T* and the M3 quite comfortably, while at the same time showing some significant strengths in both. They were identical from 100Hz to 6kHz, showing impressive channel balance but a gently curving downtilt of 4dB. Whereas the *T* then recovered substantially, showing some channel divergence above 12kHz, the M3 flattened and then turned down again at 9kHz, smoothly following the original trend under exeptional control. The trace as a whole was devoid of other identifiable resonances.

Separation measurements were fairly unspectacular, if reasonably consistent, and showed quite good control of ultrasonic spuriae. Tracking posed no problems, stability was quite impressive despite the 1.5g tracking weight, and surface noise stayed under good control.

SOUND QUALITY

Liked in particular for its lively openess, the M3 was a bit of a lightweight when it comes to bass 'slam', but managed to sound remarkably uncongested throughout most of the band.

The midrange showed reasonable focus and stereo was quite promising. while the balance as a whole sounded a touch 'bright' and 'cold' somewhat lacking in richness and mid bass power. Some treble brightness was audible, but the combination of control and detail was good for the price.

CONCLUSIONS

A very decent sounding cartridge for the price, not to mention some impressive results in the technical testing, ensures recommendation for this Grado, and the suggestion that other models in the Master series deserve checking out according to the depth of your pocket. However, it is not a cartridge to use with an inadequate turntable; Grados have a habit of sounding only as good as their players.

TEST RESULTS

Type, mass	moving magnet 5.5g
Stylus type	elliptical
Stylus inspection result	confirmed small & neat
Output Level (1kHz, 5cm/s)	3.4mV
Relative output (0dB = 1mV/cm/s)	−1.5dB
Channel balance	0dB
Channel separation (L,R)	23.6, 21.8dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5Hz	+2, −2dB
Frequency response limits 30Hz-20kHz	+2, −2/3dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	25, 23, 22dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	33, 32, 25dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0, 0, 0dB
Response limits ref computer mean, 1kHz-15kHz	+1, −2dB
Response limits ref computer mean, 1kHz-20kHz	+3, −2dB
Test tracking weight, loading	1.5g, n/apF
LF resonance frequency, 12.5g arm (vert, lat)	10, 10Hz
Estimated compliance (vert, lat)	16, 16cu
Recommended arm effective mass	6-14g*
LF resonance rise, 12.5g arm (vert, lat)	18, 17dB
Typical selling price	£43

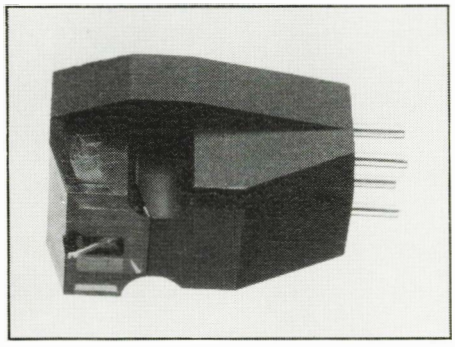
**with slight damping if available*

For graph references see issue No 43

RECOMMENDED

GOLDRING EPIC

GOLDRING PRODUCTS LTD, UNIT 8, GREY FRIAR'S RD, MORETON HALL IND EST,
BURY ST EDMUNDS IP32 7DX. TEL: (0284) 701101



This well established budget cartridge from Goldring attracted much interest and favourable comment from its introduction, as did the version Goldring build for Russ Andrews, the RATA *RP20*. The body is rather large, though it can be mounted tightly with good contact area; it is now made of good quality plastic material which allows firm mounting with no problems.

The stylus assembly made a fine tight fit, and the specified elliptical tip was confirmed and neatly mounted. Compliance is moderate and well-damped, so arms of up to 16g effective mass looks a safe enough bet. The downforce of 2g helps to give reasonable tracking performance.

LAB REPORT

Plenty of output for the least sensitive amplifiers, plus a response which shows little change in shape with added capacitance will ensure no compatibility problems here. In fact the rather 'dim' response was improved a couple of dB by an extra 250pF without any untoward side effects, so adding a little extra capacitance may be beneficial.

The response trend is determinedly downtilted at high frequencies, falling some 6dB between 1kHz and 20kHz, which is not too promising. But it does follow a smooth and even trend, the final HF region is under fine control, and the curve itself is pretty smooth, with only one minor (750Hz) 'glitch'.

Channel balance was acceptable enough for the price, and separation likewise, at least showing good balance and evenness if not at a particularly exalted level. Tracking abilities are adequate, and groove stability pretty good.

SOUND QUALITY

Dominated by the dulled response, the *Epic* tended to sound bass heavy but was quite impressive in terms of integration and focus, and was quite liked as a result on the listening tests. One hesitates to call it lively, but 'punchy' is not a bad adjective. Dynamics and coloration were pretty decent throughout, and stereo imaging showed some depth, albeit with some congestion.

CONCLUSIONS

This unpretentious cartridge is rather too dull in balance for the standard of ancillary equipment we used during listening, but the tight high frequency control is not ill-suited to the budget equipment it is likely to partner. Now that the body plastic has been reinforced, the generally decent performance in other respects indicates cautious recommendation in the right system context.

TEST RESULTS

Type, mass	moving magnet 6.5g
Stylus type	elliptical
Stylus inspection result	neat simple elliptical
Output Level (1kHz, 5cm/s)	3. 8mV
Relative output (0dB = 1mV/cm/s)	0dB
Channel balance	0.3dB
Channel separation (L,R)	28.6, 25.7dB
Tracking ability (L,R)	70, 69μm
Frequency response limits 100Hz-5Hz	+1, −3dB
Frequency response limits 30Hz-20kHz	+1.5, −6/7dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	21, 27, 29dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	18, 23, 25dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0.5, 1dB
Response limits ref computer mean, 1kHz-15kHz	+0, −3dB
Response limits ref computer mean, 1kHz-20kHz	+2, −3dB
Test tracking weight, loading	1.8g, 200pF
LF resonance frequency, 12.5g arm (vert, lat)	10, 10Hz
Estimated compliance (vert, lat)	13, 13cu
Recommended arm effective mass	6-14g
LF resonance rise, 12.5g arm (vert, lat)	11, 11dB
Typical selling price	£17.50

For graph references see issue No 43

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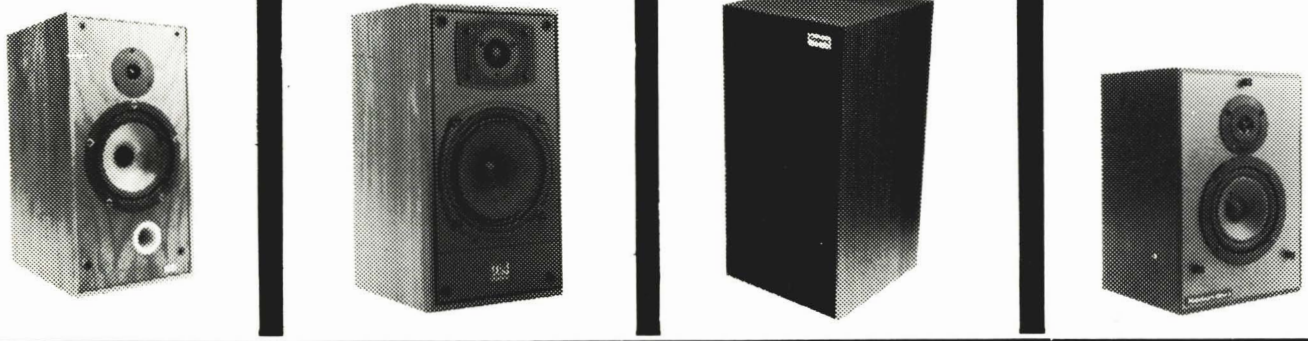
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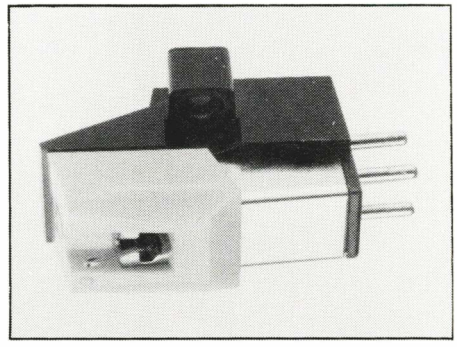
BEST BUY

LINN BASIK

LINN PRODUCTS LTD, 257 DRAKEMIRE DRIVE, CASTLEMILK, GLASGOW G45 9SZ.
TEL: 041-634 0371

Conceived originally by Linn as a giveaway with the arm of the same name, to drive home the company's view that the arm is infinitely more important than the cartridge, the current model *Basik* is now available as a separate £18 item. It is made in Japan by Audio Technica and based on the *AT93E*, but seems to have acquired something of a cult reputation for itself as a 'giant killer'.

This simple moving magnet design has good mechanical properties in terms of body rigidity and stylus fit, though the stylus itself was rather heavily glued. Compliance is on the high side of medium, which means that arms should be on the low side of medium mass, a category which just about accommodates Linn's own designs!



LAB REPORT

Output is quite sufficient in level, and although fairly tolerant of capacitance, there was little doubt that it sounded best when well-loaded.

Frequency response actually measured best with low capacitance, where it was very good indeed, holding ±1dB from 20Hz-16kHz; increased capacitance emphasised the 10kHz peak a touch and curtailed the bandwidth slightly. Channel balance was poor in terms of absolute error. The high writing speed trace was a little untidy, confirming the slight unevenness on the original chart.

Separation was distinctly uninspiring, lurking around the 20dB mark, due we suspect to the lively highish vertical compliance. Tracking, on the other hand, was pretty good.

SOUND QUALITY

Reflecting its low cost in terms of general brashness and unsubtlety, the *Basik* nevertheless did a decent job in conveying detail and dynamics through most of the range, though surface noise tended to be exaggerated and the sound could occasionally be described as 'fierce'. Definitely preferred on rock rather than classical music, this cartridge tried hard to give a good impression of overall integrity. Groove stability was reasonable.

CONCLUSIONS

No cartridge better deserves the epithet 'cheap and cheerful', yet the Basik goes much further in delivering the goods than its price level might indicate. It is one of the brightest-sounding amongst the better low cost cartridges, which will either be a blessing or a curse to the prospective purchaser, according to system and taste.

TEST RESULTS

Type, mass	moving magnet 5g
Stylus type	spherical?
Stylus inspection result	rather heavy glueing, small
Output Level (1kHz, 5cm/s)	3.38mV
Relative output (0dB = 1mV/cm/s)	−1.5dB
Channel balance	0.98dB
Channel separation (L,R)	28.1, 28.5dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5Hz	+1, −1dB
Frequency response limits 30Hz-20kHz	+1.5, −3.5dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	20, 23, 19dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	20, 19, 16dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	1.5, 1.5, 1.5dB
Response limits ref computer mean, 1kHz-15kHz	+3, −0dB
Response limits ref computer mean, 1kHz-20kHz	+3, −2dB
Test tracking weight, loading	2g, 300pF
LF resonance frequency, 12.5g arm (vert, lat)	8.8, 8.6Hz
Estimated compliance (vert, lat)	25, 26cu
Recommended arm effective mass	6-14g
LF resonance rise, 12.5g arm (vert, lat)	15.6, 11.2dB
Typical selling price	£18

For graph references see issue No 43

BEST BUY

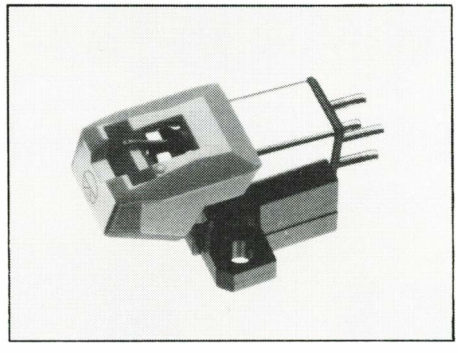
LINN K9

LINN PRODUCTS LTD, 257 DRAKEMIRE DRIVE, CASTLEMILK, GLASGOW G45 9SZ.
TEL: 041-634 0371

This latest Linn moving magnet takes the cheap 'n' cheerful *Basik* as a starting point, beefs up the bodywork with a metal casting, improves the stylus assembly fit still further, and slaps on a Vital stylus with the clear intention of transforming something that nobody would describe as a sow's ear into the proverbial silk purse.

The mechanical improvements seem to be well founded, with plenty of headshell contact area, and inspection confirmed the presence of an advanced elliptical Vital tip. Compliance indicates that low- or medium-mass arms will match well.

Electrical output suits normal moving magnet inputs, though capacitance loading will affect the frequency response. Tracking abilities were more than adequate at the sensible 1.8g downforce.



LAB REPORT

With low capacitance loading the response showed a gentle 2dB downtilt between 200Hz and 6kHz, followed by a broad slight recovery and eventual rolloff. At the recommended and subjectively preferred higher loading the treble trough was reduced but a broad treble peak appeared, +1.5dB 10-13kHz.

While the frequency response was quite impressive, the separation betrayed the humble origins of the generator system. Not that the values were particularly poor, just that they were inferior to many others, with significant channel asymmetry.

SOUND QUALITY

Very conscious of the need to avoid bias in favour of a cartridge that must inevitably benefit from our use of the maker's own turntable and tonearm, our confidence was boosted by similarly high ratings and good comment consistency in two separate 'blind' panel presentations.

Linn seem to have succeeded in improving further the punchy delivery of the *Basik* while replacing the somewhat aggressive top end of the cheap model with a much sweeter, more open, yet still slightly bright presentation.

Comments praised bass detail and differentiation, the 'liveliness' of strings, and good stereo staging, while acknowledging that the overall sound did not match the very best.

CONCLUSIONS

Even given the probable helpfulness of the ancillary equipment used in the listening tests, the *K9* has clearly succeeded in its goal of adding some extra refinement to the *Basik* package, delivering a lively and highly competitive middle market contender which clearly merits Best Buy status. A relatively lightly damped model, it should really only be considered for use with good quality turntables and tonearms.

TEST RESULTS

Type, mass	moving magnet 7.2g
Stylus type	'vital' elliptical
Stylus inspection result	high quality vital confirmed
Output Level (1kHz, 5cm/s)	3.3mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.4dB
Channel separation (L,R)	23, 30dB
Tracking ability (L,R)	80, 80μm
Frequency response from graph 100Hz-5Hz	+1, −1.5dB
Frequency response from graph 30Hz-20kHz	+1, −4dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	36, 34, 30dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	23, 27, 22dB
Response limits ref computer mean, 1kHz-15kHz	+3, −0.5dB
Response limits ref computer mean, 1kHz-20kHz	+3, −0.5dB
Test tracking weight, loading	1.8g, 200pF
LF resonance frequency, 13.5g arm (vert, lat)	9, 8Hz
Estimated compliance (vert, lat)	16, 20cu
Recommended arm effective mass	6-15g
LF resonance rise, 13.5g arm (vert, lat)	12, 17dB
Typical selling price	£60

For graph references see issue No 43

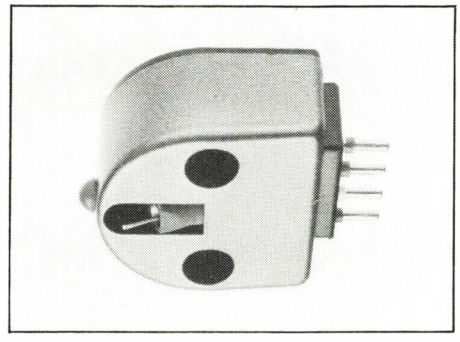
RECOMMENDED

LINN TRAK

LINN PRODUCTS LTD, 257 DRAKEMIRE DRIVE, CASTLEMILK, GLASGOW G45 9SZ.
TEL: 041-634 0371

The *Trak* is a low cost version of the well respected and established *Asak*, and is understood to have slightly less stringent production tolerences and to undergo final quality control in Japan, without the automatic Glaswegian inspection applied to the most costly models.

It is a low output moving-coil model of solid construction, with a distinctive metallic blue can. A fine small nude stylus of rectangular section was well fitted. Tracking weight is 2g which helps cope with the low compliance. This is best suited to arms towards the middle of a 10-18g effective mass range, in view of the virtual absence of LF damping.



LAB REPORT

Output is sufficient for any decent moving-coil stage, and the 470ohm recommended loading is pretty widespread, so there are unlikely to be any compatibility problems here.

Frequency response is very similar to all Linn's m-c models, fitting a fairly tight 3dB window across the bandwidth 40Hz-20kHz. The mid-range downtilt was some 2.5dB between 200kHz and 5kHz, followed by a well controlled 11kHz peak and gentle rolloff thereafter. Channel balance was very close throughout, though the trace was a little livelier than the other Linn m-cs, with a few small 'glitches' at the low frequency end.

Separation was pretty good, if not quite to *Karma* standards, rarely falling below 30dB except for gentle worsening at high frequencies. Despite the name, tracking abilities were a bit marginal, though the lack of damping will place much of the responsibilities on the turntable and arm.

SOUND QUALITY

The sound was considered a trifle 'heavy', a little recessed in the lower treble, and then with a slight emphasis at the extreme top. However, 'difficult' distorted treble was handled pretty well, and the sound was reassuringly solid, with fine full-range dynamics, good focus, and plenty of detail. All-in-all a thoroughly impressive result for the price, albeit leaning slightly in the direction of 'boom 'n' tizz.

CONCLUSIONS

Clearly fine value for money in itself, the *Trak's* limitations lie more in the difficulties it can present tonearms than anywhere else, though tracking abilities are also a trifle suspect. The chances are that anyone with a tonearm capable of doing the *Trak* justice may well have set his cartridge sights a little higher than £150 yet at the same time this model definitely delivers the goods, and deserves warm recommendation.

TEST RESULTS

Type, mass	low output moving-coil 6g
Stylus type	vital
Stylus inspection result	confirmed, small nude rectangular special ell
Output Level (1kHz, 5cm/s)	0.18mV
Relative output (0dB = 1mV/cm/s)	−26dB
Channel balance	0.25dB
Channel separation (L,R)	27.2, 28.9dB
Tracking ability (L,R)	74, 71µm
Frequency response limits 100Hz-5Hz	+1.5, −1.5dB
Frequency response limits 30Hz-20kHz	+2.5, −1.5dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	32, 24, 25dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	35, 30, 25dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0, 0.5, 0dB
Response limits ref computer mean, 1kHz-15kHz	+2.5dB
Response limits ref computer mean, 1kHz-20kHz	+3.5, −0dB
Test tracking weight, loading	2g,n/a
LF resonance frequency, 12.5g arm (vert, lat)	11.5, 12Hz
Estimated compliance (vert, lat)	11, 10cu
Recommended arm effective mass	10-18g
LF resonance rise, 12.5g arm (vert, lat)	17.5, 17.5dB
Typical selling price	£150

For graph references see issue No 43

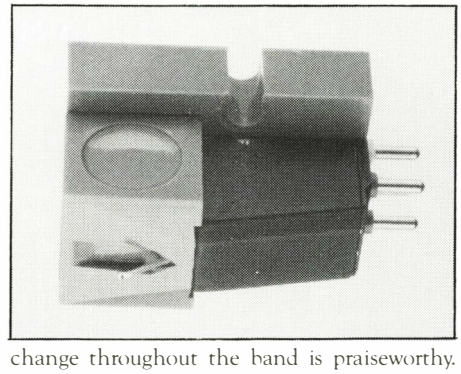
BEST BUY

NAGAOKA MP10

PATH GROUP PLC, 1 BERENS ROAD, LONDON NW10 5DY.
TEL: 01-969 2514

Very much the 'baby' of the Nagaoka moving magnet range, the *MP10* shares the same impressive rigid body structure, albeit as a plastic moulding in an unattractive dull red colour, with lower mass than the metal models higher up the range. Humbly sporting a spherical tip, which was actually quite small and neatly mounted, a substantial 2.3g downforce ensures good tracking ability and groove stability.

Compliance is lower, nicely symmetrical, and less damped than the other Nagaokas, so although the *MP10* is probably best served by low mass arms, medium mass models are almost as suitable.



LAB REPORT

Substantial enough in output for any moving magnet input, Nagaoka specify low capacitance loading, which should be particularly respected in this instance, as the treble rolloff is already quite severe, and is only made worse by increasing capacitance.

Frequency response shows a pronounced downtilt commencing at 300Hz, increasing in slope a little around 2kHz until levelling out some 5dB down at 13kHz, then finally rolling off at 17kHz. Despite the inaccuracy of this response in absolute terms, the lack of sudden change throughout the band is praiseworthy. Furthermore, channel balance stayed closely within 0.5dB, and 'glitches' were merely minor unevenesses, predominantly below 1kHz.

Separation figures rivalled many cartridges costing many times the price, even showing respectable control at high frequencies.

SOUND QUALITY

Despite the treble rolloff, which in the manner of spherical styli becomes more severe towards the end of a side (our response was taken at roughly the middle of a side), the *MP10* was very well liked for the 'seamlessness' and control of its sound, which showed remarkably good integration for such a low cost design. High frequencies did sound 'shut in', and depth was curtailed, but the bass and mid were satisfyingly energetic, 'bouncy' and 'punchy'.

CONCLUSIONS

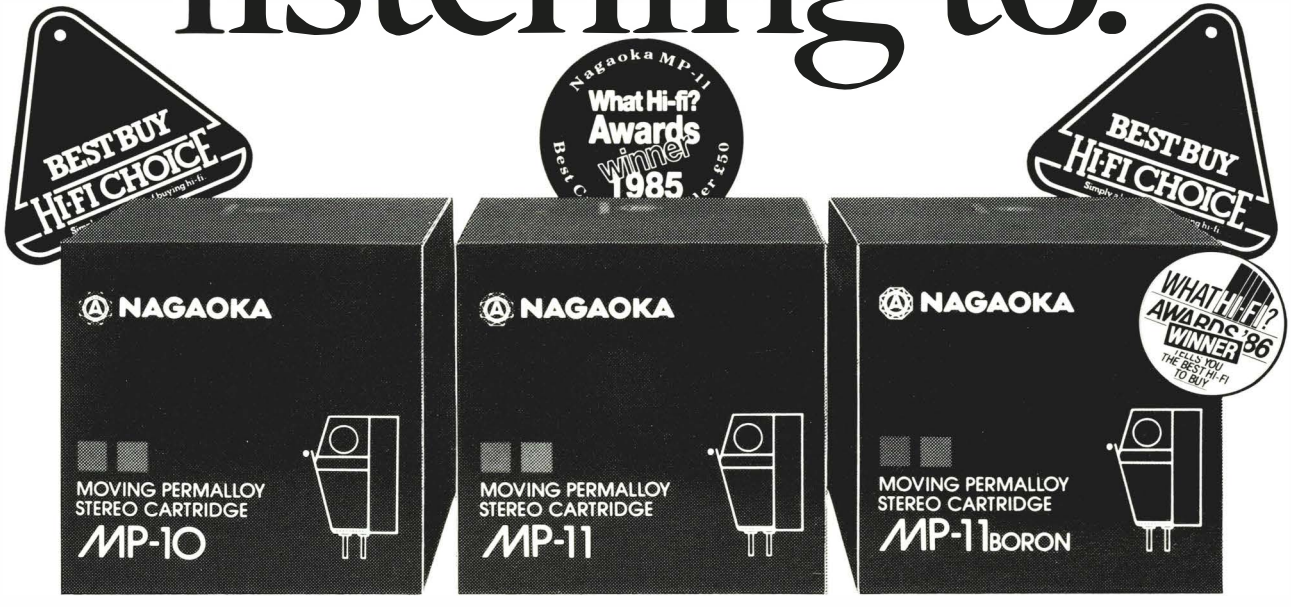
An obvious Best Buy; spherical tip apart, the *MP10* is clearly substantially better balanced than the other Nagaokas, with much better stability and control than the over-compliant *'11*. Moreover, the slightly 'dim' balance could well prove to be an ideal partner to the less-than-tidy tonearms, amplifiers and loudspeaker which its price suggests will be frequent partners.

TEST RESULTS

Type, mass	moving magnet 6.8g
Stylus type	spherical
Stylus inspection result	small and neat
Output Level (1kHz, 5cm/s)	3.75mV
Relative output (0dB = 1mV/cm/s)	0.9dB
Channel balance	0.54dB
Channel separation (L,R)	28.9, 30dB
Tracking ability (L,R)	80, 80µm
Frequency response limits 100Hz-5Hz	+1, −3dB
Frequency response limits 30Hz-20kHz	+1.5, −7dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	27, 29, 24dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	32, 30, 25dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0, 0dB
Response limits ref computer mean, 1kHz-15kHz	+0, −3.5dB
Response limits ref computer mean, 1kHz-20kHz	+0, −4dB
Test tracking weight, loading	2.3g, 100pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 8.7Hz
Estimated compliance (vert, lat)	17, 18cu
Recommended arm effective mass	5-13g
LF resonance rise, 12.5g arm (vert, lat)	11.3, 12.3dB
Typical selling price	£15

For graph references see issue No 43

Now a group of MPs really worth listening to.



MP10 "Very much the 'baby' of the Nagoaka moving magnet range, the MP10 shares the same impressively rigid body structure".

"Separation figures rivalled many cartridges costing many times the price, even showing respectable control at high frequencies".

"The MP10 was very well liked for the 'seamlessness' and control of its sound, which showed remarkably good integration for such a low cost design".

"An obvious best buy."

HiFi Choice

MP10 £16

Styli fully interchangeable for ease and economy of upgrading.

MP11 "In terms of sound quality, the MP11 stood out as the clear winner. Its ability to get the last degree of articulation and control from a bass guitar or synth line could make even the excellent C77 seem a little ponderous at times. Piano and synthesiser chord changes seem to be conveyed more precisely with the MP11, while vocals are open and backing vocals are very well separated and articulated....It has all the detail and delicacy of the C77 with an added power and life that really help to convey a rhythm line."

"Superb sound. Excellent mounting quality. Nothing to criticise at the price."

What HiFi 12 cartridge supertest

"With much improved quality control, the MP11 now offers a superb all round performance for the price."

What HiFi Awards 1985 Best cartridge under £50.

MP11 £22

MP11 Boron "Low mass tips are often expensive to engineer and difficult to align."

"Nagaoka have come up with a novel solution to reducing moving mass in the popular MP11 design".

"Nagaoka use a shanked diamond, where only the tip is made from diamond, but unlike other shanks which use diamond or a metal alloy this uses Boron. Boron has similar 'strength' properties to sapphire and yet it's nearly a third lighter than diamond."

"The sound quality improvement fully justifies the price difference on the new model. The MP11 Boron shows itself very capably in complex cymbal and percussion passages. It proved more capable of revealing the atmosphere of the recording acoustic".

"The audibly lower distortion of the MP11 Boron gives music a much more confident dynamic quality...it can compete well out of its price category."

What HiFi

MP11 Boron £34

NAGAOKA

MPs that keep their promise.

PATH GROUP PLC, DESBOROUGH INDUSTRIAL PARK, DESBOROUGH PARK ROAD, HIGH WYCOMBE, BUCKS.
TELEPHONE: (0494) 459981 TELEX 8814198 FAX: 01 278 6954

BEST BUY

NAGAOKA MP11 BORON

PATH GROUP PLC, 1 BERENS ROAD, LONDON NW10 5DY.
TEL: 01-969 2514

The *MP11* has been a particular favourite in Nagaoka's range of moving magnet models for some years, though in the past our tests have favoured the *MP10*. Nagaoka have now taken the unusual and creative step of introducing a *Boron* version, featuring a cantilever made from this exotic material, usually only found on exotically priced cartridges.

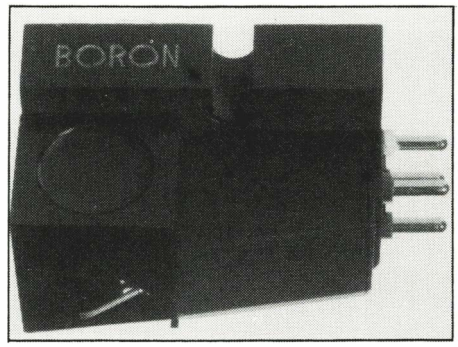
This is a large cartridge which is also on the heavy side, but it has a fairly well-fitting stylus assembly and a good body shape which can be fixed firmly enough in the headshell despite semicircular lugs.

Our original preference for the *MP10* was due to the *'11's* undesirably high compliance. The *Boron* comes in with a much more sensible compliance, closer to the *'10* than the *'11* yet high enough to ensure good tracking performance at the sensible 2g tracking weight. Nevertheless low and medium mass arms will match best, and decent quality turntables should be used as internal damping is modest.

Electrical output is fine for any normal input, though capacitance variations do have an influence on the response. Channel balance was a reasonable 0.6dB.

LAB REPORT

Both responses were good by any standards.



With the recommended low capacitance a gentle 2dB downtilt from 200Hz to 10kHz was followed by a 2-3dB peak at 18kHz. With higher capacitance the response held within ±0.5dB to 12kHz, rolling off therafter. It is something of a moot point as to which of the two is to be preferred.

Separation was reasonable enough, though decidedly asymmetric between the channels.

SOUND QUALITY

Subjectively, the *MP11 Boron* was in fact preferred with additional capacitance, sounding a little 'spitty' with low loading.

Reactions varied somewhat, but were generally very favourable considering the modest price. A major strength was the overall balance, which was 'weighty' and 'powerful', conveying a good sense of scale and space. Low level resolution and dynamics attracted some mild criticism, however, as did some 'thickening' in the bass and midrange.

CONCLUSIONS

While this could not be described as a particularly exciting cartridge, it auditioned well and the technical performance was also entirely adequate. It is certainly good enough to respond to good quality ancillaries, and definitely merits a 'Best Buy' rating.

TEST RESULTS

Type, mass	moving magnet 6.8g
Stylus type	elliptical
Stylus inspection result	mild elliptical
Output Level (1kHz, 5cm/s)	4mV
Relative output (0dB = 1mV/cm/s)	0dB
Channel balance	0.6dB
Channel separation (L,R)	30, 23dB
Tracking ability (L,R)	80, 80µm
Frequency response from graph 100Hz-5Hz	+0.5, −1dB
Frequency response from graph 30Hz-20kHz	+0.5, −1.5dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	37, 45, 32dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	30, 31, 20dB
Response limits ref computer mean, 1kHz-15kHz	+3, −0dB
Response limits ref computer mean, 1kHz-20kHz	+3, −5dB
Test tracking weight, loading	2g, 100pF
LF resonance frequency, 13.5g arm (vert, lat)	8, 8Hz
Estimated compliance (vert, lat)	20, 20cu
Recommended arm effective mass	5-13g
LF resonance rise, 13.5g arm (vert, lat)	15, 15dB
Typical selling price	£35

For graph references see issue No 43

BEST BUY

ORTOFON OM10

ORTOFON UK LTD, DENMARK HOUSE, TAVISTOCK INDUSTRIAL ESTATE, RUSCOMBE, TWYFORD, BERKS RG10 9NJ TEL: (0734) 343621

This cartridge is often supplied with the popular Dual 505 budget turntable, and is also available as a separate item. The OM designation refers to an optional mass facility, because the 5g cartridge mass contains 2.5g of ballast, which may be removed if the tonearm is capable of balancing such a low mass.

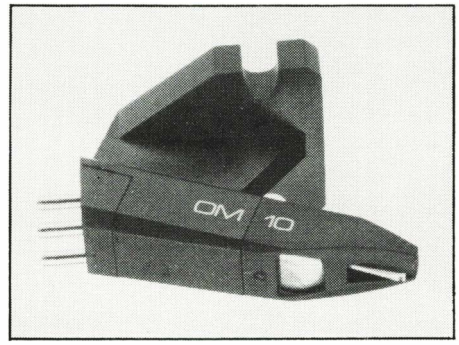
Experiencing this difficulty ourselves, we elected to retain the ballast, but this option, theoretically at least, should allow a wider range of arm masses to be accommodated.

However, it can be argued that the provision of mass as mere ballast must compromise structural rigidity, and certainly the body mounting was rather skeletal, though the stylus assembly made a good fit. Compliance was moderate enough to suit a wide range of arms, the heavier ones benefitting from ballast removal.

LAB REPORT

With enough output to drive any amplifier, this model is designed to work into a highish capacitance to achieve the manufacturer's intended results at the high frequency resonance. Where pre-amp input loading is low, adaptors may be used in the signal line.

Frequency response looks most impressive despite the low cost of the cartridge, dropping quite smoothly 3dB between 100Hz and 7kHz,



then rallying to 19kHz. Adding capacitance to the manufacturer's recommendation reduces the treble droop to 1dB at 3kHz, and the response starts rolling gently at 10kHz. Channel balance was found to be quite close, but with a broad 0.5dB error 100-600Hz which cannot be corrected and may be audible. There is also evidence of quite pronounced 'glitches' in response at 500Hz and 1.2kHz, with some general uneveness at high frequencies.

Separation figures were pretty good, albeit asymmetric to a marked degree between channels and with significant sample variation, while tracking abilities were fine.

SOUND QUALITY

Nice but noisy (referring to record surfaces) is a snapshot comment on the *OM10* sound. High frequencies were audibly down compared with the more expensive *OMs* but were nevertheless clean and well controlled.

The midrange was nicely integrated and open-sounding, while the bass did show a degree of overhang.

CONCLUSIONS

Clearly one of the leading 'cheapies', the *OM10* gives a decent overall performance, albeit with some sample variation, not to mention a fine level of sound quality for the price.

TEST RESULTS

Type, mass	moving magnet 5g*
Stylus type	'E'
Stylus inspection result	neatly mounted simple elliptical
Output Level (1kHz, 5cm/s)	3.6mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.2.3dB
Channel separation (L,R)	23.6, 21.6dB
Tracking ability (L,R)	80, 80µm
Frequency response limits 100Hz-5Hz	+1, −1dB
Frequency response limits 30Hz-20kHz	+1, −5dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	30, 45, 39dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	22, 24, 25dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0.5, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+1.5, −0dB
Response limits ref computer mean, 1kHz-20kHz	+1.5, −0dB
Test tracking weight, loading	1.5g, 400pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 7.6Hz
Estimated compliance (vert, lat)	19, 24cu
Recommended arm effective mass	5-15g**
LF resonance rise, 12.5g arm (vert, lat)	7, 11.7dB
Typical selling price	£15

**includes 2.5g ballast*
***if arm can be re-balanced with ballast removed*

For graph references see issue No 43

RECOMMENDED

ORTOFON OM20

ORTOFON UK LTD, DENMARK HOUSE, TAVISTOCK INDUSTRIAL ESTATE, RUSCOMBE, TWYFORD, BERKS RG10 9NJ. TEL: (0734) 343621

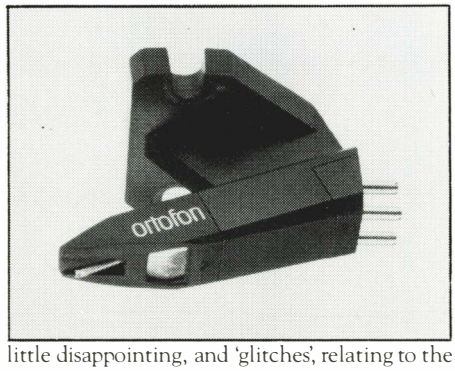
This is the £35 middle model in Ortofon's stylish 'optional mass' range of moving magnet cartridges. It is a 2.5g cartridge with 2.5g of removable ballast, the latter necessary more to enable conventional arm counterbalances to work than for any other reason, as it contributes nothing to the structural rigidity. In fact body rigidity is not too bad and stylus fit is quite good.

Even fully laden, the *OM20* can match a fair range of arm effective masses, though high mass examples will benefit from ballast removal. Tracking weight is a low 1.25g, but tracking ability was still good.

LAB REPORT

Substantial output avoids any likelihood of amplifier sensitivity mismatch. Ortofon usually specify high capacitance loading, but there was no mention in the instruction leaflet on this occasion. In fact the subjective difference was quite slight, and the measured change not that great either.

Frequency response was very flat with capacitance loading, falling within a 1dB 'window' from 30Hz to 15kHZ, while without capacitance the high frequency extension was marginally increased, at the expense of an overall 2dB 'window'. Channel balance was a little disappointing, and 'glitches', relating to the mounting we suspect, are visible either side of 1kHz. The trace as a whole was a little uneven at high frequencies, but not severely so.



Separation figures were reasonable enough, and were well maintained at high frequencies, though they were somewhat asymmetric and uneven throughout the band.

SOUND QUALITY

Generally very well balanced tonally, if a touch 'thin' and 'bright', the *OM20* succeeds handsomely as an all-rounder despite a certain lack of excitement. Focus, depth and dynamics were well below the best, but the general level of competance and control were very convincing, with good lateral stereo.

CONCLUSIONS

Definitely deserving recommendation, this turned out to be our favourite amongst Ortofon's moving magnet cartridges. While it may not produce one of the most dynamic sounds around, it offers impressive compatibility mechanically and sonically with the fairly modest equipment which one would expect it to partner, and generally delivers the goods in a well-balanced manner.

TEST RESULTS

Type, mass	moving magnet 5g*
Stylus type	'E'
Stylus inspection result	mild elliptical, decent quality
Output Level (1kHz, 5cm/s)	3.6mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.23dB
Channel separation (L,R)	23.6, 21.6dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5Hz	+1, −0dB
Frequency response limits 30Hz-20kHz	+1.5, −0dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	30, 26, 25dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	35, 36, 28dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	1, 1, 1.5dB
Response limits ref computer mean, 1kHz-15kHz	+1.5, −0dB
Response limits ref computer mean, 1kHz-20kHz	+1.5, −0dB
Test tracking weight, loading	1.25g, 400pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 7.6Hz
Estimated compliance (vert, lat)	21, 25cu
Recommended arm effective mass	5-16g**
LF resonance rise, 12.5g arm (vert, lat)	7, 11.7dB
Typical selling price	£35

**includes 2.5g ballast*

***if arm balances with ballast removed*

For graph references see issue No 43

BEST BUY

ORTOFON MC10 SUPER

ORTOFON UK LTD, DENMARK HOUSE, TAVISTOCK INDUSTRIAL ESTATE, RUSCOMBE, TWYFORD, BERKS RG10 9NJ. TEL: (0734) 343621

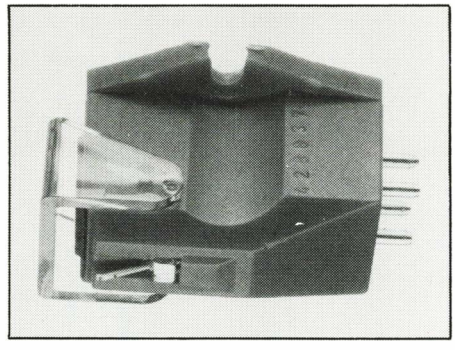
Ortofon deserve considerable respect for their singlehanded bearing of the moving coil torch through the dark years of moving magnet domination. But when the 'coils became fashionable again, and lots of amplifiers started including provision for low output cartridges (so removing all the hassle of step-up devices), they were left a little out on a limb, with such low outputs that transformers were still almost mandatory.

The *MC10 Super* set out to change all that, providing a fully competitive and comparable £50 model in the middle of the popular price bracket. However, there are still a few of the old oddities around it's true to say, including an unusually 'deep' body requiring different arm height adjustment from most other models, not to mention the silly hinged stylus guard, and semicircular mounting lugs which are prone to distortion. Stylus was an accurately shaped and aligned small nude elliptical.

Compliance is impressively symmetrical, lightly damped, and very sensibly chosen for low- to medium-mass arms. Although the tracking reserve is not great, it will still be sufficient for all but the most extreme cases.

LAB REPORT

Output level is close to ideal for normal amplifier moving coil inputs, and the clever trick is that Ortofon have done this while retaining the sonically superior low impedance coils.



Frequency response shows a fairly pronounced midrange downtilt amounting to some 3dB between 200Hz and 7kHz, whereupon there was a mild and slightly uneven recovery. Channel balance was pretty good throughout. The overall trace showed areas of vague uneveness, but no distinct resonances. Separation figures were rather average, though quite well balanced and notably well maintained at high frequencies.

SOUND QUALITY

What a delightfully sweet-sounding cartridge this is. There is a touch of the 'boom'n'tizz' which indicates a little loss of control at the frequency extremes, but even these balance each other nicely, while the midrange sounds delightfully clear, open and uncongested, with decent stereo, depth, dynamics and focus, and a pleasantly 'airy' sound. It has much of the delicacy of far more expensive designs, if lacking quite the same degree of control, sophistication and smoothness.

CONCLUSIONS

Ortofon's extensive experience has somehow managed to come up with a beautifully judged package, which combines the full open, dynamic qualities of moving coils without resort to overdamping or undue lack of control. The balance errs a trifle on the latter side (indicated by the separation figures perhaps), which may place a premium on the quality of the turntable. But it is hard to envisage a better overall combination of the various parameters within the cost constraints.

TEST RESULTS

Type, mass	low output moving-coil 7.2g
Stylus type	'E'
Stylus inspection result	fine small nude elliptical
Output Level (1kHz, 5cm/s)	0.32mV
Relative output (0dB = 1mV/cm/s)	−22dB
Channel balance	0.1dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	75, 74μm
Frequency response limits 100Hz-5Hz	+1.5, −1dB
Frequency response limits 30Hz-20kHz	+1.5, −2dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	22, 26, 20dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	24, 28, 21dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0.5, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+3, −0dB
Response limits ref computer mean, 1kHz-20kHz	+3.5, −0dB
Test tracking weight, loading	1.5g, n.a.
LF resonance frequency, 12.5g arm (vert, lat)	9, 9Hz
Estimated compliance (vert, lat)	15, 15cu
Recommended arm effective mass	5-15g
LF resonance rise, 12.5g arm (vert, lat)	14, 12dB
Typical selling price	£52

For graph references see issue No 43

RECOMMENDED

RATA RP20

RUSS ANDREWS TURNTABLE ACCESSORIES, EDGEBANK HOUSE, SKELSMERGH, CUMBRIA LA8 9AS.
·———TEL: (053 983) 247———·

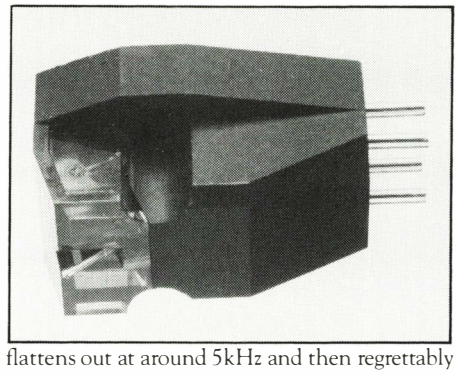
For a number of years now, RATA have been importing and distributing fairly expensive Grace and Supèx cartridge models from Japan; more recently they have launched a home-grown range under their own brand name. First of the RATA models to appear was the *RP20,* which is built for Russ Andrews by Goldring, and in fact shares a common body with the Goldring *Epic.* The body design is inherently good, if rather allowing tight mounting with a good contact area. Internal wiring differs from that of the *Epic,* as does the elliptical tip, which has a rather sharper profile. However, the inherent shape is good, if bulky. Stylus fit is pretty secure.

Compliance is close enough to the *Epic* for a similar range of suitable arm masses, but damping is lighter, so the heavier arms are better avoided, particularly as tracking weight is reduced to 1.5g.

LAB REPORT

The healthy output will drive amplifiers most efficiently. Claimed to be independent of loading capacitance, our sample still showed both measured and audible improvement when using high capacitance.

The response trace illustrates the reduced damping at high frequencies, where the treble



flattens out at around 5kHz and then regrettably builds up to a substantial peak on one channel though the other channel is very impressively controlled. Once again the slight 800Hz 'glitch' is visable, though the trace is nice and steady otherwise. Tracking abilities and groove stability seemed much the same, in spite of the lower tracking weight.

SOUND QUALITY

Marred by the distinctly audible treble peak on one channel (5dB difference between channels!), the sound was otherwise very promising for the price with good integration and low frequency solidity, and a clear dynamic midrange with the beginnings of fine stereo imaging. The 'sparkle' was a bit strong at the top of course, and tended to upset the imaging rather, but hopefully this is merely a sample problem.

CONCLUSIONS

Despite the treble problems of our sample, and now that body strength is improved, this model clearly merits recommendation. It offers an inherently rather better balanced sound than the *Epic* which justifies the slightly higher cost.

TEST RESULTS

Type, mass	moving magnet 7.6g
Stylus type	simple elliptical
Stylus inspection result	confirmed neat mounting
Output Level (1kHz, 5cm/s)	3.55mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.9dB
Channel separation (L,R)	28, 26.6dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5Hz	+1, −2.5dB
Frequency response limits 30Hz-20kHz	+1, −3dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	26, 41, 27dB
Stereo Separation R on L 100Hz, 1kHz, 10kHz	19, 24, 27dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	1, 1, 0dB
Response limits ref computer mean, 1kHz-15kHz	+3, −1dB
Response limits ref computer mean, 1kHz-20kHz	+6, −1dB
Test tracking weight, loading	1.8g, 250pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 9Hz
Estimated compliance (vert, lat)	15, 15cu
Recommended arm effective mass	6-14g
LF resonance rise, 12.5g arm (vert, lat)	15, 14dB
Typical selling price	£20

For graph references see issue No 43

RECOMMENDED

RATA RP40

RUSS ANDREWS TURNTABLE ACCESSORIES, EDGEBANK HOUSE, SKELSMERGH, CUMBRIA LA8 9AS.
·———TEL: (053 983) 247———·

The RATA cartridges are based on the budget moving magnet Goldring *Epic* mouldings, with rather better cantilever and styli, and some changes to the internal generator. The '40 is the middle of three models, eponymously priced.

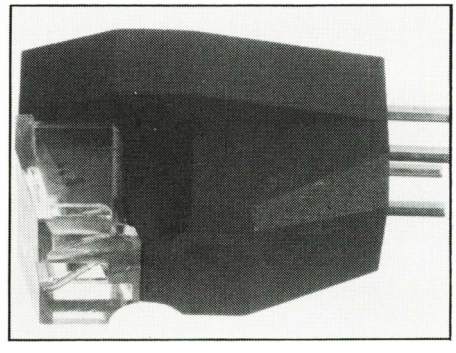
Rather bulky and heavy, the body has full circular lugs and a generous mounting area for proper mechanical coupling to the headshell; the plastic is now strengthened, after our problem with cracking and crumbling on early samples. Stylus assembly fit is excellently tight.

Mechanically, it suits low and medium mass arms. Compliance is somewhat asymmetrical, and reasonably well-damped. At (1.5g) downforce, tracking abilities were good, and channel balance was close.

LAB REPORT

Frequency responses looked far from promising, falling a full 3.5dB to the 8kHz trough, then rising 5-6dB to an ultrasonic 19kHz peak. The addition of capacitance has little effect with this genarator reducing the trough depth a dB or so. The high quality mechanical design is reflected in the smooth traces with just a single 'glitch'.

Further evidence of this may be seen in the fine separation performance, which was also



smooth, unusually well extended, and almost perfectly symmetrical, with values between 33 and 40dB steadily improving to unusally high frequencies.

SOUND QUALITY

The *RP40* was quite well received despite the recognised oddities of its response characteristic. Balance was determinedly 'heavy', yet with a slight 'edge' at high frequencies. Focus was quite good, and stereo spread excellent, with an impressive sense of scale. Good midrange and treble detail and decent dynamic resolution were also noted, as the '40 did a good job of sorting out the layers and complexity of the mix.

CONCLUSIONS

Behind the far from neutral balance, there is a fine cartridge doing its best, showing fine cantilever control at high frequences, with good stereo and detail as a result. Whether the balance is desirable or tolerable will depend to a degree upon the other bits of a system, but if this aspect works out, the *RP40* is an impressive contender, meriting cautious recommendation.

TEST RESULTS

Type, mass	moving magnet 7.1g
Stylus type	elliptical
Stylus inspection result	good quality elliptical
Output Level (1kHz, 5cm/s)	3.7mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.3dB
Channel separation (L,R)	28, 29dB
Tracking ability (L,R)	80, 80μm
Frequency response from graph, 100Hz-5Hz	+1, −2dB
Frequency response from graph, 30Hz-20kHz	+3, −3dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	34, 39, 39dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	33, 37, 40dB
Response limits ref computer mean, 1kHz-15kHz	+3, −1.5dB
Response limits ref computer mean, 1kHz-20kHz	+5, −1.5dB
Test tracking weight, loading	1.5g, 400pF
LF resonance frequency, (13.5g arm) (vert, lat)	10, 8Hz
Estimated compliance (vert, lat)	14, 20cu
Recommended arm effective mass	6-15g
LF resonance rise, (13.5g arm) (vert, lat)	12, 14dB
Typical selling price	£40

For graph references see issue No 43

Upstairs

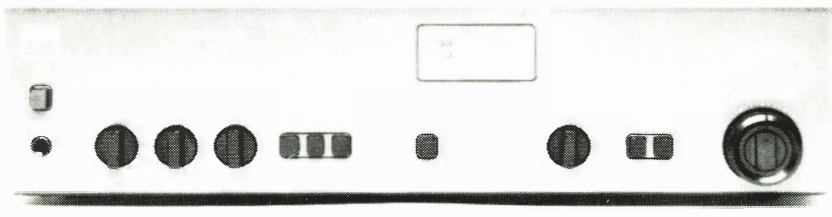


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RECOMMENDED

REGA RB100

REGA RESEARCH LTD, 119 PARK STREET, WESTCLIFF-ON-SEA, ESSEX SS0 7PD.
TEL: (0702) 333071

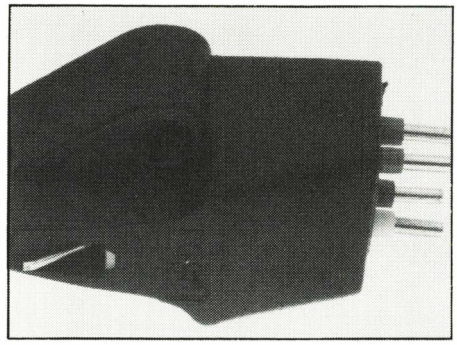
Rega's original Japan-sourced *R100* cartridge was slow in acceptance but eventually became a firm favourite, a fate which the *RB100* may be destined to repeat. Plain and simple, this £38 model is unusual in having a fixed stylus. In some senses it is a moving magnet built like a moving coil. The body has proper fixing lugs and decent headshell contact area, so the mechanical integrity of the whole is potentially superior to conventional m-m types.

Compliance on our sample was on the high side, suitable really only for low to medium mass arms, including Rega's own. Internal damping is fairly light, so nasty cheap turntables should be avoided. Some asymmetry was noted in the vertical and horizontal planes.

Electrical output is a little below average, though sufficient to drive any normal amplifier, but anyone attempting shop comparisons will need to advance the volume to avoid a misleading result.

LAB REPORT

Frequency response followed the unashamed downtilt favoured by a number of successful UK cartridges. Here the droop was a substantial 5dB from 200Hz to 10kHz, ameliorated by only a single dB with higher capacitance loading. Recovery to the treble resonance was a mild 2dB, at 18kHz. Despite the odd shape the trace



was very smooth, showing fine control and channel balance even at high frequencies. An outstanding spectrum of separation was further evidence of excellent cantilever control; the bass started at 35dB and improved to a remarkable 40dB at 10kHz.

SOUND QUALITY

The Rega proved the hardest cartridge in the report to tie down subjectively. Our initial 'hands on' experience suggested that the *RB100* could hold its own with m-c models several times its price. But a later try-out in a different system and with two different samples raised a few doubts; then the 'blind' test results showed contradictory results between panelists and different tracks of the programme. The *RB100* may be unusually system-dependent; the balance is duller than average, and acceptability would seem to depend on how this combines with other components and the musical balances of different discs. At worst, a pleasantly 'laid back' and spacious balance becomes tiresomely dull.

CONCLUSIONS

A contrary design in some respects, the *RB100* has a remarkable mechanical performance for its price, with a balance that is as far from average — and 'neutrality' — as it is possible to be. In the right system context it is a potential 'Best Buy', but the wrong combination could be an absolute disaster. It merits recommendation, but with a stern 'try before you buy' warning.

TEST RESULTS

Type, mass	(fixed) moving magnet 5.9g
Stylus type	not specified
Stylus inspection result	good quality elliptical
Output Level (1kHz, 5cm/s)	2.8mV
Relative output (0dB = 1mV/cm/s)	−3dB
Channel balance	0.5dB
Channel separation (L,R)	25, 30dB
Tracking ability (L,R)	80, 80μm
Frequency response from graph 100Hz-5Hz	+1, −3dB
Frequency response from graph 30Hz-20kHz	+1, −4dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	36, 45, 40dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	35, 37, 39dB
Response limits ref computer mean, 1kHz-15kHz	+0, −3.5dB
Response limits ref computer mean, 1kHz-20kHz	+2, −3.5dB
Test tracking weight, loading	1.8g, 150pF
LF resonance frequency, 13.5g arm (vert, lat)	8, 6Hz
Estimated compliance (vert, lat)	20, 35cu
Recommended arm effective mass	5-12g
LF resonance rise, 13.5g arm (vert, lat)	13, 15dB
Typical selling price	£38

For graph references see issue No 43

RECOMMENDED

SHURE M92E

HW INTERNATIONAL LTD, 3-5 EDEN GROVE, LONDON N7 8EQ.
TEL: 01-607 2717

This is the bubble-packed baby amongst Shure's P-adaptable moving magnet cartridges, costing £15.

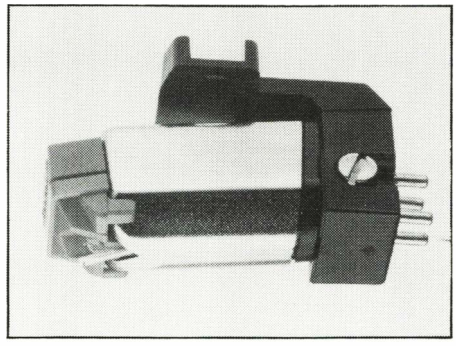
Stylus is a simple neatly mounted elliptical, and tracking weight a light 1.25g. Compliance is modest enough, though unusually the vertical figure is higher than the horizontal. The range of arm masses which can ideally be accommodated is therefore quite narrow, but well chosen nonetheless, while heavy damping will assist general compatibility with cheaper equipment.

LAB REPORT

Output level is pretty substantial, so no problems here, but this model is fairly sensitive to capacitance loading, and a high rather than low figure improves the trace 2dB at 9kHz while also suppressing the 20kHz peak.

Frequency response shows yet again the problem of the P-adaptor, yet in other respects is most impressive, particularly with loading, where the ruler straight range from 300Hz to 9kHz falls a gentle 2dB, with decent rolloff control beyond. Channel balance is pretty close, and the trace is relatively free from 'glitches' outside the P-mount influence.

Separation figures were unimpressive, with significant channel asymmetry, and tracking abilities were not too impressive either, though they are nevertheless adequate.



SOUND QUALITY

As is so often the case with low cost cartridges, the *92E* was quite a pleasant surprise, though it showed its limitations nonetheless, particularly in terms of a 'flattened' sound stage with little apparent depth. The balance was very well judged, with no part of the range particularly obtrusive. Though the treble range was under quite good control, there was little real detail here, and some of its attempts to simulate this were rather obvious. The mid was somewhat recessed, but the bass kept trucking along quite nicely, with little boom or overhang. In all, the *92E* gave a rather impressive display of control for the price, though it was inclined to make heavy weather of high frequency distortion.

CONCLUSIONS

Capable of a respectably decent sound for a respectably low price, the *92E* deserves cautious recommendation. And one cannot help feeling that it might have made a Best Buy were it not hampered by the P-mount adaptor, which reduces its competitiveness in its price class. P-mount users would do well to investigate this model if seeking a low cost replacement, as it is a pretty decent performer.

TEST RESULTS

Type, mass	moving magnet 6.4g
Stylus type	simple elliptical
Stylus inspection result	confirmed, nearly mounted
Output Level (1kHz, 5cm/s)	4.85mV
Relative output (0dB = 1mV/cm/s)	+2dB
Channel balance	0.6dB
Channel separation (L,R)	27.6, 25.1dB
Tracking ability (L,R)	59, 69μm
Frequency response limits 100Hz-5Hz	+3, −3dB*
Frequency response limits 30Hz-20kHz	+0, −4dB*
Stereo Separation L on R 100Hz, 3kHz, 10kHz	18, 22, 22dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	26, 35, 30dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0.5, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+0, −4dB
Response limits ref computer mean, 1kHz-20kHz	+0, −4dB
Test tracking weight, loading	1.25g, 250pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 12Hz
Estimated compliance (vert, lat)	18, 12cu
Recommended arm effective mass	10-15g
LF resonance rise, 12.5g arm (vert, lat)	10, 7dB
Typical selling price	£15

**at low capacitance (c. 100pF)*

For graph references see issue No 43

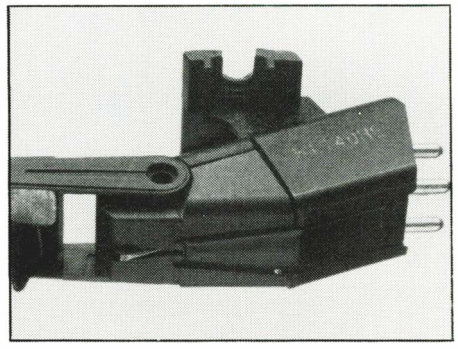
RECOMMENDED

SHURE ML140HE

HW INTERNATIONAL LTD, 3-5 EDEN GROVE, LONDON N7 8EQ.
TEL: 01-607 2717

Along with its sister *120* model, this design constitutes a new lightweight body style for Shure's sub-*V15* models, including a very neat re-design on the built-in stabiliser/damper brush mechanism.

'HE' is the part of the nomenclature that refers to a Hyperelliptic profile stylus, which proved to be a nicely set nude stone with swept elliptical extended contact. The LF resonance indicates moderate compliance and damping, suitable to a usefully wide range of arms.



LAB REPORT

Output was average, as is the recommendation for capacitance loading, so there are unlikely to be any compatibility problems with this cartridge. In fact the response does show a fair amount of variation with loading, so some experimentation *in situ* may be worthwhile; our subjective preference was for low rather than high capacitance.

Frequency response was almost identical to the *V-15 MR* — pretty smooth and flat in either condition, one producing an effectively flat response to 10kHz rolloff, the other a gentle 2dB downtilt between 200Hz and 10kHz, then down a further 2dB at 20kHz. Channel balance was out a surprising amount for such an expensive model, and although correction can be made with the balance control, this leaves a minor discrepancy above 10kHz.

Separation figures were pretty decent in themselves, and were quite well maintained at high frequencies, but also showed some channel asymmetry. Despite the low 1g downforce, tracking was good, and groove stability more than adequate with the stabiliser's assistance.

SOUND QUALITY

This cartridge gave a well balanced slightly 'bright' sound which was much better integrated at high frequencies than the *'120*. There was some bass softening, but extension was good and the overall focus and dynamics were promising.

Upper bass seemed slightly suppressed, so the sound was a little lacking in 'body', but was crisp, clear and informative nonetheless, particularly through the central midband. Qualitatively the treble was a match for many moving coils.

CONCLUSIONS

This is a well balanced cartridge, preferred in a number of ways to the more expensive *V-15 V MR*. Though expensive, it sounds good and has very sensible parameters for matching other equipment, while providing good tracking at low downforce with the help of the stabiliser.

TEST RESULTS

Type, mass	moving magnet 4.5g
Stylus type	hyperelliptical
Stylus inspection result	confirmed, nude stone
Output Level (1kHz, 5cm/s)	3.75mV
Relative output (0dB = 1mV/cm/s)	−1dB
Channel balance	0.15dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5Hz	+0.5, −1dB
Frequency response limits 30Hz-20kHz	+0.5, −1.5/3.5dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	33, 35, 31dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	27, 28, 24dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0.5, 1dB
Response limits ref computer mean, 1kHz-15kHz	+1, −1dB
Response limits ref computer mean, 1kHz-20kHz	+1, −1dB
Test tracking weight, loading	1g, 250pF
LF resonance frequency, 12.5g arm (vert, lat)	10, 9.5Hz
Estimated compliance (vert, lat)	15, 16cu
Recommended arm effective mass	6-16g
LF resonance rise, 12.5g arm (vert, lat)	14, 11dB
Typical selling price	£120

For graph references see issue No 43

RECOMMENDED

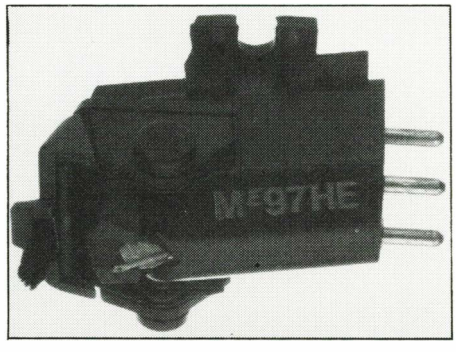
SHURE ME97HE

HW INTERNATIONAL LTD, 3-5 EDEN GROVE, LONDON N7 8EQ.
TEL: 01-607 2717

Shure revived four favourite designs of the past for their 'Encore' series, and on the basis of work carried out in previous editions, the *'97HE* looked to be the 'one most likely to'.

This £40 moving magnet model features Shure's stabiliser/brush, which dampens the vertical low frequency resonance completely. The additional stability ensures that the *'97HE* will work stably in virtually any context, even in high mass arms, while the highish compliance provides adequate tracking abilities at the rather low 1g downforce.

Shure's 'Hyperelliptic' stylus profile (hence *HE*) is a form of swept ellipse. Excessive glue on our sample made it difficult to assess alignment or quality.



LAB REPORT

Response shows substantial variation with capacitance loading above 1kHz. The Shure recommendation of 250pF is about midway between the values we measured, and would appear a good compromise. The traces are quite smooth, with slight ripple but no 'glitches', and the 3dB discrepancy at very high frequencies is the only cause for mild complaint.

Separation was very good, giving high but asymmetric readings in the midband, which were well maintained into bass and treble.

SOUND QUALITY

Though regarded as inherently more tidy than exciting, the *'97HE* acquitted itself very respectably on the 'politeness' of the sound and neutrality of the balance, though focus, dynamics and the resolution of low level detail were a little weak. Some of the 'liveliness' of other presentations was missed, but stereo perspectives were clear and stable, and coloration, bar a touch of hardness, was low.

CONCLUSIONS

Though there remain reservations about the mechanical construction, the cantilever engineering is to a high standard, and the *'97HE* delivers a very respectable technical and sonic performance at a realistic price. The stabiliser undoubtedly works, acting as a safety net to help the cartridge get the most out of high mass arms. Though it won't turn a sow's ear of a turntable into a silk purse, it will at least keep going and produce a respectable result.

By not aiming too high in the first place, the designers have achieved an artful compromise capable of giving a respectable sound in almost any application.

TEST RESULTS

Type, mass	moving magnet 6.6g
Stylus type	nude hyperelliptical
Stylus inspection result	tip obscured by glue
Output Level (1kHz, 5cm/s)	4mV
Relative output (0dB = 1mV/cm/s)	0dB
Channel balance	0.4dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 72μm
Frequency response from graph, 100Hz-5Hz	+1, −1.5dB
Frequency response from graph 30Hz-20kHz	+1, −3dB
Stereo Separation L on R 80Hz, 3kHz, 10kHz	32, 42, 36dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	38, 51, 37dB
Response limits ref computer mean, 1kHz-15kHz	+0, −2.5dB
Response limits ref computer mean, 1kHz-20kHz	+0, −2.5dB
Test tracking weight, loading	1g*, 250pF
LF resonance frequency, 13.5g arm (vert, lat)	9*, 6Hz
Estimated compliance (vert, lat)	16, 35cu
Recommended arm effective mass	5-15g
LF resonance rise, 13.5g arm (vert, lat)	10*, 16dB
Typical selling price	£40

*excluding stabiliser, see text

For graph references see issue No 43

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HI FI NEWS AND RECORD REVIEW – AUGUST 1986

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HI-FI CHOICE BEST BUY 1986

AMPLIFIERS

Cliché or not, the amplifier is the heart of the hi-fi system. Its purpose is to accept the different signals from the various sources, conform and order them as necessary, and then provide the power to drive and control the loudspeakers. In what is known as an integrated amplifier, the first part of this task is carried out in the pre-amplifier section, while the power amplifier part deals with the loudspeakers, but the whole is contained within a single box. In more costly systems these two sections are often separate units, and power supplies may also be separately cased. The tasks are quite distinct, so integration is only a matter of cost and compactness.

Twenty years ago amplifiers were mostly low powered, using Class A circuitry with valves and output transformers. Then the transistor took over rapidly, offering higher specification power, lower cost, and improved longevity. So far, so good, but the valve amplifier — like the moving coil cartridge — never quite died. And after a couple of false starts it is currently enjoying its strongest revival yet, albeit at prices which will make most readers of a *Best Buy Guide* blanche. The valve versus transistor debate is a fascinating one, though too rarefied for much of an airing in this introduction. Where cost-effectiveness is king, the transistor still rules.

The other historical trend concerns the complexity of the pre-amplifier section. When hi-fi had to make the best of barely adequate source quality, a complicated and flexible pre-amplifier section was a useful means of making the best of a bad job. During the Japanese invasion of the '70s, rival manufacturers vied with each other to invent and incorporate more and more extensive features: tone controls became graphic equalisers, and the often baffled user was encouraged to fantasise that he was on the bridge of the Starship Enterprise. However, improvements in sources have since started a 'simply better' backlash. A fledgling Naim Audio abandoned tone controls on the grounds that they degraded sound quality. This was a major heresy at the time, but the trend is now firmly established, and even some of the Japanese manufacturers followed suit.

Two Markets

There are now two distinct types of hi-fi amplifier. The so-called 'bells and whistles' models still exist, though they now tend to be down- rather than upmarket products. Those who appreciate the flexibility of extensive switching and tone shaping can now take advantage of the low prices which derive from highly efficient manufacture for a mass market.

However, the real hi-fi amplifier action has been towards improvements in sound quality, much of which has been due to simplifying the circuitry by eliminating as many frills as possible, and even in some cases omitting a complete gain stage through the use of the latest transistors. The ear has proved a more subtle tool than any spectrum analyser in adjusting circuit topography, simplifying earth patterns, beefing up power supplies, and selecting key passive components, all in the interests of improving sound quality.

Pre-amplification

As hi-fi amplifiers become increasingly minimalist, the pre-amp now only retains two key functions: the sorting out of the signals from the vinyl disc source, and the switching of the various inputs and outputs. Tuners, cassette decks, CD players, and what-have-you all put out more or less the same sort of signal, which is already equalised to 'flat'. Vinyl disc apart, the pre-amp then becomes little more than a glorified switch with volume and balance controls. Which explains why suchlike devices — using purely passive components and hence inherently simple — are now becoming available in the most specialist end of the market.

Vinyl disc replay is quite a different kettle of fish. The pre-amp is connected directly to the transducer itself, with no intervening electronics, and this introduces all sorts of difficulties. Furthermore, the signal from the cartridge is very small, and requires two distinct stages of equalisation to get a 'flat' end result. To add insult to injury, there are now two popular kinds of cartridge, the high(?) output moving magnet and low output moving coil (plus a few odd permutations), and they are different enough to need quite separate treatment. There's not even a standard for the source or input impedance of low-output cartridges.

For the future, it is quite possible we will see wider use of turntables with built-in cartridge pre-amps, so that each source feeds a 'flat' signal at line level to a simple switching and attenuating pre-amp. But now that the first digital signal source (CD) is becoming accepted, with others planned for the future, we will also shortly be seeing a new type of pre-amp which accepts digitial signals directly, carrying out various functions by means of an on-board microcomputer before finally converting the signal back to analogue before feeding to the power amplifier. Such a system should theoretically be immune from the signal degradation which has been leading the market towards simpler analogue amplifiers, and could lead to a revival of more complex pre-amps, though progress will be slow because any pre-amp section will need to handle conventional signals alongside digital for many years to come.

Power Amplifiers

This is the part of the amplifier whose job it is to drive the loudspeakers — and a right old job that can turn out to be. Like the cartridge, a loudspeaker is a transducer, and the task is to turn the electrical model of the music signal back into a mechanical (acoustical) signal for the benefit of the ears. The loudspeaker is a form of motor, but its task of covering the whole range of audio frequencies is mechanically almost intolerable, and there is an inevitable lack of control at various resonance points. While the amplifier provides the loudspeaker with a voltage which corresponds to the amplified music signal, it is the characteristics of the loudspeaker itself which determines the current demand. This current demand can be very unpredictable, particularly at resonance points, which is why serious hi-fi amplifiers are usually designed with plenty of surplus current capacity, and with an eye on the stability of the voltage signal whatever the current demand.

The main measurements on amplifiers relate to power output and distortion. Power is normally expressed in Watts, but we translate this into a measure of relative loudness, the dBW, which is far more meaningful. More important than the maximum power output itself is the way the power is maintained into different loads, and this is analysed in the reviews. The various distortion measurements also help explore the limits of the amplifier, but paradoxically, striving for very low distortion seems to prejudice sound quality.

Choosing

There are a number of criteria one could use when selecting an amplifier, and the most valid is probably sound quality. Despite the attention it attracts, power output comes much further down the list, because the differences between most models is not in fact that great, and measured power is by no means a reliable indicator of subjective loudness capability. At the top end of the market, upgrading is less likely to involve an increase in power than improved sound quality gained through changes in power supplies for pre- and power amplifiers.

The range of facilities required should naturally be taken into account, paying particular attention to the type of cartridge being used. But it should also be borne in mind that every unused feature contributes nothing and will probably have a negative effect upon the potential sound quality. While some people seem more sensitive than others to the sound of amplifiers, both pre- and power sections are fundamental to the system as a whole, simply because all signals pass through them *en route* to the loudspeakers.

The reviews provide an excellent guide to shortlisting some of the better sounding bargains in amplifiers around. But as ever they cannot replace an individual's selection to his or her own tastes, preferably in the correct system and ideally in an 'own room' context. Once again, the conscientious specialist dealer provides a vital link.

For space reasons, some Recommended and Best Buy amplifiers have been omitted where models closely resemble those already reviewed. The NAD *3020B* and Proton *520* are similar to the NAD *3120*, but have tone controls fitted, while the Best Buy Rotel *820* and *840BX* resemble the *820BX*, the former having tone controls, the latter greater power output.

Reviews reprinted from issue Nos 39 & 44 by Martin Colloms

CHELMSFORD **Rayleigh Hi-Fi** READING

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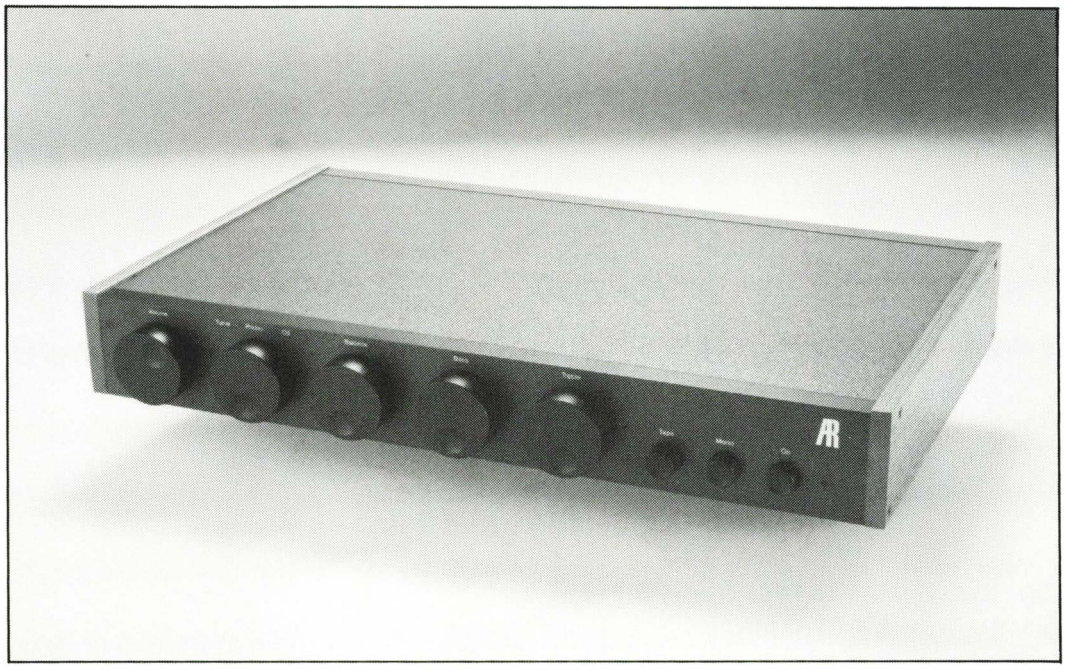
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Finished in satin with silver-grey lettering and dark wood end-cheeks, the AR amplifier remains unchanged externally for 1986, although there have been internal improvements. This moderately-priced 35W design provides disc, tape, tuner and CD inputs, with both moving-coil and moving magnet disc options. Bass and treble controls are provided, as is a mono button. Speaker connections are 4mm sockets, while all the signal inputs are the usual phonos.

Internal construction was clearly to fair standards, using two main epoxy 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.

LAB REPORT

Rated at 15.5dBW the second sample gave a generous 18.8dBW, which is heading towards 80W per channel. Power bandwidth was fine at 8ohms but more restricted at 4ohms. Peak power into 8ohms approached 100W (19.5dBW) and held well into 4ohms, while at 2ohms, 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 10ohms; however this should not cause problems except possibly with older sources.

SOUND QUALITY

The current model achieved most respectable scores in the listening sessions, well above average and showing an improvement over the original.

The sound was smooth, even bland, *via* the auxiliary input, 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 in control at the frequency extremes.

Some loss of detail and clarity were noted *via* disc 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.

CONCLUSIONS

Since our earlier tests were carried out, the construction has been improved, including phono input sockets, while the generous power delivery has been held, thereby confirming its fine value rating.

With a fine dry, dynamic range, and a lively musical performance, this amplifier is both versatile and load tolerant. The controls have a better 'feel' but otherwise the strong performance merits a firm 'Best Buy' rating.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

TEST RESULTS

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			35W(=15.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.8dBW	18.9dBW	18.9dBW
Both channels, 4ohm load	15.5dBW	16.5dBW	14.4dBW
One channel, 2ohms, pulsed	12.0*dBW	15.6dBW	14.0dBW
Instantaneous peak current		+19A	−19A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−70dB	−73dB	−65dB
Intermodulation, 19/20kHz, rated power, aux input			−63dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			>80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−79dB
Disc (mc) input (IHF, CCIR weighted)			−75dB
Aux/CD input (IHF, CCIR weighted)			−81dB
Residual, unweighted (volume control at min)			−77dB
DC output offset			34mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	34dB	32dB	30dB
Disc (mc) input (IHF)*	31dB	29dB	28dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	−68dB	−62dB	−42dB
Aux input	−70dB	−62dB	−42dB
Output impedance (damping)	0.3ohm	0.3ohm	0.3ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.1dB	0.1dB	5.8dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.52mV	47kohms 150pF
Disc (mc) input*	Phono	0.032mV	47kohms 150nF
Aux input		24.2mV	10kohms 50pF
Disc equalisation error, 30Hz-15kHz			+0.2dB, −0.3dB
Size (width, height, depth)			43×7×28.5cm
Typical price inc VAT			£175

For graph references see issue No 44

RECOMMENDED

A&R ARCAM ALPHA

A&R CAMBRIDGE LTD, DENNY INDUSTRIAL CENTRE, WATERBEACH, CAMBRIDGE CB5 9PB.
TEL: (0223) 861550



Launched at the end of 1984 under the company's Arcam brand name (also used on their speakers), the distinctively styled *Alpha* represented A&R's first completely new integrated amplifier design since the introduction of the well-known A60, which was their first hi-fi product. While the A60's price has been held to £175, A&R perceived the need for a fully-equipped amplifier at a somewhat lower price, aiming to retain the by now traditional virtues of the A60, including full facilities.

A compact integrated design, *Alpha* is distinguished by a good finish and appearance which result from A&R's professional view of engineering design. The five inputs include one moving magnet disc, and the well-laid out controls incorporate bass and treble. Output power is 30W per channel, with an output stage rated to take account of some of the more difficult loudspeaker loads. The disc input comes with a standard 47kohms/100pf characteristic, but additional loading may be retro-fitted with options down to 8kohms and up to 420pF.

The price is modest but A&R have not skimped on quality details, such as the custom silver-plated 4mm speaker cable sockets, which provide 'direct' and headphone-switched options. All inputs are the usual RCA phono jacks, with the headphone outlet a standard ¼in socket on the front panel.

Inside, the construction quality is exemplary. The unit is built on a single board with clean, simple signal paths and optimised 'star' grounding. Internal wiring is virtually non existent. The output stage is complementary bi-polar direct coupled, and the earlier stages use high quality integrated circuits. Coupling components have been reduced to a minimum in order to maximise sound quality and some top grade polypropylene capacitors have even been included.

Lab Report

Attaining a comfortable 101dBA maximum loudness on test, the peak 8ohm power delivery reached 17dBW (50W) and rated power was comfortably achieved into 2ohms on peaks. Power bandwidth was fine with a healthy peak current averaging 9A.

Distortion levels were moderate, particularly with respect to high frequency intermodulation. Noise levels were fine, with the DC offsets satisfactorily low. Input overload margins were ample and the stereo channel separation results were rather better than average. Power supply modulation was respectable for the type, while all other aspects conformed to a well balanced competent design.

Sound Quality

We were impressed by the sound quality of this model, our views somewhat at variance with those of A&R themselves, since we rated the *Alpha* higher than the latest improved A60! Essentially neutral, the disc input sounded uniformly competent, well ordered in basic areas of stereo width and focus, frontal detail and general control. High frequency definition could have been better, while bass was a trifle 'soft'. It partnered inexpensive systems well and yet did not draw undue attention to itself in a more costly arrangement.

Via the CD input a mild improvement in clarity was noticed, while the overall effect was unstrained but with moderated dynamics.

Conclusions

This well styled and built amplifier should work dependably in a wide range of systems, proving unobtrusive in amplifier terms. The overall compatibility was very good, and this coupled with the good standard for absolute sound quality assures the Alpha of firm recommendation.

Update

A new alpha will shortly be available, not yet *Choice* tested but which the manufacurer claims is slightly improved, with a toroidal transformer. Price will be £140 and an alternative will be black finish.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			30W(=15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	15.8dBW	16.2dBW	16.0dBW
Both channels, 4ohm load	12.3dBW	13.3dBW	13.1dBW
One channel, 2ohms, pulsed	–dBW	14.6dBW	–dBW
Instantaneous peak current		+7.5A	–11.0A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–73.7dB	–73.1dB	–66.2dB
Intermodulation, 19/20kHz, rated power, aux input			–77.9dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–73.7dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			n/a dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–73.0dB
Disc (mc) input (IHF, CCIR weighted)			n/a dB
Aux/CD input (IHF, CCIR weighted)			–76.9dB
Residual, unweighted (volume control at min)			–78.9dB
DC output offset			left –8mV, right +6mV
DC offset, pre-amp			left n/a mV, right n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	27.0dB	27.1dB	27.6dB
Disc (mc) input (IHF)	n/a dB	n/a dB	n/a dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	68.2dB	71.8dB	56.3dB
Aux input	69.2dB	70.3dB	64.3dB
Output impedance (damping)	0.27ohm	0.27ohm	0.33ohm
Channel balance, disc, at 1kHz			0.28dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0.05dB	0.22dB	0.87dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.42mV	46kohms 110pF
Disc (mc) input*	n/a	n/a mV	n/a kohms n/a nF
Aux input	Phono	36.0mV	23.0kohms 36pF
Power amp	n/a	n/a mV	n/a kohms n/a pF
Output, pre-amp (tape)			10.0V max, 180ohms
Disc equalisation error, 30Hz-15kHz			+0dB, –1.5dB
Size (width, height, depth)			40×8×22cm
Typical price inc VAT			£130

For graph references see issue No 44

RECOMMENDED

AUDIOLAB 8000A

CAMBRIDGE SYSTEMS TECHNOLOGY LTD, 26 ROMAN WAY, GODMANCHESTER, HUNTINGDON, CAMBS PE18 9LN. TEL: (0480) 52521



Now a well established model, the 8000A was the first of a new range of electronics designed by two 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; however these are said to be specifically designed to have a negligible effect on sound quality. Comprehensively equipped, the input facilities are all phono, and include disc (mm and mc), tape 1 and 2, plus tuner and CD/aux. A proper 'record out' selector matches the input selector. A headphone socket is provided, which mutes the two sets of speaker outputs *via* a high-quality relay. A small dealer modification provides for separate pre/power amp use if this is required by the user, but in this mode the circuitry which prevents switch-on thumps will not operate.

As well engineered internally as it is finished externally, the amplifier 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 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.

Lab Report

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 ±28A peak current capability was more than sufficient for the rated power. Peak level approached 100W per channel (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 barrier 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, 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 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 level at low impedance for other power amplifiers. Subjectively, no change in sound quality could be heard with the tone controls engaged.

Sound Quality

This amplifier surprised all those who heard it. On moving-coil input the overall subjective rating was 'good plus', which is 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.

A marginal improvement of depth was noticed *via* moving-magnet input, while the treble remained slightly imperfect; here a hint of 'fuzziness' and 'grain' was a little sweeter than on moving-coil, with some further advance in treble quality and a touch more clarity.

The sound remained very good *via* aux 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 prouduced into the severe load.

Conclusions

For '86, Audiolab have maintained a good sound quality, by subtle improvements to the interior circuitry. The 8000A remains a fine integrated amplifier of very good power delivery and also provides an excellent finish and build quality. The tone controls do not detract from the performance, while its load tolerence is exceptional. A highly versatile model, this superior quality design remains firmly recommended.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

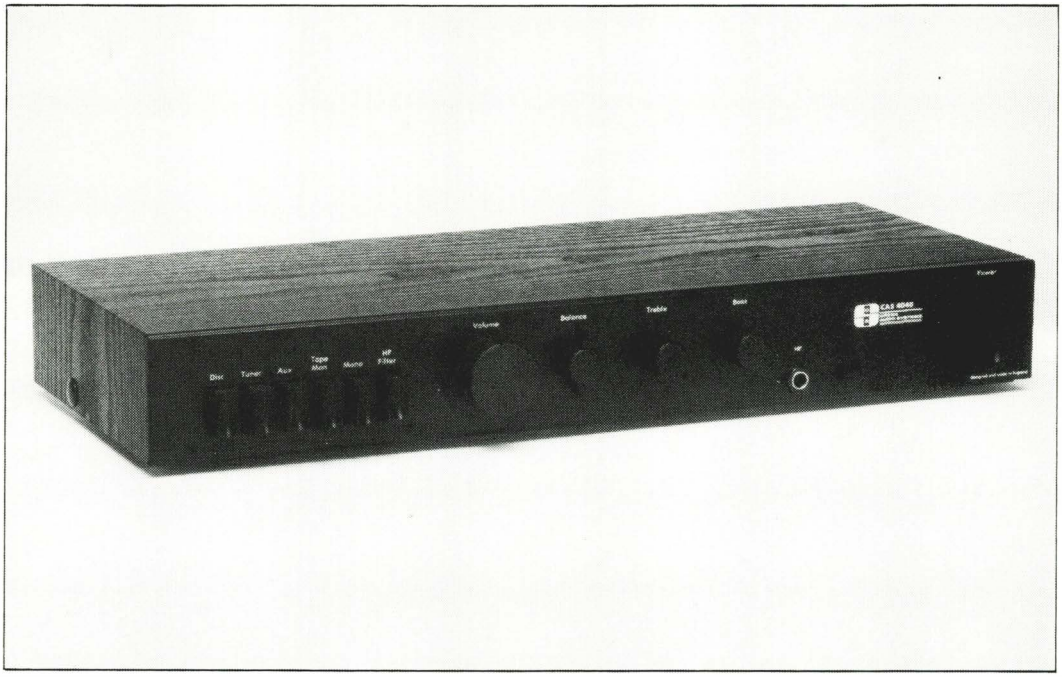
Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			50W(=17dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.4dBW	19.5dBW	19.0dBW
Both channels, 4ohm load	17.2dBW	17.6dBW	17.0dBW
One channel, 2ohms, pulsed	17.8dBW	18.0dBW	17.3dBW
Instantaneous peak current		+27A	−28A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−90dB	−95dB	−80dB
Intermodulation, 19/20kHz, rated power, aux input			−85dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−85dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−78dB
Disc (mc) input (IHF, CCIR weighted)			73dB
Aux/CD input (IHF, CCIR weighted)			−82dB
Residual, unweighted (volume control at min)			−78dB
DC output offset			left 2mV, right 3mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	29dB	30dB	30dB
Disc (mc) input (IHF)*	26dB	26dB	26dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	−90dB	−72dB	−50dB
Aux input	−78dB	−77dB	−56dB
Output impedance (damping)	0.03ohm	0.04ohm	0.12ohm
Channel balance, disc, at 1kHz			0.04dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.04dB	0.0dB	3.6dB
Input data	socket type	sensitivity	loading
Disc (mm) input	DIN	0.3mV	47kohms 35pF
Disc (mc) input	DIN	0.007mV	100ohms 4.7nF
Aux input	DIN	12mV	20kohms 70pF
Output, pre-amp (tape)			7.7V max, 600ohms
Disc equalisation error, 30Hz-15kHz			+0.1dB, −2.2dB
Size (width, height, depth)			44.5×7.4×34cm
Typical price inc VAT			£299

For graph references see issue No 44

RECOMMENDED

CREEK 4040

CREEK AUDIO SYSTEMS, 2 BELLEVUE ROAD, FRIERN BARNET, LONDON N11 3ES.
TEL: 01-368 4425



Creek's UK-built budget amplifier 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 not direct from the manufacturer.

LAB REPORT

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 4ohm 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, 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 significant error in the treble.

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 and lively. 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.

CONCLUSIONS

At moderate disc modulation levels one cannot deny this amplifier 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 feel personally that more work could much improve this already promising design.

Note

Creek Audio 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. Various technical changes have been made since we last reviewed the 4040 *but as yet these have not been evaluated in* Choice.
*Phono sockets will be fitted for disc input from Autumn '86.

TEST RESULTS

Power output	Integrated amplifier		
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, 4ohm load	11.0dBW	13.9dBW	13.2dBW
One channel, 2ohms, pulsed	8.5dBW	12.0dBW	12.6dBW
Instantaneous peak current		+10A	−9A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−50dB	−57dB	−38dB
Intermodulation, 19/20kHz, rated power, aux input			−35dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			see text
Noise			
Disc (mm) input (IHF, CCIR weighted)			−74dB
Aux/CD input (IHF, CCIR weighted)			−75dB
Residual, unweighted (volume control at min)			−61dB
DC output offset			2mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	16dB	15dB	−3dB
Aux/CD input (IHF)	17.9dB	18dB	17.9dB
Stereo separation			
Disc input (mm)	69dB	−67dB	−43
Aux input	−65dB	−65dB	−40dB
Output impedance (damping)	0.03ohm	0.04ohm	0.09ohm
Channel balance, disc, at 1kHz			0.04dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.6dB	0.2dB	5.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.47mV	47kohms 220pF
Aux input	DIN	70.4mV	54kohms −pF
Disc equalisation error, 30Hz-15kHz			+1.4dB, −0.5dB
Size (width, height, depth)			42×6×18cm
Typical price inc VAT			£145

For graph references see issue No 39

RECOMMENDED

CROFT MICRO (Pre-amplifier only)

CROFT ACOUSTICS, 15 HARRISON ROAD, ERDINGTON, BIRMINGHAM B24 9AB.
TEL: (021) 373 1442



The *Micro* is croft Acoustics' least expensive product, and perhaps rates as the world most value-conscious valve pre-amplifier, though it still might be considered a mite esoteric for this *Best Buy Guide* appearance. Drawing on Croft's experience in designing and manufacturing upmarket products, the only compromise involved in the *Micro's* construction appears to be in the case.

This Pre-amp offers a single moving-magnet disc input (just adequate for the higher output moving-coil cartridges provided the power amp sensitivity is healthy enough), plus CD, tuner and tape. No balance or tone controls are included.

Inside, the hardwired construction (using single strand wire) is to a high standard throughout, with all power supplies fully regulated, while audiophile-grade capacitors are used in the RIAA disc equalisation and coupling networks. Each disc input uses a double triode, with shunt feedback equalisation, and the line stage has unity gain, comprising a simple cathode-follower buffer. With some sources, the auxiliary input gain may be too low and the intending purchaser should therefore check compatibility with other equipment. Compact Disc will be fine but some tuners or cassette decks may prove too quiet in the context of a given system combination.

Lab Report

Measured performance was to a textbook standard, with negligible distortion and satisfactory overload margins, although the latter deteriorated at high frequencies. Channel separation was fine, while signal-to-noise ratios were particularly good. Output impedance was satisfactorily low, and sufficient for selected cable runs of up to five metres.

The RIAA equalisation was commendably accurate at ±0.2dB from 30Hz to 15kHz, rising a little at ultrasonic frequencies, to +2.1dB at 100kHz. Note that the rated input sensitivities were for a nominal 0.5V nominal IHF output level.

Sound Quality

Both disc and auxiliary inputs set a very high standard. On disc, the sound was lively and dynamic, transparent and basically well balanced. No specific weaknesses were observed.

A similar result was obtained via auxillary (CD).

The bass showed drive and extension, with the treble just a little 'fuzzy'. Detail and depth effects were fine and stereo images well-focused. The sound proved notably unfatiguing, with a stable, coherent quality. Background noise was also satisfactorily low when used with moving-coil cartridges of decent output such as the van den Hul *MC10 Super*.

Conclusions

We really liked this modest pre-amp. If carefully interfaced to a selected system, the sound quality competed with some of the best pre-amplifiers costing two or three times the price, and for the valve enthusiast, the *Micro* is a godsend. An exceptional product, it can only be strongly recommended, as no Best Buy category exists for separates!

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−76.0dB	−78.3dB	−76.5dB
Intermodulation, 19/20kHz, rated power, aux input			−93.1dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−41.0dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−73.5dB
Aux/CD input (IHF, CCIR weighted)			−92.0dB
Residual, unweighted (volume control at min)			−86.5dB
DC output offset			left 0mV, right 0mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	22.8dB	24.0dB	5.9dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	61.2dB	62.8dB	36.0dB
Aux input	101.3dB	82.0dB	57.3dB
Channel balance, disc, at 1kHz			0.37dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.02dB	0.19dB	6.20dB

Input data	socket type	sensitivity	loading	
Disc (mm) input	Phono	2.92mV	47kohms	110pF
Aux input	Phono	550mV	480kohms	45pF
Output, pre-amp (tape)		11.1V max,	500ohms	
Disc equalisation error, 30Hz-15kHz		+0.26dB,	−0.16dB	
Size (width, height, depth)		25.5×7×18.5cm		
Typical price inc VAT		£150		

For graph references see issue No 44

BEST BUY

DENON PMA-707

HAYDEN LABORATORIES, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST PETER, BUCKS SL9 9UG.
TEL: (0753) 888447



The Denon brand has recently been making spectacular headway in the hi-fi cassette deck market while recent Denon tuners and cartridges have been highly rated in previous editions of *Hi-Fi Choice*. Historically the company has not been particulary well known in the UK for its amplifier designs, no doubt the distributors are hoping that the £100 *PMA-707* will put this right!

Immaculately finished in black, the '*707* is a compact integrated amplifier, with a rated power output of 25W per channel into 8ohms, both channels driven. As might be expected, the clearly-lettered front panel offers just basic facilities — a headphone outlet is provided *via* the usual ¼ in front panel jack socket, and there is provision for connecting two sets of speakers and two tape decks with facilities for cross-dubbing. Other inputs include LP disc (moving magnet only), Compact Disc/video and tuner. Speaker terminals are simple spring-clip devices, while inputs are *via* the usual array of RCA phono sockets. The disc input may be used with or without a 12dB/octave subsonic filter, operating below 16Hz, and the single tone control offers a useful 'loudness' enhancement if desired.

Inside, this amplifier was better built than one might have expected at the price, with through-flow internal heatsinking, plus two generous 1000*u*F reservoir capacitors. The output stage is direct-coupled complementary bi-polar, with an integrated driver chip. The moving-magnet analogue disc input RIAA equalisation is based around a low-noise dual-channel integrated circuit, and construction is a straightforward single board with generous power transformer.

LAB REPORT

Power delivery was quite respectable, exceeding 50W peak, with an excellent power bandwidth plus realistic load tolerance and good peak current capability. All measured distortions were negligible and the noise levels were very good. DC offset at the power amplifier was fine, with the output impedance as specified. Disc overload was exemplary and the stereo channel separation surprisingly good. The amp remained good on channel balance except at the lowest volume settings.

On the input side, the sensitivities were to a sensible level, while the RIAA disc equalisation was also very good. The '*707* performed well on the 40Hz power test with negligible supply modulation.

SOUND QUALITY

The *707* scored a straight 'average' on the listening tests which was a significant achievement considering the price. Peak sound levels reached a surprising 102dBA into 8ohms, with a fair 4ohm delivery. The *707* sounded quite lively and direct on CD, strong on detail but weaker in terms of stereo focusing. A touch of 'grit' was audible in the treble while the bass was about average in firmness and power.

Some loss in bass quality was observed *via* disc, with a further loss in focus apparent in the treble. Conversely, the sound retained a reasonable level of interest with a generally solid, tidy effect.

CONCLUSIONS

This cheerful-sounding amplifier performed well on lab tests; the power delivery was pretty good and the basic performance was finely specified. A solid, dependable budget amplifier, it rose well above the 'rack system' class and merits Best Buy status.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

TEST RESULTS

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			25W(=14dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.9dBW	17.0dBW	16.7dBW
Both channels, 4ohm load	13.2dBW	13.6dBW	13.2dBW
One channel, 2ohms, pulsed	–dBW	13.1dBW	–dBW
Instantaneous peak current		+7.6A	–7.2A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–81.0dB	–84.5dB	–69.9dB
Intermodulation, 19/20kHz, rated power, aux input			–81.6dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–91.6dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			–dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–69.5dB
Disc (mc) input (IHF, CCIR weighted)			–dB
Aux/CD input (IHF, CCIR weighted)			–76.6dB
Residual, unweighted (volume control at min)			–85.4dB
DC output offset			left 2mV, right 11mV
DC offset, pre-amp			left –mV, right –mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32.2dB	31.5dB	30.8dB
Disc (mc) input (IHF)	–dB	–dB	–dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	86.2dB	79.7dB	49.4dB
Aux input	87.2dB	75.8dB	49.7dB
Output impedance (damping)	0.150hm	0.150hm	0.120hm
Channel balance, disc, at 1kHz			0.11dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0.03dB	0.07dB	3.92dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.54mV	45kohms 300pF
Disc (mc) input*	n/a	n/a mV	n/a kohms n/a nF
Aux input	Phono	32.5mV	54kohms 200pF
Power amp	n/a	n/a mV	n/a kohms n/a pF
Output, pre-amp (tape)			9.5V max, –ohms
Disc equalisation error, 30Hz-15kHz			+0dB, –0.40dB
Size (width, height, depth)			43.5×9×27cm
Typical price inc VAT			£100

For graph references see issue No 44

RECOMMENDED

HARMAN-KARDON PM645

HARMAN (AUDIO) UK LTD, MILL STREET, SLOUGH, BERKS SL2 5DD.
TEL: (0753) 76911



Harman Kardon amplifier models have enjoyed a good run of favourable reviews in previous *Hi-Fi Choice* issues, and have been well received elsewhere. The design of the successful *PM-640, '650* and *'660* models was partly based on research by the designer Matti Otala which indicated a need for higher peak current capability than had previously been thought necessary, to allow an amplifier to drive a 'real' loudspeaker load under dynamic conditions. These original 'high peak current' models have been updated somewhat, as the addition of '5' to the model numbers indicates, and to represent the current series we have chosen the *PM-645*.

At around £190, the *'645* enters a crowded and competitive part of the market, but does come fully equipped and very well finished. Built for the American company in Japan (by the Silver Corporation), it is handsomely presented in a pale gold anodised livery. It is rated at 40W (16dBW) per channel and claims high output current capability as a major design feature, making it suitable for a wide range of speakers, and will happily tolerate two sets of loudspeakers of normal impedance rating.

No moving-coil input is present but the remaining line-up of facilities is comprehensive enough. Tone controls are provided together with a headphone outlet and switching for two independent sets of loudspeakers. The 'bass contour' adds 'loudness' compensation, while both subsonic and treble cut filters are present. In addition to CD, tuner and disc inputs, two tape decks may be connected. The inputs are the usual RCA phono sockets and speaker connection uses binding posts.

Inside, a generously sized power transformer feeds a complementary, bi-polar, direct-coupled output stage. A considerable number of printed circuit boards have many cable harnesses, involving long signal paths. It is surprising how complex the construction of a straightforward amplifier such as this can be made. However, the quality of workmanship is high.

LAB REPORT

Confirming the listening results, this amplifier provides almost 95W (19.5dBW) peak into 8ohms, with almost the same available into 2ohms! Superb load tolerance this, with peak current of 20A available. Power bandwidth was excellent. Distortion levels were moderate and unexceptional, with fine noise levels. DC offset was held to a low level. The output impedance of the power amplifier was negligible throughout the band. Input overload margins were fine while good stereo separation figures were also recorded. There were no problems with channel balance or input sensitivities and their associate impedances.

The power supply modulation result could have been better. RIAA equalisation was however to a good standard, measuring +0.8, −0.3dB, showing some mild bass lift.

SOUND QUALITY

Rating a straight 'good' in the listening tests, the *'645* did pretty well, perhaps better than one would have predicted from a view of its interior! It proved capable of good sound levels, contradicting its modest specification, reaching 104 and 103dBA with 8 and 4ohm loads. Slight mechanical hum was audible, however. Considered well balanced on both cartridge and CD inputs, it could portray a fair proportion of the depth and ambience in the programme, while stereo images were stable and well-focused.

Bass was generally good if a little lightweight, while the treble quality was well above average. In the mid the tonal balance was pitched higher than normal with some veiling of fine detail.

CONCLUSIONS

This competent amplifier performed well in virtually all aspects of testing. Its output power was rather generous and furthermore it could be provided to a wide range of loads, including double sets of 8ohm loudspeakers. The constructional quality and finish were to the usual high standard so recommendation is the appropriate outcome, though the recent price increase has reduced competitiveness.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

TEST RESULTS

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			40W(=16dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.0dBW	18.0dBW	17.9dBW
Both channels, 4ohm load	15.2dBW	16.0dBW	15.8dBW
One channel, 2ohms, pulsed	−dBW	19.5dBW	−dBW
Instantaneous peak current		+19.0A	−22.5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−62.0dB	−62.9dB	−62.7dB
Intermodulation, 19/20kHz, rated power, aux input			−66.2dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−69.0dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−71.7dB
Disc (mc) input (IHF, CCIR weighted)			−dB
Aux/CD input (IHF, CCIR weighted)			−73.9dB
Residual, unweighted (volume control at min)			−74.5dB
DC output offset			left 12mV, right 5mV
DC offset, pre-amp			left −mV, right −mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	29.3dB	29.5dB	29.5dB
Disc (mc) input (IHF)	n/a dB	n/a dB	n/a dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	55.0dB*	83.3dB	61.3dB
Aux input	52.3dB*	77.1dB	53.8dB
Output impedance (damping)	0.10ohm	0.10ohm	0.13ohm
Channel balance, disc, at 1kHz			0.52dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.01dB	0.52dB	0.91dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.35mV	47kohms — pF
Disc (mc) input	—	—mV	—ohms — nF
Aux input	Phono	21.0mV	—kohms — pF
Power amp	—	—mV	—kohms — pF
Output, pre-amp (tape)			9.13V max, —ohms
Disc equalisation error, 30Hz-15kHz			+0.87dB, −0.30dB
Size (width, height, depth)			44×10×36cm
Typical price inc VAT			£189

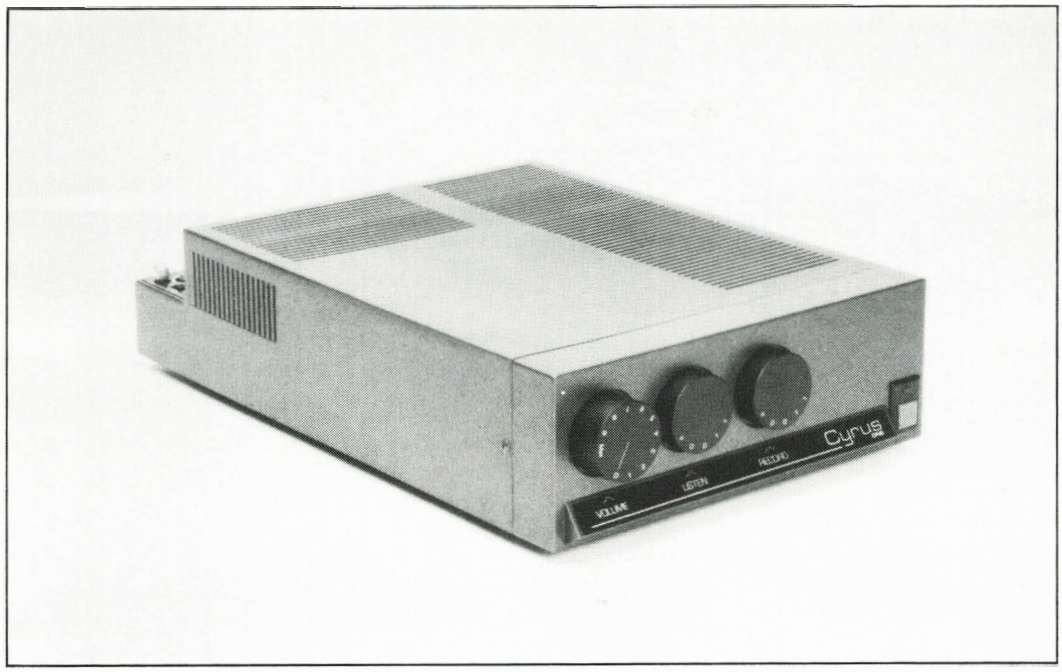
*inc noise

For graph references see issue No 44

BEST BUY

MISSION CYRUS ONE

CYRUS ELECTRONICS LTD, STONEHILL, HUNTINGDON, CAMBS PE18 6ED.
TEL: (0480) 57477



The distinct resemblance in the appearance between the *Cyrus One* and the now superceded *778* is not accidental. However, almost nothing of the *778* remains as regards internal design, for the *Cyrus* represents a new approach on the part of Mission's designer, in returning to normal transistors (rather than MOSFETS) for the output stage. Rated output is a modest 30W (14.5dBW) while the amplifier is also distinguished by the inclusion of a variable gain disc input that is quiet enough to carry out a reasonable job with medium output moving coil cartridges.

Largely constructed from plastic casings this design is particularly compact. Input facilities are comprehensive (all phono sockets) and it also has a versatile 'record out' selector which can delete the recorder from the signal path when not in use.

Inside, the direct coupled complementary output amplifiers are fed from a single dual-rail power supply energised by a good quality toroidal transformer. Fast 15A output transistors are used with a 70 MHz FT. No line amplifier is present; instead the power amp is run at a higher than usual gain while the line inputs are fed directly to the medium impedance volume control.

The disc amplifier is based on a 5334 integrated circuit, with evident use of high quality metal film resistors and selected audio grade coupling capacitors.

LAB REPORT

The specified rating was comfortably exceeded, with a peak power of 17dBW into 8ohms and a full power bandwidth 'cruising' power of almost 16dBW (40W). Fully driven into 4ohms, the power supply sagged with the level down to 13dBW overall. The 12.5dBW output into 2ohms was reasonably healthy coupled with a decent +11, −10A peak current.

All the distortion results were generally good except on mc, where the −58dB recorded could be considered marginal; OK only for the healthier-output models such as the Ortofon *MC10 Super*. DC offsets were negligible, while input overload margins were fine. Channel separation was strangely and deliberately just average at around 45dB, though this did not appear to spoil the sound!

Channel balance was very good with a uniform RIAA equalisation showing just a touch of bass and treble cut. A subsonic filter was included. Note that the disc input impedance remained constant regardless of the mc or mm operation. The auxiliary setting was well matched to CD sources. Ripple rejection was just average at −84dB judging by the 40Hz 4ohm power spectrogram.

SOUND QUALITY

Almost from the outset, the high sound standard set by the *One* was well appreciated. Here was a musical, transparent amplifier of adequate size which conveyed a decent measure of depth, space and ambience in the stereo sound stage. Focusing was good, and its overall character was relatively neutral, remaining so throughout its usable and surprisingly wide dynamic range. Moderate clipping overload seemed hardly to affect the sound.

Very little deterioration was noted *via* disc. The clean, confident and slightly lightweight character remained; such a performance in fact came close to rivalling some of the costly recommended separates.

CONCLUSIONS

Reauditioned for 1986, the *Cyrus One* showed some detail improvements including better bias tracking. Whatever the reason, the *One* has again moved upwards, with listening test scores indicating a 15% sonic improvement which was rather surprising. Once warm (5-10 minutes) the amplifier establishes the reference standard for its category. Dynamic and musical, it won't compromise even an expensive audio system and is therefore a strong Best Buy.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

TEST RESULTS

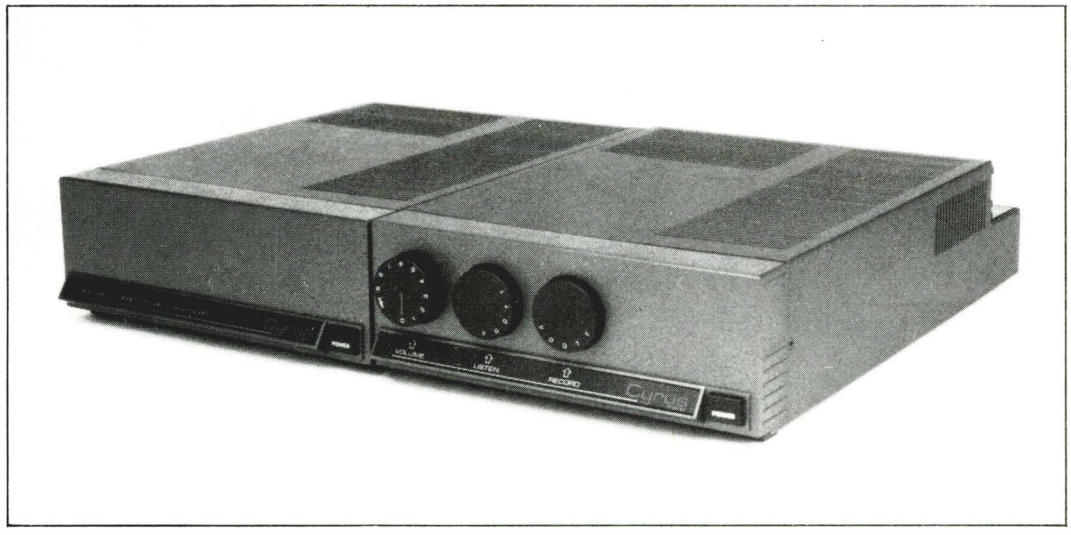
Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			25W(=14dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	15.9dBW	16.5dBW	16.3dBW
Both channels, 4ohm load	13.0dBW	13.7dBW	13.4dBW
One channel, 2ohms, pulsed	–dBW	12.5dBW	–dBW
Instantaneous peak current		+11A	−10A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−90dB	−92dB	−72dB
Intermodulation, 19/20kHz, rated power, aux input			−90dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−90dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−90dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−72dB
Disc (mc) input (IHF, CCIR weighted)			−58dB
Aux/CD input (IHF, CCIR weighted)			−77dB
Residual, unweighted (volume control at min)			−75dB
DC output offset			left 6mV, right 7mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	31dB	28dB	28dB
Disc (mc) input (IHF)	30dB	28dB	28dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	−47dB	−47dB	−48dB
Aux input	−42dB	−43dB	−42dB
Output impedance (damping)	0.05ohm	0.05ohm	0.06ohm
Channel balance, disc, at 1kHz			0.2dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.05dB	1dB	3dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.4mV	47kohms 280pF
Disc (mc) input*	Phono	0.04mV	47kohms 280pF
Aux input	Phono	64mV	−kohms −pF
Power amp	n/a	n/a mV	n/a kohms n/a pF
Output, pre-amp			−V max, −ohms
Disc equalisation error, 30Hz-15kHz			+0dB, −1.6dB
Size (width, height, depth)			21×9×34cm
Typical price inc VAT			£150

For graph references see issue No 44

BEST BUY

MISSION CYRUS TWO AND PSX

CYRUS ELECTRONICS LTD, STONEHILL, HUNTINGDON, CAMBS PE18 6ED.
TEL: (0480) 57477



Mission's *Cyrus One* and *Two* look very similar but important internal differences distinguish them, as well as the matter of some £150 sterling! For the *Two*, the output level has been increased to 50W (17dBW) and output current has also been doubled. Higher quality components are used while the disc stage has also been extensively upgraded to produce an 11dB improvement in noise level *via* mc with optimised input loading. Two large selector switches dominate the front panel, one for the sources and the other for record 'out'. No balance, tone or any other controls are present, save for volume.

The internal construction follows the *'One*, using a single printed circuit board, plus a large Holden and Fisher toroidal mains transformer. The direct coupled output uses fast complementary output transistors in classic class A/B mode while the single power supply is shared between the channels. Input connections are phono, the speakers connected *via* large 4mm socket/binding posts which are located rather too close together. Mains input is *via* an IEC socket and matching cable, while a headphone outlet is located on the back panel. (This is not as inconvenient as it sounds, since the rear panel is an accessible horizontal ledge.)

LAB REPORT

Producing close on 18dBW on peaks, the *Two* happily drove the 8ohm load to 17.6dBW over the test power bandwidth. A significant 3dB loss in level was noted into 4ohms, both channels driven, suggesting the transformer could be larger (a special booster pack is now available — the optional *PSX*). The pulsed rating on 2ohms showed a little more than 2dB loss, confirming the worthwhile peak current rating of +22.5, −17.5A (the asymmetry would be advantageous if reversed in polarity). Load tolerance was good.

Both types of measured distortion were very low, particularly the high frequency intermodulation. Input noise levels were fine, including moving coil, while the DC offset at the speaker terminals was held to a satisfactory level. Input overload levels were ample, and the overall output impedance was held to a negligible value. As with the *One*, channel separation was held at a constant but satisfactory average of 45dB, but a channel imbalance of 1.8dB was noted on disc, although this was said to be atypical.

Volume tracking was fine except at low settings and a better potentiometer would be an advantage here. All input loadings and sensitivities were to a sensible standard, while disc equalisation was accurate with a subsonic rolloff plus a touch of HF rolloff. The significance of the 40Hz power spectrum is not yet well established, but here the *Cyrus Two* was unexceptional.

SOUND QUALITY

One word sums up this remarkable amplifier: impressive! Good as the *Cyrus One* undoubtedly is, the *Two* is in another class altogether. The sound stage was spacious and deep, showing fine ambience, focus and breadth. It was transparent and produced much fine detail, remaining neutral and highly confident over the whole frequency range. It could also be driven hard without audible distress.

Maximum sound levels of 103dBA and 101.5dBA into an adverse load were obtained and it also clipped well. The fine quality held up well *via* disc. The tonal character was slightly bright with a touch of mid 'thinness', but lacked the usual hardness or brittleness often encountered with moderately priced gear. It could also do fair justice to some substantially good cartridges such as the van den Hul *MC10*, costing as much as the amplifier!

CONCLUSIONS

Reassessed for 1986 the *Cyrus Two* provided an improved performance and remains quite exceptional in sound quality terms. Adding the *PSX* (a larger, separate power supply for the power amp section) we have a pre- and power-amp combination of slightly greater power delivery and a still better sound, and in this guise the *Cyrus* is edging towards true audiophile territory, but still at a realistic price. The *Cyrus Two* commands a Best Buy rating while the *PSX* system is also strongly recommended.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

TEST RESULTS

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			50W(=17dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.7dBW	17.8dBW	17.6dBW
Both channels, 4ohm load	14.4dBW	14.7dBW	14.6dBW
One channel, 2ohms, pulsed	–dBW	15.4dBW	–dBW
Instantaneous peak current		+22.5A	−17.5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−85dB	−80dB	−75dB
Intermodulation, 19/20kHz, rated power, aux input			> −90dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −90dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			> −90dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−76.0dB
Disc (mc) input (IHF, CCIR weighted)			−69.0dB
Aux/CD input (IHF, CCIR weighted)			−80.0dB
Residual, unweighted (volume control at min)			−73.0dB
DC output offset		left −26mV, right 13mV	
DC offset, pre-amp		left n/a mV, right n/a mV	
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	38.0dB	36.0dB	36.0dB
Disc (mc) input (IHF)	26.0dB	23.0dB	23.0dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	47.0dB	47.0dB	46.0dB
Aux input	43.5dB	43.0dB	42.0dB
Output impedance (damping)	0.15ohm	0.15ohm	0.15ohm
Channel balance, disc, at 1kHz			1.8dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.06dB	0.1dB	5.0dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.33mV	47kohms 260pF
Disc (mc) input	Phono	0.023mV	470ohms 7pF
Aux input	Phono	60.0mV	14.0kohms 300pF
Power amp	—	mV	—kohms pF
Output, pre-amp (tape)		75.0V max,	700ohms
Disc equalisation error, 30Hz-15kHz		+0dB,	−1.0dB
Size (width, height, depth)		21×9×34cm	
Typical price inc VAT		£300 (£500 with PSX)	

For graph references see issue No 44

RECOMMENDED

MUSICAL FIDELITY A1

MUSICAL FIDELITY, UNIT 16, OLYMPIC TRADING ESTATE, FULTON ROAD, WEMBLEY HA9 0ND
TEL: 01-900 2999



With a rated 20W per channel, the Musical Fidelity *A1* is one of the smallest amplifiers in *Choice* yet its price exceeds £200. In return, however, it sets out to offer a high standard of sound quality, based primarily on the full class A output stage. Enough standing current flows continuously through the output stage to always meet the rated load demand and to help dissipate the large amounts of heat generated, the whole top surface is a finely finned satin black radiating surface.

A 'straight line' design, the *A1's* only controls are for volume and input selection. All inputs are *via* RCA phono sockets; speaker outputs are 4mm sockets. Tape, auxiliary/tuner, CD and disc inputs are provided, and the latter may be switched for moving magnet or moving-coil sensitivities, and the relevant loadings.

With the input stage executed in integrated circuits, the bi-polar output stage is direct-coupled complementary. The power supply is shared between channels and energised by a sizeable toroidal transformer.

After prolonged use this amplifier runs rather hot — too hot in fact to touch comfortably, and under no circumstances should it be covered: LP's melt readily on it! I suggested a thermal trip to safeguard against overheating, and this is now a production feature.

Lab Report

The rated output was met into 8ohms, but the level fell significantly into 4ohms, effectively to under half power here. Peak current was a modest ±3.8A, which was just sufficient for 4–8ohm speakers under peak programme conditions. At rated power, distortion levels were a satisfactory −50dB or 0.3%. It was fine on intermodulation except *via* moving-coil, this result due to premature overload. Noise levels were fine while the output offset was satisfactorily low. Input overloads were fine in practice while the stereo separations were particularly good.

Channel balance was accurate and the input sensitivities were judged sensibly. The output impedance was higher than average at a typical 0.4ohms, and this could marginally affect the tonal balance of some loudspeakers.

It performed well with respect to the 40Hz modulation tests, showing a very clean output at a modest power level. But the RIAA equalisation was less satisfactory. Both bass and treble were somewhat curtailed, the bass particularly so *via* the moving-coil input, this heard on audition. Indeed, via moving-coil the bass rolled away below the 100Hz and was already −4dB by 50Hz.

Sound Quality

Performing well in the listening tests, the *A1* could produce higher sound levels than expected — up to a satisfactory 96dBA (4ohms), though higher impedance loads are preferred. Mild transformer hum was noted.

On Compact Disc/auxiliary, this amplifier proved to have a respectable bass quality plus pleasant transparency. Good depth and ambience was present in the stereo sound stage. Well-focused, it also possessed a natural, articulate quality.

The sound quality suffered a little *via* the disc input, with less midrange sweetness and some softening in the bass. *Via* moving-coil, a further loss occurred, and here the bass was disappointingly weak. The characteristic treble delicacy and stereo depth remained, however.

Conclusions

Close to Best Buy territory, the *A1* actually missed this ultimate rating due to its weaker performance on the moving-coil input. At the price, the power level was also on the low side. Conversely, it did live up to its maker's name, providing, sweet musical and transparent sounds of fine stereo quality, these qualities securing firm recommendation.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			20W(=13.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	13.8dBW	13.7dBW	13.5dBW
Both channels, 4ohm load	8.7dBW	8.9dBW	8.8dBW
One channel, 2ohms, pulsed	−dBW	8.3dBW	−dBW
Instantaneous peak current		+4.0A	−3.6A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−50.0dB	−52.0dB	−50.0dB
Intermodulation, 19/20kHz, rated power, aux input			−62.4dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−71.9dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−26.0dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−70.0dB
Disc (mc) input (IHF, CCIR weighted)			−67.0dB
Aux/CD input (IHF, CCIR weighted)			−82.7dB
Residual, unweighted (volume control at min)			−76.2dB
DC output offset			left 26mV, right 4mV
DC offset, pre-amp			left n/a mV, right n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	21.6dB	29.9dB	29.8dB
Disc (mc) input (IHF)*	25.3dB	28.6dB	23.0dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mc)	66.9dB*	92.8dB	65.8dB
Aux input	66.6dB*	93.3dB	68.4dB
Output impedance (damping)	0.37ohm	0.41ohm	0.44ohm
Channel balance, disc, at 1kHz			0.15dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.15dB	0.12dB	1.64dB
Input data	socket type	sensitivity	loading
Disc (mm) input		0.43mV	47kohms 120pF
Disc (mc) input		0.04mV	120kohms 0.20nF
Aux input		23mV	46kohms 50pF
Output, pre-amp (tape)			7.5V max, −ohms
Disc equalisation error, 30Hz-15kHz			+0dB, −2.75dB
Size (width, height, depth)			41×6.5×26cm
Typical price inc VAT			£209

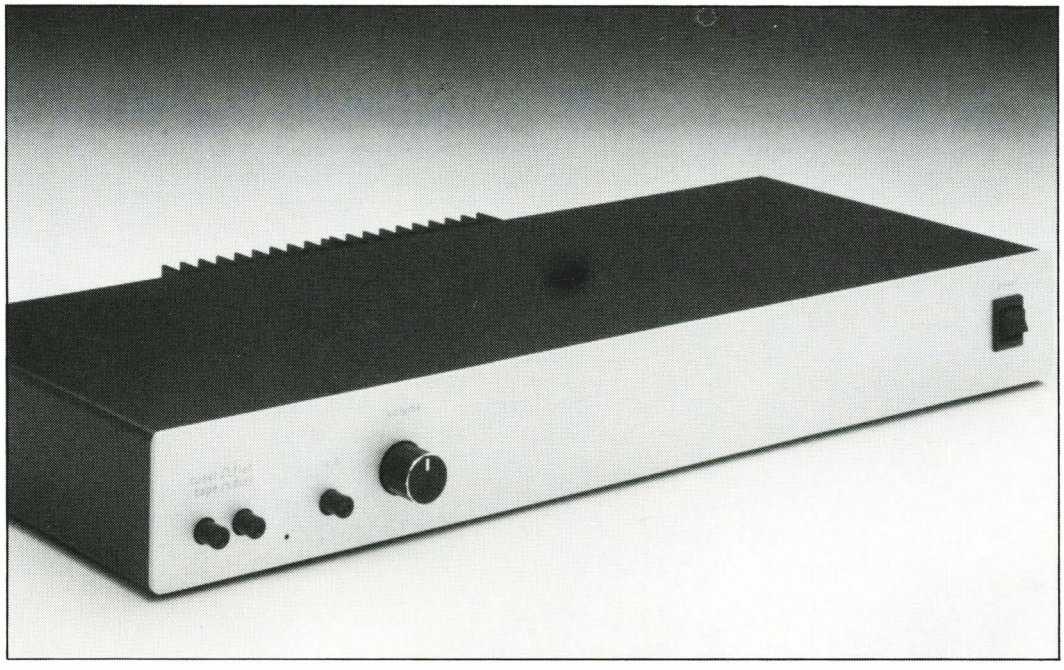
*inc noise

For graph references see issue No 44

RECOMMENDED

MYST TMA3

MYST LTD, THE OLD SURVEYOR'S OFFICE, WEOBLEY, HEREFORD.
TEL: (054431) 8811



With the price held to £250 for 1986, the *TMA3* is an example of an amplifier built to very high standards but in low production volumes. The company concerned is a small but dedicated, and have designed this no-frills, low-line integrated amplifier to give a normal-use output of 40W per channel.

Appearance is distinctive, with a cobalt blue case complemented by a satin silver alloy front panel; black finish is now available at a slightly higher price. The controls are reduced to a bare minimum, namely power, volume and just two selector buttons whose various combinations produce tape, tuner, CD and LP disc. All inputs are DIN sockets except for LP disc.

Internal construction is a model of its kind with neat cabling, clear layout, and fully shrouded mains wiring and contacts. Both moving coil and moving magnet cartridges are catered for by plug-in boards, and various loading requirements may be readily met.

A combination of integrated circuit and discrete transistor technology is employed, each where considered appropriate. *Via* mc the input is a virtual earth or shunt feedback current input, considered by many to be the ideal loading, and an input buffer is placed before the RIAA equaliser stage. The moving-magnet offers the normal cartridge loading.

The CD input bypasses the line buffer and is fed directly to the power amplifier *via* the volume control. The impedance here is a satisfactory 12kohms while the normal auxiliary input is higher at 17kohms.

Remarkably simple, the power amplifier is based on a classic Hitachi circuit, with only five transistors. The output is direct coupled complementary with Hitachi 2SK226/2SJ82 MOSFET output devices coupled to the speakers *via* a 2.5amp quick blow fuse.

LAB REPORT

Rated output was comfortably exceeded, with the peak programme output near to 17dBW (50W) per channel with an excellent power bandwidth shown at 16.7dBW. The output held well into 4ohms, while the 2ohm pulsed level was only 2dB below the 8ohm result. The ±12A peak current was sufficient for the rating, and good overall load tolerance was shown.

Harmonic distortion had deteriorated by 20kHz, measuring only −50dB at full power with considerable crossover effects. The high frequency intermodulation results were fine, however, so distortion was not considered a real cause for concern. Input noise levels were fine while input overload levels were satisfactory. Note that the mc figures relate to EMF at the input, whereas in practice the shunt design implies much better figures using a real cartridge. Channel separation was above average, while volume tracking was excellent. Above 200Hz, the RIAA equalisation was most uniform, but the subsonic filter rolloff incorporated rolls off a little early in the audible bass register, and may account for the 'light' character *via* LP disc.

SOUND QUALITY

Scoring above average, the *TMA3* sounded a trifle 'lean', even bright, in tonal balance terms, but this did not impart noticeable 'brittleness'. Tidy and well integrated in character, it provided moderate depth to the stereo images, and above average focus. The bass was found to lack some definition, and did not throw full 'weight'.

The quality held up well *via* disc (mm), but *via* mc some additional loss of definition and clarity was observed. It behaved well at full power into the normal load, providing 102.5dBA, with 101dBA into the adverse load.

CONCLUSIONS

This excellently constructed, compact integrated amplifier, offers well matched inputs, no frills, and a dependable performance with good load tolerance. It should offer a long life, and taking this in conjunction with the above average sound quality, merits recommendation.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

TEST RESULTS

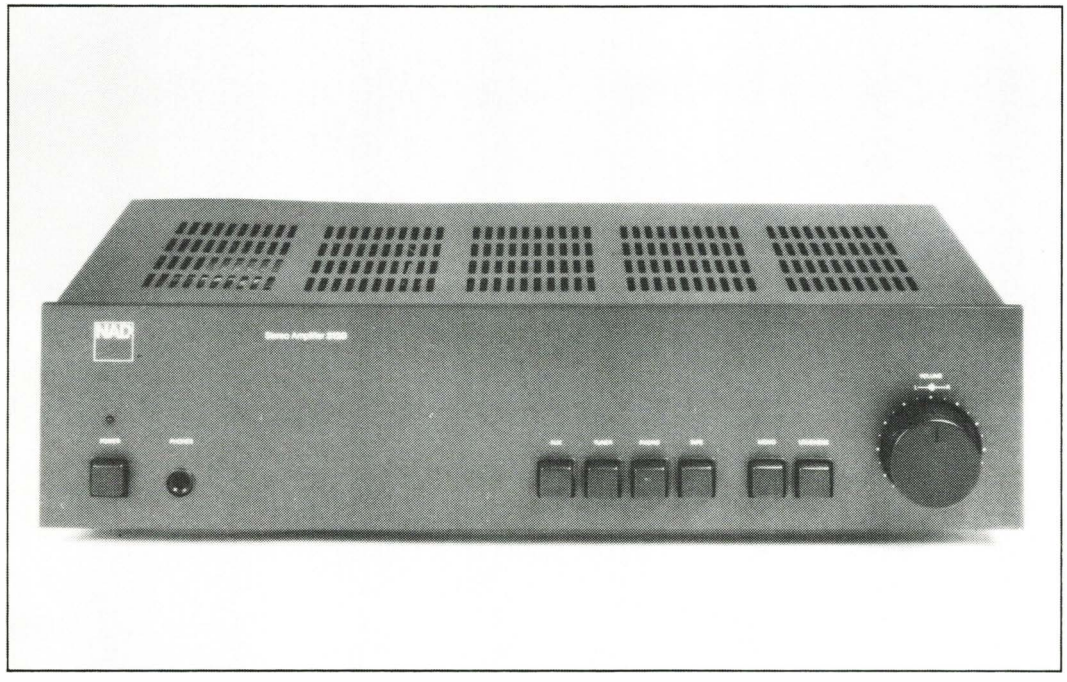
Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			35W(=15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.7dBW	16.7dBW	16.7dBW
Both channels, 4ohm load	14.2dBW	14.3dBW	14.3dBW
One channel, 2ohms, pulsed	−dBW	14.6dBW	−dBW
Instantaneous peak current		+12.0A	−12.0A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−80.0dB	−68.0dB	−50.0dB
Intermodulation, 19/20kHz, rated power, aux input			−75.0dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−77.0dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−74.0dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−66.0dB
Disc (mc) input (IHF, CCIR weighted)			−66.0dB
Aux/CD input (IHF, CCIR weighted)			−72.0dB
Residual, unweighted (volume control at min)			−78.0dB
DC output offset			left 13mV, right 6mV
DC offset, pre-amp			left nilmV, right nilmV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	20.0dB	20.0dB	20.0dB
Disc (mc) input (IHF)*	10.0dB	6.0dB	6.0dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	−70.0dB	70.0dB	64.0dB
Aux input	77.0dB	71.0dB	55.0dB
Output impedance (damping)	0.095ohm	0.09ohm	0.11ohm
Channel balance, disc, at 1kHz			0.4dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.3dB	0.2dB	0.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	63mV	47kohms 200pF
Disc (mc) input*	Phono	see text	see text
Aux input	DIN	40.0mV	−50.0kohms 110pF
Power amp	n/a	n/a mV	n/a kohms n/a pF
Output, pre-amp (tape)			00.0V max, 000ohms
Disc equalisation error, 30Hz-15kHz			+0.08dB, −0.55dB
Size (width, height, depth)			43×21.5×6cm
Typical price inc VAT			£250 (available in black at £275)

For graph references see issue No 44

BEST BUY

NAD 3120

NAD Sales Cousteau House, Greycaine Road, Watford WD2 4SB.
Tel: (0923) 26499



Following Rotel's lead the NAD designers have taken a close look at their *3020*, and have obtained a reduction in cost plus improvement in sound quality by throwing some parts away and simplifying the wiring. Essentially therefore the *3120* is a version of the *3020* with the tone controls omitted, as well as the LED power level indicators and the balance control. Refinements include the fitting of decent 4mm socket/binding posts for speaker connection, while output has been increased into 8ohm loads. If the load is known to be more arduous, a reduced 4ohm power setting can be selected but in practice, unless such a load were to be driven flat out indefinitely, the switch might just as well be left on the 8ohm setting, with the attendant benefits of increased headroom. However if two sets of speakers are to be used in parallel, the 4ohm setting is advisable.

A nominal moving coil facility is now included, in addition to the usual moving magnet cartridge input, the impedance remaining high for both.

Robustly constructed, this amplifier is built to normal commercial standards. The output remains a direct coupled complementary with metal cased 2N3055/2955 output transistors. Gross thermal overload results in protection *via* a thermal circuit breaker, which is self resetting.

Lab Report

Maximum subjectively assessed sound levels were noted as 102 and 99.5dBA which tied in well with the lab measured output power, well above the conservative 20W (13.5dBW) specification. Peak 8ohm power exceeded 50W with a fine power bandwidth seen at the 7.1dBW level. The loss into 4ohms was mild while the 2ohm pulsed output was quite generous, and still well above specification. Substantial ±14A current peaks were allowed so the design remained as load tolerant as ever.

Distortions, both harmonic and intermodulation were negligible. Noise levels were also very good, suprisingly so in fact, via mc. The DC offset was satisfactory while the amplifier's output resistance was typically low. Input overload margins were ample, but stereo separation was at a pretty average level.

Channel balance was fine even on the RIAA equalisation which was also commendably accurate. Channel tracking held to a close tolerance over a wide range.

Input sensitivities and loadings were satisfactory. Assessing the 40Hz spectrogram, the grounding was clearly very good as no mains ripple components could be seen down to the instrument resolution of — 100dB.

Sound Quality

Scores indicated a well above average performance which was a fine result for the price. *Via* auxiliary it gave an open and lively impression dynamics were well presented, with a pleasing contrast shown between soft and loud passages. Channel separation was stable and wide, while the transparency was sufficient to portray reasonable depth. On the debit side the bass showed a touch of boom while the mid seemed a little hard tonally and the treble was mildly grainy.

Via disc, a very similar standard was achieved. The stereo focus remained good, while recorded ambience was nicely reproduced despite some observed forwardness in the treble register. Overall it was considered to show a significant improvement over the *3020*.

Conclusions

The *3120* performed well on test. It proved quite powerful with a good adverse load tolerance and could produce well focused ambient stereo images. The price is moderate and in conjunction with its above average quality, indicates that a Best Buy classification is still appropriate.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			20W(=13.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.1dBW	17.2dBW	17.2dBW
Both channels, 4ohm load	13.7dBW	14.8dBW	14.6dBW
One channel, 2ohms, pulsed	–dBW	14.8dBW	–dBW
Instantaneous peak current		+14A	–14A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–83dB	–91dB	–76dB
Intermodulation, 19/20kHz, rated power, aux input			–80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–84dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			–83dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–80dB
Disc (mc) input (IHF, CCIR weighted)			–73dB
Aux/CD input (IHF, CCIR weighted)			–80dB
Residual, unweighted (volume control at min)			–84dB
DC output offset			left 22mV, right 24mV
DC offset, pre-amp			left n/a mV right n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	34dB	30dB	35dB
Disc (mc) input (IHF)*	32dB	33dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	50dB	46dB	38dB
Aux input	50dB	50dB	45dB
Output impedance (damping)	0.19ohm	0.19ohm	0.22ohm
Channel balance, disc, at 1kHz			0.2dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0.5dB	0.3dB	1.6dB
Input data socket type	sensitivity	loading	
Disc (mm) input	Phono	0.55mV	47kohms 110pF
Disc (mc) input*	Phono	0.038mV	21kohms –pF
Aux input	Phono	28mV	33kohms 100pF
Power amp	Phono	–mV	34kohms 1000pF
Output, pre-amp (tape) 11/DIN			5V max, 1.7ohms
Disc equalisation error, 30Hz-15kHz			+0.1dB –0.4dB
Size (width, height, depth)			42×10×24cm
Typical price inc VAT			£119

For graph references see issue No 44

RECOMMENDED

NAIM NAIT

NAIM AUDIO LTD, SOUTHAMPTON ROAD, SALISBURY SP1 2LN.
TEL: (0722) 332266



The *NAIT*, Naim's inexpensive integrated amplifier, offers an 'unspecified' low output power, with a 'straightline' circut design format. Tape tuner, and disc mm inputs are provided, the first two in DIN and the disc in phono. Controls comprise push-button selectors, balance and volume. The unit is built in traditional Naim extruded alloy case with black textured finish and satin polished front edge. 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 well laid out, 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 electronic protection integrates voltage and current against time, and allows the use of complex loads. In fact the circuitry is largely borrowed from Naim's more costly amplifier line.

Lab Report

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 4ohm loading on continuous duty. The peak current delivery was fine for the size of amplifier, with the 8ohm peak output level measuring 13.5dBW and still holding up well at 11.3dBW for the 'extreme' 2ohm 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-to-noise ratios were fine, though the disc input sensitivity was lower than average. Disc input overloads were satisfactory and stereo separation about average, with output impedence 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.

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 trifle thin, but vocal detail was impressive with decent focus and depth rendition. The bass was not perfect, yet 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.

Conclusions

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 stood up well to 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 recommendation. We were not, however, impressed by the switch-on thumps from the loudspeakers!

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

Power output	Integrated amplifier		
Rated power into 8ohms, maker's spec	15W(=12.5dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	13.0dBW	13.3dBW	13.1dBW
Both channels, 4ohm load	10.0dBW	11.6dBW	11.4dBW
One channel, 2ohms, pulsed	9.4dBW	11.3dBW	10.9dBW
Instantaneous peak current		+9A	−9A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−68dB	−72dB	−51dB
Intermodulation, 19/20kHz, rated power, aux input			−70dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−52dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−78dB
Aux/CD input (IHF, CCIR weighted)			−80dB
Residual, unweighted (volume control at min)			−75dB
DC output offset			2mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	25dB	25.5dB	24dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	−69dB	−66dB	−50dB
Aux input	−68dB	−66dB	−42dB
Output impedance (damping)	0.03ohm	0.04ohm	0.04ohm
Channel balance, disc, at 1kHz			0.3dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.3dB	8.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.52mV	46kohms 140pF
Aux input	DIN	21.1mV	61kohms 220pF
Disc equalisation error, 30Hz-15kHz			+0.5dB, −1.5dB
Size (width, height, depth)			28×22×7.5cm
Typical price inc VAT			£242

For graph references see issue No 39

RECOMMENDED

PROTON D540

VENTURA LEISURE LTD, VENTURA HOUSE, THE BROADWAY, OLD AMERSHAM, BUCKS.
TEL: (02403) 4602



Still a relatively new name on the UK hi-fi scene, Proton is an American brand mainly sourced in the Far East. Although the products have much in common with those of NAD, they are distributed largely through different outlets at retail level.

A compact, low profile integrated amplifier, the 540 offers a nominal 40W per channel and at first sight, looks rather pricey at £240. However, there is more here than meets the eye; like the NAD 2200 power amplifier (they are related), it has a dramatic peak power capability measuring 300W peak (24.5dBW), which only fell away 1dB into a cruel 2ohm loading. In real terms the latter figure represents 850W peak per channel from this unassuming design!

The 540 looks simple enough, but on opening a small door in the front panel, a set of auxiliary controls are revealed — bass, treble, balance, loudness, mono/stereo and bass equalisation; this last gives 10dB boost at 40Hz, intended for small sealed-box speakers. Two sets of speakers may be connected while separate selectors are used for signal and tape record outputs. The inputs include moving-magnet (with several capacitance options), moving-coil (with loading options), tuner, video, Compact Disc and two tape decks.

Inside, the unit is tightly packed, with dual mains transformers and 10,000μF reservoirs on the high voltage supply. The signal routing is very complex and extended, with many plugs and sockets, extender boards and harnesses. In addition, a 'bridge' mode is incorporated, with pre/power connectors, to allow use of an additional power amplifier. Robust output devices are fitted.

Lab Report

The peak ratings have already been noted but the continuous ratings were also worth commenting on — for example, continuous output was virtually double the spec at 80W and peak current delivery was substantial at +33A! The 40Hz power spectrum was also very creditable.

Both harmonic and intermodulation distortion levels were negligible and good input overload margins were also demonstrated. Input noise levels were fine throughout, while DC offsets were held to a very small value.

Channel separations were good, and the amplifier also offered a negligible output impedance. On channel balance, a close tolerance was held at all levels and inputs. Input characteristics proved to be all in order, including the versatile input loading options. On RIAA equalisation, some mild treble loss was observed *via* moving-coil input, but in general, the accuracy was good.

Sound Quality

Achieving a quite respectable 'good' in the auditioning, the quality was rated as consistent *via* the various inputs, with CD having only a slight lead. It could play loud — up to 107dBA on the test loading — and proved to be solid and competent. Bass was firm, the treble slightly grainy and there was a trace of roughness in the midrange.

Stereo focus was quite good, and worthwhile levels of depth and ambience were portrayed. Moreover, the 540 reproduced a good measure of the dynamics and drive of the program we tried.

Conclusions

This compact amplifier established a unique niche for itself in this issue. Offering a decently competent sound, it was highly versatile in terms of sources, and also offered many other facilities. A particular feature was the relatively high peak program power output, exceeding 200W, which was held into some of the worst speaker loads. Taken overall, the 540 offered good value and attained a solid recommendation.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

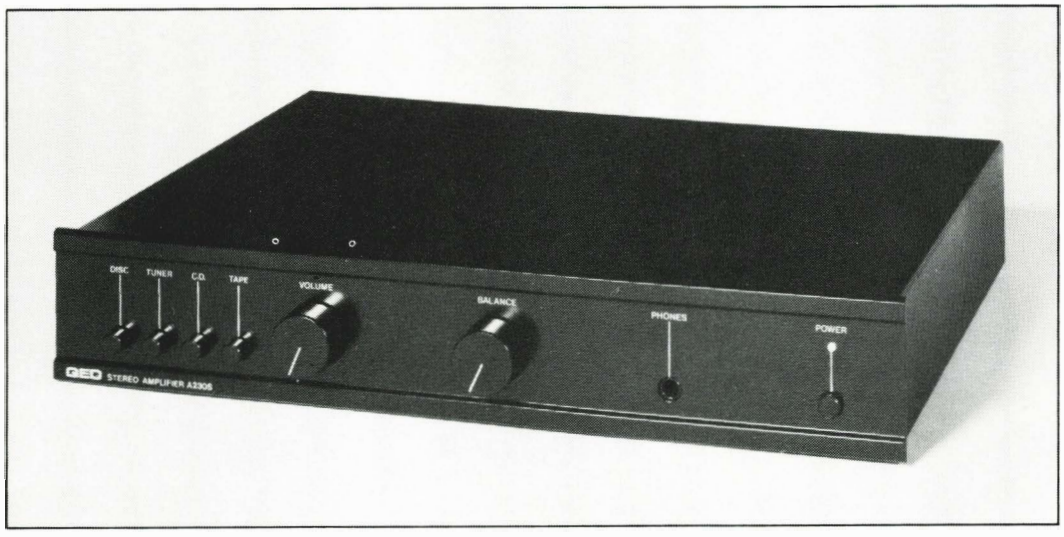
Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			40W(=16dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.3dBW	18.4dBW	18.1dBW
Both channels, 4ohm load	15.9dBW	16.5dBW	16.0dBW
One channel, 2ohms, pulsed	–dBW	23.5dBW	–dBW
Instantaneous peak current		+32.5A	–33.5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–85.0dB	–88.5dB	–74.3dB
Intermodulation, 19/20kHz, rated power, aux input			–85.8dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–84.3dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			–50.7dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–76.6dB
Disc (mc) input (IHF, CCIR weighted)			–69.2dB
Aux/CD input (IHF, CCIR weighted)			–80.4dB
Residual, unweighted (volume control at min)			–94.4dB
DC output offset			left 4mV, right 6mV
DC offset, pre-amp			left 0mV, right 0mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	35.3dB	34.5dB	33.5dB
Disc (mc) input (IHF)	26.9dB	25.9dB	25.7dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	48.2dB	58.3dB	38.6dB
Aux input	68.0dB	62.6dB	40.7dB
Output impedance (damping)	0.08ohm	0.06ohm	0.26ohm
Channel balance, disc, at 1kHz			0.02dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0.02dB	0.26dB	0.19dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.40mV	47kohms 200pF
Disc (mc) input*	Phono	0.016mV	96ohms 0.7nF*
Aux input	Phono	24.2mV	34.0kohms 140pF
Power amp	Phono	161mV	16kohms 35pF
Output, pre-amp (tape)			14.8V max, —ohms
Disc equalisation error, 30Hz-15kHz			+0.05dB, –0.95dB
Size (width, height, depth)			42×8×32cm
Typical price inc VAT			£239

For graph references see issue No 44

BEST BUY

QED A230S

QED AUDIO PRODUCTS LTD, UNIT 12, ASHFORD INDUSTRIAL ESTATE, SHIELD ROAD, ASHFORD, MIDDLESEX TW15 1AU. TEL: ASHFORD 46236



Designed and built in Britan, this amplifier had the distinction of just breaking the £100 barrier when introduced, a price which had previously been considered uncommercial so far as UK manufacture is concerned. The price is now £109, but with a further review imminent. In fact the *A230* forms part of a QED system, including turntable and tuner and loudspeakers.

The amplifier is cased in black stove-enamelled cover although for an extra £20 this can be replaced by a real veneer sleeve of fine quality. Front panel facilities include selector buttons for disc (moving magnet), tuner CD, and tape using phono socketry. No tone controls are present, but a headphone outlet is, linked to one set of 4mm speaker connections on the rear panel. Another set of sockets is provided to bypass the headphones, offering a more direct path and claimed higher quality.

Interior construction was to a surprisingly good standard. Not only are a number of high quality parts used, but the mains wiring is properly switched as well as shrouded. A top quality toroidal mains transformer feeds a pair of selected 4700μF capacitors. The disc stage has an input buffer followed by a passive filter for the high frequency part of the RIAA equalisation*. An active stage follows, with the low frequency section plus subsonic filtering, using selected TLO 72 FET op amps. Employing Darlington complementary triples, the output stage is direct-coupled to the load and series fuses are avoided. The differential input is filtered to prevent slew limiting or associated latching in the later amplifier stages.

Lab Report

Rated at 30W (14.5dBW) the *A230* offered a healthy output on test, approaching 16.5dBW 8ohms. A good 8ohm power bandwidth was shown at 16dBW, with the loss in level at 4ohms being typically slight at 1.6dB, though it had reached 4dB by 2ohms. Peak current was generous for the size reaching ±12.5A and indicating a fine load tolerence. The 40Hz power spectrogram was less encouraging, however and showed a high content of spurious signals associated with the line frequency.

Distortion levels were satisfactory as were the input noise figures. DC offset should not cause any problems, while input overload margins were fine. Channel separation was better than average but channel balance was less satisfactory, and level tracking seriously deteriorated at low volume settings. Input sensitivities and loadings were fine.

Our sample proved to be extraordinarily accurate on RIAA equalisation with nicely tailored rolloffs at the band extremes. From 70Hz to 15kHz it met amazing ±0.06dB limits for both channels.

Sound Quality

Auditioned *via* the auxiliary input with selected CD sources, this little amplifier gave a lively, coherent performance. Clarity was fine; especially in the midband, and some depth and ambience were present with scoring above average here. The band extremes were a little untidy — there was some softness in the bass and a touch of 'zing' in the treble.

An equally promising standard was achieved *via* the disc input. Clean and articulate, mid detail was most presentable, and while the treble hinted at brightness this was not excessive. A touch of hardness did however creep in at higher listening levels. Maximum sound levels of 100dBA (8ohms) and 98.5dB (4ohms) were obtained on the listening tests.

Conclusions/Update

With a moderate price increase, the performance and finish have both been improved. Once again this tolerant amplifier did well in the tests and confidently retains its Best Buy rating. That said, the LP disc input has recently been extensively revised, and this change has yet to be evaluated in *Choice*.

**NB The disc input now has conventional single stage RIAA equalisation using an NE5532 IC, 2% polypropylene capacitors and 1% metal film resistors.*

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

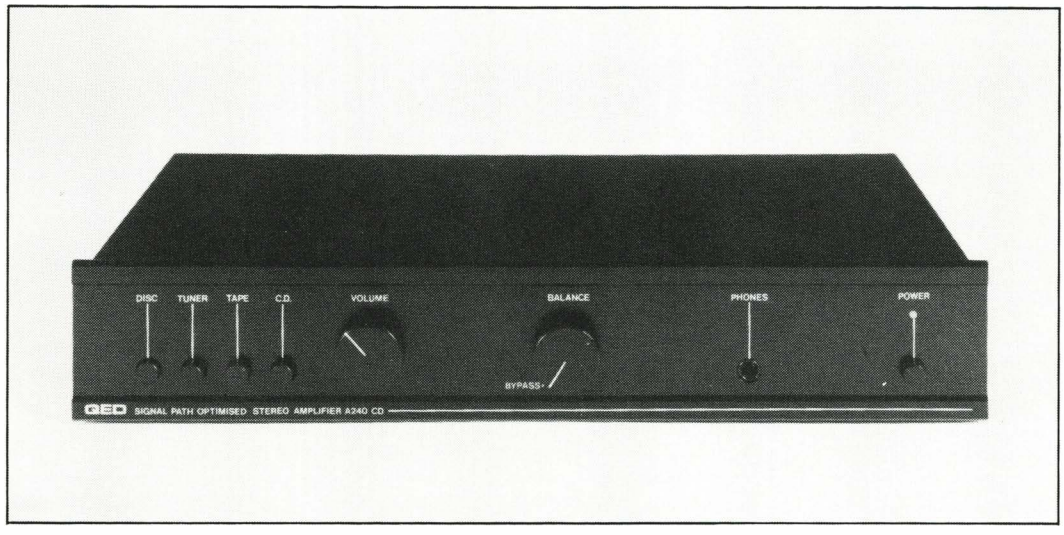
Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			30W(=14.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.0dBW	16.3dBW	16.0dBW
Both channels, 4ohm load	14dBW	14.8dBW	14.6dBW
ne channel, 2ohms, pulsed	–dBW	12.5dBW	–dBW
nstantaneous peak current		+12.56A	–12.5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–85dB	–71dB	–62dB
Intermodulation, 19/20kHz, rated power, aux input			–67dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–65dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			n/a dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–67dB
Disc (mc) input (IHF, CCIR weighted)			n/a dB
Aux/CD input (IHF, CCIR weighted)			–72dB
Residual, unweighted (volume control at min)			–75dB
DC output offset			left 5mV, right 23mV
DC offset, pre-amp			left n/a mV, right n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	31dB	29dB	26dB
Disc (mc) input (IHF)*	n/a dB	n/a dB	n/a dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	73dB	72dB	44dB
Aux input	65dB	66dB	54dB
Output impedance (damping)	0.55ohm	0.05ohm	0.06ohm
Channel balance, disc, at 1kHz			0.6dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0.2dB	0.5dB	10dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.6mV	47kohms 70pF
Disc (mc) input*	n/a	n/a mV	n/a kohms n/a pF
Aux input	DIN	40mV	52kohms 50pF
Power amp	n/a	n/a mV	n/a kohms n/a pF
Output, pre-amp (tape)			5V max, -ohms
Disc equalisation error, 30Hz-15kHz			+0dB, –1dB
Size (width, height, depth)			35.5×7×24.5cm
Typical price inc VAT			£109

For graph references see issue No 44

BEST BUY

QED A240-CD

QED AUDIO PRODUCTS LTD, UNIT 12, ASHFORD INDUSTRIAL ESTATE, SHIELD ROAD, ASHFORD, MIDDLESEX TW15 1AU. TEL: ASHFORD 46236



It is now some time since QED first enjoyed the UK market's warm acceptance of their original *A230* amplifier design. Now they have developed and introduced a new more powerful model in the form of the *A240CD*.

As its name implies, this model has been designed with attention given specifically to performance on Compact Disc. Like the *'230*, it is available in two versions. One with a wood sleeve, and both finish and appearance have been much improved compared with the earliest *'230*. Our review sample was in black livery with gold legends.

Offering a marginally higher rated power output at 40W, the *A240* is only 1dB louder than the smaller model, so in reality its other features are of greater significance than the power increase. The 'CD direct' facility allows the Compact Disc user to bypass the preamplifier for optimum sound quality; there is also the option (at extra cost) of fitting a higher performance analogue disc input stage. No tone controls or filters are provided, and the balance control may be bypassed. All inputs are *via* the usual RCA phono sockets, while the speaker outlet connections are provided by high-current 4mm sockets.

Essentially, the design is based on a single board construction, and the interior view revealed good build quality with fine quality components. At the output the amplifiers use a bipolar complementary arrangement, direct-coupled to the load: integrated circuits are used for the earlier stages including the RIAA equalisation.

Lab Report

Conservatively rated, this amplifier raised 18dBW under peak programme conditions. The continuous output was near 17dBW, falling to 14.5dBW into 4ohms, and the output was held up well into 2ohms, reflecting the good peak current rating of ±12.75A.

Distortion levels were fine, with really good results for intermodulation at high frequencies. Noise levels were fine while the DC offset at the power amplifier was respectably low. The modest input overload margins reflected the omission of a line amplifier but in practice they were considered sufficient. Really good for its class, the stereo separation results were commendable, with channel balance generally good but deteriorating at low signal levels — for example, an 8dB imbalance at a −60dB setting. The input characteristics were fine. The reason for the slight brightness on disc was obvious from inspection of the RIAA equalisation where mild shelf boost above 400Hz was apparent.

Quite a good result was obtained on the 40Hz power intermodulations test.

Sound Quality

Rated a highly respectable 'good plus', the *A240* significantly improved upon the performance of the *A230S*. It also provided quite decent sound levels of 100dBA, which held up well into the 4ohm load. I wonder whether the 'super' disc option is worth worrying about, since our tests gave a similarly good rating for both the disc and CD inputs.

It was considered well balanced *via* CD, with notably good drive and dynamics. Focus was very presentable, While quite good levels of depth and ambience were portrayed. The bass had 'speed' coupled with good definition, while the treble was also well above average.

The treble seemed slightly less tidy while the impression was of a mildly 'thinned' tonal balance in the midrange, plus some added brightness. The solid bass, good definition and decent stereo remained, however.

Conclusions

QED are learning fast. The *A240* is their best yet, and was well placed in a highly competitive market. We liked this lively performer, which offered very good value and was worth a Best Buy rating.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			40W(=16dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.9dBW	17.3dBW	15.9dBW
Both channels, 4ohm load	13.4dBW	14.8dBW	14.5dBW
One channel, 2ohms, pulsed	−dBW	15.5dBW	−dBW
Instantaneous peak current		+13A	−12.5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−71.6dB	−76.9dB	−63.1dB
Intermodulation, 19/20kHz, rated power, aux input			−79.6dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−74.7dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			n/a dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−72.0dB
Disc (mc) input (IHF, CCIR weighted)			n/a dB
Aux/CD input (IHF, CCIR weighted)			−69.5dB
Residual, unweighted (volume control at min)			−77.5dB
DC output offset			left 10mV, right 12mV
DC offset, pre-amp			left n/a mV, right n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	19.1dB	17.5dB	15.2dB
Disc (mc) input (IHF)*	n/a dB	n/a dB	n/a dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	89.0dB	88.5dB	66.6dB
Aux input	75.0dB	69.3dB	43.6dB
Output impedance (damping)	0.09ohm	0.09ohm	0.10ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	−20dB	−40dB
Aux input	0.04dB	0.68dB	8.05dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.49mV	47kohms 150pF
Disc (mc) input*	n/a	n/a mV	n/a ohms n/a pF
Aux input	Phono	60mV	14kohms 15pF
Power amp	n/a	n/a mV	n/a kohms n/a pF
Output, pre-amp (tape)			10.8 max, 8.9ohms
Disc equalisation error, 30Hz-15kHz			+0.02dB, −0.85dB
Size (width, height, depth)			36×6×25cm
Typical price inc VAT			£149

For graph references see issue No 44

BEST BUY

ROTEL RA-820BX

ROTEL HI-FI, 25 HEATHFIELD, STACEY BUSHES, MILTON KEYNES MK12 6HR.
TEL: (0908) 317707



Each successive review appears to reflect a further suffix to this model's number, and rumour has it that further development is imminent. The special *'BX* version of the *RA-820* is a purist amplifier at a modest cost. Maximising sound quality has been the aim and the intensive research done by Rotel's UK team in this direction would appear to have been rewarded. The *840BX*, though not reviewed here, is similar but with higher output and an mc disc input.

A slim but full width integrated amplifier, it comes in satin black, with a fairly low nominal power rating of 25W (14dBW). However, a good load tolerance is claimed, and this was confirmed on test. Another 'no frills' design, both tone controls and filters have been omitted; likewise fuses and protection circuits have been removed from the signal path. Inputs include tape, tuner, CD/aux and disc (mm only). Rear panel sockets are phono, gold plated for disc, while reasonably solid connectors are provided for speaker connection, these large enough to take a decent size of wire.

Inside, construction is very tidy, essentially a single board, with the mains wiring properly terminated and shrouded. Two 8200μF capacitors provide a sizeable reservoir, while the direct-coupled complementary output stage uses paralleled pairs of transistors to increase the current capacity as well as the overload margin. A 0.22ohm resistor is placed in series with the output — a backstop against extreme overload such as a short circuit. ICs are used in the preamplifier stages together with selected audio components.

Lab Report

The specified rating was comfortably exceeded with a fine power bandwidth of 15.7dBW at 8ohms. The reduction into 4ohms was moderate, while the 2ohm pulsed output exceeded rated level at 14.5dBW. This was equivalent to 100W into 2ohms while peak current was a very generous ±15A. Distortion levels were moderate, especially with respect to the high frequency intermodulation. Input noise levels were good, with excellent input overload margins. The DC offsets at the speaker terminals were poorer than average but should not give trouble in practice.

Channel seperation was satisfactory *via* the disc input but should be much better *via* auxiliary particularly at 20kHz. Volume tracking and channel balance were both pretty good, while output impedance to the speakers was constant as well as moderate. Input sensitivity and loading characteristics were sensible, (0.7mV disc, 45mV tuner). Over a 50Hz to 10kHz range the RIAA equalisation was very accurate, with some rolloff outside these limits due to mild subsonic and ultrasonic filtering. Mains ripple was not particularly well rejected as the 40Hz power spectrum showed. Here the 100Hz line component was only 60dB down — one wonders how the *'BX* would sound if this were improved.

Sound Quality

Aside from its moderate peak sound level, the panel rated this amplifier very highly. In fact its scores place it up among the select few, some of which cost as much as four times its price. Its trump card was a clear sound, sufficiently transparent to properly portray depth and ambience effects in stereo images which were also of fine width and focus. It has an involving sound, yet it is also musical and subtle. Bass was clean and quite firm, and the treble well controlled. Such a performance proved an embarrassment to many more costly separates.

Only a marginal loss of sound quality was detected *via* disc. Here it sounded a trifle lean and lightweight, but the depth, atmosphere, expressive power, focus and life all remained. This amplifier could justify a really good mm cartridge, even one which might cost as much as the *'BX* itself!

Conclusions

This latest Rotel again stormed through the listening tests. The *'BX* version has now definitely come of age and can be warmly recommended. Load tolerant, it also offered a respectable output plus a clear sound with excellent stereo. With a recommendation also for the mc-equipped *'840BX*, a Best Buy rating is the only logical conclusion!

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

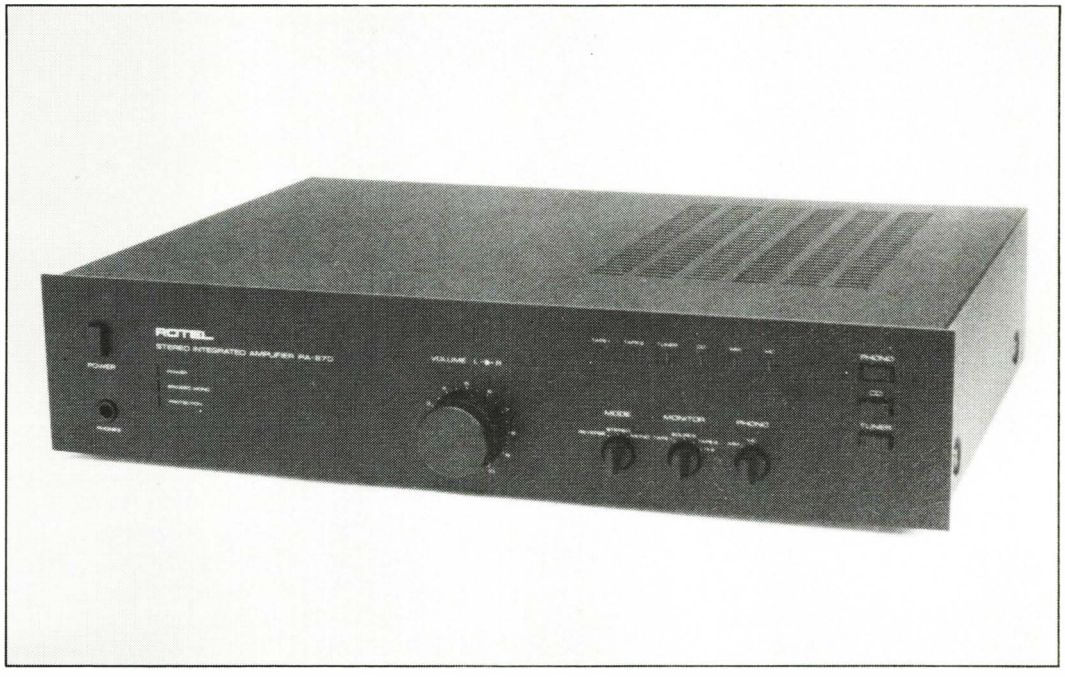
Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			25W(=14dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	15.9dBW	16dBW	15.7dBW
Both channels, 4ohm load	13.0dBW	13.7dBW	13.5dBW
One channel, 2ohms, pulsed	–dBW	14.5dBW	–dBW
Instantaneous peak current		+15A	–15A
Distortion			
Total harmonic distortion	20Hz	1kHz	20kHz
at rated power, aux input	–66dB	–74dB	–55dB
Intermodulation, 19/20kHz, rated power, aux input			–65dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–73dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			n/a dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–74dB
Disc (mc) input (IHF, CCIR weighted)			n/a dB
Aux/CD input (IHF, CCIR weighted)			–82dB
Residual, unweighted (volume control at min)			–n/a dB
DC output offset			left 36mV, right 19mV
DC offset, pre-amp			left n/a mV, right n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	36dB	34dB	34dB
Disc (mc) input (IHF)*	n/a dB	n/a dB	n/a dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	63dB	64dB	41dB
Aux input	62dB	48dB	24dB
Output impedance (damping)	0.24ohm	0.24ohm	0.25ohm
Channel balance, disc, at 1kHz			0.05dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0.1dB	0.8dB	0.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	–mV	50kohms 220pF
Disc (mc) input*	Phono	n/a mV	n/a ohms n/a pF
Aux input	Phono	–mV	50kohms 180pF
Output, pre-amp		>1V max,	3.8kohms
Disc equalisation error, 30Hz-15kHz		+0dB,	0.6dB
Size (width, height, depth)		43×6×25cm	
Typical price inc VAT			£140

For graph references see issue No 44

RECOMMENDED

ROTEL RA-870

ROTEL HI-FI, 25 HEATHFIELD, STACEY BUSHES, MILTON KEYNES MK12 6HR.
TEL: (0908) 317707



Rotel's refinement of their larger amplifier designs has followed much the same path as the development of the current *RA-820BX* from the original *RA-820* budget amplifier. First launched for the 1983-4 season, the *RA-870* was originally a 'straight line' development of the 'conventional' tone-equipped *RA-860*, and it was also designed to provide a higher-power option when augmented by an *RB-870* power amplifier. Rotel subsequently introduced the *RC-870* pre-amplifier to form a matching pair of separates with the *RB-870*. This logical progression has now been completed with a re-design of the *RA-870* to incorporate much of the *RC/RB* technology, and it becomes in effect a 'BX' version.

This is a 'no frills' design, where normally redundant features have been abandoned in favour of direct signal paths and maximum sound quality. Modestly rated at 60W per channel, it may also be set in bridged mono mode and used together with an *RB-870* power amp to give a system of typically 200W per channel. Channel balance adjustment is provided by the dual concentric volume control, friction-ganged. Two tape decks, moving-coil and moving-magnet cartridge, plus CD and a tuner may be connected *via* phono sockets. Speaker connection is by means of large binding posts.

Using two mains transformers, the output stage is in double mono form. Generously rated output transistors are used in parallel pairs, the configuration being direct-coupled complementary. Integrated circuits are employed in the pre-amp section, mainly drawn from the well regarded *RC-870*.

Lab Report

On peak program rating this amplifier doubled its manufacturer's claim, reaching 20dBW. Even at 2ohms, it managed 20.3dBW (400W), backed by a generous peak current capacity which exceeded 30A. Power bandwidth was exceptional, even into 4ohms. Throughout the lab tests the distortion figures were low and most of the input noise levels were also very respectable.

With negligible DC offsets, the output impedance was very low around 0.06ohm. Input overload margins were ample, while channel balances were accurately maintained. The RIAA equalisation curve showed a well designed midband of high accuracy over a 50Hz to 20kHz bandwidth, with some sensible tailored rolloff outside the band. The input characteristics were well ordered with sensible loadings and sensitivities.

The 40Hz input third power spectrogram was tidy enough with the 100Hz component 76dB down. Fine channel separations were recorded.

Sound Quality

Proving substantially loud on the maximum level test, the '870 attained a comfortable 106dBA with negligible loss into 4ohms. Certainly justifying its price it achieved a 'good plus' on audition, with the CD input having a small lead on absolute quality.

On disc, it portrayed stereo images with a good sense of scale, and with decent depth and ambience. Focusing was stable and clear with good stage width. Dynamics were fine, though the overall effect was slightly veiled and more absolute definition would have helped.

The detail improved *via* Compact Disc, and a worthwhile standard was achieved. Compared with the top examples, it remained slightly 'flattened' in its representation of stereo depth perspectives, while the treble was a touch sibilant. However, the bass was well above average and it handled high power levels with authority and control.

Conclusions

Rotel's designers have learnt the lessons derived from the '820 — their whole range has now been revitalised. All now attain a similarly high standard of sound quality, and offer a range of additional facilities as well as higher power outputs. The bridged mode option was a special feature of the *RA-870*, and if coupled with an additional *RB-870* would make an economical high power (300W) system. As it stands the *RA-870* is well placed in the Recommended class.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			60W(=18dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.9dBW	19.2dBW	19.0dBW
Both channels, 4ohm load	17.6dBW	18.1dBW	17.9dBW
One channel, 2ohms, pulsed	–dBW	24.6dBW	–dBW
Instantaneous peak current		+30.0A	–40.0A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–78.0dB	–81.8dB	–71.3dB
Intermodulation, 19/20kHz, rated power, aux input			–73.7dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–77.1dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			–78.5dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–74.6dB
Disc (mc) input (IHF, CCIR weighted)			–63.0dB
Aux/CD input (IHF, CCIR weighted)			–78.6dB
Residual, unweighted (volume control at min)			–82.5dB
DC output offset			left 11mV, right 3mV
DC offset, pre-amp			left 0mV, right 0mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32.3dB	30.7dB	30.5dB
Disc (mc) input (IHF)*	35.5dB	34.0dB	33.9dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	80.5dB	89.7dB	65.8dB
Aux input	84.3dB	81.1dB	58.4dB
Output impedance (damping)	0.06ohm	0.06ohm	0.07ohm
Channel balance, disc, at 1kHz			0.7dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0.01dB	0.10dB	0.02dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.33mV	47kohms 110pF
Disc (mc) input	Phono	0.048mV	180 ohms 0.5nF
Aux input	Phono	22.0mV	52.0kohms 50pF
Power amp	—	n/a mV	n/a kohms n/a pF
Output, pre-amp (tape)			10.5V max, —ohms
Disc equalisation error, 30Hz-15kHz			+0dB, –1.02dB
Size (width, height, depth)			43×10×34cm
Typical price inc VAT			£315

For graph references see issue No 44

BEST BUY

SANSUI AU-G30X

SANSUI (UK) LTD, UNIT 10A, LYON INDUSTRIAL ESTATE, ROCKWARE AVENUE, GREENFORD, MIDDLESEX. TEL: 01-575 1133



Outwardly, this Sansui model is virtually identical to the *AU-G33X* tested in the 1985 *Amplifiers and Tuners* edition, but in fact the *AU-G30X* is the result of considerable development work by Sansui's engineers in Japan during the intervening period.

While the earlier version demonstrated a good technical performance when tested in the laboratory, it did not fare well in the listening tests. But this model has been totally redesigned, with redundant sections stripped away and the remaining components and circuit layout optimised for improved sound. Sansui have (to borrow Rotel's terminology) done a '*BX*' upgrade, refining the design by listening for audible improvements rather than aiming to improve measured performance.

With a rated power output of 45W (16.5dBW) per channel, the '*30X* is a fully equipped design, reasonably priced considering the specification and features on offer. It incorporates the usual control facilities such as speaker switching, bass and treble tone controls and filters, but bypass settings are provided for optimum sonic performance.

A higher-performance moving-magnet disc input stage has been included this time, while the old and compromised moving-coil option of the '*33X* has now been omitted. Based on a classic Sansui design, the power amplifier is a direct-coupled complementary configuration with a well located central power supply. Internal heatsinks are used with through-flow ventilation.

LAB REPORT

As so often happens, there was little to show in the lab measurements that could account for the new sound. The audible change is the result of revised circuits, components and layouts and not necessarily an alteration in specification.

Power output reached 19dBW peak (90W), while short term delivery into 2ohms was a very satisfactory 17.5dBW, with a good peak current reserve approaching 19A. High frequency distortion was slightly poorer than before — this being the only clue to reduced negative feedback.

Input characteristics were fine, while the frequency responses were both wide and uniform. Channel balancing was very good, though a loss of channel separation was also evident at high frequencies. The output resistance was constant at a moderate 0.25ohms. The DC offsets were a little higher than average and could be reduced.

Good sound levels of 103dBA were achieved in the test system, while the 40Hz power spectrum showed a very clean result.

SOUND QUALITY

Reversing our previous opinion, this time the amplifier scored a 'good plus' on the listening tests, which was a fine result for a model at this price level. On disc, the sound was robust, with firm stereo images, stably focused and exhibiting good depth and ambience. Offering decent clarity, good detail was also evident, while the sound improved further when using Compact Disc as the source. It produced fine bass, extended and powerful with good definition. Mid glare and treble 'grain' were held to low levels, and did not impair the good stereo performance. Good sound levels were possible without strain and it also proved load tolerant.

CONCLUSIONS

Sansui now have a middle-rank amplifier offering a competitive sound quality. A load-tolerant model, it also has a decent power output as well as versatile facilities, if and when required. The basic stereo performance was much better than before, with sufficient sound quality improvement to bring the design up to full 'Best Buy' listing.

Note: The author privately assessed an early model supplied by the manufacturer, prior to this review.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

TEST RESULTS

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			45W(=16.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.2dBW	18.3dBW	18.1dBW
Both channels, 4ohm load	15.9dBW	16.0dBW	16.5dBW
One channel, 2ohms, pulsed	–dBW	17.5dBW	–dBW
Instantaneous peak current		+18.5A	–20.0A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–77.4dB	–78.8dB	–68.8dB
Intermodulation, 19/20kHz, rated power, aux input			–90.0dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–87.4dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			n/a dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–68.2dB
Disc (mc) input (IHF, CCIR weighted)			n/a dB
Aux/CD input (IHF, CCIR weighted)			–73.0dB
Residual, unweighted (volume control at min)			–87.0dB
DC output offset			left 47mV, right 36mV
DC offset, pre-amp			left n/a mV, right n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32.9B	32.0dB	32.6dB
Disc (mc) input (IHF)*	n/a dB	n/a dB	n/a dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	68.4dB	53.5dB	30.6dB
Aux input	77.9dB	53.0dB	30.3dB
Output impedance (damping)	0.26ohm	0.26ohm	0.25ohm
Channel balance, disc, at 1kHz			0.01dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0.01dB	0.08dB	1.04dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	1.75mV	47kohms 100pF
Disc (mc) input*	n/a	n/a mV	n/a kohms n/a pF
Aux input	Phono	27.0mV	55.0kohms 230pF
Power amp	n/a	n/a mV	n/a kohms n/a pF
Output, pre-amp (tape)			13.4V max, 100ohms
Disc equalisation error, 30Hz-15kHz			+0.1dB, –1.9dB
Size (width, height, depth)			43×11×33cm
Typical price inc VAT			£189

For graph references see issue No 44

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ALPHA AUDIO *Leicester* — "With the S.A. Board fitted the A240 definitely is a super sounding machine!" *Mark Glanville*	IN HI-FI *Edinburgh* — "Clearly the front runner in its class." *Ken Docherty*

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Styled in smart satin black, the budget A320 was originally launched as a 'purist' version of the fully-equipped A300, being essentially identical except for absence of tone controls. As well as a slight cost saving, the A320 was claimed to offer improved sound quality, and indeed this was confirmed on our auditioning for the 1985 edition. However, in all technical aspects the two models were indistinguishable.

Internally the layout was very tidy, partly 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 aluminium 'U' bracket as heatsink. The common power supply is modestly sized, and the usual pre-amp 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.

Lab Report

Rated at 25W (14.5dBW) the specifications were cut a little fine, the amplifier just reaching 13.9dBW over the single-channel 8ohm power bandwidth. On the plus side, the level held up well on 4ohms continuous dual-channel duty. For the size, the peak current available was quite generous at ±9A. Peak output level reached 15.1dB into 8ohms, falling very little into 4ohms, and a reasonable 3.6dB into 2ohms.

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, stereo channel separation was rather better than average, while 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 band-limiting or tailoring was evident.

Sound Quality

The A300 scored 'above average' on the listening test sessions, 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.

The bass was a little soft *via* the disc input, but not seriously so, and program dynamics were portrayed with greater faithfulness than usual at this price level.

The rendition of depth and space *via* the auxiliary input was encouraging, with once again a reasonably solid central image focus. Detail was good with a pleasing separation of complex musical strands. The bass lacked the real power and definition of larger models but performed quite well nonetheless. The sound was satisfactory into mild clipping, providing 100dBA into the standard load, and a modest 97dBA into the adverse load.

Conclusions

Reauditioned this year, the '320 was slightly clearer as well as better focused, while the basic technical performance remains undisturbed. As a competent budget model, the A320 comfortably attains recommendation.

Test measurements

To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

Test Results

Power output			Integrated amplifier
Rated power into 8ohms, maker's spec			25W(=14dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	14.3dBW	14.5dBW	13.9dBW
Both channels, 4ohm load	12.9dBW	13.2dBW	12.7dBW
One channel, 2ohms, pulsed	11.4dBW	11.7dBW	11.5dBW
Instantaneous peak current		+9.0A	−9.4A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−82.0dB	−85.0dB	−73.0dB
Intermodulation, 19/20kHz, rated power, aux input			−73.0dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			>−80.0dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−81.0dB
Disc (mc) input (IHF, CCIR weighted)			n/a dB
Aux/CD input (IHF, CCIR weighted)			−82.0dB
Residual, unweighted (volume control at min)			−75.0dB
DC output offset			24mV
DC offset, pre-amp			left n/a mV, right n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32.0dB	31.0dB	31.0dB
Disc (mc) input (IHF)*	n/a dB	n/a dB	n/a dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	−69.0dB	≏67.0dB	−53.0dB
Aux input	−72.0dB	−68.0dB	≏53.0dB
Output impedance (damping)	0.06ohm	0.06ohm	0.12ohm
Channel balance, disc, at 1kHz			0.3dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.3dB	0.6dB	0.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.44mV	46kohms 260pF
Disc (mc) input*	n/a	n/a mV	n/a kohms n/a pF
Aux input	Phono	29.5mV	38.0kohms 40pF
Power amp	n/a	n/a mV	n/a kohms n/a pF
Output, pre-amp (tape)			00.0V max, 000ohms
Disc equalisation error, 30Hz-15kHz			+0.5dB, ≏0.2dB
Size (width, height, depth)			44×30×10cm
Typical price inc VAT			£99

For graph references see issue No 44

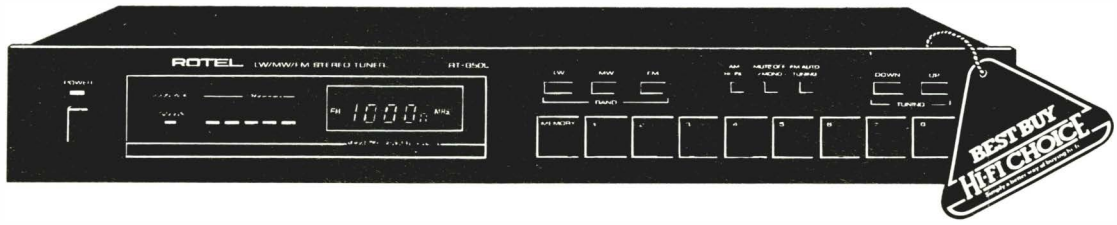
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TUNERS

Not the most glamorous of the hi-fi components, tuners are usually bought on cosmetic grounds, by the 40 per cent or so who choose to partner a previously selected amplifier. Years ago, people bought receivers instead, but these have fallen from favour and fashion. But at least the separates option allows the tuner to be added later as a system upgrade, and may also allow the customer to choose a level of performance to suit his pocket and interest in the radio medium.

The motivation to buy a tuner must surely relate closely to the characteristics of radio programming in whatever country. And in this respect the UK is very wierd indeed — a bizarre combination of Government over-regulation and indecision at the local level alongside a national network widely regarded as the envy of the world. The result is certainly some of the best programming in the world, but biased in such a way that could only exist in a non-commercial operation, and leaving substantial gaps in the balance and depth of popularly-orientated programming. But for those with broad or specifically classical music tastes, the BBC is one of the few services which continue to transmit substantial amounts of live performance, and this is a powerful reason for contemplating a significant investment in a decent tuner. Given a reasonably decent hi-fi system, radio transmissions of pre-recorded material rarely equal the quality obtainable by reproducing that same source directly in the home; broadcast treatment of LP discs is a particular travesty. Yet the live transmission from studio or concert hall, if sensitively miked and mixed, can produce a spine-chilling realism that transcends other sources in certain respects. It is a treat that should not be overlooked.

Basic Requirements

From the hi-fi perspective, FM (VHF) is the only form of radio which is worth considering, and the only source of stereo broadcasts in the UK. But many programmes are only available on AM (Medium and Long wave) transmissions, so an FM-only tuner may need the backup of a common or garden transistor radio to cope with the BBC's, infuriating habit of trying to squeeze five channels into three FM networks by switching and swapping frequency allocations. There is clearly a powerful argument for looking closely at the FM/AM combination tuner. But do not look too closely, because the quality of the AM sections fitted to most hi-fi tuners is embarassingly bad. The typical medium priced portable will probably comfortably outclass the hi-fi tuner's AM section, presumably because its portability requires that it works under a wider range of reception conditions.

But frankly — and rather sadly — AM is a dead loss for quality reception in Europe these days, simply because the airwaves are grossly overcrowded with powerful transmitters. To get them all in without even worse interference problems, the stations restrict the bandwidth of the signals they transmit, by rolling off most of the treble range well below the natural range of human hearing, an expediency which deals fidelity a fatal blow. Moreover, AM in the UK remains resolutely monophonic, without even that curiously random and intermittent luxury of FM in stereo provided by the BBC.

The Vital Element

Nostalgia aside, we must accept that FM is it, and then see what is needed to get decent results. In pole position, not too surprisingly, comes the quality of the aerial ar antenna. It is a common misconception that you only need rooftop aerial if you're trying to pull in distant signals over difficult terrain. In fact you may need an even better aerial to get good results in the urban jungle than you do amongst the rolling hillsides, because of the need to get well above traffic and other electrical interference and to avoid the multiple reflection effects of nearby large buildings.

To get a decent aerial system needs a budget of perhaps 25 per cent of the cost of the tuner, and the attentions of a skilled LOCAL installation engineer. The local part is important because a knowledge of local terrain and transmission conditions is very important in choosing and siting the aerial. And it makes some sense to look for a radio enthusiast rather than someone who spends 90 per cent of his time pointing TV aerials at the local repeater. But programming preferences can also influence the selection of an aerial, so make sure the contractor is properly briefed. The ideal aerial for tuning to local stations is not the ideal for long distance reception. The final choice will depend upon the range you wish to recieve and the direction of the relevant transmitters. It may be possible to get adequate local signals from a single fixed antenna of two to four elements, though the disposition of transmitters may sometimes require the addition of an aerial rotator. Long distance reception needs a higher gain multi-element antenna, which has a commensurately 'tighter' reception beam, and a rotator will almost certainly be needed for a good aerial, because without it there is little point in buying other than a cheap tuner. And it is also worth pointing out that signal has to be many times stronger for the tuner to produce a stereo rather than a mono output. If you want stereo radio, you do need a real aerial, and preferably not something inadequate that needs a booster along in the cable in order to make the stereo beacon light up.

The Tuner Itself

Tuners may be very simple or highly complex. The bare necessity is an aerial connection and a couple of sockets for passing the stereo signal on to the amplifier, plus some sort of device for tuning in the stations, but the ingenuity of manufacturers has come up with all manner of additional facilities to enchance the performance or baffle the uninitiated. The opposite extremes are admirably illustrated by comparing two well-respected models which cost the best part of £1,000, one from the UK and the other from the Continent. The former has no apparent frills at all, carrying out functions like muting entirely automatically; the other gives an almost infinite number of options under manual or automatic control, with a front panel to rival the complexity of a personal computer. Both have their loyal adherents, yet the philosophical rift is so great it is hard to see how the purchaser of one would have even considered the other.

Tuners consist of two distinct sections. The 'front end' receives most of the attention, and is the part which is responsible for capturing the wanted signal from the aerial — and more important, is responsible for rejecting all the other signals coming down the aerial, either interference or from stations on other frequencies which are often many times more powerful than the wanted signal. The *Choice* tests analyse the front end RF performance in some considerable detail, but their complexity does not lend itself to simple interpretation in such a brief introduction. The reviews contain their own interpretation of capture ratio, AM rejection and the like, but the interested reader should refer to the specialist *Choice: Amplifiers and Tuners* edition for more background information Because specialist tuners have traditonally been designed by specialist radio engineers, most of the attention has been lavished on the receiving 'front end' circuitry. Yet the broadcast system in the UK is such that most locations receive a reasonably strong transmission signal for a limited number of stations. UK hi-fi manufacturers have been busily getting back into the tuner market after years of Japanese domination by emphasising the superior sound of simple, carefully designed audio circuitry — in much the same way as they have creamed off some of the top end of CD player sales. The paradoxical result is that some of the best sounding tuners often have comparitively weak RF performance, but this will only prove a liability under abnormally difficult reception conditions. The sheer complexity of the tuner with exceptional RF capabilities can prove a handicap on basic sound quality. The customer has the option of going in either direction, according to his needs, preferences, and local signal conditions.

Reviews reprinted from issue No 44 by Martin Colloms.

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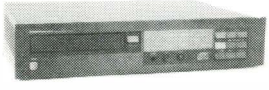
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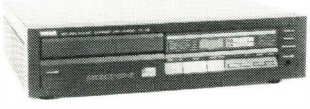
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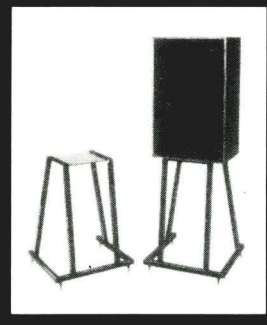
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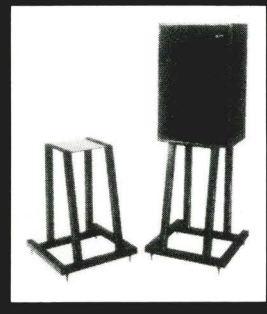
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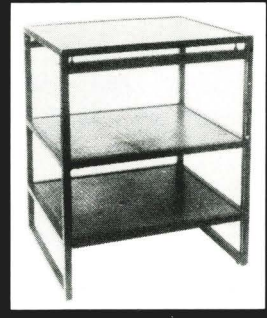
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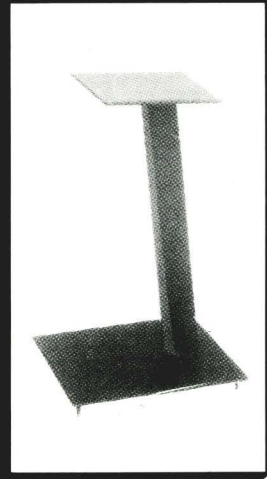
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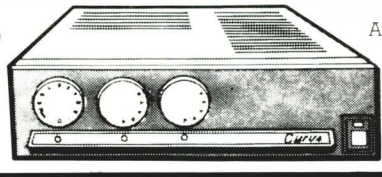
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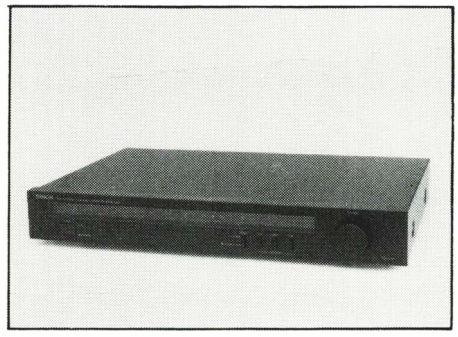
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Modestly priced, this tuner still claims a substantially good performance according to the manufacturer's specifications. With a straightforward, manually-tuned slide-rule dial the *717* is designed to match the *707* amplifier at a similar selling price. It covers the three UK wavebands, MW, LW and FM, but as its design indicates, no preset tuning is possible. Facilities include mono/stereo muting, a limited resolution signal strength indicator, plus a tuning indicator lamp, with dial position shown by a moving LED. The audio output is *via* a short captive cable with phono plugs attached.

LAB REPORT

Proving to be one of the better performers in the lab, the *717* returned a fine 25μV stereo sensitivity, backed by whistle-free reception and a good ultimate signal-to-noise ratio, using the tough 'CCIR ARM' reading method with a 1kHz reference level. Alternate channel selectivity was a fine 74dB which in conjunction with good results for capture ratio and AM suppression indicate a powerful RF performance suited to a wide range of reception conditions. Channel separation was satisfactory while distortion verged on 'good'. The pilot tones were



nicely rejected and a close channel balance was maintained. Output for full modulation was nearly 0.5V, a typical result, and was well maintained from 10Hz to 10kHz (at −0.5dB), falling more quickly to −3dB at 16kHz. The AM rejection was found to vary with signal level over quite a wide range; for example, 50dB at 40μV and 70dB at 2mV inputs, the latter a remarkable result. Overall the technical performance was pretty good.

SOUND QUALITY

Scoring just 'average' on sound quality, the audio performance showed a lack of stereo width and focus precision, with some untidiness in the treble definition. Modest depth was heard and the result was fairly musical. At the price level, this is a decent performance. However, on AM the sound was poor, with a rough distorted effect, and showing sharp coloration; intelligibility was satisfactory on speech.

CONCLUSIONS

The radio frequency performance was good enough for the price, while the stereo sound quality was satisfactory. The AM sound was thought rather unpleasant, but overall, this tuner was powerful enough in radio performance terms to merit recommendation.

TEST RESULTS

Sensitivity for 50dB signal-to-noise ratio	
Mono/stereo	2.5μV/25μV
Ultimate signal-to-noise (CCIR/ARM/1kHz ref)	
Mono/stereo	−74.5dB/−66.0dB
Muting threshold, R.F. level	approx 10μV
Alternate channel selectivity	−74dB
Pilot tone rejection, 19kHz/38kHz	−64.2dB/−105.5dB
AM rejection	−56dB
Capture ratio	2dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	−47dB/−45dB
Stereo separation, 1kHz/5kHz/10kHz	−27dB/−28dB/−30dB
Output level, 100% modulation	454mV
Channel balance, stereo	0.15dB
Dimension (width, height, depth)	43.5 x 7 x 30cm
Typical price inc VAT	£100

For graph references see issue No 44

RECOMMENDED

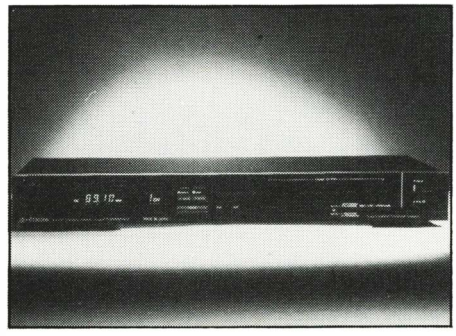
HITACHI FT-5500 Mk 2

HITACHI SALES (UK) LTD, HITACHI HOUSE, STATION ROAD, HAYES, MIDDLESEX UB3 4DR.
TEL: 01-848 8787

A well established design, the *5500* is now available in 'Mk II' form, still competitively priced. It proved rather complicated to measure since its various modes effectively result in four sets of tuner results! These have been sensibly simplified in the table. A field condition computer system ('FCCS') can select various modes according to reception conditions, automatically assuring optimum sound quality and noise suppression. Medium wave AM and VHF/FM coverage are offered, but long wave has been omitted. Sixteen presets are available, with auto-seek and manual tuning facilities; in addition, an RF attenuator plus narrow and wide IF options may be selected.

LAB REPORT

Previously the *5500* could overload on strong RF signals, but now the switchable RF attenuator has provided a solution. Good sensitivity was shown (10dB worse with the RF attenuator), and although the signal-to-noise ratios were very good, the muting threshold at around 7μV, was set too low for my taste. On 'wide', the alternate channel selectivity was acceptable, indeed better than usual at 29dB, and the narrow IF gave a fine 74dB of rejection when required. The multiplex pilot tones were excellently rejected.



The capture ratio results vary with the different modes, from an excellent 'narrow band/single' result, to 4dB on 'wide/double'. AM rejection remained pretty constant at around 60dB. On the best settings the total harmonic distortion was around 0.5% in stereo, worsening to 1% on 'narrow/double'.

Frequency response was rather 'tailored' with 1.8dB of bass lift by 80Hz, and the same degree of cut at 10kHz; it was 3dB down by 13.5kHz.

SOUND QUALITY

The overall sound was highly rated on FM, with very low background noise in stereo, fine instrumental detail and clarity, together with well focused, wide stereo images. Bass was good, the mid was tonally a touch thin, and the treble pretty clean. Stereo depth was unexceptional. On the narrow IF setting the image quality was degraded, together with a loss of detail. On AM the sound was basically satisfactory.

CONCLUSIONS

In its latest form the *5500 II* showed a versatile all round performance, both on the RF and the audio front, though some initial learning will be needed to obtain best results. Recommended.

TEST RESULTS

Sensitivity for 50dB signal-to-noise ratio	
Mono/stereo	5μV/55μV
Ultimate signal-to-noise (CCIR/ARM/1kHz ref)	
Mono/stereo	for all settings, 80dB/69dB
Muting threshold	single, wide, IF, 7μV (narrow 15μ)
	double, wide, 17μV (narrow 15μV
Alternate channel selectivity	29dB (narrow 74dB)
Pilot tone rejection, 19kHz/38kHz	−69dB/−123dB
AM rejection	single wide, −62dB (narrow −59dB)
	double wide −61dB (narrow −60dB)
Capture ratio	wide, 1.5dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	single, wide −66dB/−54dB
	(double −65dB/51dB)
Stereo separation, 1kHz/5kHz/10kHz	−52dB/−52dB/−48dB
	(narrow 49dB/48dB/42dB)
Output level, 100% modulation	single, wide 752mV
	(narrow 707mV)
Channel balance, stereo	0.24dB
Dimension (width, height, depth)	43.5 x 5.5 x 28.5cm
Typical price inc VAT	£200

For graph references see issue No 44

RECOMMENDED

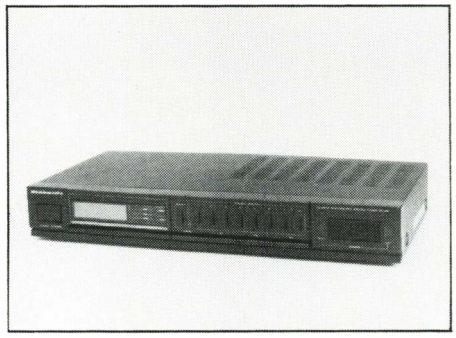
MARANTZ ST-151L

MARANTZ AUDIO (UK) LTD, 15-16 SAXON WAY INDUSTRIAL ESTATE, MOOR LANE,
HARMONDSWORTH, UB7 0LW. TEL: 01-897 6633

This slimline digital tuner is nicely styled and superbly finished despite a modest price. It covers three wavebands, with both long and medium AM bands as well as VHF/FM. Up to eight stations on each waveband may be pre-set in memory.

Interior design is simple and tidy; the front end has the usual varicap tuning system with no moving parts, using microprocessor central control and a quartz synthesiser.

Aerial connections include a 75ohm male coaxial socket and alternative 300ohm binding posts for FM, plus an external AM aerial terminal; an AM loop aerial is provided.



LAB REPORT

The RF sensitivity was poorer than average while the audio signal-to-noise ratios were unexceptional. Muting threshold was set rather low — 100μV would have been more sensible in view of the stereo performance. Alternate channel selectivity was pretty good, and this, combined with respectable results for AM rejection and capture ratio, meant that this model performed pretty well in crowded reception areas.

Total harmonic distortion was satisfactory in stereo at a little under 1%, while the stereo separation was really good at around 60dB midband — a remarkable result here.

A healthy output of 1 volt was delivered, enough for even a 'passive' pre-amp, and the channel balance was very close; frequency response was most uniform from 10Hz to 16kHz, being just 0.3dB down at 10kHz. While the pilot tone sidebands were just satisfactory at 29dB down, rejection of the pilot itself was −53dB.

SOUND QUALITY

Rated a little above average on FM, this tuner sounded a bit 'thin' with a loss of treble sweetness, but conversely it showed fairly good clarity and depth. Bass was a touch weak, however. Whistles occurred above 3mV input, so in very strong signal areas a 6 or 12dB aerial attenuator may be required; whistles also appeared with signal levels below 100μV, making this model unsuitable for fringe areas as well.

On AM it sounded rather above average, with a satisfactory, articulate sound, not as nasal or as coloured as usual, so it should make a good all-rounder for local station reception.

CONCLUSIONS

Suited to normal signal strength areas, this basic tuner gave reasonably good sound on all bands (given the intrinsic limitations of AM), and proved quite selective. A recommendation is deserved.

TEST RESULTS

Sensitivity for 50dB signal-to-noise ratio	
Mono/stereo	26μV/105μV
Ultimate signal-to-noise (CCIR/ARM/1kHz ref)	
Mono/stereo	−65dB/−60dB
Muting threshold	28μV
Alternate channel selectivity	−72dB
Pilot tone rejection, 19kHz/38kHz	−30dB/−48dB
AM rejection	−58dB
Capture ratio	3dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	−53dB/−43dB
Stereo separation, 1kHz/5kHz/10kHz	−64dB/−59dB/−49dB
Output level, 100% modulation	1026mV
Channel balance, stereo	0.03dB
Dimension (width, height, depth)	41.5 x 6.5 x 23cm
Typical price inc VAT	£85

For graph references see issue No 44

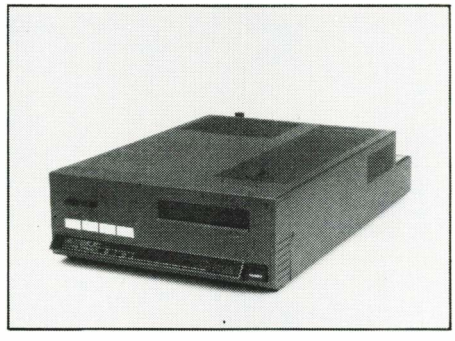
RECOMMENDED

MISSION CYRUS

CYRUS ELECTRONICS LTD, STONEHILLL, HUNTINGDON, CAMBS PE18 6ED.
TEL: (0480)57477

This compact design is styled to match the *Cyrus* amplifier series and the sound is claimed to match it too! Elegantly simple, it uses a large digital display with full synthesiser operation, and covers stereo plus medium wave AM bands. Tuning is manual via an auto-seek mode, with eight presets for each band.

A standard UK coaxial socket is provided for FM while a rear mounted AM loop aerial may be added for long range reception.



LAB REPORT

We tested two tuners as the first provided a poor 4.8dB result for capture ratio. However, the second sample was only slightly better at 4dB, pointing to some weakness in the IF design. AM rejection (IHF) was unexceptional at 51dB and varied strongly with level. Sensitivity was fine but at low RF levels some mild background warbles were audible in stereo mode. The ultimate signal to noise ratio reached almost 60dB, which was rather poorer than the best examples in the issue; in our view, the muting level was set too low. Alternate channel selectivity was pretty good at 71dB while the pilot tone rejection (IHF, no modulation) was fine on paper at −43 and −64dB for 19kHz and 38kHz components. However, under modulation the 38kHz sidebands deteriorated to just −24dB — not a good idea for recording purposes and representing a potential source of IM beats. Stereo distortion was just average at 0.3% while separation was likewise about average, measuring 44dB midband and falling to 35dB at 10kHz. The tuner's healthy 1V output will drive the *Cyrus* amplifier inputs satisfactorily.

SOUND QUALITY

Living up to its *Cyrus* namesakes, this tuner provides satisfying audio quality on FM stereo. Tidy and musical, it produced good stereo width and depth, plus pleasing ambience, a sweet treble and good detail. Backgrounds were not entirely silent, and on quiet programmes the hiss level was not up to the best possible standard.

On AM, the sound was rather below average, being 'thick' with a 'hollow' coloration.

CONCLUSIONS

Though 'best buy' material on sound quality grounds, this model's radio frequency performance let it down. For high-quality local station reception it will probably perform well but in more difficult conditions its abilities were questionable; at this stage the design qualifies only for recommendation.

TEST RESULTS

Sensitivity for 50dB signal-to-noise ratio	
Mono/stereo	7.7μV/27μV
Ultimate signal-to-noise (CCIR/ARM/1kHz ref)	
Mono/stereo	−68dB/−59.0dB
Muting threshold, R.F. level	5.5μV
Alternate channel selectivity	−71dB
Pilot tone rejection, 19kHz/38kHz	−43dB/−64dB
AM rejection	−51dB
Capture ratio	4.8dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	−57dB/−50dB
Stereo separation, 1kHz/5kHz/10kHz	−44dB/−41dB/−35dB
Output level, 100% modulation	998mV
Channel balance, stereo	0.04dB
Dimension (width, height, depth)	21.5 x 8.5 x 39.5cm
Typical price inc VAT	£180

For graph references see issue No 44

BEST BUY

NAD 4020B

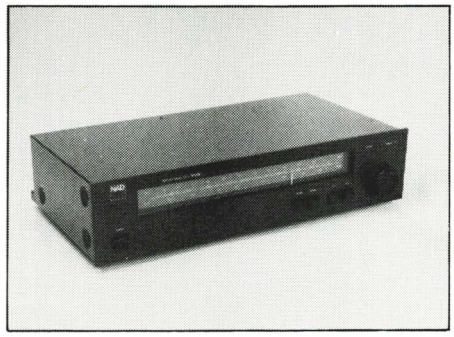
NAD SALES, COUSTEAU HOUSE, GREYCAINE ROAD, WATFORD WD2 4SB
TEL: (0923) 26499

Traditionally styled, looking much as tuners did a decade ago, the *4020B* is none the worse for that. A large 'slide rule' tuning scale dominates the front panels, showing clearly that traditional analogue design still evades the almost ubiquitous synthesiser chip. I still like analogue tuners and appreciated the rapid dial response of the flywheel-loaded tuning of this model. On the debit side, preset station facilities are absent.

A simple but effective tuning indicator uses two red lamps flanking a green 'OK' light. FM and the medium wave AM band are covered, and muting and mono modes can be separately engaged. On the rear panel, in addition to the movable rod AM aerial, there is also a proper UK coaxial socket for FM. Clip connectors are provided for an additional AM aerial as well as 300 ohm and 75 ohm FM options.

Lab Report

While not up in the super class the sensitivity was sufficient for most applications (but not extreme fringe). Stereo signal-to-noise levelled off at 58dB and did not improve greatly in mono while the muting threshold of 5μV was too low to give sensible service. The pilot tone rejection



was fine and total harmonic distortion was satisfactory both as regards mono and stereo. Stereo separation was pretty good right up to 10kHz while the radio frequency parameters were also good, including selectivity, AM suppression (rejection of interference) and capture ratio. The audio frequency response was sensibly flat and the RF input showed a fine overload performance.

Sound Quality

Scoring very well on the listening tests, clean stereo reception was obtained with signal levels over 800μV. Background hiss was just satisfactory, countered by a lively and open sound, plus good stereo image, showing fair depth and space.

The AM sound was quite presentable and in fact above average; but as usual this is not saying much!

Conclusions

While this was neither the quietest or the most sensitive tuner of the group, it nonetheless provided a great sound for the money. Easy to use, it was musical as well as ambient, proving a worthy match for the NAD *3120* as well as any other comparably good amplifier. The value rating suggests a Best Buy.

Test Results

Sensitivity for 50dB signal-to-noise ratio	
Mono/stereo	4μV/80μV
Ultimate signal-to-noise (CCIR/ARM/1kHz ref)	
Mono/stereo	63dB/58dB
Muting threshold, R.F. level	5μV
Alternate channel selectivity	68dB
Pilot tone rejection, 19kHz/38kHz	58dB/−70dB
AM rejection	60dB
Capture ratio	1.4dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	−51dB/−50dB
Stereo separation, 1kHz/5kHz/10kHz	55dB/52dB/48dB
Output level, 100% modulation	910mV
Channel balance, stereo	0.03dB
Dimension (width, height, depth)	42 x 24 x 10cm
Typical price inc VAT	£139

For graph references see issue No 44

RECOMMENDED

PIONEER F-99X

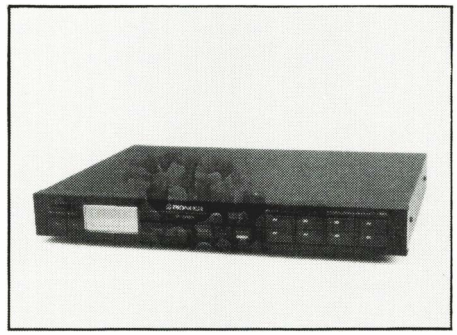
PIONEER HIGH FIDELITY (GB) LTD, FIELD WAY, GREENFORD, MIDDLESEX UB6 8UZ.
TEL: 01-575 5757

Pioneer's original *F90* tuner had a distinguished record, including high ratings in previous issues of *HFC*. In contrast with the usual policy of planned obsolescence, Pioneer have chosen to enhance this model, in the form of the '*99X*.

A total of 16 stations, FM and medium wave in any combination, may be programmed for pre-set tuning; long wave AM is not covered. Facilities include manual and power tuning, plus a variable IF bandwidth, the latter allowing optimum audio performance in 'wide' mode. The aerial socket is soldered directly to the printed circuit, a mechanically unwise thing to do, and on our sample the initially poor sensitivity was traced to a broken connection here.

Lab Report

This tuner provided an exceptional sensitivity combined with an excellent front end, this ensuring a strong performance over a wide range of reception conditions. In 'narrow' mode, the selectivity was very good, with an excellent AM rejection. The capture ratio varied with IF bandwidth and was at its best on the wide setting. Pilot tones were rejected well and the results for ultimate signal-to-noise were up with the best.



Significant advances have been made over the *F90* with respect to distortion, which in 'wide' mode, full modulation stereo, held to 0.05%, −66dB — a superb result. Channel separation held well at 51dB at 1kHz, 53dB at 1kHz, 53dB at 10kHz, and the results degraded little on the narrow IF setting.

Channel balance was perfect, and the audio output was 785mV from a low output impedance of 900ohms. Frequency response was wide and flat, ±0.2dB through the midband, with the −3dB points at 10Hz and 16.5kHz.

Sound Quality

This design's reputation held up during the auditioning. Good on narrow IF, it improved noticeably on 'wide'. The bass was firm and clean, with exceptional stereo stage width and focus. Image depth was fairly good, though the midrange sounded a little 'thin' with a mild 'edginess' in the treble. Complementing these FM results, the AM performance was well above average.

Conclusions

This powerful tuner lacked long wave but would perform well under some of the most difficult reception conditions. The sound quality was good, both on FM stereo and AM, and a strong recommendation was assured.

Test Results

	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	2.4μV/24μV (narrow 1F2.0μV/24μV)
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	−81dB/−70dB
Muting threshold	13μV
Alternate channel selectivity	−15dB (narrow, 76dB)
Pilot tone rejection, 19kHz/38kHz	−60dB/−83dB
AM rejection	−76dB
Capture ratio	1.2dB (narrow, 3.0dB)
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	−69dB/−66 (narrow, −65dB/−50dB)
Stereo separation, 1kHz/5kHz/10kHz	−50dB/−51dB/−53dB (narrow, 41dB/42dB/47dB)
Output level, 100% mod	785mV
Channel balance	0dB
Dimensions (width, depth, height)	42×32×6cm
Typical price inc VAT	£240

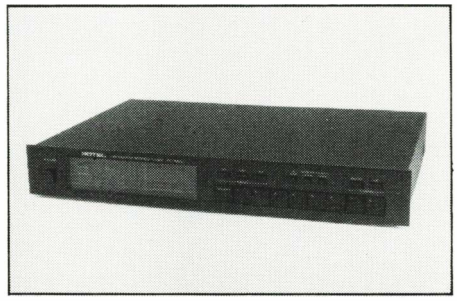
For graph references see issue No 44

BEST BUY

ROTEL RT-850L

ROTEL HI-FI, 25 HEATHFIELD, STACEY BUSHES, MILTON KEYNES MK12 6HR.
TEL: (0908) 317707

Rotel's two tuners, the '830 and '850 have been designed with an accent on sound quality — in a sense they are of the 'BX' generation. The *RT-850* is the more expensive model, and covers FM stereo, medium and long-wave bands; a full digital design, it offers both auto-seek 'power' tuning and manual frequency entry. In power tune mode, the muting threshold is sensibly set to ignore weak, noisy stations.



LAB REPORT

The RF performance was substantially good, with a decent sensitivity coupled with other figures which point to a good performance in fringe reception areas. Background whistles were suppressed well but the rejection of ultrasonic signals was not as effective. Rejection of the exact pilot tone frequency was numerically quite good, but in the presence of normal modulation, spurious sidebands appear at only 23dB down. Ultimate signal to noise ratios were more than satisfactory. Alternate channel selectivity was to a decent standard while both the AM suppression and capture ratio were first rate.

On stereo, worst case, harmonic distortion held to 0.2% in the midband, which was a fine result, while stereo channel separation was also pretty good. Channel balance was excellent, while stereo frequency response proved to be very flat and extended, only 1dB down at 10Hz, and 3dB down at 17.5kHz. At high signal strengths some variation in AM rejection was noted; for example, 50dB at 30mV, and some spurious RF responses were also apparent.

SOUND QUALITY

Justifying the designers' efforts, the '850 scored well in the listening tests, and was one of the best sounding models at the price level. The FM stereo showed a good rendition of depth and ambience, coupled with fine central focus and width; tonally, it was sweeter than usual, with good perspectives, and a clear sparkling treble.

Unfortunately, on AM the sound was barely average even allowing for the inherently poor sound of this waveband. It was however relatively crisp and intelligible, particularly on voice.

CONCLUSIONS

With sound quality regarded as a major parameter in *Hi-Fi Choice* assessments, the *RT-850L* happily scored a Best Buy in its price category. Furthermore, the basic tuner RF performance was also pretty good.

TEST RESULTS

Sensitivity for 50dB signal-to-noise ratio	
Mono/stereo	2μV/17μV
Ultimate signal-to-noise (CCIR/ARM/1kHz ref)	
Mono/stereo	−73dB/−63.0dB
Muting threshold, R.F. level	4.4μV
Alternate channel selectivity	68dB
Pilot tone rejection, 19kHz/38kHz	−40dB/−51dB
AM rejection	−66dB
Capture ratio	1.1dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	−63dB/−55dB
Stereo separation, 1kHz/5kHz/10kHz	−40dB/−42dB/−34dB
Output level, 100% modulation	575mV
Channel balance, stereo	0.01dB
Dimension (width, height, depth)	43 x 6.5 x 31cm
Typical price inc VAT	£150

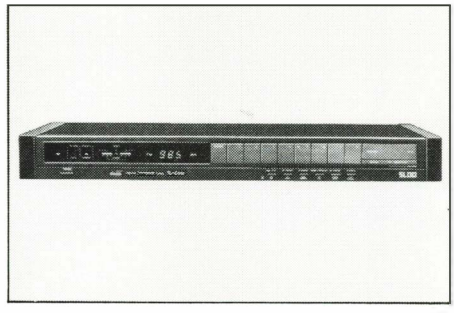
For graph references see issue No 44

BEST BUY

SANSUI TU-D99XL

SANSUI (UK) LTD, UNIT 10A, LYON INDUSTRIAL ESTATE, ROCKWARE AVENUE, GREENFORD, MIDDLESEX. TEL: 01-575 1133

This slimline compact model is an upmarket design with a comprehensive specification. A quartz locked synthesiser model, it offers FM coverage as well as AM medium wave, with 8 auto-tuned preset station positions on each band. Details include a record calibration tone at −6dB on peak level, plus a local/normal switch for front end sensitivity and a normal/narrow IF switch to aid separation of closely spaced stations. There is also a noise suppressor for weak stereo stations. At the rear, a Japanese-style coaxial connector is fitted using a special plug which has to be made up. 300ohm FM connection is via binding posts and these also serve for the AM loop antenna.



LAB REPORT

The '99X acquitted itself well in the lab tests. The RF performance was fine with very good sensitivity, a sensible muting threshold and excellent AM suppression as well as capture ratio. Selectivity was satisfactory in 'normal' and very good in 'narrow' IF mode. Signal-to-noise ratios were up with the best, while harmonic distortions held to a fine 0.1%, −60dB, in all conditions. Channel suppression was very good in normal mode and was still more than satisfactory in 'narrow'; for this tuner 'narrow' mode operation was no hardship. Output level was healthy, balance very good with the frequency response respectably flat.

SOUND QUALITY

Scoring very well on the listening tests, the '99 produced just slight background whistles, which had cleared by the 200μV input level, and from 500μV upwards the stereo output was very quiet. It presented a close copy of the original source, although the merest dullling of transients was noted. Otherwise the sound — stereo, depth, and tonal neutrality — all met high standards. High level RF blocking was cleared via the 'local' switch.

The AM sound was thought unpleasant with a notable hardness and ringing sound. Here it rated below average.

CONCLUSIONS

With a front rank sound quality and a very strong RF performance, this is clearly a fine tuner design. Suited, with the 'local' switch, to both fringe and high strength locations, a versatile performance is offered, and if the AM section is not considered important, it could fit the bill nicely. The '99X represents very good value in its price sector, and qualifies for a Best Buy rating.

TEST RESULTS

	Tuner
Sensitivity for 50dB signal-to-noise Mono/stereo	2.5μV/25μV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	76dB/71dB
Muting threshold	40μV
Alternate channel selectivity	40dB/75dB
Pilot tone rejection, 19kHz/38kHz	71dB/>93dB
AM rejection	>68dB
Capture ratio	1.0dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	−60dB/−63(−60*)dB
Stereo separation, 1kHz/5kHz/10kHz	55/58/52dB(37/40/42*)dB
Output level, 100% mod	825mV
Channel balance	0.15dB
Dimensions (width, depth, height)	43×26×5cm
Typical price inc VAT	£230

**Narrow IF bandwidth*

For graph reference see issue No 44

MISSION ELECTRONICS

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LOUDSPEAKERS

If you're planning to spend one or even several hundred pounds on a new pair of loudspeakers, it does make sense to take at least as much care over the decision as one would in buying a pair of shoes. If you get the shoes wrong your feet will protest, so if you get the loudspeakers wrong your ears will rebel, and you will find yourself not using the system as much. But with hundreds of alternatives to choose from, each distinguished from its rivals by a different permutation of jargon, how do you begin to narrow the choice, and even start to make a selection? Cue for a little jargon-free advice!

The first step on the road is to try and specify one's own personal and particular requirements, he writes glibly, opening several cans of worms. It is possible to do this on a basic, simplistic level, checking the price, size and intended location. But there are real benefits for those prepared to take a little more trouble. With a little care, the assistance of the data in this book, and (hopefully) the co-operation of a skilled retailer, the end result can be that much more worthwhile.

Setting The Budget

Those buying just loudspeakers will have a pretty good idea of the money they have available, which as ever is the fundamental bottom line of any purchasing decision. But there is — and always has been — controversy over the proportion of a budget that should be devoted to loudspeakers, *vis à vis* that spent on the other components of a system.

Ten years ago conventional wisdom recommended devoting as much as possible to the loudspeaker, as it was regarded as the weakest link in the chain. An alternative philosophy, pointing out that the loudspeaker could do nothing to compensate for an inadequate source, switched attention towards turntables and amplifiers. And as usual the pendulum probably swung too far, and is now beginning to turn back towards the loudspeaker.

Personal Preferences

Here we get into the realms of personal taste, and this requires either the painful process of individual experience or the sympathies of a competent dealer in order to establish where one's personal priorities lie. Where one listener may be barely conscious of the subtleties of stereo imagery, another will take particular pleasure in pin-pointing musicians within a recorded acoustic. Those who listen predominantly to electronic rather than acoustic instruments are liable to sacrifice coloration in favour of dynamic impact.

While a magazine can assist in presenting these alternatives, it is only through skilled demonstration that an individual can be confronted with the different but equally valid options to make an educated choice for himself.

At the time of writing I am temporarily living with a £1000 system which suits me very well, but which certainly represents one extreme. It consists of a £600 turntable with £200 amplifier and £80 loudspeakers on £100 stands. At the other (rather less) extreme, another could enjoyably combine a £500 remote control multi-source midi-system with £500 worth of high performance, low coloration loudspeakers and stands. But unless one actually has the opportunity to hear the difference between these two very distinct approaches, how can one possibly have any basis for making a choice?

Siting Is Important

The site chosen for loudspeakers is often as influential as the choice of loudspeakers themselves. Over the years I have used open stand locations, both with conventional box speakers and panel types, and also stand-mounted wall-backed designs. Each has its own strengths and weaknesses and imposes its own characteristics on the sound, so again personal preference enters into the equation. Some will suit one room layout better than another, and choice must frequently take as much account of the visual as the sonic aesthetics.

Having chosen the siting, one may then choose the loudspeakers and stands to suit. Alternatively, choose the speakers you like in the shop, and then move them around at home until they sound to your taste, because small changes in position can give big alterations in sound, particularly when operating near a rear wall.

The end result comes from a complex interaction between the loudspeaker, its support, its site, the acoustics of the room, and the general characteristics of the driving system. It is rarely entirely predictable. For those intending to spend a fair amount of money, it is not unreasonable to expect the luxury of a home demonstration, and/or the option to return and change a pair which do not suit after a day or two.

The shop demonstration will suffice in most instances of choosing a loudspeaker or system, but the real value of a skilled specialist dealer is his ability to create in the home an experience similar to that which impressed in the shop, even within the inevitable constraints of the domestic environment. Experienced set-up advice can (or should) be worth a great deal, and certainly the normal retail markup.

Big Ones or Little Ones

For any given budget there is an obvious choice between large or small loudspeakers. One instinctive reaction is to favour the big one, particularly if it has lots of drive units, but others will plump for a miniature or compact on aesthetic grounds. In fact the differences and trade-offs are much more subtle and far-reaching.

Fundamentally, the larger the box the more extended the bass is for the same specific loudness. Ultimately a good big 'un is going to beat a good littl 'un on loudness and bass extension, hands down. But it is also going to cost a great deal more. The large enclosed volume remains the route to extended bass, and this in turn adds 'weight' and 'scale' to the sound. But it can also reveal the low frequency inadequacies of the sources, be they the equipment or the recordings themselves. Meanwhile most of the important musical information can be handled at adequate domestic levels by even the smaller enclosures.

Big speakers suffer from several innate disadvantages. Large box enclosures are expensive to build and ship, and represent an undesirably large surface area of unwanted radiation, which can colour the sound and blur stereo precision. Extra drive units do increase power handling, but bring problems of crossover complexity and unit integration.

Little speakers can prove more fragile if used for the occasional party, and are certainly not at their best when trying to recreate the power and drama of rock music or a full concert hall acoustic. Their appearance is bound to be more discrete, but they will nearly always need a special stand to produce the best results.

Modus Operandi

Given the excessive number of different models competing for attention, manufactuers are inclined to make much of the uniqueness of their particular brew. Indeed many will consciously aim towards some form of USP (unique selling point), or alternatively rush into incorporating that of a successful competitor. The result is that the industry has become riddled with buzz words to describe any single type of engineering solution, and this leads to the sort of stereotyping which entirely misses the point of loudspeaker engineering.

Examples are legion, from the bextrene bass/midrange cones of the early 'seventies through to the latest metal dome tweeters which are currently springing up everywhere. The result is that people talk of a 'metal dome sound' as something desirable (or not) *per se*, whereas in fact there will be a whole range of different metal dome sounds, in all probability some distinctly more 'equal' than others.

The underlying axiom is that great loudspeakers are not created by adopting a quick technological 'fix'. Indeed, history has often shown that the 'radical innovation' is a mere flash in the pan, with benefits in one area more than offset by unforseen penalties elsewhere.

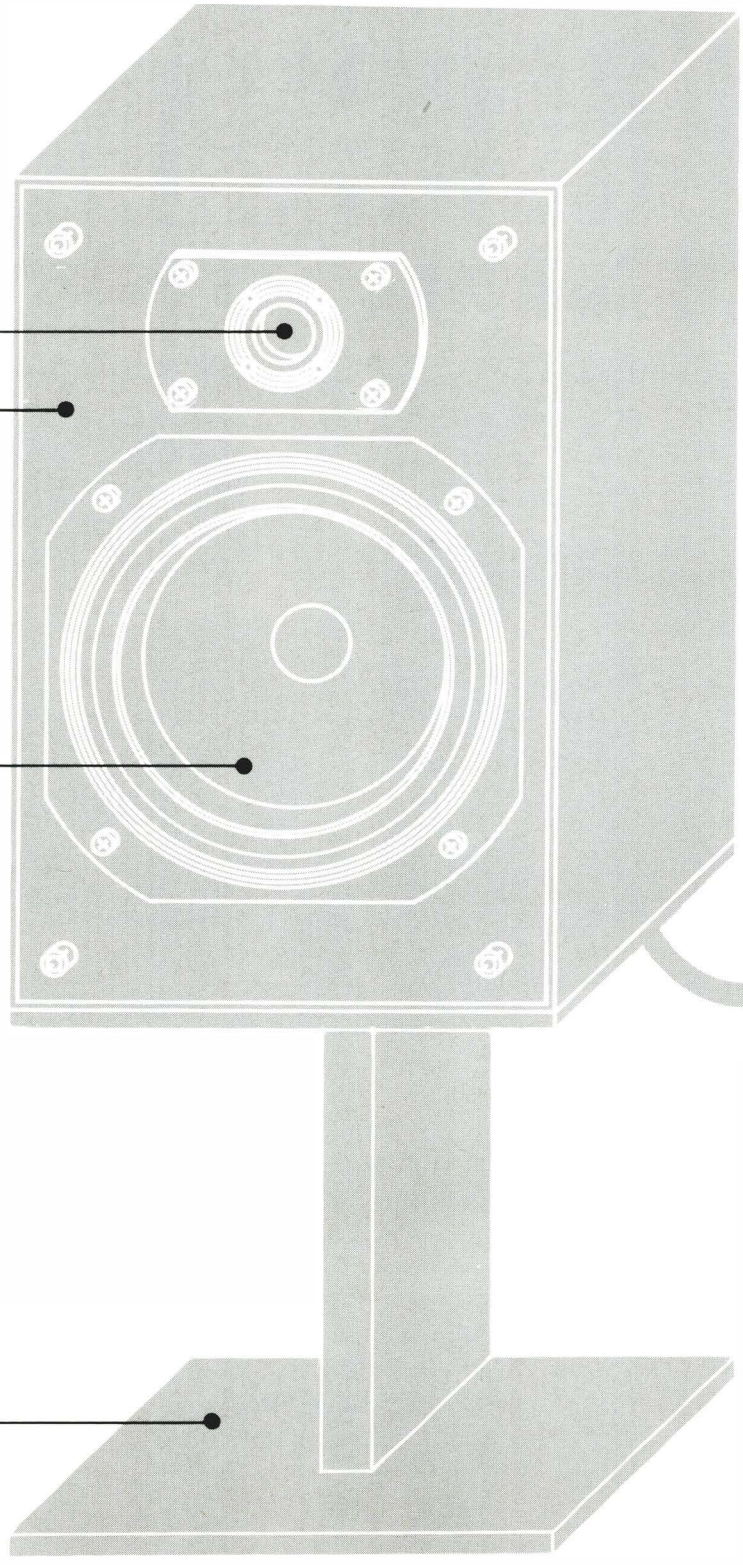
Technology has steadily improved the performance of loudspeakers over the years, and some innovations have proved decidedly worthwhile. But the whole is much greater than the apparent sum of the parts, and the buyer would do well to bear this in mind.

Reviews reprinted from issue Nos 41 & 46 by Martin Colloms

ANATOMY OF A LOUDSPEAKER

High frequency sounds from the tweeter may 'beam' in some designs while others have purposely tailored vertical or lateral dispersion patterns. The speaker needs setting to put the tweeter at an appropriate height for the ears of seated listeners.

Angling speakers inwards can improve stereo imagery. Room placement for good stereo is as important as that for good bass. Experimentation with angling and relative distances from the room boundaries is recommended.



Grilles on or off? Many speakers sound better with grilles removed, because of the diffractive effects of the grille frame. Can you live with naked drive units?

Electrical matching: Speakers are far more easily damaged by an amp that is under-powered than one that is 'too big'. A small amp, when driven flat out, may 'clip' the output waveform, lopping off the tops of the waves. This generates high-level high-frequency distortion products that can destroy tweeters. Big amps can only damage a speaker by pushing the drive unit out too far or by heating the voice coil over a period of time — unlikely in normal use. Loudspeaker manufacturers give a bracket for the power ratings of suitable amplifiers, so choose speakers and amp to match each other.

Efficiency. A more efficient speaker is one which is better at converting electricity into sound. A speaker of 90dB sensitivity will sound literally twice as loud as one of 80dB for the same power. To achieve the same by upgrading amplifier power would require a 50W amp be replaced with a 500W model! Higher efficiency may save you expenditure on unwanted amplifier power.

'Special' speaker cables may give subtle improvements in clarity and bass definition. In any case, use heavy-duty multi-strand cables rather than light gauge lighting flex or 'bell wire'.

The stands should be inert, rigid and coupled to the floor to prevent the speaker rocking or moving. The speaker system will then be able to produce clean deep bass and stable stereo imagery.

Where will the speakers be placed? If designed for true bookshelf or near wall location, they will only give a balanced output in that location. Speakers designed for free space do best on stands and will boom if put near walls or corners.

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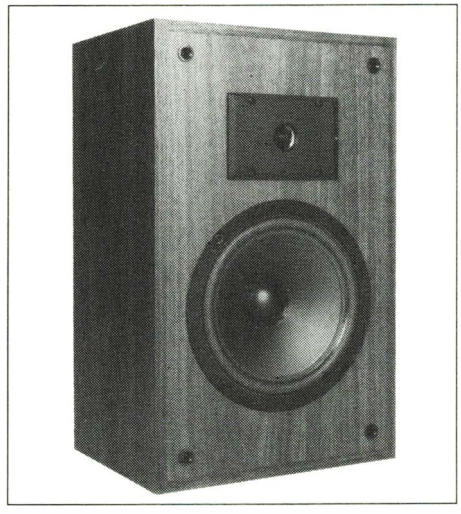
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BEST BUY

ACOUSTIC RESEARCH 18

ACOUSTIC RESEARCH, HIGH STREET, HOUGHTON REGIS, BEDS LU5 5QJ.
TEL: (0582) 867777



Last year the Acoustic Research budget speakers did not fare too well in *Choice*, as a hurried changeover from pulp cone systems to inadequately developed plastic cones gave unimpressive end results. Since then AR have completed an extensive development programme, resulting in a new set of budget models. The *18* is the middle-sized system, selling at a typical £115 a pair.

This compact two-way design uses a 210mm frame, 165mm cone bass/mid unit, plus 19mm cone dome tweeter. Both radiating elements are plastic, graphite-loaded polypropylene for the larger driver and polycarbonate for the ferrofluid-cooled tweeter.

During development it was discovered that the bass/mid unit possessed a naturally flat response with a convenient rolloff near the intended crossover point. Experiment confirmed that the system could work without an electrical crossover to this unit, and that a single capacitor feeding the tweeter would complete the design. The overall acoustic slopes approximate to 12dB/octave, with the ferrofluid damping helping to establish a defined tweeter bandpass. One outcome of the simple crossover design is that the amplifier is directly wired to the bass/mid unit. Past experience suggests that if such a system can be made to work correctly, this may confer benefits in terms of clarity and definition.

Built largely from 17mm chipboard, the vinyl-clad enclosure has a sealed-box volume of 15.4 litres, loading the bass unit to system resonance at 85Hz. The grille is satisfactorily shallow and rebated. Electrical connection is by 4mm socket/binders. Placement on stands is recommended, fairly close to the rear wall — 0.4 — 0.6m should be a good starting point.

SOUND QUALITY

Improving on its predecessors, the *AR18* scored an average rating while being priced well below. In terms of tonal balance it did sound 'small' for example with a lack of body on piano, but this was not too serious. The bass was nicely articulate, if too dry in the lower register. The midrange seemed somewhat forward, but balanced quite well through to the treble. Stereo imaging gained an overall 'average' rating, but more dynamic clarity was apparent than is usually found in speakers of this price. Again of average quality, the treble was fortunately unobtrusive. Quite good power handling was shown at the higher test levels.

LAB REPORT

In anechoic free space the *'18* provided a really good axial response, albeit one which showed some treble improvement when the grille was detached. The reference sensitivity was a high 90dB/W, with the associated −6dB bass rolloff at 60Hz. Fair bass should be available down to 50Hz, if somewhat attenuated. The general trends are best seen at the 2 metre measuring distance, in particular a rising output through the midrange with a moderate variation in output.

The off-axis curves were poorer than usual, partly because the high crossover frequency operates the bass/mid unit in its more directional region. The above-axis result was also unpromising, so the loudspeaker should be at or directed towards head height. The overall indications were of a 'light', 'forward' balance with some 'lumpiness'.

With a power handling of 60W, up to 103dBA will be possible from a stereo pair. Amplifiers down to 10W per channel will provide sensible sound levels provided party use is not envisaged. Rated 'good' in terms of amplifier loading, the impedance characteristic was fairly even, dipping to a minimum of 5 and averaging 6.5ohms. Most amplifiers will not find this speaker any problem to drive.

Measured in the listening room (without the benefit of wall augmentation), the response showed some mid dominance around 1kHz, but the overall balance was tolerable and the energy reasonably uniform through the crossover region.

Distortion performance was more than competant at the higher 96dB sound level, particularly in the bass. At higher frequencies the third harmonic was held to below 1%, averaging 0.7%. At the reduced 86dB level a proportional improvement was obtained across the range.

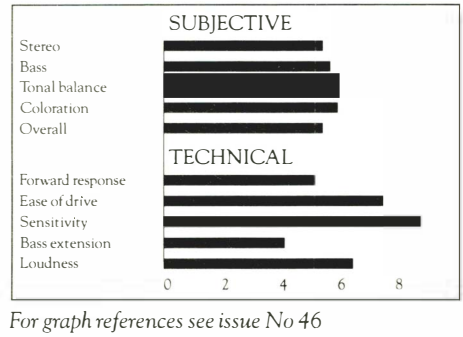
CONCLUSIONS

While the *'18* was not particularly tidy in response terms, it passed the lab tests in quite good form. Subjectively it proved better balanced than anticipated, with moderate coloration, a pleasing dynamic quality, and above average programme detail. The good sensitivity and amplifier loading ensures a Best Buy value for money rating.

GENERAL DATA

Size (height × width × depth)	45.5 × 27.5 × 21cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −60W
Recommended placement	on stand, near wall (0.5m)
Frequency response, within ±3dB, at 2 metres	65Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	60Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	90dB/W
Approximate maximum sound level (pair) at 2 metres	103dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	average
Typical price per pair, inc VAT	£115

PERFORMANCE SUMMARY



For graph references see issue No 46

RECOMMENDED

ACOUSTIC RESEARCH 22

ACOUSTIC RESEARCH, HIGH STREET, HOUGHTON REGIS, BEDS LU5 5QJ.
TEL: (0582) 867777



Closely related to the *AR 18*, the *'22* shares a similarly-sized enclosure and the same 230mm frame bass/mid unit. In the *'18* this driver is 'let rip', with no crossover for the low frequency section. Some additional crossover elements are used in the *'22*, to help define a more even response and more precisely integrate a different, wider range tweeter.

The *'22* is a sealed-box model with an internal volume of around 16 litres, resulting in a system resonance close to 60Hz. The carcass is vinyl-clad 17mm stock, and the front baffle is 17mm MDF. The back is recessed and the enclosure is quite rigid despite the lack of additional bracing, and shows above average resonance properties. A loose filling of polyester wadding provides some absorption for internal standing waves.

The bass unit has a shallow, flared polypropylene cone of 165mm effective radiating diameter, the cone plastic reinforced by a graphite loading. The treble is handled by a 25mm soft plastic dome tweeter, ferrofluid-cooled. The crossover is of normal commercial quality and conforms to 12dB/octave rates. Internal connections use clip-on terminals, while combined 4mm socket/binding posts making the external links to the amplifier.

The grille is a quite slim 9mm moulding, with a rebate to reduce diffraction in the treble. Location on rigid stands is advised, spaced possibly 0.5m from a back wall, though this dimension may be varied to suit local acoustic conditions.

Sound Quality

While the *'22* was a little better balanced tonally than the *18* — naturalness on singing voice and the like — it nonetheless scored slightly below its less expensive brother. Some listeners remarked on a higher perceived level of coloration with some 'spikey' sounds in the upper treble. Some of the dynamic 'life' of the *'18* was missing in the *'22*, though in certain areas the latter was more accurate. It scored about average on other subjective parameters, and is therefore quite a competent performance in view of its modest price.

Lab Report

The sensitivity was close to average at 88.5dB/W, some 1.5dB less than the *18*. Consequently the maximum sound level was less, the system reaching 101dBA for a maximum input of 75W program. (Some differences in frequency response shape accounts for an extra dB loss in the peak dBA reading.) Set against the reference sensitivity, the bass extended to 60Hz, −6dB, and realistic output down to 50Hz can be expected under room conditions.

The reference response was smoother than for the *'18*, except in the treble where a 5dB plateau appeared from 14-19kHz. The output showed little change when the grille was detached (dotted line). The speaker performed well on the 2 metre set of characteristic forward responses, exceptionally so in the lateral phase at 30° and 45°. In fact the high treble peak was almost gone by 20°, suggesting that a 'straight ahead' orientation for the enclosures in the listening room, listening off-axis, should give the best results. Some mid dominance may be seen, while the bass appears to be mildly underdamped. A small dip on the 15° vertical axis indicates that the speakers should be located at a sensible height, and not too low compared with a seated listener's head.

In-room, the *'22* demonstrated a well balanced response, though with noticeable uneveness. The central midrange was satisfactory, but the treble peaked at 5kHz and showed an undesirable 'corner' at 16kHz (the axial peak). Surprisingly the output peaked at 150-200Hz, while the lower bass was somewhat depressed.

The impedance characteristic suggests that the *'22* is a good amplifier load; although below the 8ohm standard, it should not present any problems. The distortion characteristics were fine at 86dB, averaging 0.4% third harmonic and 0.7% second, and although there was naturally an increase at the higher 96dB level, distortion remained well controlled.

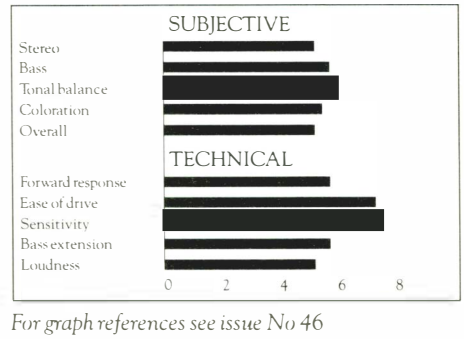
Conclusions

The *'22* should be better than the *18*, but in practice was not. The general characteristics were similar, but it proved harder to forgive the high treble 'sting' of the *'22* than the response untidiness of the *18*, particularly as the *'22* is more expensive. However, in context the value for money is still good, so the system qualifies for recommendation.

General Data

Size (height × width × depth)	44 × 27.5 × 21cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −75W
Recommended placement	on stands near wall (0.5m)
Frequency response, within ±3dB, at 2 metres	70Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	60Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	88.5dB/W
Approximate maximum sound level (pair) at 2 metres	101dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good
Typical price per pair, inc VAT	£149

Performance Summary

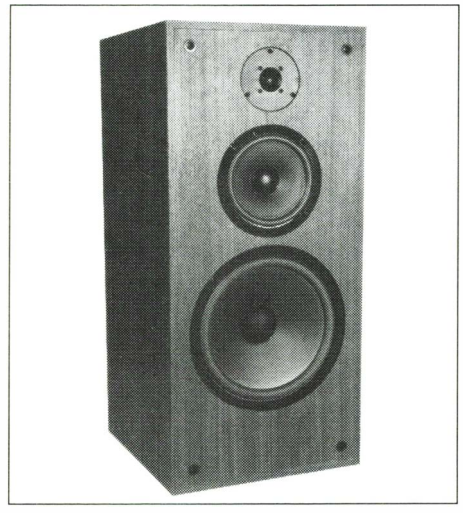


For graph references see issue No 46

RECOMMENDED

ACOUSTIC RESEARCH 44

ACOUSTIC RESEARCH, HIGH STREET, HOUGHTON REGIS, BEDS, LU5 5QJ.
TEL: (0582) 867777



For 1986 Acoustic Research (UK) have forged a new range of budget speakers, and these have been helping to lift their ratings in *Choice*. The *44BX* is currently the largest, comprising a classic three-way sealed-box design. The well-proportioned cabinet encloses 52 litres, most of which is allotted to the 250mm long-throw bass driver, though a decent sized rear chamber isolates the midrange unit from the bass pressure.

The system resonance lies at 50Hz, resulting in good bass extension. Free space mounting on rigid 35-45cm stands is advised. The diaphragms of both the bass and midrange drivers are graphite loaded polypropylene, with a flared profile; the surrounds are of foamed polyurethane, with a damping sealent. Above 4kHz, the treble range is delivered by a 25mm soft plastic dome tweeter; all drivers are custom made for AR in Japan.

The substantial chipboard enclosure is built mainly of 17mm panels with circumferential and side bracing, the net result being quite low in resonance effects. We understand that the enclosure has recently been further improved since our review, with additional reinforcement. The 11mm thick grille is rebated, and the exterior finish is 'walnut' vinyl. Internal damping is handled by a fill of polyester fibre, and the good commercial quality crossover is essentially to 12dB/octave, second-order characteristics. Cable connection is by 4mm socket/binding posts.

Sound Quality

Scoring above average in the listening sessions, the results were appropriate to the price. The *'44* gave a solid, powerful impression with quite good dynamic 'attack', and a pleasing level of instrumental detail. Mild 'boxiness' and 'nasality' were noted, with a touch of overhang in the bass, and some 'edge' and 'grain' in the treble.

Stereo images were satisfactorily focused, and some measure of ambience and depth was reproduced. Several listeners correctly guessed that this was a three-way design, so the drivers cannot be all that well integrated. Overall the sound seemed quite well balanced, with the slightly emphasised midrange adding to the vocal clarity. The system handled high powers with great competence.

Lab Report

The sensitivity was an above average 88.5dBW, though this was achieved at the expense of a lower than usual load impedance, which dipped to 3.3ohms at 100Hz, and averaged 5ohms over the range. Tougher 4ohm rated amplifiers are to be preferred, with a 10W suggested minimum power, while maximum drive of up to 150W can be used, giving good sound levels of 104dBA in-room. Backing this power capability, the distortion traces at 96dBA showed an average 1% over most of the frequency range, though the third harmonic 1-4kHz was probably higher than desirable; by 86dB, the important distortions averaged a comfortable 0.3%.

The smooth reference response curve fitted quite close limits despite a suggestion of mid 'forwardness' and some treble lift at 15kHz. The bass was mildly underdamped, but well extended to 43Hz, −6dB. The grille did not significantly upset the response, but can be seen to act as a treble attenuator. At 2 metres the speaker showed some improvement in driver integration, and the lateral off-axis responses are notably well controlled, but the 15° above-axis response in the vertical plane shows a 6-8dB dip around the upper crossover. This suggested that the stands used should be sufficiently high to bring the point between the mid and treble units up to or above ear height. Placement on the floor is asking for trouble, never mind the consequent coloration increase in the bass and low midrange.

Measured in the listening room, the bass holds up well down to 30Hz without serious imbalance, though the lower midrange, 200-500Hz, shows a mild depression, while the range just above this was a mite forward, and is responsible for a trace of mid dominance. Integration is most satisfactory across the mid-treble, while a slight 'corner' can be seen just before the treble finally rolls away. The balance overall is good.

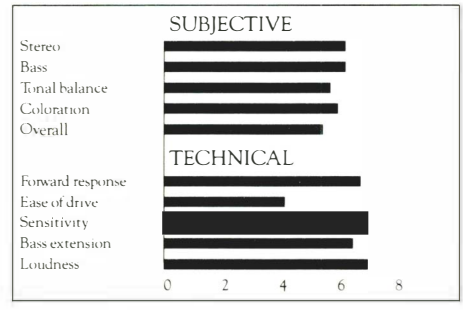
Conclusions

This is a powerful, well designed three-way system. The amplifier loading characteristics are tougher than usual, but sensitivity is healthy and the bass well extended. Tonal balance is pretty good, stereo detail and clarity were both well above average, so the system represents good value and is clearly recommended.

General Data

Size (height × width × depth)	70 × 32 × 34.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) – 150W
Recommended placement	open 35cm stands
Frequency response, within ±3dB, at 2 metres	50Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	43Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	88.5dB/W
Approximate maximum sound level (pair) at 2 metres	104dBA
Impedance characteristic (ease of drive)	below average
Forward response uniformity	good
Typical price per pair, inc VAT	£339

Performance Summary

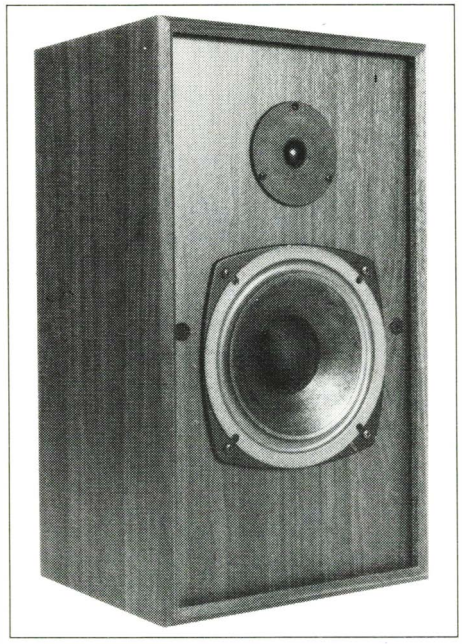


For graph references see issue No 46

RECOMMENDED

AKROYD A25

ROYD LOUDSPEAKER CO, UNIT A6, STAFFORD PARK 15, TELFORD, SHROPSHIRE TF3 3PB.
TEL: (0952) 617511



Akroyd have been building loudspeaker systems for a number of years, and although we had unpromising results with one of their earlier models a few years ago, we received the recent A25 model, said to be a relative of the *Coniston*, for 1986. This fair-sized compact system costs a competitive £100 a pair considering that the vinyl-covered sealed-box chipboard enclosure contains a volume of 25 litres, and that this is a three-driver system.

The 220mm frame, bass driver has a quite lightweight 160mm cone resulting in a speaker system resonance of 72Hz. Underdamped at low frequencies, output was actually well maintained down to 40Hz. The main midrange driver employs a coated pulp cone with classic flared profile, an inverted half-roll polyurethane foam surround, and a pressed-steel chassis, the latter strangely showing premature signs of rust — perhaps it had been stored in a damp environment? The treble is handled by the popular Danish VIFA 19mm soft plastic dome, a variation of the long-established SEAS equivalent.

The enclosure is built from 11mm stock and is devoid of bracing. It is acoustically damped by a couple of layers of polyester fibre, but the walls are untreated, leaving the panels a touch resonant. The grille is a plus feature, being cunningly located in a concealed groove in the picture frame front of the enclosure, and formed of 25mm thick acoustically transparent foam. We found a steel disc cemented to the inside of the rear panel, but could not discover its purpose.

Electrical connection is *via* the usual combination 4mm socket/binding posts. The high quality hard-wired crossover uses air-cored inductors and Mullard film capacitors. The crossover slopes are electrically 12dB/octave, but will be higher order in practice due to the drive unit characteristics.

Sound Quality

The *A25* scored below average on blind listening, but not disastrously so. Somewhat inconsistent with different program, the panel showed noticeable divergence of opinion as to its merits. Coloration altered piano tone, adding some 'nasal' and 'boxy' emphasis. Taken overall the sound seemed fairly well balanced, yet the treble drew attention to itself, occasionally sounding isolated or exaggerating background hiss in the program. The bass was well controlled with even extension to the lower frequencies.

Stereo imaging was interesting — not particularly well focused, but showing good 'attack' and some resolution of the space and ambience in recordings. Depth was weak, but the system showed some life and dynamic impact.

Lab Report

The *A25* has an average sensitivity of 87dB/W, indicating a minimum power of 12 watts. A practical maximum of 75W will provide peak sound levels of 100dBA in a typical room, and the bass was more extended than average reaching down to 52Hz, −6dB.

The alignment was close to ideal, as the room response shows. An attenuated but extended output was obtained down to 30Hz, while some mid prominence is associated with a notch at 1kHz (the marker position). At higher frequencies the treble looks nicely even, if over-extended in the high range.

The Akroyd looked rather primitive on the axial reference response at 1 metre. A valley may be seen at 1kHz, apparently due to a drive unit resonance mode, while beyond this point the output recovered, but showed some uneveness coupled with a slight treble lift. With smoothing at 2 metres these features still persisted, and were in fact more clearly defined. Within the obvious irregularities the off-axis traces were actually very well controlled, proving that the 'lumps' were not crossover related.

Just touching the 6.4ohm baseline, this speaker proved easy to drive, with an average impedance value of 10ohms. Distortion levels were poorer than average particularly at 96dB, but improved at the lower 86dB level.

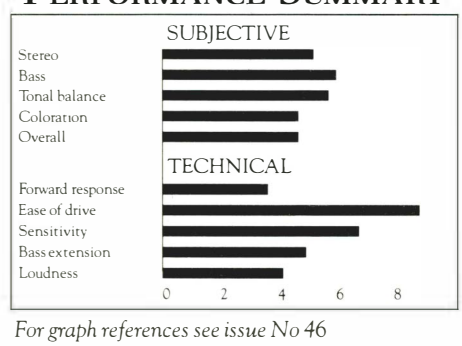
Conclusions

The results for this speaker were rather mixed, both for the lab tests and the auditioning. The indications are that it may not be to everybody's taste, but that it is still worth sampling. Decently sized for the price and with fair bass performance, it has done enough to achieve recommendation, but a personal audition is strongly advised.

General Data

Size (height × width × depth)	51 × 29.5 × 24cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(12) −75W
Recommended placement	on stand near wall
Frequency response, within ±3dB, at 2 metres	see graph
Low frequency rolloff (−6dB point) at 1 metre	52Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	87dB/W
Approximate maximum sound level (pair) at 2 metres	100dBA
Impedance characteristic (ease of drive)	good+
Forward response uniformity	below average
Typical price per pair, inc VAT	£100

Performance Summary



For graph references see issue No 46

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BEST BUY

B&W DM100

B&W LOUDSPEAKERS LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING, WEST SUSSEX. TEL: (0903) 750750

The '100 is the smaller brother of the successful *DM110*, and follows many of its sibling's good engineering features. For example, the 190mm bass driver chassis is a die-casting, the 145mm flared pulp cone has surface damping treatment and a generous magnet provides the energy.

Our samples were finished in a good quality 'black ash' vinyl. The enclosures are built from plain 15mm chipboard, with an internal volume of 11 litres. A sealed-box design, system resonance was a rather high 100Hz.

Crossing over at around 3kHz, the network is essentially third order, 18dB/octave and uses five elements plus an attenuating resistor. The 25mm soft plastic dome tweeter (made by B&W) is protected by a user-replaceable fuse.

The grille baffle is made from 15mm stock, unrebated, and is best detached for serious listening. Free space or shelf mounting is possible. Electrical connection is made *via* 4mm socket/binding posts.

Sound Quality

The '100 romped through the listening tests with a substantially 'good' score, which is very good for the class. Sounding a trifle 'loud' and light-weight in tonal balance, it provided an even, well-integrated sound, with consistently high levels of both detail and clarity.

Stereo focus was good, with quite good representation of depth and recorded ambience. Perspectives were nicely handled, while the coloration was fairly low throughout the range. It proved a bit shy in the low bass but the upper bass was both clean and tuneful. Good power handling was shown up to 75W above which point some detail was lost.

Lab Report

On axis at the reference 1 metre distance, this speaker proved its pedigree by providing a ±2dB output from 80Hz to 20kHz. The grille was acoustically poor, as the solid line (grille on) showed. The reference sensitivity was 89dB/W, above average, and the −6dB rolloff occurred at 75Hz, a higher than usual frequency.

Pair matching was very good. Maximum sound levels of 103dBA are possible and a minimum amplifier power of 10 watts per channel is indicated.

At 2 metres microphone distance, a well integrated set of curves is seen, with only minor variations over the various axes. The overall balance was pretty good.

The fine sensitivity was not compromised by the impedance, which did not fall below 6ohms and averaged 8ohms. Driven to a 96dB sound level the distortion results were good, averaging 0.3% above 300Hz and well balanced below that frequency. By 86dB, a general improvement has occurred with second harmonic falling to negligible levels above 300Hz.

While the low frequency range showed some attenuation, the room response illustrated the finely balanced midrange and the integrated treble of this well engineered performer.

Conclusions

A fitting companion to the '110, the '100 managed to establish a fine performance in its own right, despite its competitive pricing. It sailed through both the lab and the listening tests, proving to be sensitive, clean sounding, and offering good stereo. It suits shelf or stand mounting and offers very good value. A Best Buy classification is mandatory.

Reassessed. First reviewed 1985. Current typical price £100.

For graph references see issue No 41

BEST BUY

B&W DM110

B&W LOUDSPEAKERS LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING, WEST SUSSEX. TEL: (0903) 750750

Available for some years now, the '110 has been a highly successful loudspeaker. Built to a tried and tested formula, this success seems due to a skilful balance of performance, engineering and fine value. A two-way model of some 22 litres internal volume, it is reflex-loaded by a 5cm diameter port, backed by a 7cm tube.

Bass and midrange frequencies are handled by a 220mm flared pulp cone unit, built on a substantial diecast frame with six hole fixing. A B&W-built unit is also used for the treble, a 25mm soft dome plastic foil unit with cast plate.

The enclosure is well finished in a 'walnut' vinyl material, while the grille and its thick non-rebated frame can be detached. 4mm socket/binding posts are fitted at the rear. The crossover is said to be 4th order acoustic Butterworth, achieved by a good quality 2nd order internal network in conjunction with the drivers' acoustic responses. Acoustic foam is used to provide internal absorption.

Sound Quality

Despite its budget price the '110 scored 'above average'. A good midrange was solidly backed by a lively, articulate quality, and the speaker showed a pleasing transparency with good rendition of fine detail.

Tonally it was well balanced, with just a hint of untidiness at the response extremes; in the extreme treble, a touch of 'tizz' was evident while the bass extreme sounded a little underdamped. Some box coloration was present despite the fine overall effect, and this occasionally made itself apparent. Stereo images were well focused, particularly with the grille detached, and the '110 made a surprisingly good attempt to recreate depth of image. High powers were also handled very well.

Lab Report

An excellent pair match was shown, certainly within ±0.5dB limits over the whole range. The reference response was very good indeed, marred by a ripple at 5kHz to 8kHz which was removed by detaching the grille. Sensitivity was a high 89.5dB/W with the remarkable response of ±2dB, 65Hz to 19kHz. The −6dB LF point was typical for the type at 56Hz, and the system is well tuned.

A 350W peak programme signal was handled without damage but 100W peak would be a fairer rating, allowing a generous maximum sound level of around 104dBA for a stereo pair, near disco levels! Out at 2m the forward response family of curves was very good, bar the 15° vertical off-axis response. This suggests that fairly high stands should be used, with the treble units close to ear level. Good driver integration was shown here particularly in the lateral axis.

Even at 96dB sound pressure level, the speaker produced only moderate distortion levels of under 0.3% midband, and this was mainly the less harmful 2nd harmonic. At 86dB and above 200Hz 3rd averaged 0.2%, and 2nd still less. These are very fine results.

The impedance curve gave no cause for concern and essentially represents an 8ohm system of typically good behaviour; no decent amplifier should find this speaker a problem.

In the listening room, the computer averaged response was impressive too. Good output can be seen down to 40Hz with a notably even and well matched midband, while the treble rolloff also conformed to an even axial output.

Conclusions

This well engineered loudspeaker provides good sensitivity with low distortion. The amplifier load is good, the responses even and the tonal balance most presentable. The sound quality is most competitive and the power handling exceptional, while its lively, transparent quality consistently pleases. Overall this is a clear candidate for Best Buy status.

Reassessed. First reviewed 1984. Current typical price £140.

For graph references see issue No 41

RECOMMENDED

BBC LS3/5a

GOODMANS LOUDSPEAKERS LTD; SWISSTONE LTD (ROGERS); SPENDOR AUDIO SYSTEMS LTD.
·———ALL MANUFACTURING TO FIXED SPECIFICATIONS UNDER BBC LICENCE———·

Three manufacturers are currently licensed by the BBC to produce *LS3/5As*, and all must stick to the Corporation's tight specifications. Designed as a miniature broadcast monitor for cramped spaces, by offering a fine sound quality in its own right it has stood up to much larger competition for more than 10 years. Mounting on high stands well clear of room walls at approximately ear level provides best results.

A sealed plywood box of 5½ litres volume, the *3/5A* is a two way system employing selected KEF drivers, a 110mm Bextrene cone bass/midrange and a 19mm plastic dome treble unit. An elaborate and costly crossover is employed to equalise the drivers to a strict specification.

Sound Quality

The *LS3/5A* has consistently done well in previous live-versus-recorded sessions and fairly well on analogue programme sources. However, with digital material, problems which were only hinted by analogue material were now clearly apparent, making the design sound more dated. Several areas attracted criticism — the bass lacked extension and sounded 'boomy' in the upper bass register, while the mid had a noticeably 'hard', 'nasal' quality and the treble seemed forward with a grainy, 'zitty' effect at the extreme top end. Some 'tubby', wooden and boxy colorations were also evident, with only moderate rendition of stereo depth.

However, it continued however to provide good voice detail and articulation, with a reasonably accurate tonal balance. Comparison between the Goodmans and Spendor versions showed great similarity while a much older model from Audiomaster (no longer in production) sounded slightly dimmer by comparison, with less mid nasality. However the difference was small by speaker standards.

Lab Report

Sensitivity was low, measuring 81.5dB/W and necessitating a minimum amplifier power of 30W per channel. A 50W maximum is suggested although with care 100W amps may be used. The bass rolloff −6dB point measured 57Hz, quite good for the size, while pair matching was very good (all three current makes). The impedance curve never dipped below 7.5ohms, so the design qualifies as an easy 10ohm load. Modest 96dBA maximum sound levels are possible.

Reference curves were taken for the Goodmans and Spendor samples and showed good agreement with the reference unit, though the 1.2kHz prominence seems to have become more pronounced over the years. This perhaps reflects a change in the B110, although it is still within specification. By modern standards the response looks a trifle lumpy, though in its time this system was regarded as a very smooth performer.

Conclusions

At risk of offending the BBC, we feel that the *3/5A* is due for a revision; as a working broadcast tool it no doubt does its job, but as a piece of value engineering it is beginning to fall behind. Other speakers have shown a progressive reduction in price as well as an improvement in sound quality, but the *LS3/5A* has steadily increased in price more or less in line with inflation. Nevertheless, on the most recent listening tests the *LS3/5A* scores were sufficient to retain recommendation!

First reviewed: Rogers 1978, Goodmans and Spendor, 1983 (retested 1984, reassessed 1985/6.) Current typical price £220

For graph references see issue No 41

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RECOMMENDED

CASTLE CLYDE

CASTLE ACOUSTICS LTD, SHORTBANK ROAD, SKIPTON. N. YORKS BD23 2TT.
TEL: (0756) 5333

Possessing a 9.8 litres internal volume, the *Clyde* 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 a well-designed, 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.

SOUND QUALITY

The *Clyde* was felt to sound a little 'small' with a degree of 'forwardness' in the midband, but 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.

The imaging was 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.

LAB REPORT

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 9ohms. 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 ⅓-octave analysis at a 2 metre measuring distance the output was excellently uniform and integrated; in this respect the system illustrated an almost 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 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.

CONCLUSIONS

Now a well-established model, the *Clyde* is a tidy little performer which packs a surprising punch in terms of a clear, even and lively sound. It offers a high sensitivity and is an easy amplifier load, giving good dynamic range with moderate distortion, plus good finish and engineering.

Re-auditioning in 1986 with a current version suggests perhaps that the *Clyde* is at last beginning to show its age, with slightly below average results overall. Considering the low price this is still a good result, though our recommendation is now perhaps a little less enthusiastic in the light of increased competition.

Re-auditioned. First reviewed 1981. Current typical price £112

For graph references see issue No 41

RECOMMENDED

CASTLE PEMBROKE

CASTLE ACOUSTICS LTD, SHORTBANK ROAD, SKIPTON, N. YORKS BD23 2TT.
TEL: (0756) 5333

Although basically a compact design the *Pembroke* nonetheless encompasses a bass-reflex-loaded volume of some 32 litres. The enclosure had 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 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 socket/binding posts more suited to 'special' cables. Internal fuses, accessible behind the bass driver, protect against sustained amplifier overload.

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 sound 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, the *Pembroke* sounded as smooth as the remarkable lab test results would indicate!

LAB REPORT

Pair matching was good except around the 14kHz area where significant 2dB errors were observed. The grille had no deleterious effect on the sound. 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 at 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 2 metres, 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?

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, indicating that the loudspeaker will be very easy to drive with any reputable amplifier. The computer-averaged room response also appears 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. However, overall this is a fine result.

CONCLUSIONS

Comfortably 'recommended', this traditional-looking speaker offers a sweet, smooth sound with an excellent overall balance of engineering-based performance.

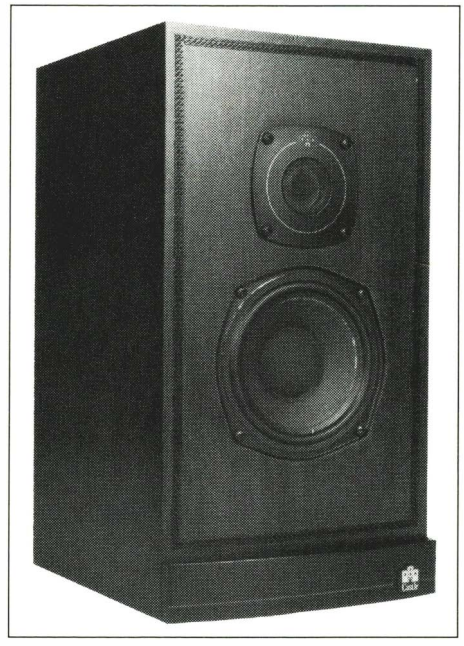
Reassessed. First reviewed 1983. Current typical price £240.

For graph references see issue No 41

RECOMMENDED

CASTLE DURHAM

CASTLE ACOUSTICS LTD, SHORTBANK ROAD, SKIPTON, N.YORKS BD23 2TT.
TEL: (0756) 5333



The *Durham* is a brand new design, selling for £150, and so sits at the higher quality end of the budget speaker sector. Such models typically use a larger 210mm frame for the main bass/midrange driver, but here the Castle designer employs a small, high power driver with 150mm pressed steel frame and 110mm active cone diameter. This flared pulp cone is suspended on a strong mechanical system designed for reflex-loading.

Castle themselves make both drivers, the treble range being handled by their established 30mm plastic cone, which is fitted with a large central phasing plug that results in an annular radiating element. The good quality crossover essentially conforms to 12dB/octave second-order form, and is distinguished by the use of film capacitors for the treble section. Hard-wiring is used internally, external system connection is made *via* combined 4mm socket/binding posts, and positor' overload protection is fitted.

The enclosure is robustly contructed from 19mm chipboard, finished in real walnut veneer, and the side panels are internally reinforced by a cross-brace. Bituminous pads further damp panel resonances, and an acoustic foam lining moderates internal standing waves. The 15 litre internal volume is reflex-tuned to 65Hz by a ducted port 40mm in diameter and 30mm long. A foam grille ensures good frontal dispersion characteristics. The standard of construction is as good as the finish, and a site fairly close to a rear wall mounted on a good quality stand, will take account of the slightly 'forward' frequency balance.

Sound Quality

Handling realistic peak power levels without noticeable limiting, the *Durham* scored above the group average during the listening tests. It sounded quite clear, giving some resolution of the recorded acoustic. Depth was not particularly well constructed in the stereo image, though frontal plane focusing was more than satisfactory.

Coloration in the usual sense was low, but like so many recent speakers, the tonal balance tended to 'thinness' with a 'forward' upper-mid-range. While the mid-treble balance was quite uniform, the upper treble hinted at brightness with some 'grain' or related imprecision. The bass was of an average standard — somewhat shy and lacking extension though fairly articulate and tuneful.

Lab Report

Assessed from the 1 metre response, the lab sensitivity is a fairly high 89dB/W, though the bass extension to 67Hz, −6dB is unexceptional in this price range. A minimum power of 10W per channel is suggested, while a sensible 50W maximum will provide peak sound levels of up to 102dBA, ample for all normal purposes.

Under anechoic conditions, the output rises smoothly by some 5dB from 80Hz to 1kHz. Some loss is seen in the presence range, while the treble shows mild uneveness. The impedance curve had an average value of 8ohms, and constitutes an easy amplifier load since it did not fall below 6.4ohms. The forward frequency response group at 2 metres proved uniform, with a fine consistency over the range of forward axes. The speaker's 'light' frequency balance is plain to see, and the output is notably uncritical of the precise listening axis.

In the listening room, the computer measurements showed a properly defined output through the mid and treble ranges, but with a loss of level in the upper bass to low midrange, 90-250Hz. The bass output was shy, did not match the mid level even with the help of wall lift, and fell off quickly at lower frequencies.

The distortion was judged about average at a sound level of 86dB at 1 metre, though the third harmonic appeared a bit high in the lower treble. By 96dB the range above 60Hz was nicely controlled, but signs of stress were apparent below 60Hz, for example 10% of third harmonic at 40Hz. The second harmonic peak at 20kHz is considered harmless.

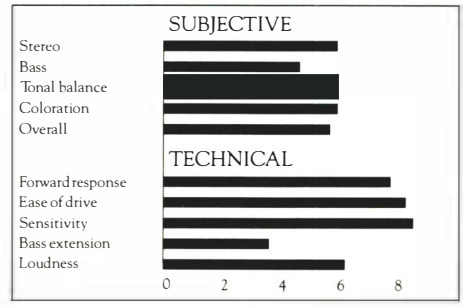
Conclusions

Though evolved from a smaller system, the *Durham* performed quite well in this issue. Despite a 'lean' midrange, the listening results were encouraging, and this system is clearly well engineered, sensitive and nicely finished. The bass is on the weak side, but does not prevent this model from meriting recommendation.

General Data

Size (height × width × depth)	40 × 21.5 × 25cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −50W
Recommended placement	near rear wall
Frequency response, within ±3dB, at 2 metres	100Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	67Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89dB/W
Approximate maximum sound level (pair) at 2 metres	102dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	very good
Typical price per pair, inc VAT	£150

Performance Summary



For graph references see issue No 46

BEST BUY

CELESTION DL4

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
·———TEL: (0473) 73131———·

by David G. Prakel

The author of this volume, Martin Colloms, was called in as design consultant on the Celestion *DL* series. Consequently the review is written by DGP, based on the comparative measurement and blind listening data generated during the test programme.

Smallest of the three is the *DL4*. This 10 litre box is styled to capitalise on the association with the *SL6* while the 25mm soft plastic film tweeter has a front-plate ribbed in the manner of the *SL6/SL600* trim plates. The brown painted Medite baffle has been divided with painted lines to follow the *SL6* 'modular' appearance.

A 165mm paper-coned mid/bass driver has been chosen which, coupled with reflex loading, enables the system to achieve above average sensitivity.

The 12mm chipboard carcass has a recessed back panel for stiffness and is neatly chamfered around the front edge to give a smooth transition to the moulded plastic grille frame. Michell gold-plated binding posts have been used — an 'audiophile' touch unusual in a £100 speaker.

An eight-component crossover is hard-wired to the back of the moulded terminal block — the two drivers crossing over just below 3kHz. The highish sensitivity of the finished system allows even modestly powered amplifiers to produce fair levels with these speakers.

SOUND QUALITY

There was no disagreement about the considerable strengths and the few compromises in this speaker when presented in 'blind' conditions to the listening panel. All listeners, particularly those seated on-axis, commented positively on the stereo depth imaging ability, but no one was fooled into thinking this was a large speaker as extended bass simply wasn't there. However the bass was always described as tight and tuneful and the overall performance dynamic, exciting and informative.

The only real criticism of this design came from its top end performance which was variously described as 'shrill' or 'whistly'. Later listening tests confirmed that the speaker sounds best on tall stands with some reinforcement from a back wall, say within 0.5m.

LAB REPORT

The 1m on-axis plot showed a controlled bass rolloff with just a trace of upper bass prominence, the −6dB point at a high 85Hz suggesting that the speaker is best used fairly close to a room boundary. Around the crossover region there is some discontinuity in the response plot, and to some extent in the in-room analysis which also showed the limited bass energy of this system. Good dispersion characteristics were shown by the family of 2m curves, suggesting a strong stereo performance. However the 15 degree above axis plot has a 'treble-strong' balance which indicates that the speakers should be auditioned with the tweeter at least at ear height. Tall stands close to a wall are indicated.

At 96dB sound level, the major distortion peak is a relatively innocuous 2nd harmonic, rising to just over 3% at 200Hz. A tiny tweeter irregularity can be seen around 8-10kHz but the general distortion above the 200Hz centred peak is well below 0.3%.

The impedance plot shows an unremarkable dip to 6.5ohms between 5k and 10kHz.

CONCLUSIONS

Taking into account the fact that the *DL4* sells for just under £100 its performance in blind listening tests and in later sighted listening tests is a considerable achievement for the price. This is not a cheap 'audiophile' quality speaker but a design which will produce meaningful musical results when partnered with an inexpensive amplifier and a typically dull budget cartridge; brighter sources may sound 'spitty' and 'hard' however. The strong stereo performance and controlled bass would indicate Best Buy status at this price.

Reassessed. First reviewed 1985. Current typical price £100.

For graph references see issue No 41

RECOMMENDED

CELESTION DL6

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
·———TEL: (0473) 73131———·

by David Prakel

The author of this volume, Martin Colloms, was called in as design consultant on the Celestion *DL* series. Consequently the review is written by DGP, based on the comparative measurement and blind listening data generated during the test programme.

Though similar in principle to the *DL4*, the *DL6* has a considerably larger box. The same 25mm plastic dome tweeter has been used but this time it is crossed over to a 200mm paper mid/bass unit built in a substantial cast chassis and with an inverted PVC roll surround. Paper-pulp-coned drivers with large magnets keep sensitivity of both the models above average — Celestion quote 89dB/W/1m.

The *DL6* reflex-loaded with the port venting through the back panel of the speaker to maintain the visual consistency of the range. The same chamfered box front and tapered grille frame give the speaker a distinctive appearance and reduce the frontal area of the speaker to some extent. The carcass is produced in 16mm chipboard, again with a Medite baffle and fibre filling.

The eight-component crossover is to the same layout as the *DL4* (12dB slopes) again hard-wired and with the components glued to the back of the terminal block, which carries gold-plated Michell 4mm binding posts. Heavy gauge internal wiring is used.

SOUND QUALITY

In the panel listening tests the *DL6* rapidly established itself as a more extended and refined version of the *DL4*. The same strong imagery and lively informative sound was there but the bass was considerably more extended and a degree 'richer'. Treble was slightly 'whiskery', described as being slightly 'gritty' or 'scratchy'. Though on some programmes the speaker could sound a little 'whispy' or 'thin' it was not marked down for this.

The *DL6* gave considerable insight into the scale of music and produced a spacious sound retaining details of the ambience of the recording venue. However, off-axis listeners seemed less able to appreciate the speakers' imaging ability.

Bass was surprisingly controlled and extended for a speaker at this price. The *DL6*'s ability to produce a coherent sense of space with wide dynamic range, plenty of detail and good low end control helped it do well in both 'blind' and later 'sighted' listening tests.

LAB REPORT

The 1m axial plot showed evidence of the 3kHz crossover point and a slightly ragged treble output rising to peak at 10kHz (about 2dB up on the 1kHz level). The −6dB rolloff point in the bass comes at 60Hz and the upper bass peaks before rolling off into the midband trough. The twin peaks were shown also in the 2m plots. The off-axis curves indicated well controlled dispersion though again there is a 'glitch' in the 15° above-axis plot around the crossover point. As with the *DL4*, the '6 should be used on stands to aim the tweeter towards the listener's ear.

The in-room plots gave a very even smooth output with some evidence of the crossover notch but a well extended low-end.

CONCLUSIONS

The control and power embodied in this design sets it a way apart from the run-of-the-mill £120 speaker. Particularly good when pushed hard by a large amplifier, the *DL6* produced none of the listener fatigue generated by lesser designs at this price. Bass performance, stereo imagery and balance were all above average though the treble performance has been bettered in this price bracket. The balance of performance strengths, however, enables us confidently to recommend the *DL6*.

Reassessed. First reviewed 1985. Current typical price £130.

For graph references see issue No 41

BEST BUY

CELESTION DL8

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
TEL: (0473) 73131

by David Prakel

The author of this volume, Martin Colloms, was called in as design consultant on the Celestion *DL* series. Consequently this review is written by DGP, based on the comparative measurement and blind listening data generated during the test programme.

Where the Celestion *DL4* and *DL6* share a common tweeter, the *DL6* and *DL8* use the same mid/bass driver. However, in the *DL8* the 200mm paper-pulp-coned unit is used in a sealed box and crossed over to a derivative of the copper-deposition dome tweeter used in the *SL6*. This 32mm diameter unit achieves the necessary sensitivity by using a lightweight fabricated aluminium dome and an enormous magnet. The crossover network integrates the two drivers at around 2.5kHz with 12dB-slope tuned circuits, plus an additional capacitor in series with the bass driver.

The *DL8* carcass is built by wrapping a V-grooved 18mm chipboard plank around a recessed back and an 18mm Medite baffle. Finish is 'walnut' grained vinyl. The back panel terminal block is fitted with gold-plated Michell binding posts; inside the speaker, this block carries the hard-wired crossover. Fibre wadding is used in the cabinet while the drivers are wired with heavy gauge cable.

SOUND QUALITY

The gentle treble slope was noted by the listening panel, but the marks achieved were encouragingly high for a speaker selling at this mid-market price point. The metal dome tweeter gives the *DL8* an immediate ease and a treble clarity rarely heard in conventional tweeter designs. Again there was the hallmark of the *DL* range — a spaciousness and a controlled yet powerful sound.

Bass showed no trace of overhang while the purposeful tailoring of the low frequencies was just noted by one or two listeners who marked the speaker down as lacking the very deepest extension — which is not to criticise the precisely damped and tuneful bass of which the *DL8* is capable.

Listening tests outside the blind listening panel showed that the *DL8* lacked some of the sparkle and 'life' of the *DL6*, but equally well the treble never 'bit' in the same manner as the *DL6* when pushed too far.

LAB REPORT

The 1m axial plot showed the −6dB point of the system at 55Hz. The tweeter resonance lies outside the audio band being shown up by the rise in second harmonic distortion above 20kHz. General levels of distortion are commendably low, though the reflex-loaded *DL6* shows even lower bass distortion around 100Hz.

The 2m family of curves showed an excellent uniformity with a gradual slope falling from the mid through the treble. The 15 degree above-axis trace has a crossover notch which suggests that positioning with the tweeter on ear level would be appropriate. The in-room ⅓-octave measurements show an excellent smooth trend with a well sustained high end.

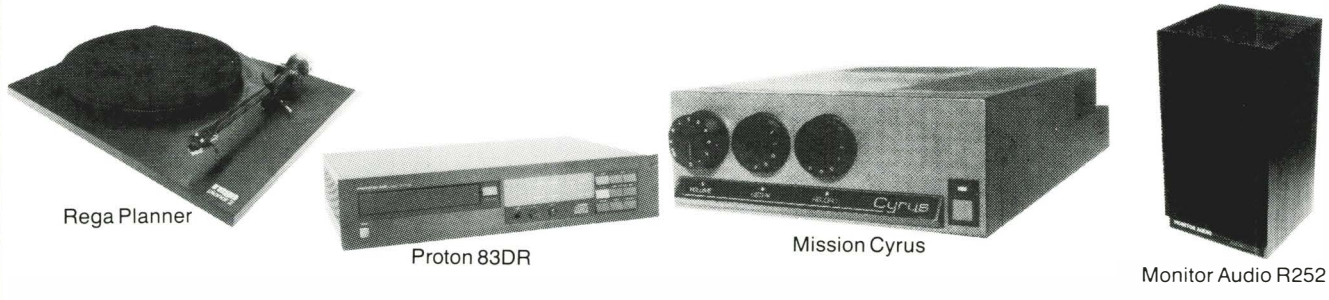
The 6.5ohm minimum impedence is of no real consequence. Sensitivity measured slightly under specification at 88dB/W.

CONCLUSIONS

The *DL8* has an easy relaxed quality with an imperturbable treble sound and a spaciousness and airiness that sets it apart from other loudspeakers in this price bracket. It offers an unusual blend of high power handling and above average sensitivity — attributes not normally associated with the smooth refined qualities of a metal dome tweeter. It is an easy speaker to live with and will not 'close up' when driven loud. A Best Buy rating is obviously in order for a speaker possessing these qualities while selling for £180.

Reassessed. First reviewed 1985. Current typical price £180.

For graph references see issue No 41



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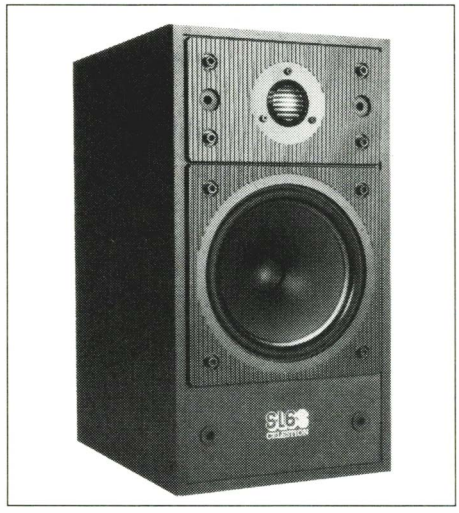
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BADA

CELESTION SL6S

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
TEL: (0473) 73131
David Prakel



A 'luxury compact' loudspeaker, the *SL6S* is a thoroughgoing redesign of the famous *SL6* primarily aiming to cure the sensitivity and bass limitations of the original design. The new 32mm aluminium dome tweeter offers both a higher frequency first bending mode and a lower mass, leading to higher sensitivity than the electroformed copper dome tweeter which it displaces. The closed-box cabinet is now made in medium density fibreboard (MDF), with thinner panels to reduce energy storage. A 'figure 8' brace and inset back panel help make the cabinet rigid; foam absorption is now used internally. It is available in black or walnut wood veneer finish, with optional high twin-pillar stands.

The 165mm Kobex-coned mid/bass driver is now built in a lugged die-cast chassis, which is bolted rather than clamped onto the cabinet. The unique two-part surround is effectively a mechanical crossover. The PVC originally used to terminate the *SL6* cone was good at reducing travelling waves in the cone, but was stiff and impaired bass impact. Laser velocimetric analysis showed that termination was already complete half-way through the roll surround, so Celestion have introduced a two-piece surround, the outer half in soft rubber giving a freer suspension at lower frequencies for improved bass articulation and 'speed'. The voice-coil inductance of this driver has also been reduced, to give better bass 'attack'.

The crossover is hard-wired and gives improved integration; a change of slope on the high pass leg has altered polar distribution, and stand height is now less criticial. Gold-plated binding posts are fitted.

SOUND QUALITY

The *SL6* has a generous, open sound with good stereo depth and separation — an altogether brighter, more out-of-the-box sound than its predecessor, it is also more capable of catching the impact and power of bass notes. *SL6* bass performance was marred by cabinet effects and the 'slowing' effect of the stiff mid/bass driver surround; the new speaker has a notably articulate bass, free from 'congestion' or 'drumming' coloration.

Furthermore, *SL6* delivers something of the exceptional stereo imagery achieved in the more expensive metal-cabinet *SL600* (still based on original *SL6* drivers and crossover).

A comparison of response traces shows the extra treble energy in the *'6S* which makes the speaker a little 'bright', and can produce a slight 'pinched' coloration, though otherwise the mid-band sounds unusually transparent.

LAB REPORT

For the *'S* model sensitivity has improved by roughly 2dB, and the maximum sound level achievable by a pair in-room is now increased to just over 100dB, from the previous 98dB. The speakers showed good pair matching, and the grille and its frame had little effect on the anechoic measurements. The 2m forward response curves are particularly even, showing evidence of the increased treble energy.

The 96dB distortion plots showed some improvement in high frequency figures over the *SL6*, but at this level this compact speaker is nearing its limits. The 86dB traces showed a dramatic reduction in the 200Hz third harmonic cabinet problem, which was very clearly seen in traces taken on the earlier *SL6*. The distortion performance at this level is good.

The *SL6S* computer averaged in-room response shows much better driver integration than before. A uniform output with surprisingly extended low frequencies combines excellent room interfacing with an impressively smooth treble rolloff. The *'6S* crossover presents a better load than *SL6*, the one 6ohm minimum confirming a true 8ohm load.

CONCLUSIONS

Retaining the strengths of the *SL6*, the *SL6S* loses none of that design's sweet treble and musical detail. Bass performance has been improved in both extension and clarity, and the redesign speaker is altogether more neutral, producing some of the excellent imaging properties of the *SL600* at under half the price.

Improved sensitivity and continued good drive characteristics make this an easy speaker to match; better treble dispersion allows greater freedom in room placement. The twin-pillar 40cm stands (L series) are recommended for the preferred free space location. *SL6S* rates as one of the very best compact speakers and carries a clear recommendation.

Author Martin Colloms' involvement as design consultant finds David Prakel writing this review, based on his own interpretation of the lab and listening data.

GENERAL DATA

Size (height×width×depth)	37.5×20×27cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(20) –150W
Recommended placement	free space, 40cm stand
Frequency response, within ±3dB, at 2 metres	60Hz to 16kHz
Low frequency rolloff (–6dB point) at 1 metre	50Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	84dB/W
Approximate maximum sound level (pair) at 2 metres	101dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good+
Typical price per pair, inc VAT	£350

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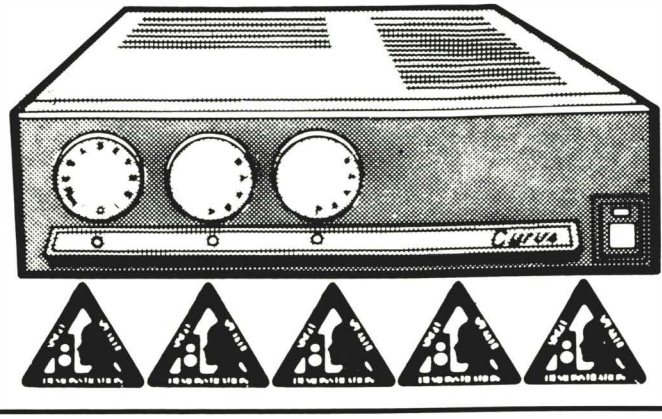
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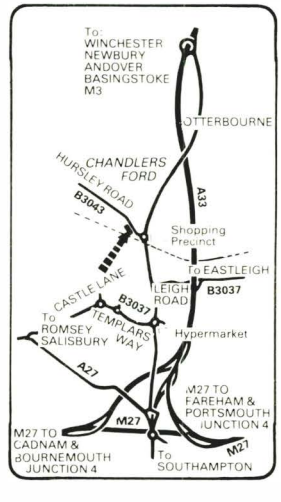
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Diesis is a small British company with cabinet making experience, and this is reflected in the excellent natural wood finish of this product. A miniature design, the *Solitaire* is virtually hand made, and fits in the upper price bracket for the type. Measuring 35 by 20.2 by 26cm deep, the sealed box has an internal volume estimated at 12 litres. In this two-way design the treble is handled by an Elac 25mm polyamide dome, while the 165mm bass unit is made by SEAS, with a pulp cone that Diesis treat with a damping compound. The simple three-element crossover has three additional resistors for attenuation and damping.

Strongly constructed of double skinned chipboard, the front panel is a thicker grade of 20mm MDF. However, the 6mm grille panel is unrebated and stands slightly proud of the panel. The interior is lined with two grades of foam, and is hard-wired with good cable. Electrical connection is *via* 4mm socket/binding posts, and although this model is small enough for shelf mounting it will in fact perform best on open stands, probably not too far from a rear wall.

SOUND QUALITY

The *Solitaire* did well on test, proving to be a tidy and civilised performer. Despite its small size, it coped with the maximum 350W programme input despite beginning to sound a little ragged at this level; 100W is probably a sensible maximum.

If a touch 'lightweight', this speaker possessed a clean midrange, producing a well integrated sound with a natural tonal balance. No areas of the frequency range proved obtrusive and good stereo focus was evident with quite good depth. The only area of criticism, apart from the lack of really low bass, was a loss of the full dynamic impact of the material — at times it sounded just a little dry and overcontrolled. Coloration appeared low on most program, except on solo piano, where some mild 'boxiness' was noted.

LAB REPORT

The reference response showed a 1 metre uniform characteristic with a modest 85dB/W sensitivity. Maximum level was of the order of 100dB for a stereo pair. Pair matching was good, except in the 5-12kHz range where tweeter sample differences amounted to 2dB, more than expected.

The grille was not beneficial to the response, imposing a dip at 3kHz as well as some upper range ripples; Bass rolloff was quite average, −6dB at 57Hz. At 2 metres, the forward response family showed some driver overlap at the crossover region, with the best sound obtained on axis. A mild peak was present above 15kHz while the midrange showed mild forwardness. But ±3dB limits sufficed for a 65Hz to 20kHz response.

At 96dB sound pressure level, the *Solitaire* was clearly working hard, giving a fair amount of second and third harmonic distortion. At the reduced 86dB spl, distortion fell below 1% over most of the range, which was a more satisfactory result. System resonance was 82 Hz, a bit high, but reflecting the small size. The impedance curve suggested a smooth 8ohm load, meeting the B.S. standard.

In the room the average response confirmed the lightweight balance, but only just. The mid was slightly prominent but the overall curve was quite well balanced.

CONCLUSIONS

This well-crafted miniature has a modest dynamic range. The sound is pleasantly neutral, with a generally good performance, if slightly lacking in bass power and extension. The quality control on tweeter matching needs watching but otherwise the performance of the *Solitaire*, the first Diesis model to appear in *Choice*, justifies a recommendation.

Reassessed. First reviewed 1984. Current typical price £220.

For graph references see issue No 41

GOODMANS MEZZO

GOODMANS LOUDSPEAKERS LTD, 2 MARPLES WAY, KINGSCROFT CENTRE, HAVANT, HANTS.
TEL: (0705) 486344

The *Mezzo* is the middle sized model in the Goodmans 'M' series of moderately priced speakers, and revives the name of a model popular many years go. Since this review was originally carried out there have been some changes to the layout of the front baffle, removing the LED indicator lights and re-arranging the drive units vertically. Though we have not formally reassessed the model, such changes ought to have positively improved the level of performance.

The substantially built 37 litre bass-reflex enclosure has a three-way driver system. The 80mm cone midrange unit and the 25mm soft dome tweeter are now mounted vertically, and a larger-than-usual 250mm pulp-cone bass driver occupies the lower section of the enclosure.

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.

SOUND QUALITY

The *Mezzo* acquitted itself well on the listening tests, comfortably achieving a score worthy of *Choice* 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' in character. The treble was quite pleasant and free of obvious vices, and the midrange sounded open if a trace 'boxy', while 'cuppy' coloration was also audible.

Opinions about this speaker did, however, vary a little, though this is a factor that may have been improved — by the recent front baffle rearrangement. 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 REPORT

Measured at 1 metre, the output looked unpromising, but the overall forward response was rather better. Mean sensitivity was above average at 88dB/W, with a quite extended −6dB/W bass rolloff point at 46Hz. In conjunction with a 100W peak power handling, substantial 104dBA sound levels were possible.

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 2 metres, 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 output was rather more consistent than anticipated, and correlated well with the smooth impression gained on the subjective tests.

Failing to meet the 8ohms spec, the *Mezzo* showed an impedance dip to 5ohms, but its modest reactive content and average value of 7ohms it remains quite easy to drive.

CONCLUSIONS

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. The already good performance should have been enhanced by the new front panel arrangements, particularly in terms of the stereo performance, so at its realistic price level, the *Mezzo* carries a firm *Choice* recommendation, with the provision that personal audition to confirm the results of the recent changes is advised.

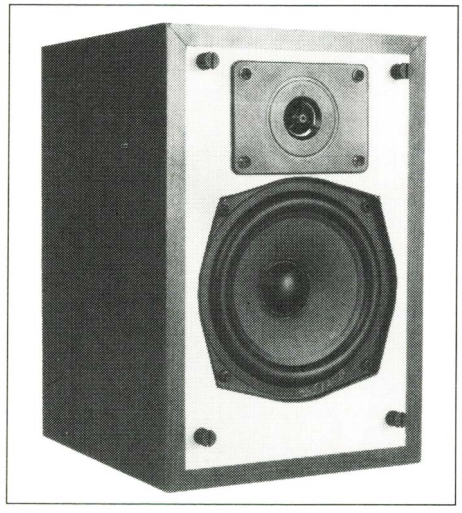
Reassessed. First reviewed 1984. Current typical price £150.

For graph references see issue No 41

BEST BUY

GOODMANS MAXIM

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TEL: (0705) 486344



In recent years, the British loudspeaker company Goodmans has introduced new models nostalgically named after the classic M-series designs produced two decades ago. We have already seen the reincarnated *Mezzo* and the *Magnum* in recent years, and have now received perhaps the most famous of all. The *Maxim* was a true miniature of exceptional quality for its time, setting a pattern for many other commercial models leading up to the BBC *LS3/5a* design.

However, times change. While the new *Maxim* is certainly a true miniature, in real terms it is far less expensive than its predecessor. The veneered case of the original has been replaced by a vinyl-clad chipboard, and the drivers are not all of Goodmans manufacture. The new *Maxim* is actually one of the cheapest models to be included in this issue, with a typical retail price of around £70.

This speaker is intended for stand mounting, not too close to a rear wall. The bass reflex type enclosure has an internal volume of only 5 litres, and is tuned by a small ducted port 30mm in diameter and 50mm long, fitted to the rear panel and effective at around 70Hz. The panels are 12mm thick, and polyester fibre provides internal absorption.

A two-unit design, the bass/midrange driver has a 130mm steel frame and a 100mm flared pulp cone with vinyl half-roll surround, and uses a decent magnet. The treble range above 4kHz is covered by the familiar Audax 12mm plastic cone/dome unit which has ferrofluid cooling/damping.

The grille is 12mm thick and unrebated — better left off for more serious listening. The crossover has generous power handling capacity and provides nominal 12dB/octave slopes. Electrical connection is *via* combined 4mm socket/binding posts.

SOUND QUALITY

The *Maxim* scored well for its price in the blind listening tests. In contrast to many small inexpensive systems, which tend to have a 'loud' quality, almost 'shouting' at the listener, the panel found the *Maxim* was pleasantly balanced, with a broad, even midrange. Low bass was understandably absent, while upper bass was somewhat muted, but managed to appear articulate and tuneful. The treble was more than satisfactory, sounding nicely balanced, and showing pleasing detail without drawing excessive attention to itself.

Coloration was quite good and the mid detail was presented well. While clearly a small box, it made no excuses; it just got on with the job. Stereo images were well focused, with fine width and acceptable depth.

LAB REPORT

The sensitivity was only a little below average at 85.5dB/W, so the *Maxim* may be used with amplifiers from 20W per channel up to a sensible maximum of 50W. Acceptably loud 97dBA maximum in-room sound levels will be possible from a pair.

The reference response on axis at 1 metre was pretty good, measuring ±2.5dB 130Hz — 20kHz, though there was a hint of midrange excess and inevitable low frequency deficiencies with −6dB at a high 82Hz. The forward response group at 2 metres gives a better idea of the sound energy reaching a normally seated listener, and this showed very good characteristics, generally uniform with excellent integration. Uncritical of precise listening axes, this speaker offered a consistent response.

The impedance fell to just below the 8ohm limits at 350Hz, but typically held around 10ohms which is a relatively straightforward amplifier load.

This loudspeaker behaved well under power peaks of up to 75W, and achieved satisfactory swept distortion results at the 86dB test level. Overall, second harmonic held to about 0.8% while the more important third harmonic was typically 0.3%. The higher 96dB test level was hard on this miniature, but it coped pretty well even at low frequencies.

The computer-averaged room response confirmed the smooth broad midrange character of this model, neatly demonstrating the excellent mid/treble balance and the associated crossover integration.

CONCLUSIONS

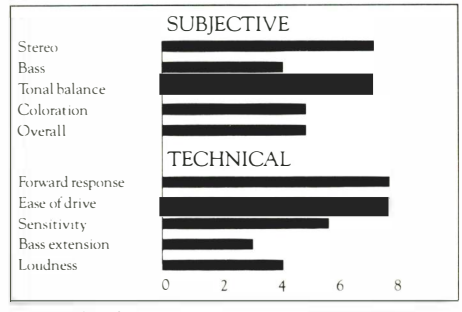
Perfect speakers cannot be had for this price, However the *Maxim* achieved much of the midrange and treble quality of more costly models. Nicely balanced, it performed competantly in the lab tests and scored well for its price on audition. A comfortable budget miniature, it gives sound value and achieves a Best Buy rating.

Note: The author provided a private opinion on an earlier version of this model for the manufacturer.

GENERAL DATA

Size (height × width × depth)	26 × 17 × 21cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(20) – 50W
Recommended placement	50cm stand, 0.5m from wall
Frequency response, within ±3dB, at 2 metres	120Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	82Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	85.5dB/W
Approximate maximum sound level (pair) at 2 metres	97dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	excellent
Typical price per pair, inc VAT	£70

PERFORMANCE SUMMARY



For graph references see issue No 46

RECOMMENDED

HARBETH HL1 IV

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 current Mk IV version reviewed here. The 50 litre enclosure, reflex tuned by a large 62mm diameter tunnel port, has a cabinet 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 assists the cabinet diffraction. An exclusive polypropylene 200mm driver 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 high frequencies using an auto transformer to aid consistent frequency balance.

Sound Quality

The original *HL1* proved to be of monitor quality, and survived comparison with live sounds very well. On complex recorded programme in stereo it was a little weaker with some sibilant and chesty effects on vocal.

Fully reauditioned in Mk IV form (this arrived too late for new measurements except a room curve, not shown), the *HL1* bettered its earlier result by offering a clearer, more dynamic sound. Improvements in mid clarity were heard leading to still greater transparency as well as more precise transient definition.

Our first samples were slightly bright, which Harbeth acknowledged, stating that the treble level would be reset in production. Subsequent auditioning in 1986 confirmed that this had been done, and that the mid/treble integration was now first class. Overall the balance remained very good while the bass was somewhat underdamped in the reflexed area, more suited to classical than rock programme in this respect.

Lab Report

A useful above average sensitivity of 87.5dB was recorded, which is on target and not compromised by the impedance; this was judged to be a good amplifier load, typically of the order of 8ohms with a 6.6ohm minimum. While some high phase angles were apparent (for example, 70° at 2kHz), the impedance here was substantial enough 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 1m was fairly uniform, and ignoring a 5kHz notch met ±3dB limits, 55Hz-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.

Conclusions

Reassessed, the *HL1 IV* was technically very similar to the *III*, except for the revised bass mid unit, this custom built by Audax on a cast frame, using the advanced TPX cone polymer. With notably improved midrange and fine overall mid/treble balance and integration, the design continues to stand the test of time, and carries a strong *Choice* recommendation.

Reassessed. First reviewed 1985. Current typical price £348

For graph references see issue No 41

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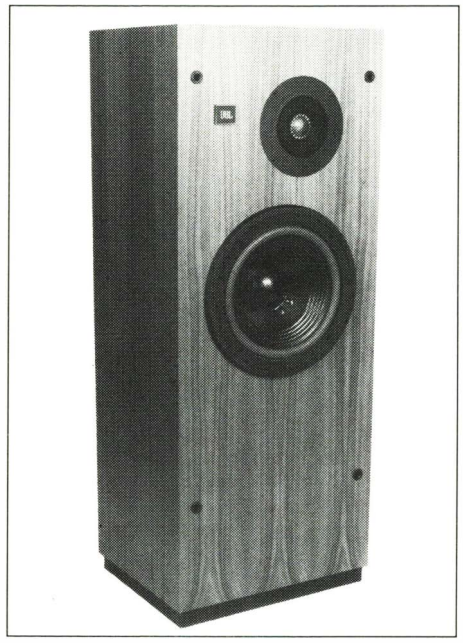
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RECOMMENDED

JBL 60T

HARMAN (AUDIO) UK LTD, MILL STREET, SLOUGH, BERKS SL2 5DD.
TEL: (0753) 76911



Placed at the quality end of the compact loudspeaker market, the *L60* is a quite substantial loudspeaker — at a quite substantial price tag of £370 a pair. For a start, this is a floor-standing design, which has its own particular appeal, to the many people conscious of the visual obtrusiveness of hi-fi. It must, however, be said that for perfectionists a better performance will be obtained by elevating the speaker on rigid low stands, designed with a floor-keying feature. Standing 78cm high, the *L60* is a two-way reflex-loaded system of some 35 litres. It is tuned to a low 26Hz, which promises good bass extension.

The bass/mid unit has a die-cast frame fitted with a light pulp cone with foam surround. The frame measures 230mm overall, while the actual diaphragm diameter is 160mm. The generous motor system has an oversize high-power 50mm voice-coil. Crossing over at around 2.5kHz, the treble range is handled by a version of JBL's 25mm titanium dome tweeter with its integral 'diamond pleat' surround. The high quality 12dB/octave four-element crossover includes two polypropylene capacitors, and uses internal push-on connectors; combination 4mm socket/binding-posts are used for external connection.

The main enclosure construction material is 19mm chipboard, finished in natural walnut veneer. There is no internal bracing, but a 20mm fibreglass lining helps absorb internal standing waves. The port is reasonably sized, 48cm in diameter and 128mm long. An assembly fault on our sample left one bass unit mounting nut loose inside the enclosure.

SOUND QUALITY

The *60T* scored above average for the listening tests, which is an appropriate rating for the price, and was impressive in several respects. While the bass was somewhat rich and a little too powerful, it was also fairly clean and well extended. Futhermore the upper-bass to mid-treble balance sounded agreeably uniform, in contrast to many modern systems. This helped to give a good sense of scale to a wide variety of program material.

Some moderate 'boxy' colorations were present in the midband, and the treble could sound a little 'wiry' and 'brash' on strings and brass. Stereo focus was quite good, with a fair representation of depth. Dynamics were also above average.

LAB REPORT

The average 88dB/W sensitivity was mildly compromised by a load impedance below the 8ohm standard tolerance; in fact the lowest value was a touch over the 4ohm level, and was not considered too severe in amplifier loading terms. A minimum input power of 10 watts per channel is suggested, while the system showed fine power handling to 150W peak program, so good peak sound levels of 104dBA are possible in a typical room.

The bass was well extended to 40Hz, −6dB, and as the room curve testifies, the response was well maintained down to 25Hz, albeit with some excess below 60Hz. Above 100Hz the computed room response shows fine balance and most even output, bar some mild abberation in the mid treble.

This speaker measured pretty good on axis at 1 metre, bar a degree of crossover interaction around 3kHz. Removing the grille effected a small improvement (dotted line). The 2m set of forward responses indicated fine driver output integration except in the 3kHz area, and the lateral off-axis curve was particularly good. Reflecting JBL's experience in this area, the audibly significant third harmonic distortion at 86dB was held to low levels. The second harmonic trace rose somewhat at the higher 96dB sound level, but the general trend showed good control right down to 20Hz.

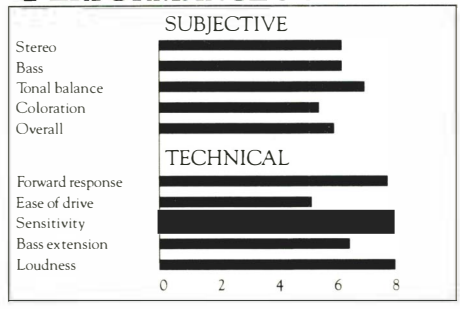
CONCLUSIONS

This speaker possesses many positive qualities including a fine treble, an extended and powerful bass suited to larger rooms, moderate distortion levels, and the capability for high sound levels. Stereo performance was rather above average, and the *60T* sounded pretty well balanced in musical terms. It offers realistic value for money, and thus merits *Choice* Recommendation.

GENERAL DATA

Size (height × width × depth)	78 × 30.5 × 26.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −150W
Recommended placement	floor or low stand (15cm)
Frequency response, within ±3dB, at 2 metres	45Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	40Hz
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)	average (not 8ohm)
Forward response uniformity	very good
Typical price per pair, inc VAT	£370

PERFORMANCE SUMMARY



For graph references see issue No 46

RECOMMENDED

JPW P1

JPW LOUDSPEAKERS LTD, PO BOX 31, PLYMOUTH, DEVON PL1 1YH.
TEL: (0752) 784284

Least expensive of a range of speakers designed and produced by a small UK company, the *P1* is a standard-formula budget two-way design. Selling for a modest £115, it is distinguished by a real wood veneer in a price category where most are vinyl coated. The cabinet is a 19 litre sealed-box, solidly constructed from 19mm chipboard, its interior lined with acoustic fibre. The 9mm thick grille panel is unrebated.

Bass is covered by a 200mm VIFA unit with a modest magnet and a straight-sided pulp cone. Treble is allotted to a second VIFA unit, a 19mm polyamide soft dome. A standard four-element 12dB/octave crossover divides the signal electrically.

Sound Quality

The original *P1* scored below average on the tests, but not seriously so in view of the modest price. Panel comments were mixed. Over and above a basically satisfactory sound, criticisms of a 'boxy' and 'thickened' effect were made, and while the bass was respectable it lacked real extension. The tonal balance was lightweight and the upper range showed some uneveness, varying in effect according to programme. Both a sharpness and a 'wiry' coloration were evident, and the upper treble was sometimes rather prominent. Stereo images were quite well focused, but again the depth effect was variable with different program. Sometimes it sounded OK, but on occasion the sound was described as rather two dimensional.

Subsequent 1985 & 1986 audition of later samples showed significant improvements in midrange 'sweetness' and mid/treble integration, though the 'bright' balance was still noted.

Lab Report

Pair matching was very good, within ±0.3dB over the whole range. Reference sensitivity was high at a mean 90dB/W, and with a 100W power handling, a pair will be capable of 105dBA; even 15W amps will give quite decent sound levels. The −6dB bass rolloff came in at a typical 60Hz and despite the grille rebating, a significantly smoother response was obtainable with grille removed.

Out at 2 metres, the smoothed output still showed some tendency to 'lumpiness', with a plateau around 1kHz and minor peaks at 15kHz. Nevertheless ±2dB limits sufficed for an 80Hz to 20kHz response. Driven to the 96dB sound level, requiring only a modest 4W input, the JPW distortion was about average at around 1% over most of the range. At 86dB, third harmonic distortion was lower at 0.3%, while second remained much the same. Compression measured −1.4dB, poorer than average, but intermodulation was rather better, at −44dB.

From the impedance graph, the system resonance was seen at 88Hz. The impedance variation was small, averaging 7ohms, with a small dip to 6 at 15kHz, which is pretty harmless. In view of the high sensitivity, this loudspeaker should not present any problems for any modern amplifiers.

The room-integrated response illustrated the 'lumpy' nature more clearly, with an almost three-humped response along with a forward midrange. The treble 'bites' a little at 5kHz, and while the bass was fairly extended, it rolled away a little too soon. Realignment to 88dB plus better driver integration at the crossover would help matters a lot here.

Conclusions

Despite the above discussion of its various character quirks, the *P1* remains a well-crafted, well-finished speaker offering a good general performance. The subjective ratings, enhanced by the improvements of subsequent samples also suggest good value. It is both sensitive and easy to drive, while progressive refinement has maintained its competitiveness by 1986 standards, though a personal audition is advisable, to see whether its tonal quality appeals to you.

Reassesed. First reviewed 1984. Current typical price £115

For graph references see issue No 41

RECOMMENDED

JPW AP3

JPW LOUDSPEAKERS LTD, PO BOX 31, PLYMOUTH, DEVON.
TEL: (0752) 784284

A relative of the *AP1*, the '3 is a larger version with some refinements including the option for bi-amplified use in conjunction with an active cross-over such as the custom packages produced by Nytech or A&R.

Sturdily built from 20mm thick chipboard, this two way design is reflex-loaded, the 25 litre internal volume giving a system resonance of 73Hz. The grille baffle is rebated to improve acoustic performance, while the external finish was in our case an excellent walnut veneer. The panels are damped internally by a bituminous layer, and volume absorption within the enclosure is effected by a polyester fibre wad.

The bass/midrange main driver is from VIFA, with a 200mm diecast chassis and a doped pulp cone. For the treble at 19mm plastic dome unit (VIFA again) takes over. A simple 3-element crossover is used to provide nominally 12dB/octave acoustic rolloff slopes, but in active mode the electronic crossover takes over, the drive units barely requiring equalisation.

Sound Quality

Achieving a 'good' rating on the listening test, the *AP3* did well in spite of comments concerning a mild excess in the upper bass, a mild tonal 'thinness' in the midrange, and a forward, bright treble. Somehow the speaker remained well enough balanced overall, as well as sufficiently controlled, to allow its other qualities to show. Stereo was pretty good in terms of both width and focus, with fair depth. The voice band was liked, and sounded articulate and well differentiated. Low bass was somewhat muted but was present in the room, and compensated for by an upper bass richness.

Coloration in the general sense was fairly low, bar some 'graininess' in the upper treble.

Lab Report

Set to a 1 metre measuring distance in the anechoic chamber, this speaker demonstrated a good sensitivity of 90dB/W, uncompromised by the impedance characteristic. The latter rated as a very good amplifier load with an average value of 9ohms and a lowest of 6ohms.

The reference response showed slight bass underdamping with a −6dB rolloff at 57Hz. A rising output with increasing frequency was also shown, amounting to 5dB over the 200Hz to 15kHz range. With the grille removed some improvement was seen in the treble smoothness.

A minimum of 10 watts was indicated for satisfactory sound levels, while 100W maximum input was possible on undistorted programme (not continuous tones). Good sound levels of up to 105dBA were possible in a typical room, and for active operation, amplifiers in the 25-50W range will be entirely suitable.

At 2 metres, the forward response set was quite good, particularly in the lateral plane. Vertically the response was less regular, and the speakers should therefore be placed with some care, for example on a stand 40-50cm high and set straight ahead. The rising trend was again noticeable on the smoothed responses.

Low distortion levels were obtained at 96dB, typically 0.3 to 0.4%, at 86dB with further improvement to a very good 0.2% average.

In the listening room the *AP3* did show a generally good balance, though with a touch of treble excess and the beginnings of a 'humped' energy response.

Conclusions

This nicely finished and well built loudspeaker had a touch of its own 'character', but this did not detract from the listening results which were good for the price. Other aspects were also nicely balanced and the facility for active operation is an interesting option, providing the opportunity for a subsequent upgrading of the performance in power, clarity and balance. Offering reasonable value, the AP3 carries our recommendation.

Reassesed. First reviewed 1985. Current typical price £195.

For graph references see issue No 41

BEST BUY

MISSION 70 II

MISSION ELECTRONICS, STONEHILL, HUNTINGDON PE18 6ED.
TEL: (0480) 57477

Now officially in *Mark II* form, the '70 is Mission's least expensive speaker, whose performance in some areas threatens several of its larger brothers in the Mission speaker range.

A two-way miniature, the '70 has a sealed-box volume of 13 litres, which loads the custom 170mm pulp cone bass/mid unit. Both this and the tweeter are Danish, the latter comprising a 19mm polyamide dome, ferro-fluid damped and built by VIFA. The crossover is of good quality, 12dB/octave acoustic, and uses three electrical elements.

The cabinet is nicely finished in vinyl 'black ash', with a deep grille which is integral with the enclosure. In fact the cabinet comes apart as two shells, locked together by four capped screws at the rear. A fibre wad provides for the internal absorption, while electrical connection is made by sturdy 4mm socket-binding posts. The overall contruction quality is fairly good.

Sound Quality

While use on a shelf or bookcase is likely, this speaker actually gave a good account of itself on 42cm high stands, not too far from the rear wall. The mark was a strong 'average plus', great for the price.

There are however several criticisms. The sound could show some 'sibilance' and 'edge', with a mildly 'thin' tonal balance, some 'boxiness' and a rather 'dry' bass.

Conversely it was favoured for its lively, 'quick' nature, revealing detail throughout the frequency range, and preserving the excitement of the performances. The bass was articulate and tuneful while the stereo focus was good, with a fair reproduction of the natural recorded acoustic around the performer.

Lab Report

The axial reference response showed a smooth, slightly uptilted character, on spec at a sensitivity of 89dB/W. The bass −6dB point was a modest 84Hz which is average for the type, with a system resonance at 97Hz. Pair matching was very good, to within ±0.5dB, and at 1 metre the speaker met fine ±2dB limits from 95Hz to 17kHz.

Out at two metres the forward response family showed an exemplary set of responses. The variation over the 15° vertical axis from straight in front was minimal, and the blending was very good in the lateral plane. The forward yet uniform nature of this design was clear enough.

Working hard at 96dB, the speaker nevertheless showed well controlled distortion, generally less than 1%. down at 86dB, still a fair level, the distortions had improved to the 0.4% level, with the low frequency range rather better than average. Compression measured an average 1.9dB while the bass-mid intermodulation was fine at −42dB.

At low frequencies the impedance dipped to just under 5ohms, and a fair rating would be 6ohms, although most amplifiers should have no problems.

Computer averaged in the listening room, the *70 II* response was less even than expected. The mid was clearly forward (noted on audition), while the bass was rather 'shy', and the upper treble a trifle 'exposed'.

Conclusions

Despite the measured and auditioned tonal imbalance in the energy response, the panel liked the *70 II* for its lively, transparent quality, and here its subjective appeal served to outweigh its problems. The ratings suggest Best Buy status, but I nonetheless feel that it should be carefully auditioned before purchase.

Reassessed. First reviewed in Mark II form 1984. Current typical price £100

For graph references see issue No 41

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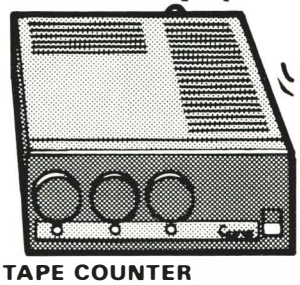
THE MAGNIFICENT 70's
The 70 II received a "Best Buy" award from that highly critical bible Hi-Fi Choice.

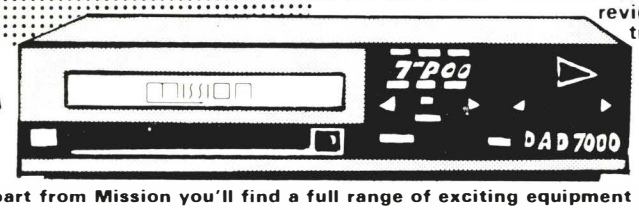


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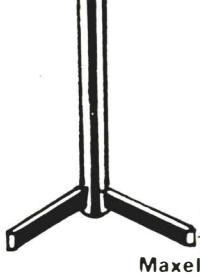


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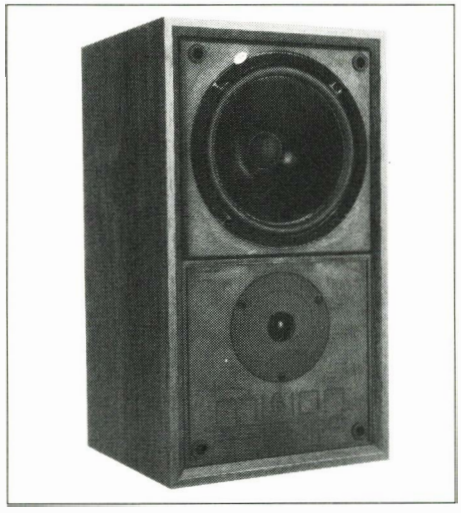
MISSION ELECTRONICS

HARROW AUDIO
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RECOMMENDED

MISSION 700LE

MISSION ELECTRONICS, STONEHILL, HUNTINGDOM, CAMBS PE18 6ED.
TEL: (0480) 57477



Mission have laid out in their instruction manual a well specified set of conditions for obtaining optimum sound from their loudspeakers. While many of the suggestions are sensible, their injunctions against the use of tone controls, which potentially contravene the guarantee conditions, do seem a little strange. These speakers are intended to be used almost touching a back wall, and arranged to direct the forward sound straight ahead. The resultant mildly off-axis delivery to the centrally seated listener has been compensated by the designer by adjusting the axial response.

The *700LE* is a compact two-way system that has evolved from the *70* series. The sealed-box volume of 9.5 litres produces a system resonance at 88Hz. On a normal stand, the enclosure is a little below head level for the seated listener, resulting in a time delay between the arrival of sounds from the bass and the treble units. Mission exploit this by inverting the usual arrangement and placing the tweeter below the bass unit. The system is therefore inherently approximately time aligned, which allows the use of a 12dB/octave crossover while still maintaining good drive unit integration. The bass unit is fed *via* a large ferrite core inductor, and the 19mm soft plastic dome tweeter receives frequencies above 3.5kHz by an LC combination plus attenuating resistor. Hard-wiring is used for the crossover itself, but only clip terminals for the drivers. Spring terminals are provided for the speaker cables and 4mm plugs can (just) be used! The bass/midrange is handled by a 135mm flared, doped pulp-cone unit with a foam surround in a 165mm pressed steel frame.

The main cabinet carcass is 12mm vinyl-coated chipboard, and the driver baffle is made from moulded reinforced plastic. A single layer of polyester wadding damps the interior, and the well made, rebated grille is another moulding. The system is well made and finished, and can be obtained with matching spiked stands.

SOUND QUALITY

Scoring an average mark on the listening test, this is a respectable result for the price level. Furthermore, wall-mounted systems tend to suffer from some disadvantage on test due to the altered stereo image presentation, but the *700LE* coped well here. Coloration was moderate and the sound was quite well balanced.

The treble was quite good with only moderate 'grain' at the frequency extremes. The general impression was pleasing and articulate, though some listeners felt that there would have been more transient 'attack' and 'air'. The bass was quite tuneful, while the midrange was a touch forward, though not so much so that it dominated the sound.

LAB REPORT

The sensitivity was on the high side at 89.5dB/W, helping to provide substantial room sound levels of up to 104dBA for a pair. A minimum power of 10W is suggested, while the speaker happily sustained peak inputs of up to 100W. The sensitivity was mildly compromised by the poorer than average amplifier loading, but any good 4 to 8ohm amplifier will have no difficulties here.

On axis at 1 metre, the reference response showed a bass rolloff at 73Hz, some lift in the 130Hz range due to underdamping, plus a mildly rising midrange. As the dotted trace shows, the grille was responsible for most of the treble response anomalies. At 2 metres, with the benefit of some response smoothing, the *700LE* met an 85Hz to 20kHz range within ±3dB limits. Good integraton was shown in the off-axis responses, with the output approaching virtual flatness at the designed 20° lateral angle. Distortion results were about average, typically 0.3 to 0.4% at 86dB, while second harmonic approached 2% at the 96dB sound level. Distortion was well controlled at low frequencies, considering its size and price.

The room curve was obtained on an open stand position for the sake of consistency and did not show the mid-bass lift which would be achieved by wall mounting. The mid-treble balance and integration was pretty good, though the low bass could benefit from more power relative to the midrange level.

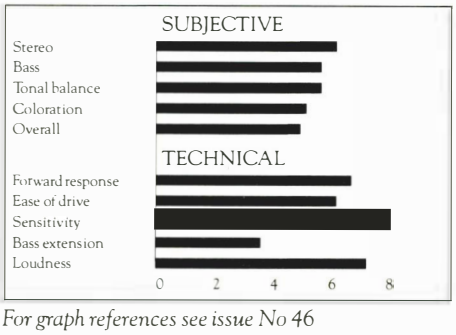
CONCLUSIONS

This speaker was well balanced for a close to the wall position. A consistent subjective performance was obtained with a complementary set of lab results. It handled power well and the good sensitivity allowed for high sound levels if so desired. The cleanest treble was obtained with the grille detached. Taken overall the value rating was respectable, and the *700LE* qualifies for recommendation.

GENERAL DATA

Size (height×width×depth)	38×21×21cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) – 100W
Recommended placement	on stand near wall
Frequency response, within ±3dB, at 2 metres	85Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	73Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89.5dB/W
Approximate maximum sound level (pair) at 2 metres	104dBA
Impedance characteristic (ease of drive)	average
Forward response uniformity	good
Typical price per pair, inc VAT	£125

PERFORMANCE SUMMARY



For graph references see issue No 46

RECOMMENDED

MONITOR AUDIO R252

MONITOR AUDIO LTD, 34 CLIFTON ROAD, CAMBRIDGE CB1 4ZW.
TEL: (0223) 246344

The *R252* is an inexpensive, two-way sealed box speaker of 17 litres internal volume, employing a 200mm steel-framed pulp cone bass/mid-range driver plus a 19mm soft plastic dome tweeter. It is hard-wired internally including the high-power capacity, good-quality crossover network.

Unusually for this price level, the solid enclosure is finished to a high standard in real wood veneer, the panels built of 12 and 15mm board. The grille is a low profile component, made from fully-rebated plywood.

No box panel damping is used, but the 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, a bass/mid unit revision provided a significant improvement in tonal balance as well as general character, sufficient to move it up to an average score, which is 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 REPORT

Sensitivity was an above average 89dB/W, 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 original loudspeaker.

At 2 metres the axial response was fairly smooth meeting ±3dB limits from 80Hz to 30kHz, and dispersion was excellent in the lateral plane. However 15° above-axis a noticeable 4kHz notch appeared and we recommend using this speaker directed at ear level. In fact Monitor Audio's matching stands are designed for exactly that purpose. The forward responses were good for the type.

Room-integrated response evidenced the 'dry' nature of this speaker, with a fairly extended but shallow bass plus a slightly prominent midrange. However, the overall effect was pretty smooth.

Distortion at 96dB sound level was moderate at around 1% second and third harmonic even at low frequencies, while higher in the range third harmonic was particularly good. Further improvement was apparent at an 86dB level, with an average of 0.3% recorded here.

Bar a mild dip to 5.5ohms at 10kHz the impedance was well behaved over the range, and the *R252* was classed as a good amplifier load.

CONCLUSIONS

This powerful two-way design is well constructed for the price. Reviewed originally in 1983 it comfortably won recommendation, with low distortion, high sensitivity and a good rating for sound quality. Some minor changes in the 1984 samples were viewed less favourably, the main points of criticism being a hard and bright quality, with insufficient output in the bass. However, a new version auditioned for 1985 had improvements to the cabinet and the tonal balance. The sound quality now shows less 'boxiness' and a smoother overall effect, and this model can now be recommended once again.

Reassessed. First reviewed 1983. Current typical price £150.

MONITOR AUDIO R352

MONITOR AUDIO LTD, 34 CLIFTON ROAD, CAMBRIDGE CB1 4ZW.
TEL: (0223) 246344

This speaker is larger than usual for its price range and consists of an excellently-veneered 36 litre 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 also fitted. Foam absorbent blocks line the interior, and the bass-reflex system is tuned to 50Hz by a substantial tunnel port.

The interesting 200mm flared pulp 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 modulation.

A 20mm soft plastic dome tweeter crosses over at around 3kHz, a high-power hard-wired crossover, heavy duty wiring, and 4mm socket/binding posts for rear connection complete the lineup.

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 images 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 overhang, but none of these effects were at all serious.

LAB REPORT

Pair matching was good, as judged by the 1 metre 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 2 metres the lateral off-axis responses were fine but the speaker was clearly a mite critical in the vertical plane. Dips were recorded at 15° above and below so accurate beaming to the listener would be important with this mode; ±3dB limits comfortably covered the 50Hz to 15kHz range.

Room averaged, the speaker's fine overall balance could be appreciated. The bass was uniform to 45Hz and well integrated while the treble showed a correct and gentle rolloff towards the extreme frequencies.

At the 96dB sound level distortion was quite low, particularly above 500Hz, and at 86dB the results were especially good. Impedance averaged 12ohms and possessed no low levels at any frequency, so the *352* should be particularly easy to drive, and as such presents a 'kind' amplifier load.

CONCLUSIONS

This well-finished and constructed speaker is sensitive, low in distortion, accurate in balance, more reasonably faithful to the programme fed it, and 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 good results from any decent amplifier. Reauditioned in 1985, the *352* continued to set a decent standard, and despite increasing competition retains recommendation for 1986.

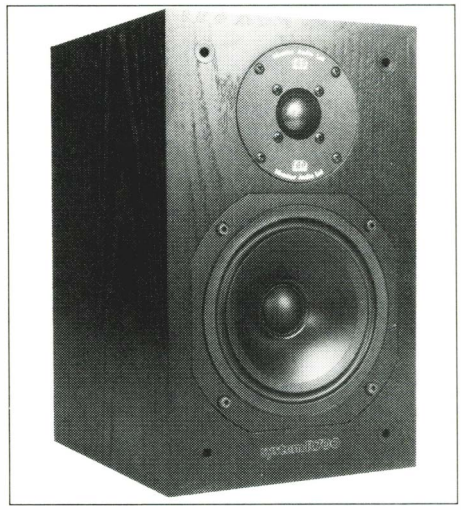
Reassessed. First reviewed 1983. Current typical price £200.

For graph references see issue No 41

RECOMMENDED

MONITOR AUDIO R700MD

MONITOR AUDIO LTD, 34 CLIFTON ROAD, CAMBRIDGE.
TEL: (0223) 246344



Hi-Fi Choice reviewed an earlier *R700* in a previous edition, but the model was withdrawn shortly before publication with the consequent removal of the prepared review. (It still appeared in the comparison chart, however.) Extensively revised since, the latest *R700* comes with an *MD* (metal dome) suffix stressing the inclusion of a new 25mm hard dome tweeter, an aluminium unit specially made by SEAS for Monitor Audio. Sensitive to handling damage, a steel mesh grille protects the fragile diaphragm.

This is a compact two-way system with an enclosure volume of 11.5 litres, tuned to 60Hz by a rear-mounted ducted port of sensible size, 50mm in diameter and 75mm long. The bass/mid unit has a 190mm diecast frame and a 130mm flared polypropylene cone with an inverted half-roll synthetic surround. This is integrated electrically with the 25mm dome treble unit by a simple two-element crossover network, an electrolytic capacitor to the tweeter and a ferrite-cored inductor to the bass. Ultimate rolloff slopes will approach 12dB/octave, second order, but considerable overlap of driver outputs will occur in the crossover region.

The enclosure has a chipboard shell, with front and back panels in 17mm *MDF*, and the review samples came finely finished in a real black ash veneer. The grille frame is made of 11mm *MDF*, rebated to reduce unwanted diffraction effects. Internal absorption is handled by a polyurethane foam lining. Hard-wired internally, the *700MD* combines 4mm socket/binding posts for electrical connection. Custom stands are made for the system, and the loudspeakers will probably sound best sited fairly near to a rear wall, though this will depend to some extent on personal taste and room acoustics.

SOUND QUALITY

Scoring above average in the blind listening sessions, the *R700MD* was commended for its 'lively' detailed nature. While not particularly low in perceived coloration, showing some 'boxiness' and 'forwardness' through the midrange, the speaker proved capable of conveying some of the 'life' and 'drama' in the test programme.

The bass tended towards 'dryness', and lacked real extension to low frequencies. But in recompense it was quite 'punchy'. Stereo images were quite well staged, with good focus and a good sense of space and atmosphere. The treble reached a notably good standard, showing an 'open', clear quality, free from 'grain' and well extended to the limit of audibility. However, in balance terms the *700MD* did show some upper mid-range 'forwardness'.

LAB REPORT

Measured at 1 metre, the *R700MD* showed a good sensitivity of close to 88dB/W, and consequently its power handling of up to 75W per channel means satisfactory sound levels will be produced with as little as 12 watts per channel. Maximum sound levels of 102dBA are possible from a pair in a typical room at full wick.

The reference response shows several alternatives. The solid line gives the axial output with the grille fitted; the fine dotted line shows the effect of detaching the grille; the dashed response shows the output when the microphone was lowered to the bass/mid axis. Taken overall a rising trend may be seen through the midrange, 200Hz to 1kHz, with output falling to −6dB at 62Hz in the bass.

At a 2 metres microphone distance with response averaging, the significant driver output overlap resulted in an erratic set of off-axis curves. However, taken overall the trend was not so bad, and reference to the computed room curve showed that the forward energy was quite well controlled above 1kHz, confirming the listening test result. Note that the tweeter peaked some 12dB around 26kHz, but this should be inconsequential. On the room curve the bass was fairly well maintained down to 50Hz, but was mildly deficient in general terms.

Never falling below 6.4ohms, the *700MD* represents an easy amplifier load. As regards distortion it was unimpressive below 500Hz at 96dB, but was excellent at higher frequencies. By 86dB the results were fine throughout the range, averaging 0.3% overall.

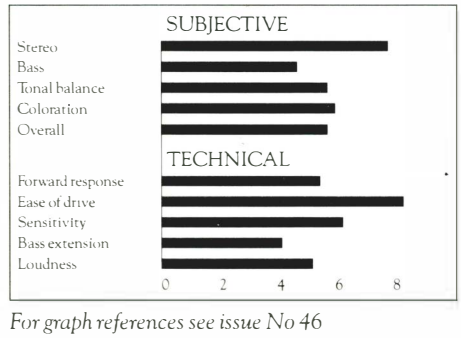
CONCLUSIONS

Representing a considerable improvement over last year's withdrawn model, this lively and communicative loudspeaker was well represented and features a fine treble range. Bass extension was limited, having been traded for good sensitivity. Despite an untidy set of off-axis responses, this speaker did pretty well on audition, and as such justifies recommendation.

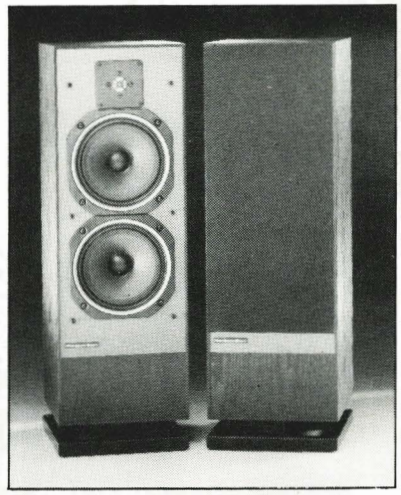
GENERAL DATA

Size (height × width × depth)	35 × 21.5 × 25cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(12) −750W
Recommended placement	stands 0.4m from wall
Frequency response, within ±3dB, at 2 metres	see graph
Low frequency rolloff (−6dB point) at 1 metre	62Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	87.5dB/W
Approximate maximum sound level (pair) at 2 metres	102dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	fairly good
Typical price per pair, inc VAT	£250

PERFORMANCE SUMMARY



For graph references see issue No 46



Re-create the experience...

MS10

"... I tacked them on the end of my reference system, and my jaw fell open with a clunk. ... They are brilliant!" "... Reaped large rewards in the enjoyability of the music." "... Given their size and price, these speakers are remarkable."

Graham Mayor, Which Compact Disc? April 1986

MS15

"... For the great mass of applications between the two extremes I'd rate the new MS as one of the outstanding candidates."

Alvin Gold, Hi Fi Answers, December 1985

MS25Ti

"... It represents a lot of speaker and a lot of performance for the money, and it is undoubtedly well constructed and neatly presented."

David Prakel, Hi-Fi Answers, June 1986

MS35Ti

"... Beautifully finished" "Mordaunt-Short have once again made themselves a speaker that we can place in the highly recommended category."

Ian Kuah, Which Compact Disc? June 1986

MS55Ti

"... I am absolutely staggered at how you have provided such amazing quality at such a low price!"

G.A. Richardson, Northamptonshire, an MS user.

(No official review available at time of going to press).

MS100

"... Fast ... Secure ... Incredibly detailed and alive." "It doesn't seem to be entirely reasonable that such small boxes can issue forth with such positive, almost tangible sound." "... It slowly dawns on you that with the MS100, Mordaunt-Short have a rather extraordinary loudspeaker quite unlike most of its competition."

Alvin Gold, Hi-Fi Answers, January 1985

MS300

"... As with the MS 100 the MS300 possessed that indefinable quality of allowing the program to remain musical and involving to a degree that one began to forget the mechanical aspects of the reproduction of sound."

Hi-Fi News and Record Review, February 1985



Mordaunt-Short

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Mordaunt-Short Limited,
Durford Mill, Petersfield, Hampshire GU31 5AZ
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RECOMMENDED

MORDAUNT SHORT MS10

MORDAUNT SHORT LTD, DURFORD MILL, PETERSFIELD, HANTS GU31 5AZ.
TEL: (0730) 80721

Rising costs are now weighing heavily on the shoulders of the quality system producers, who have been compelled to seek unusual solutions to the problems of producing speakers at the £80 a pair level. Here Mordaunt Short have made use of a small bass/mid driver with a cone just 90mm across, with a pressed steel frame to support it. This two-way system is completed by a 19mm plastic cone/dome tweeter, both units manufactured by Audax.

The diminutive enclosure has a 5.2 litre internal volume, reflex-tuned to a high 68Hz by a 30mm diameter tuned port, 65cm long, located on the rear panel. Built in plain chipboard the cabinet was well finished in 'black ash' vinyl, but the grille baffle was unrebated, with an acoustically poor profile.

A three-element crossover network aims at nominal 12dB/octave acoustic slopes, with push-on tags used for the internal wiring. 'Positec' protection against overload is included, a most uncommon and welcome feature at this price level. Electrical connection to the amplifier is made *via* 4mm socket/binding posts.

Sound Quality

The panel were very consistent in their judgments, scoring the *MS10* below average but not seriously so, and in fact this is a commendable result given the group context.

On 'blind' testing, it was identified as a small box, the weak bass and 'thin' 'forward' character were noted, and particularly a blend of 'metallic brashness' in the upper midrange. Some 'boxiness' was also evident. On the other hand, it did have some appealing qualities — stereo focusing was particularly good and the sound was detailed as well as subjectively transparent. It also managed to convey some measure of the recorded acoustic.

Lab Report

Measured on axis at 1 metre, sensitivity was below average at 85dB, though this is good for the size. An amplifier range of 20 to 50W is appropriate, giving a maximum sound level of 98dB, sufficient for all but 'disco' domestic use. Set against the reference sensitivity, the low frequency rolloff was high at 80Hz, −6dB. Conversely, the impedance characteristic was excellent, not falling below 8.5ohms and rated as a very easy amplifier load.

The reference response was encouragingly uniform, and with the grille removed 100Hz to 20kHz limits (±3dB) were easily met, though the trend shown at 2 metres suggested some brightness as well as a shyness in the bass. Bar a small notch in the vertical axis, the forward response set looked very tidy and the drive units can be seen to integrate well.

Driven to 96dB sound level, the speaker was working near its practical limit with distortion rising to 4% at 300Hz; at higher frequencies it was more satisfactory. A useful reduction in distortion was recorded at the lower 86dB sound level with the overall result averaging 0.4%, though this was still higher than usual. Conversely, the figures at low frequencies were quite good for such a small box.

In the listening room the *MS10* provided a relatively uniform mid/treble response, but the bass was lumpy at 50Hz and lacked extension, as well as being rather deficient. A thin tonal quality was only to be expected from this.

Conclusions

Well worth considering, this recommended minature would perform well in a bookcase location and a system fitted with a sweet-sounding cartridge. It produced a 'lightweight' sound, but this was redeemed by the low levels of subjective coloration as well as the fine clarity. The treble was also somewhat better than average for its class.

Reassessed. First reviewed 1985. Current typical price £80.

For graph references see issue No 41

RECOMMENDED

MORDAUNT SHORT MS100

MORDAUNT SHORT LTD, DURFORD MILL, PETERSFIELD, HANTS GU31 5AZ.
TEL: (0730) 80721

The *MS100* is an upmarket miniature in real wood veneer. The finish is excellent and the box rigidly constructed, but the grille baffle is a thick unrebated structure, which, as M-S themselves admit, is best detached for serious listening. The speaker can be supplied with optional matching stands, which bolt securely to the underside, and optimum placement is said to be close to the rear wall of a room.

This speaker is unusual in its use of a custom-made 170mm frame size bass unit using a 120mm rigid pulp cone, which is designed to operate without a crossover network. In this sense everything up to 5kHz is fed direct and unobstructed to the bass/mid unit. A simple crossover network allocates a sensible proportion of the remaining 1½ octaves to the 19mm Audax plastic cone/dome tweeter.

Damped by a dense fibre filling, the sealed box volume of 8½ litres tunes the system resonance to 75Hz. Positec overload protection is fitted, a self-resetting system using special positive temperature coefficient links which change from a very low to a high resistance once a continuous averaged current is exceeded; fast transients are unimpaired.

Sound Quality

In the past I have favoured the use of a small passive equaliser with this system to help correct a degree of forwardness in the midrange. Conversely other listeners both here and in their own homes, have decided to leave it 'untouched'.

In this unaltered state the *MS100* performed quite well on the subjective tests.

The mid was clearly prominent with some associated 'shout' but it proved possible to adjust to this provided that it was not played too loud. If offered in return a high level of transparency and detail throughout the frequency range, an aspect which, despite its near-to-wall location, gave considerable depth to the stereo image, while recorded ambience was also read well. The overall balance was tidy, with fair bass extension and low coloration (mid area excepted here) while stereo images were well focused.

Lab Report

At 1 metre under anechoic conditions, the reference response showed a well damped low frequency range while the output gently climbed to 800Hz. Above this range the output was uniform, levelling out at 88dB/W, an average sensitivity. The −6dB low frequency point was at 80Hz but the rolloff rate was desireably shallow.

Out at 2 metres, the forward response family confirmed the broad mid forwardness, and showed excellent responses laterally off axis. In the vertical plane the loss at '15° above' was more serious than usual suggesting the use of fairly high stands, which indeed M-S can supply.

At 96dB sound level, the distortion was about average at 1% second harmonic, and rather less third harmonic. By 86dB both had settled at the 0.3% level over most of the range except above 14kHz where some minor high frequency resonances disturbed the results.

The suggested amplifier power range is 15 to 50 watts, the latter providing reasonable sound levels of up to 100dBA for a stereo pair in a typical room. The *MS100* was rated as an easy amplifier load with a non-reactive trend and an average impedance value.

Conclusions

The 'official' rating based on the test results would indicate a 'worth considering' verdict, but I feel that this loudspeaker's particular strengths in terms of immediacy, stereo focus and depth, all outweigh its tonal balance weakness. While I must suggest a careful audition prior to purchase, I also feel that this well made speaker deserves recommendation.

Reassessed. First reviewed 1985. Current typical price £160.

For graph references see issue No 41

RECOMMENDED

ROGERS LS2

SWISSTONE ELECTRONICS LTD, 310 COMMONSIDE EAST, MITCHAM, SURREY.
TEL: 01-640 2172

This very compact loudspeaker may be considered as having grown out of the little *LS1*, which it now replaces. With a 10.5 litre internal volume, the proportions are improved, and this should reduce box coloration. The cabinet is nicely veneered in real walnut, and has a decent chamfered grille baffle with an MDF board front panel. Plain chipboard is used for the rest of the carcass. Reflex-loaded, the box is tuned to 60Hz by a decently sized port, 50mm diameter by 110mm long.

In this two-way system, bass and midrange are handled by a Rogers-built polypropylene-coned unit, constructed on a 110mm pressed steel frame. High thermal power handling is obtained *via* a Kapton motor coil former. A five-element crossover of nominally 18dB/octave slopes is used to divide the frequency range at around 3.5kHz, with the treble register handled by a 19mm soft plastic dome unit of good dispersion.

The enclosure is undamped, but the bass unit is partially decoupled to reduce the transmission of driver frame vibrations to the cabinet panels. Electrical connection is made *via* 4mm socket binding posts and the overall constructional quality is very good.

SOUND QUALITY

Scoring well above average on the panel test, the *LS2* has improved on the earlier *LS1* result. Some panel variation was noticed in the results, however, suggesting a mildly biased speaker 'character'. It was weaker on rock material and lacked full dynamic power, but nonetheless sounded tidy and coherent throughout the frequency range.

Coloration was fairly low, though the bass did not achieve a clean 'slam', the mid could show mild upper range hardness, and the treble a hint of 'sizzle'.

On the plus side, it sounded well balanced with good detail, fair clarity, reasonable depth, and good stereo focus. Bass was tidy but low bass was rather muted.

LAB REPORT

A low sensitivity of 86.5dB/W was recorded, which suggests a minimum power input of 25-30W per channel; 150W is a sensible maximum power input, though it survived much higher levels without complaint. Maximum sound levels of 100dBA will be possible from a stereo pair.

With the grille removed the response was smoother in the upper range. The curve was somewhat unbalanced, the trends suggesting the extraction of all that was available from the main driver. Well tuned, the bass extended to a respectable rolloff at −6dB, 51Hz.

Measured out at 2 metres, the speaker showed a respectable set of forward and off-axis responses which confirmed its generally balanced and well integrated nature. A 60Hz to 20kHz frequency range was easily met for the quoted ±3dB limits.

A 96dB sound level was some task for this system, yet good distortion results were obtained, averaging 1% second and 0.3% third right down to 50Hz. At 86dB the results improved to a surprisingly good level. Just dipping to 6.4ohms amplifier load, rated very good.

With the forward response computer averaged in the listening room, this speaker's pedigree was confirmed. Low bass did rolloff quickly below 50Hz and the treble was a touch forward, but the overall result was distinguished by its notably even nature.

CONCLUSIONS

Another finely crafted design from the hand of Richard Ross at Rogers, the *LS2* stands as a neutral miniature offering good power handling, fine stereo and encouraging sound quality. Best suited to classical programme, this design is confidently recommended.

Reassessed. First reviewed 1985. Current typical price £165

For graph references see issue No 41

BEST BUY

ROGERS LS6

SWISSTONE ELECTRONICS LTD, 310 COMMONSIDE EAST, MITCHAM, SURREY.
TEL: 01-640 2172

The *LS6* slots in below the *LS7*, and offers a similar basic package in terms of size but at a lower price. A newly developed polypropylene cone is used for the bass/midrange unit, built on steel frame and fitted with a generous magnet. The treble is handled by 19mm soft plastic SEAS dome unit, crossing over at around 3.5kHz.

Standing 51cm high, this speaker is suited to free space mounting on solid stands, like the *LS7*. The 23 litre enclosure is reflex-tuned to 50Hz by a 50mm diameter port; the internal section is slant-cut to an approximately 110mm length. Reflexing gives a fourth order bass response but in fact this system is fifth order, achieved *via* a 440μF series capacitor.

The high quality crossover network is essentially to a third order pattern and is built using excellent components.

Built from plain chipboard, the enclosure has an MDF driver baffle with a chamfered port opening and grille baffle.

The constructional quality and standard of finish is high. Electrical connection is *via* 4mm socket/binding posts.

SOUND QUALITY

Scored with great consistency by the panel, the *LS6* achieved a very similar rating to the *LS2*, though with superior bass extension and power handling. The '6 was found to be very well balanced with a transparent, informative mid, and an open, 'airy' nature. Stereo depth was quite well developed, with good width and image focus.

Quite lively and dynamic, coloration was generally low. While the upper treble could sound 'grainy' on occasion, when re-auditioned for 1986 the overall midrange balance and the bass tuning were both significantly improved. It handled high powers well, showing a convincing superiority here over the *LS2*, but not quite reaching the standard set by the *LS7*.

LAB REPORT

At the reference 1 metre microphone distance, set on the median driver axis, this speaker provided a very uniform, well controlled response. There was no difficulty in establishing a sensitivity at a solid 87.5dB/W. With the grille off the response met ±2dB limits from 55Hz to 16kHz, very creditable with a −6dB low frequency limit at 50Hz, about average for the price and size.

Out at 2 metres, this speaker's fine driver outputs are excellently integrated, producing a first class set of off-axis responses.

In the listening room the forward energy was finely balanced above 80Hz but bass was also up a few dB at the 50Hz system resonance, falling quickly at lower frequencies. A lower system tuning frequency could improve matters here.

Driven to 96dB sound pressure, the speaker offered moderate distortion levels, averaging a good 0.3 to 0.4%. At the 86dB level, the frequency range above 100Hz averaged a fine 0.25%.

With a 150W maximum power handling, this speaker will provide generous sound levels up to 104dBA in a typical room. Conversely, as little as 15W will produce enough volume for normal purposes. The sensitivity was not compromised by the impedance characteristic, which showed an easy 8ohm amplifier load.

CONCLUSIONS

This honestly built loudspeaker has achieved sufficiently high standards in both laboratory and listening tests to qualify for strong recommendation. With its neutral balance, smooth response, fine stereo and a consistent off-axis uniformity, it also provided low distortion as well as good power handling into the bargain and merits a Best Buy rating.

Reassessed. First reviewed 1985. Current typical price £230.

For graph references see issue No 41

setting the standard in loudspeakers....

Rogers

310 COMMONSIDE EAST, MITCHAM, SURREY CR4 1HX. 01 640 2172

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RECOMMENDED

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 30 litres.

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 being 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, integrated *via* the excellent-quality 13-element 3kHz crossover. External connection is by 4mm socket/binding posts and the internal wiring is to a high standard.

SOUND QUALITY

The panel were highly impressed by the *LS7*. 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. Depth was impressive, with an almost 'crystalline' transparency.

The *LS7* provided good bass extension and despite seeming slightly 'leaden-footed' here, powerful and clean articulation were in evidence. The sound was consistently clean and free of 'boxy' effects.

Very mild criticisms concerned 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 REPORT

The *LS7* showed fine pair matching when measured at 1 metre, the axial response disfigured by a notch at 7kHz partly caused by the grille. The well-damped bass response was uniform and well balanced in character, extending to 48Hz, −6dB, which is fine for the size of enclosure.

Sensitivity was above average at 88dB/W, and an impressive 200W power handling 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.

A fine set of off-axis responses were demonstrated at 2 metres. At 15° above a mild 4kHz dip occurred (still affected by the grille), so the speaker should be directed or elevated to face the listener. Panelists' observations that the balance was slighly 'rich' were confirmed by the 2 metre 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.

CONCLUSIONS

The *LS7* 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.

It it remains a strongly Recommended loudspeaker.

Reassessed. First reviewed 1983. Current typical price £335.

For graph references see issue No 41

BEST BUY

ROTEL RL850

ROTEL HI-FI, 25 HEATHFIELD, STACEY BUSHES, MILTON KEYNES, BUCKS.
TEL: (0908) 317707

A standard two-way sealed box system, this 20 litre speaker is built in the UK. Though Rotel is a Japanese-based company, the design is UK-inspired and uses a British Elac 220mm pulp-cone bass/midrange fitted with a modest magnet and built on a strong pressed-steel frame. The treble is handled by a Peerless 25mm soft fabric dome, and the connections are hard-wired in oxygen-free copper cable, using a simple three-element crossover network, with an additional resistor to provide attenuation for the treble. Built from 15mm thick chipboard, the enclosure is finished in black ash, and well filled with acoustic absorption. The grille panel is unrebated and 15mm thick — it probably should be discarded to get the best sound.

SOUND QUALITY

Scoring 'above average' on listening tests, the *RL850* did well in its category, and costs less than half the group average.

Some coloration was evident, namely a softening in the bass and a touch of 'boxiness' in the mid, plus a muted 'fizz' in the treble. The frequency response sounded quite even, if slightly dulled, while the upper-mid and treble lacked detail, with an inconsistency here depending on the type of programme played.

Stereo images were good, in terms of width, but central focus was not particularly strong, and depth was constrained. Despite the latter characteristic, the speaker sounded fairly 'big hearted', and could convey some of the weight and ambience present in the programme. Voice quality was quite good, and the speaker also handled high power inputs gracefully, proving quite happy up to 220W peak programme.

LAB REPORT

Pair matching was found to be very good — to within ±0.5dB, which is a great achievement for such an inexpensive speaker. The grille has some effect on the treble response and is better left off. The reference sensitivity measured an average 87dB/W; in conjunction with the generous power handling, this means that levels of up to 105dB are possible from a stereo pair, assuming that you have a large enough amplifier. Fairly smooth and well balanced, the response met ±2.5dB limits from 66Hz to 20kHz, while the −6dB bass rolloff came in at 52Hz, which is about average.

Out at 2 metres, the forward response family was fairly well integrated. A dip at 4kHz occurred above axis suggesting that this speaker ought to be at, or alternatively directed towards, ear level. The lateral responses were good.

Driven to 96dB spl, the distortion measured 1% for second harmonic, and rather less for third. Below 100Hz the usual increase to 3% or so was seen. When sound level was reduced to 86dB, distortion improved significantly to a good level, typically 0.4%. Compression was poorer than average at 2.7dB, but the bass-mid intermodulation figure was very good at −48dB.

The impedance curve indicated a normal 8ohm load, typically measuring 10ohms at higher frequencies, and posing no problem at all for a modern amplifier. Driving the listening room, the speaker produced a well balanced and extended response. Within that general trend however, the mid showed some prominence at 800Hz, while a forward energy notch was clearly present at 2.8kHz, indicating poor phase control through the crossover, leaving the treble somewhat isolated as well as uneven.

CONCLUSIONS

While some quirks have been unearthed in the performance of this speaker, the fact remains that it nonetheless offers very good value. A powerful, competent two-way system with a 200mm driver, when most in this category have 110mm, the 850 achieves Best Buy status, current production showing additional refinement.

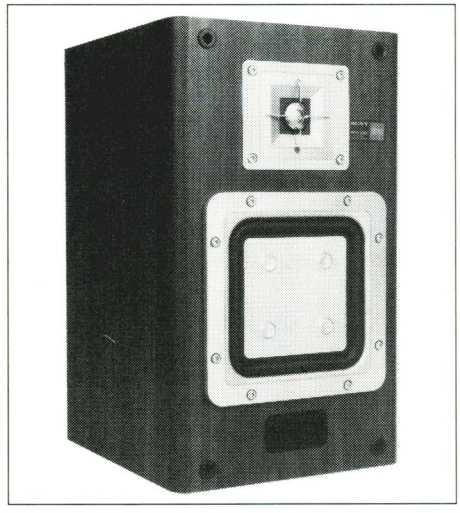
Reassessed. First reviewed 1984. Current typical price £110

For graph references see issue No 41

BEST BUY

SONY APM20ES MKII

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.
TEL: STAINES (0784) 61688
David Prakel



Sony first applied its Accurate Pistonic Motion (APM) drivers in the upmarket Esprit speaker range. The *APM22ES* then made this planar driver technology available at the £200-£250 area. The *APM20ES* reviewed here is a hybrid, marrying a true APM mid/bass driver with a metal dome tweeter dressed to look like the 25mm square tweeter of the '22, and entering the UK market at a very competitive £130.

The Japanese built 140mm square mid/bass driver is a remarkable piece of engineering in a speaker at this price. Rather than a conventional cone, an inverted 'quadropod' thin aluminium pressing moves a diaphragm made in exceptionally light aluminium honeycomb material. The die-cast chassis seen in the *APM22* is not used here, but the pressed-steel basket has been damped with mastic panels. The tweeter is a 25mm aluminium dome with a doped fabric suspension.

The cabinet is built throughout in 18mm chipboard, and finished in good quality woodgrain vinyl. The front vertical edges are rounded. The mid/bass driver, somewhat unusually, is reflex-loaded by a rectangular port equivalent to an ample 57mm diameter, backed by an angled 95mm duct.

The speakers are built — or as Sony would have it 'tailored' — to impressively high standards in Sony's German Wega factory. A good quality crossover gives second-order slopes and some driver equalisation. Binding posts which will accept 4mm plugs complete the picture.

Sound Quality

The *APM20ES* immediately impresses with its confident reproduction of space and acoustic, providing good stereo despite its rather 'positive' perceived balance. The low end of this speaker is 'rich' and a little forward but always tuneful. Bass is not oppressive leaving the sound with plenty of air.

Good midrange definition is spoiled by a touch of sibilance, which hardens into stridency when the speaker is pushed hard. Played very loud the speaker can be a little 'shouty', but this is not a great problem considering the price being asked.

Overall this loudspeaker strikes the listener as a very smooth, well-integrated performer setting a standard at this price point which equals, if not betters, many of the competing specialist UK designs. Stand mounting in free space suited it best; positions close to room boundaries tended to emphasise the already generous bass. The grille frames are cleverly designed to stand off from the baffle and the grilles had surprisingly little effect on the sound — if anything, smoothing the top end somewhat.

Lab Report

Reflex loaded and tuned to 62Hz, sensitivity was rated marginally below average at 86dB/W. Good pair matching was noted to within ±0.5dB. The −6dB low frequency cutoff was measured at 50Hz, respectably low for such a compact design.

The anechoic forward response curves showed a slight 'hole' between the drivers at 2.8kHz, though this seems to be of little subjective importance, unless lending a certain detached brightness to the treble.; The off-axis anechoic traces showed excellent dispersion, confirming the ability to produce a generous and stable stereo 'fill'.

At 96dB sound pressure levels the expected second harmonic port distortion was noted with a second hump based on 200-300Hz, no doubt adding that 'generosity' and 'forwardness' to the upper bass. A 1kHz distortion peak was little reduced at the lower 86dB level — this could well be evidence of the 'shouty' quality noted at high levels. The impedance curve dipped to 5ohms at 150-200Hz but was otherwise well controlled, the load being rated as average.

The computer-averaged in-room plot shows excellent integration and a smooth rolloff with perhaps some detachment of the mid/bass region though room effects could well predominate here. An excellent high end response however.

Conclusions

With design input from the UK, Sony has produced a much improved second series *APM20ES* with a forthright sound possesing lively bass, excellent treble clarity, easy driving, and surprisingly good stereo performance.

A thoroughly attractive compact speaker, widely available, with no serious shortcomings and many strengths, the *APM20ES* clearly deserves a Best Buy rating.

Author Martin Colloms' involvement as design consultant finds David Prakel writing this review, based on his own interpretation of the lab and listening data.

General Data

Size (height×width×depth)	43×25×29cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(15) −75W
Recommended placement	40cm stand, free space
Frequency response, within ±3dB, at 2 metres	50Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	50Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	86dB/W
Approximate maximum sound level (pair) at 2 metres	100dBA
Impedance characteristic (ease of drive)	average
Forward response uniformity	excellent
Typical price per pair, inc VAT	£130

For graph references see issue No 46

RECOMMENDED

SONY APM22ES

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.
TEL: STAINES 61688

The *APM22* is built in Germany at Sony's Wega plant, using two Japanese drivers, a 220mm square bass/mid and a 25mm square treble, both with extra light, strong aluminium honeycomb diaphragms. The bass driver is built on a fine die-cast frame and is fitted with a generous magnet, and a high quality five-element crossover is used. The 30 litre enclosure is reflex tuned by a rectangular port 75mm deep, its 44 square centimetre area equivalent to a generous 7.5cm diameter aperture.

Finished in vinyl laminate, the solid enclosure has some bracing, and is built from high density chipboard. Sensible 4mm socket/binding posts are provided for electrical connection, and this system will give its best on rigid stands, well clear of room boundaries.

SOUND QUALITY

Scoring well on the 1984 panel tests, the *APM22* achieved a 'good plus'. This has been downgraded to a 'good' by the improved 1986 standards, but is an impressive result nonetheless. The panel actually found little to criticise. The bass was powerful and tuneful, with a hint of excess, while the mid was a mite 'thin' and 'forward', showing mild 'boxiness' as well. The treble was judged to be slightly bright but of very good quality.

The *APM22* sounded notably clear and clean with very good dynamics, an 'open' explicit presentation, and a pleasing transparency. Stereo images focused well, and both depth and the recorded acoustic were well presented. The system handled high powers well, surviving 300W programme with no limiting, producing really high sound levels.

Coloration, particularly of the 'cone' variety, was found to be quite low, which was appropriate in view of the absence of cone diaphragms.

LAB REPORT

Reflex-tuned to 55Hz, the sensitivity was about average at 88.5dB/W. Pair matching was excellent, to within ±0.5dB, and the −6dB low frequency cutoff was a respectable 46Hz — good for the size. The grille did not unduly affect the treble response, though its removal still gave an improvement.

The 2 metres axial response was exemplary, meeting fine ±1dB limits from 60Hz to 20Hz. The off-axis family of responses looked tidy but the 3kHz crossover dip in the vertical plane suggests that the speaker should be near or directed towards ear level.

At 96dB sound pressure level, distortion was pretty good, though rising to normal values below 200Hz; it was much improved at 86dB, though a mild peak in third harmonic was evident at 1kHz. Compression was poorer than expected at 2.5dB but the intermodulation product was an excellent −51dB.

Dipping just below 6ohms at 170Hz, the impedance curve was otherwise well controlled, and will present no good amplifier with any problems.

In the listening room, the computer-averaged response confirmed the listening test results. The curve showed a well balanced output, with good integration and some moderate bass excess at 50Hz. The treble was particularly good.

CONCLUSIONS

The *APM22ES* is well engineered, offers an essentially neutral, open, transparent sound, and is full of detail and life. The response is wide, the stereo good and the distortion moderate, while sensitivity is above average. Furthermore it is easy to drive and usefully compact, interfacing well with our listening room. High sound levels of up to 105dB were also possible.

Achieving Best Buy status in both 1984 and 1985 editions, gradually improving overall standards since have resulted in regrading to a Recommendation for 1986, though it is clearly still a major contender at its price point.

Note: The author provided a private opinion on an earlier version of this model for the manufacturer.

Reassessed. First reviewed 1984. Current typical price £200.

For graph references see issue No 41

BEST BUY

SPENDOR PRELUDE

SPENDOR AUDIO SYSTEMS LTD, UNIT 47 STATION ROAD INDUSTRIAL ESTATE, HAILSHAM, SUSSEX BN27 2ER. TEL:(0323) 843474

Spendor's *Prelude* has now superseded the more expensive *SA2* from which it was developed. A vinyl-wrapped chipboard cabinet replaces the veneered multi-ply of the *SA2*, allowing a cost saving of some 30%, but with overall performance very little changed. For completeness, this review includes comparison to the *SA2*.

The 28 litre 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* had a superior foam grille, the *Prelude* is fitted with an attractive wooden framed construction.

The Spendor-designed high-power Bextrene-coned bass/mid unit uses a 40mm pole and massive magnet, and is 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 *SA2*, but the less worthy spring connections in the *Prelude*. Both systems are intended for free space positioning on open stands.

SOUND QUALITY

The *Prelude* listening panel scores were very promising, placing it in the 'good plus' category which is 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 nonetheless showed low distortion and high 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 in this respect 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.

LAB REPORT

At 1 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 a stereo pair is capable of a substantial 105dBA sound level in a room. Pair matching was very good.

At 2 metres 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.

Bass in the listening-room computer-averaged response 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. Averaging 13ohms, the impedance fell to a minimum of 6.7ohms in the treble, so the system may be classed as an easy amplifier load.

CONCLUSIONS

Good sensitivity, a smooth natural sound and fine stereo, have all been confirmed in recent (1986) auditioning. The extremely attractive price ensures that the *Prelude* merits a Best Buy rating.

Reassessed. First reviewed 1983. Current typical price £270.

For graph references see issue No 41

RECOMMENDED

SPENDOR SP2

SPENDOR AUDIO SYSTEMS LTD, UNIT 47, STATION ROAD INDUSTRIAL ESTATE, HAILSHAM, SUSSEX BN27 2ER. TEL: (0323) 843474

With the original *BC1* and its virtual successor the *SP1* well established, Spendor has been researching a less expensive 30 litre alternative for a few years now. The *SA2* came first, to some degree then eclipsed by the superior and cheaper *Prelude*. Now, developed from the *SP1* and sharing that fine model's 200mm polypropylene coned bass-mid unit, we have the *SP2*. The treble is handled by a special version of the established Scan *D2008* tweeter, a 19mm soft dome offering a superior performance, and in this case, ferro-fluid damped. Optimum positioning is in free space, on 40-50cm high stands.

The finely veneered enclosure is critically balanced by an optimum choice of chipboard grade and thickness, the panels bitumen damped internally. This is a reflex loaded design, tuned to 33Hz, and the ducted port is internally damped by a foam lining absorbing the higher resonant modes in the duct.

SOUND QUALITY

On test the *SP2* achieved a very high ranking position, only a little behind that of the *SP1*.

Stereo images were well focused, and showed very good width and depth. Well balanced tonally, the response sounded very uniform, though with a touch of 'softness' in the low bass despite good extension. In the upper mid, a hint of 'hardness' was noted, plus slight 'wispiness' in the high treble.

In the Spendor tradition, the *SP2* offered a highly articulate, detailed midrange. Dynamics were presented well, the system sounding open and relatively uncoloured. Just a touch of 'boxiness' was present in the low midrange, but even this was much less than usual.

LAB REPORT

Reference sensitivity was about average at 87dB while the axial frequency response showed a highly uniform characteristic, ±2.5dB 50Hz to 15kHz. The bass was well extended, reaching 45Hz, −6dB.

A minimum power rating of 15W was indicated, while the *SP2* coped with up to 150W peak programme, generating decent sound levels of 104dBA from a pair in a typical room. The impedance curve showed an easy load.

At 2 metres, the ±3dB response was a wide 48Hz to 20kHz, with the set of forward responses showing quite excellent uniformity. The slightly down-tilted response is typical of subjectively well balanced compact box systems. In the listening room the speaker showed an even, well balanced characteristic with good power down to 30Hz. Integration was very good through the frequency range.

At the high 96dB sound level, the distortion above 150Hz held to a moderate 0.4%, bar some minor clutter above 100Hz. With level reduced to 86dB, third harmonic averaged 0.25%, second 0.1%, both fine results.

CONCLUSIONS

Spendor now have their compact 30 litre monitor. Offering great consistency and accuracy, it slots in neatly below the *SP1*, conceding little to that respected, larger model. With its natural, extended response, low coloration, wide dynamic range, easy amplifier loading and very fine stereo, the *SP2* is a class winner and may be strongly recommended.

Reassessed. First reviewed 1985. Current typical price £390.

For graph references see issue No 41

RECOMMENDED

TANNOY TITAN

TANNOY LTD, THE BILTON CENTRE, CORONATION ROAD, CRESSEX INDUSTRIAL ESTATE, HIGH WYCOMBE, BUCKS. TEL: (0494) 450606

An early *Titan* turned up rather late for the 1984 edition of *Loudspeakers*, and proved somewhat unpromising. However, since then it has been improved and was resubmitted in 1985 in full production form.

Built a little like the Mission *70*, the *Titan* uses rear mounting for its two drivers, with a fixed front grille; access is *via* the flimsy screwed-in rear panel. The sealed-box interior of 9.3 litres is damped by a loose fill of polyester fibre wadding.

The drive units originate from Japan, and include a soft dome treble, plus a 160mm steel frame bass/mid unit, the latter having a light pulp cone. In one sample the tweeter fixings were loose. The crossover has three elements plus a damping resistor and is aiming at 12dB/octave acoustic slopes. Push-on connectors are used, while the rear terminals are 4mm socket/binding posts.

Vinyl covered, the 15mm thick chipboard enclosure is grooved on the long sides to reduce panel resonance. Optimum placement is near a rear wall and the angled front means that this speaker may be left neatly in the 'straight ahead' position.

SOUND QUALITY

Scoring a straight average with little panel dissension, the *Titan* did well for its price group. The sound was described as somewhat 'boxy' with a 'forward' upper midrange plus a 'bright', moderately 'ragged' top end. On the plus side the speaker also showed a clear, open character with explicit detail, and a 'lively' nature. Low bass was absent, but upper bass was fairly 'quick' and clean.

LAB REPORT

A rising response trend was characteristic of the *Titan*, though this was not extreme at 4dB from 100Hz to 20kHz, a result expected from a design intended for wall mounting.

Pure sensitivity came out at 89dB/W, above average and uncompromised by the impedance characteristic; this happily met the 8ohm standard, so the *Titan* is rated as a very good amplifier load. System resonance was rather high at 90Hz, and from the axial response (nearfield converted at low frequencies) the −6dB bass rolloff was fairly high at 67Hz. With a power input range of 10 to a maximum of 50 watts, realistic maximum sound levels of up to 102dBA can be achieved.

Out at 2 metres this loudspeaker's forward response balance, seen in the pattern of the off-axis responses, looked well integrated with good uniformity. Pair matching was fairly good, though in the 3-4kHz crossover range up to 2dB difference was noted.

When driven to 96dB sound level, distortion was poorer than average, reaching 3% in the lower frequency range for (relatively innocuous) second harmonic. Third harmonic was variable with frequency, up to 0.8% in the midband. Reduced to a moderate 86dB sound level, third harmonic remained the same, while second showed a considerable reduction.

In the listening room the *Titan* gave a forward upper mid with some treble uneveness but a fair overall balance. The bass was smooth and well integrated even if it did decay gently in the lower range.

CONCLUSIONS

Apart from the loose tweeter on our sample, the *Titan* did quite well on both lab and listening tests, confirming its suitability for shelf mounting. It sounded much better than our early examples, and is now recommended.

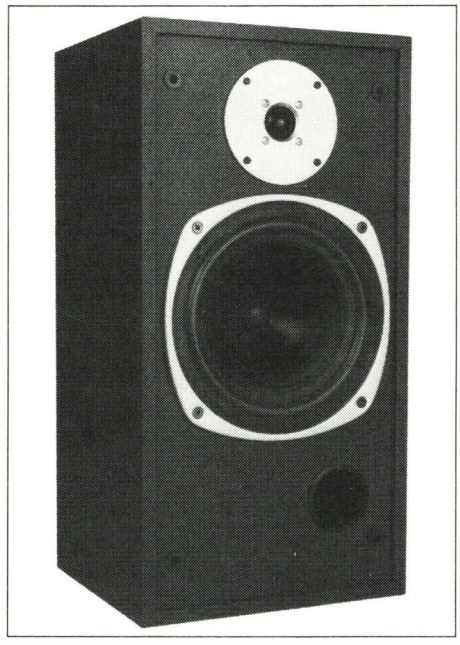
Reassessed. First reviewed 1985. Current typical price £100.

For graph references see issue No 41

BEST BUY

TANNOY MERCURY II

TANNOY PRODUCTS LTD, THE BILTON CENTRE, CORONATION ROAD, CRESSEX IND ESTATE,
HIGH WYCOMBE, BUCKS. TEL: (0494) 450606



Tannoy have enjoyed a very successful run with the *Mercury* and over the past year or so have produced an upmarket derivative called the *M20 Gold*. 1986 sees the introduction of a new *Mercury*, incorporating significant design stages. The cabinet has been reshaped and is now taller, while the Audax soft dome tweeter has been replaced by a Tannoy soft plastic dome design. The polypropylene-coned bass unit has undergone continued development, while other changes relate to the low frequency tuning and the crossover network. Essentially, this may be regarded as a new loudspeaker.

The new *Mercury II* is a compact two-way model with a 20 litre internal volume, reflex-tuned at low frequencies by a 50mm front port, 105mm long. The bass unit is energised by a generous magnet and has a 155mm flared cone on a 235mm pressed steel frame, whose central area has been reinforced to prevent flexure. Mounted on a specially cast asymmetric plate, the tweeter employs a 25mm polyamide dome. The high quality crossover is built for simplicity and clarity and designed to 12dB/octave slopes with good quality components. Though the crossover is hardwired, spring clips are used to connect the drivers. Connection to the system is by 4mm socket/binding posts.

Built mainly from vinyl walnut 14mm chipboard stock, the enclosure includes a circumferential brace between the two drivers, and a lining of acoustic fibre. On our sample the grille was unrebated, and for critical listening is better left off. Ideal placement is in free space, on open stands around 35-45cm high.

SOUND QUALITY

The *Mercury II* scored well in the listening tests, substantially beyond its price expectations and virtually repeating the success of the original *Mercury* in its day. The sound was well balanced, uniform, and well integrated. Coloration was moderate and generally well disguised; some mild 'boxiness' and 'thickening' on piano was noted, plus a touch of 'grain' and 'edge' in the treble.

The bass was very competant, showing fair extension and good control. Stereo images were well focused with a fair measure of depth and transparency. While no significant aberrations were detected in the subjective frequency response, a couple of panelists felt that this speaker was mildly 'soft' and undynamic, though their scoring did not appear unduly affected by this. Driven by clean source material, the *Mercury II* performed equally well on rock and classical sources, both CD and analogue.

LAB REPORT

A good sensitivity of 88 dB/W was easily established from the smooth axial response at 1 metre. The bass was quite well extended to 55Hz, −6dB, but the sensitivity was somewhat compromised by the dip in load impedance at high frequencies, to 3.8ohms over a short stretch around 6kHz; elsewhere the impedance averaged an easy 8ohms. A 10 watt minimum amplifier power is suggested, while the speaker performed ably on inputs up to 150W, permitting peak sound levels of up to 103dBA.

The forward responses measured at 2 metres looked very tidy, with excellent integration seen in the forward axes. Frequency response limits of ±3dB were easily met from 55Hz to 20kHz. Some distortion rise was noticed around 200Hz, to 3% second harmonic at 96dB for example, with a similar anomaly on the third harmonic. Tuned to 40Hz, the system handled low frequency power well, only showing more serious distortion at high powers and below 30Hz.

The *Mercury* proved to be as well balanced as it sounded on the computer-averaged room measurement, right down to 30Hz in the bass. A mild prominence was evident at 1kHz, but otherwise the curve was most presentable.

CONCLUSIONS

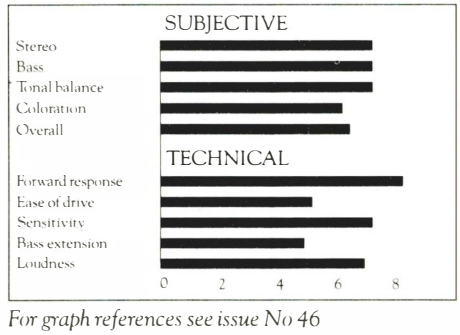
The original *Mercury* was notably well balanced, providing competant all round performance with a sensible blend of modern loudspeaker engineering. The new *Mercury* is even better balanced, has better response uniformity and lower distortion, while the price is barely greater than when the speaker was first introduced in real terms. This genuine allrounder represents an exceptionally accurate free-space system for the money, and merits a Best Buy classification.

Note: The author provided a private opinion on an earlier version of this model for the manufacturer.

GENERAL DATA

Size (height × width × depth)	50×25×23.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −150W
Recommended placement	open stands, 45cm
Frequency response, within ±3dB, at 2 metres	55Hz 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	103dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	excellent
Typical price per pair, inc VAT	£150

PERFORMANCE SUMMARY



For graph references see issue No 46

RECOMMENDED

TANNOY VENUS

TANNOY PRODUCTS LTD, THE BILTON CENTRE, CORONATION ROAD, CRESSEX IND ESTATE, HIGH WYCOMBE, BUCKS. TEL: (0494) 450606

Tannoy's *Mercury* is an established 'Best Buy' speaker; in a higher price and quality category, the *Venus* is somewhat larger, with an internal volume of around 30 litres as against the *Mercury's* 19 litres, and comes in a real walnut veneer finish. It has a substantial 6cm diameter and 6cm deep port, reflex tuning the enclosure to 48Hz.

Both drivers are made by Tannoy and comprise a 25mm plastic dome tweeter with a 210mm bass/midrange, the latter with a generous magnet, a steel frame and a critically flared polypropylene cone.

The sturdy enclosure is built of 19mm chipboard, bitumen damped and with interior absorbent. The drive units are 'time aligned', in that the treble signal passes through a time delay network to synchronise it with the midrange, while the crossover is a basic 12dB/octave type; including the time delay network, a total of 16 elements are employed. The 9mm thick grille panel is unrebated and is probably best left off to get the best results.

SOUND QUALITY

Scoring a substantial 'good plus' the *Venus* has done well on audition. It was felt to be well balanced, with an extended wide range response and a touch of bass excess. Coloration was comparatively low, while the sound was considered both 'open' and 'sweet'. A touch of 'grain' was occasionally noted in the treble.

The stereo imaging was fine, the speaker demonstrating good perspectives with fine depth and ambience as well as good focus and stage width. Coloration was comparatively low, with just a touch of 'plastic cone' and some mid 'boxiness'. It handled high sound levels well, surviving a respectable 300W peak programme and still sounding civilised and well controlled.

LAB REPORT

This speaker demonstrated an average sensitivity of 86.5dB/W. Low frequency rolloff was at 47Hz, good for the size and price, while pair matching was also good, with an absolute difference of just 1dB overall. The axial response was quite smooth, and better still with the grille detached. A mildly downtilted response was indicated, the overall trend meeting ±2.5dB limits from 50Hz to 20kHz, grille detached.

With 200W power handling capacity, maximum sound levels of 104dB should be possible from a stereo pair, particularly as the impedance does not fall below 6.4ohms, allowing an 8ohm rating for this well balanced design. Driven to 96dB, distortion was higher than expected, though mainly innocuous second harmonic. At a reduced 86dB level, it improved to a 'satisfactory' level.

Out at 2 metres, the off-axis response showed excellent integration, with the benefits of time alignment fully realised. This was as perfect a medium-sized two-way speaker as I have seen.

CONCLUSIONS

Smooth and sweet was the panel's impression of this well finished and carefully built loudspeaker. It does most things pretty well and is also easy to live with. Its subtlety and good stereo pleased the panel, whose scores suggested a firm recommendation.

Reassessed. First reviewed 1985. Current typical price £270.

For graph references see issue No 41

BEST BUY

TOSHIBA SS 33 MK II

TOSHIBA (UK) LTD, TOSHIBA HOUSE, FRIMLEY ROAD, CAMBERLEY, SURREY. TEL: (0276) 62222

The original successful *SS 33* has undergone some refinement for 1986, with a slightly smaller and less resonant enclosure and revised performance in the crossover region. Our retesting has been confined to the listening sessions and the reference response, whose results are incorporated in the text.

Toshiba's British-designed '33 is built and tested at the UK cabinet factory responsible for the enclosure, which makes for a useful saving in transport costs as well as one less mark-up to be taken into consideration.

A moderate sized 22 litre sealed box, the plain, 15mm thick chipboard enclosure is well finished on all frontal surfaces in a 'rosewood' vinyl. The grille baffle is 15mm thick, unrebated and is best left detached for more serious listening. Large enough for stand mounting, it suits a free space position in the room, not too close to the rear wall.

The 200mm steel-framed Elac bass-mid drive unit has a nicely flared, doped pulp cone. Treble is handled by a Tonegen 25mm soft dome with the crossover essentially to a third order 18dB/octave alignment. Connection is *via* spring clips and internal wiring uses push-on connectors. The cabinet panels are undamped while the interior has a loose lay of fibre wadding for internal standing wave absorption.

SOUND QUALITY

The original '33 scored 'above average', which is excellent for the price. The midband was essentially good with quite good balance and above average detail. The same was true of the stereo depth effect and focus. The overall effect was quite well balanced though with a distant upper mid. By contrast, the bass was a bit slow and lacked dynamics, while the treble showed some isolated 'hiss', and was not perfectly integrated with the rest.

Some colorations were present, notably a 'boxy' 'thickening' in the low mid, but this was not too serious.

However, the 1986 version showed a distinct improvement in coloration, and the sound was more 'open', fully maintaining the fine value of the original.

LAB REPORT

Measured at the reference 1 metre on the median axis, the '33 demonstrated an average 86db/W sensitivity. This was not compromised by the impedance, which rated as a very good amplifier load, and conformed to an 8ohm characteristic, the loading never falling below 6.2ohms.

System resonance was at 73Hz, typical for the type, while the bass response extended to a low 49Hz, −6dB. From a 15 watt programme minimum power input, this model proved quite happy up to 75 watts peak programme, and was capable of maximum sound levels of 100dBA.

A new reference response taken for 1986 showed a distinct improvement over the original. The broad sucked out mid region is almost filled, so the treble is no longer exposed. The crossover region shows better integration having a 4dB dip around 3kHz.

At 96dB sound level the distortion was satisfactory at low frequencies and improved above 200Hz, here averaging 0.3 — 0.4%. By 86dB, good distortion levels were established throughout the range.

CONCLUSIONS

This is a lot of speaker for the money. With a classic 'UK sound', the '33 sits very comfortably in a highly competitive field and, in its latest guise fully maintains this competitiveness. Its performance was nicely balanced on both listening and lab tests, and offers Best Buy value for money.

Re-auditioned. First reviewed 1985. Current typical price £80.

For graph references see issue No 41

RECOMMENDED

WHARFEDALE DIAMOND II

WHARFEDALE LOUDSPEAKERS LTD, SANDLEAS WAY, CROSSGATES, LEEDS LS15 8AL.
TEL: (0532) 601222

The tiny Diamond has a 5.2 litre enclosure, reflex-loaded by an equally small ducted port 30mm in diameter by 65cm long, positioned on the rear panel. The bass alignment is in fact 5th order since a large series capacitor is also used.

The 120mm bass unit is built on a steel frame, with treble allocated to the 19mm Son Audax plastic dome/cone tweeter. The crossover is very simple, comprising just two elements plus an attenuating resistor for the treble.

Built from plain 12mm thick chipboard, vinyl coated, the cabinet has a 12mm thick unrebated grille, and spring clip terminals are provided on the rear panel for electrical connection.

SOUND QUALITY

For the price the *Diamond* did reasonably well, but its absolute rating on the listening tests was not too promising, with a well below average score. The panel results were confusing, some listeners liking this speaker fairly well while others considered it to be too weak for serious attention.

Almost all the panel recognised it as a small box, and it was criticised for 'boxy' coloration as well as a 'thinned' midrange, and an uneven treble which tended to emphasise background hiss. The bass was soft and weak though reasonably balanced and extended — in fact rather more so than one might expect. Positioned close to the wall it managed to produce a fairly big sound though depth effects were fairly muted. Left to right imaging was fairly good.

Some merit definitely lurked within, and once one had become accustomed to the sound, it began to make its own impression, which was quite respectable for the size and price.

LAB REPORT

Pair matching was fine to 2kHz, but poor thereafter with up to 4dB of mismatch. This could well account for the just passable stereo focus. Reference sensitivity averaged 86dBW taking into account normal wall mounting. The bass −6dB point was rather high at 74Hz.

Re-tested for 1986, the 1 metre axial reference response showed close similarity to the 1985 result, albeit with some improved smoothness and less prominence of the treble region. The 'grille-off' response showed that this optional item is best removed.

Out at 2 metres, these effects are smoothed out by the averaging, but the 'lumpy' quality remains. The 100Hz to 20kHz range required ±4dB limits, although the family of forward responses were quite good.

Driven to 96dB sound level, the distortion was unacceptable; typically 3% of second harmonic and 1% of third. At the reduced 86dB level, a moderate improvement occurred, though the third harmonic still did not improve much in the midrange. It survived the compression tests with a poor 3.5dB of loss and −19dB for the intermodulation product.

The impedance curve did not fall below 6ohms, and the *Diamond* can be regarded as a safe 8ohm type amplifier load. Out in the room the averaged forward response clearly showed the speaker for what it was, a seriously midrange-forward design. Bookcase mounting will help but will not entirely solve this aberration.

CONCLUSIONS

An interesting and inexpensive miniature, as originally tested the *Diamond* appealed to some panelists, but others were unable to get on with it. In the context of 1986 standards it is felt that a Recommended rating, noting the somewhat idiosyncratic nature of this loudspeaker, is appropriate.

Note: Wharfedale are planning a so-called 'active' Diamond with stereo power amplifiers to sell for a competitive £100, which should prove a popular add-on for use with personal stereos and television sets.

Reassessed. First reviewed 1984. Current typical price £85.

For graph references see issue No 41



"Spendor now have their compact 30 litre monitor. Offering great consistency and accuracy, it slots in neatly below the SP1, conceding little to that respected larger model. With its natural extended response, low colouration wide dynamic range, easy amplifier loading and very fine stereo, the SP2 is a classwinner and is strongly recommended."

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HIFi News April 1985

spendor audio systems

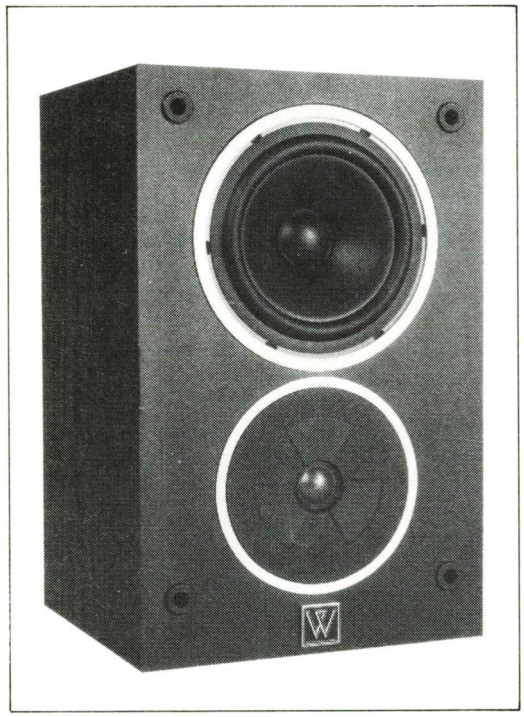
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RECOMMENDED

WHARFEDALE 504

WHARFEDALE LOUDSPEAKERS, SANDLEAS WAY, CROSS GATES, LEEDS LS15 8AL.
TEL: (0532) 601222



The success of the diminutive *Diamond* first led Wharfedale to produce a *MkII* model, and thence to create an up-market version, the 504, whose top performance is enhanced by Wharfedale's 19mm pure piston aluminium dome tweeter. This true miniature is just 29cm high with an enclosed volume of only 6 litres. Surprisingly for such a small box, it uses bass reflex loading, the small 30mm diameter rear panel port with 65mm duct tuning the system to a high 70Hz.

The bass/mid driver uses a flared-profile 90mm polypropylene cone in a 130mm housing which uses a new cabinet locking system. The two-way system has a minimal crossover of normal commercial quality, aimed to provide maximum musical transparency; essentially to 6dB/octave, the slopes are finally modified by the natural acoustic responses of the drive units. Electrical connection to the amplifier is made *via* 4mm combination socket/binding posts.

The 12mm chipboard enclosure is braced using the recessed back panel technique, with polyester fibre internal absorption, the 9mm grille has a half-rounded rebate on the inside edge. The bass unit is mounted above the tweeter, so that the drivers are brought partly into time-alignment with a normal stand (40-50cm); the 504 could be inverted if used on higher stands (60-80cm). Designed for placement almost touching a rear wall, up to 3dB of boundary lift will augment the measured response in the 80 to 700Hz range.

Sound Quality

Despite wall mounting, the 504 made a good impression for its price and size, with a rating almost at the average position. While deep bass was absent it fooled several panelists by managing to give the impression of a much larger system. Stereo images showed good width with reasonable depth, while the treble was free from 'edge' or 'grain'. Focus was rated above average, with more than satisfactory mid detail, obtained at the expense of some 'forwardness'. Transients were clean and dynamic contrasts fair.

Lab Report

The sensitivity was a below average 85dB/W. The 'good' load impedance was typically 8ohms, falling to nearer 5ohms at 10kHz which should be pretty harmless. A minimum 15 watts per channel will be required, while the 504 proved fairly comfortable with up to 50W of music programme, resulting in a moderate peak sound level of 98dBA, for a stereo pair in-room. The bass rolloff was 75Hz, −6dB, with an internal series capacitor tuning the system to a fifth-order damped alignment.

The reference response was unpromisingly 'lumpy', broadly lifted in the upper midrange and poorly integrated with the treble, the latter peaking at 6-7kHz before falling away to a lower level in the range 8-20kHz. Despite the relatively simple crossover, the family of forward responses was encouraging, the small enclosure helping to produce wide dispersion in the lateral plane. The 6kHz axial peak is revealed as a crossover problem, notably ameliorated above axis. Once installed, some experiment with system tilt may be worthwhile to achieve the best sound. The output was plotted without wall gain in the listening room, and this would amount to a lift of a few dB up to 600Hz for such a small system, which would help to fill in the lower mid and upper bass ranges though not to the degree necessary to flatten the room characteristic completely. The bass held up quite well down to 50Hz and was not confined to a single note. Above the mid region the treble was reasonably integrated, tending to a 'rich' balance and helping to give the impression of a larger model. Considering the small size, the swept distortion results were quite good; at 86dB third harmonic averaged 0.2%.

Conclusions

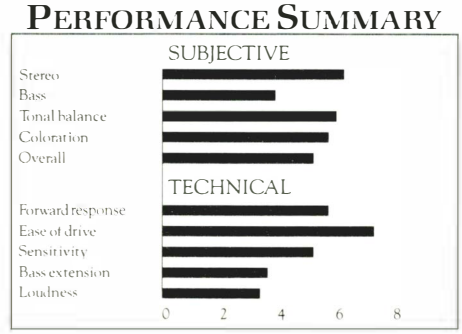
Wall-mounted this system gave a good account of itself, almost unbelievably unobstrusive and producing a clear, reasonably balanced sound with above average treble. The distortion was quite satisfactory and both the stereo and bass performance were better than expected. The value for money is quite good, so the 504 qualifies for recommendation, particularly for those seeking an up-to-date sound in a very compact package.

General Data

Size (height × width × depth)	21 × 18.5 × 20cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(15) −50W
Recommended placement	60cm stand, near wall
Frequency response, within ±3dB, at 2 metres	70Hz to 12kHz*
Low frequency rolloff (−6dB point) at 1 metre	75Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	85dB/W
Approximate maximum sound level (pair) at 2 metres	98dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good
Typical price per pair, inc VAT	£120

* *see text*

Performance Summary



For graph references see issue No 46

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1986/87 SERIES

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FEBRUARY

AMPLIFIERS & TUNERS

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AUGUST

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truth (-o͞o-), n. (*pl. pr.* -dhz). Quality, state, of being true or accurate or honest or sincere or loyal or accurately shaped or adjusted.

Truth is a very dangerous concept. Peoples' perception of what truth is, is infinitely variable and as a consequence, infinitely dangerous. The best illustration of this paradox is the prejudice, bigotry, snobbery and disinformation that is the aura surrounding the 'Best' in Hi Fi. How often have you read that the best in this months' magazine has already been superceeded by another 'Best' in next months' magazine. The peril of this approach is that the trust and confidence between customer and dealer can quickly turn to ridicule if the customer suspects (rightly or wrongly) that the dealers' enthusiasm obscured the real motives behind the suggested purchase. The truth hurts and don't some people know it: judging by the accusations (fortunately rare) that our company is 'arrogant' 'commercial' and 'a little too efficient'. Could it be that when presented with that persons' Hi Fi problem, we sincerely believed we had formulated the most cost effective solution, and did it simply, quickly and without fuss — merely by listening to the customers' needs, when he had expected a marathon session? In our opinion the only 'Best' is that which is defined as being in the best interest of the customer, and you find that out by asking him, not dictating to him! Audio critics and dealers alike (and yes we've been guilty of it too!) have written many paragraphs trying to describe a units pros and cons so that the consumer can try to determine if the critics priorities of 'Best' matches his own. This is at best unnessessarily confusing and at worst open to gross misinterpretation. We've been in business just ten years (come October '86) but even if the rest of the industry, including certain reviewers, refuse to come of age, we wont!! Our policy is simply this: Subjective Audio is determined that no customer will purchase and continue to own equipment which does not meet their needs and desires in all aspects of performance, design, appearance and most important budget. It's called 'The Pledge'. When you book an appointment with us, ask for it by name. If you're seriously interested in obtaining rational constructive and sympathetic guidance and advice to your audio needs (with the minimum of fuss) however small or grand your budget, then you owe it to yourself to put Subjective Audio to the test!

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CD PLAYERS

Compact Disc is the first new music storage medium to stand a real chance of making it since the 20 year-old Compact Cassette. It has come a long way in four years, and is now starting to represent a significant percentage of hardware and disc sales (particularly by value). Rather surprisingly, the UK has proved one of the slower growing markets, though this partly reflects a greater difference in price between a CD and its LP or musicassette equivalent than in some overseas markets. Whereas disc prices have remained stable, player prices have dropped to a third of those charged when the system was first launched. £200 is now a typical budget price, some machines cost as little as £150, and it would not be surprising if the £100 mark was breached in the New Year sales. Yet at the same time there is a healthy demand for upmarket players offering improved sound quality and/or unusual features.

If the music industry has its way, CD will steadily oust the LP and the musicassette, replacing them both with a durable, compact, all-digital replay-only medium with premium disc prices, suitable for home or portable use. However, the marketplace has yet to provide confirmation. Player prices are still a little above the level which the mass of consumers are prepared to pay, so hitherto discs have been sold to those already prepared to pay substantial prices for players. There is also the imminent possibility of a rival digital tape format known as R-DAT, which is expected to be launched in Japan this Autumn. This will offer record as well as replay capabilities, but the hardware is likely to be significantly more expensive, and it will take time to build up a catalogue of music and the distribution thereof.

The arrival of CD has been a great stimulus to the hi-fi trade, not only by creating substantial sales of CD players themselves, but also in refocusing attention on the various other parts of the hi-fi system. Visiting a hi-fi shop for the first time in years perhaps, customers are appreciating the steady advances which have taken place on all fronts, and are taking the opportunity for a general system upgrade. Even LP record players are selling well, sometimes after direct comparison with the new medium, as customers recognise the major investment they already have in vinyl discs and appreciate the fine quality now available from vinyl. Indeed, CD credibility was not helped by early claims for 'perfect sound forever', a perfection which has often fallen far short of the expectations of many hi-fi enthusiasts.

CD certainly has a number of advantages over its rivals. It is inherently rugged and unaffected by playing, free of surface and background noise and wow and flutter effects, while signals kept in digital form are theoretically immune from degradation. The addition of data channels allows complex pre-programming and accessing, while further CD applications under development include adding still video pictures and the CD-ROM computer software format. In-car, portable and personal players are already in the shops, though there is still the nagging doubt that tape is inherently more immune to the shock and vibration of such applications, while the wide dynamic range and inaudible background noise can be almost an embarrassment in a noisy environment.

Doubters notwithstanding, the format could be said to have arrived, which is an achievement in itself.

THE DISCS

Only five inches in diameter and attractively silvered, the compact disc currently costs twice the price of an LP or musicassette but should be immune from damage or wear. It can carry more than an hour of music and comes packaged in an irritatingly fragile and awkwardly designed acrylic 'jewel case', containing additional printed 'sleeve' information. There is no equivalent to the vinyl 45rpm 'single'.

For record companies in particular, establishing a brand new format is an exceedingly difficult task, in view of the vast inventory needed to represent a play-only format effectively, and in this instance the technical problems of pressing with necessarily great precision. Inevitably there was a learning curve in the disc manufacturing processes, and full quality potential is still not reached in many cases. Disc availability is still somewhat limited, helping to keep prices firm, but the range of titles now available on CD has grown spectacularly, particularly in the classical and jazz fields, emphasising the commitment of the record companies to the new format. And considerable extra disc production capacity will be coming on stream during 1986, so a shortage may turn into a glut and help bring prices down somewhat.

From the general consumer's point of view, price will still be a key factor. While early CD users are clearly prepared to pay a 100 per cent premium, it remains to be seen what sort of long term price premium compact discs can command over LP and musicassette rivals. History has shown that the broad base of recorded music sales is very price-sensitive but not especially quality conscious — musicassette purchasers who were attracted by the convenience of that medium were not deterred by quality substantially inferior to LP.

THE PLAYERS

The conventional CD player may simply be plugged into any hi-fi system, as one would a tuner or cassette deck. The amplifier 'aux', or 'tape' inputs will be perfectly adequate, though the results might be a little loud through the speakers, and require a lower volume control setting than usual. Many more recent amplifiers have a 'CD' input, and this may have a more appropriate sensitivity. Some specialist amplifiers have taken the trouble to connect the CD input directly to the pre-amp volume control, so as to minimise the interference of the signal path.

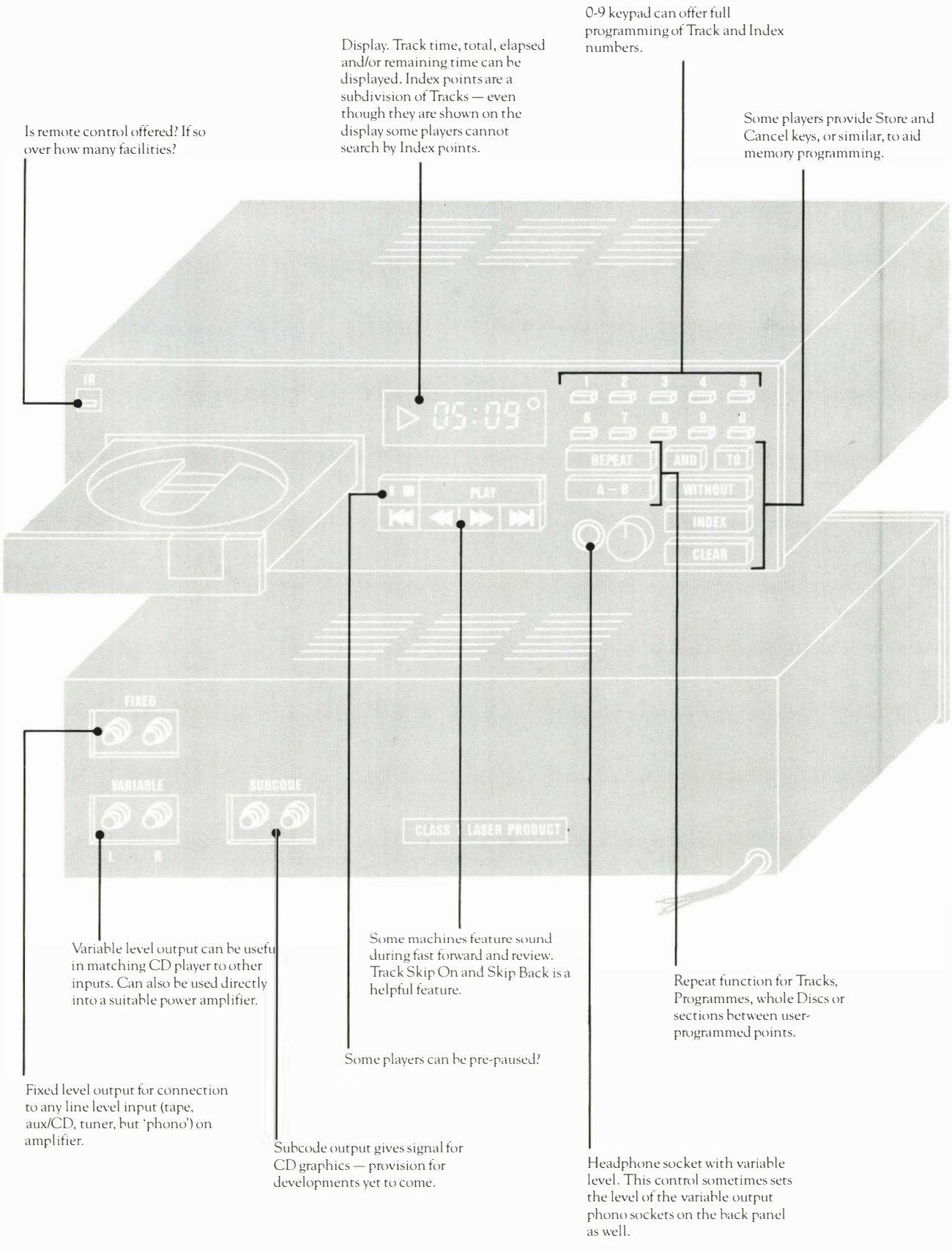
There is also a mild risk that a CD user will find his amplifier no longer seems to go as loud. The reason for this is that the digital CD medium is better at preserving the high loudness peaks in music which analogue systems 'squash' downwards. Consequently for the same peak output, the mean (average) output from CD with the same recording will be slightly lower than before. One can of course compensate by cranking up the volume, but if an amplifier is already being used close to its limits, the CD peaks could cause premature 'clipping', for which the only solution is a bigger amplifier.

The prospective purchaser faces a wide range of choice at wildly varying prices, starting below £200 and going up to around £2,000. Players are available for in-car use, are incorporated in large portables, and exist as tiny personals, with some doubling as unconventional domestic machines. The mains models can be manual or remote controlled, and simple or complicated in terms of ergonomics and programmability. Autochanger variations can accept and play from a caddy of half a dozen discs, selected and programmed remotely.

Despite protestations of 'perfect' sound, CD players show significant audible and measurement differences, and these are discussed in detail in our reviews. That said, most machines measure very competently, showing occasional weakness at the cheapest end of the market and among low voltage portable machines. Though correlation with measurement still proves elusive, listening tests proved quite capable of consistently distinguishing between the different decks. While the poorer examples can make the new medium sound quite unpleasant, the best can provide eminently satisfactory results with refreshing repeatability and the promise of longevity. However, we would certainly advise any potential purchasers to make sure they themselves like the sound of CD before embarking upon a substantial commitment to new hardware and software.

Reviews reprinted from issue Nos 40 & 45 by Martin Colloms

ANATOMY OF A COMPACT DISC PLAYER



Is remote control offered? If so over how many facilities?

Display. Track time, total, elapsed and/or remaining time can be displayed. Index points are a subdivision of Tracks — even though they are shown on the display some players cannot search by Index points.

0-9 keypad can offer full programming of Track and Index numbers.

Some players provide Store and Cancel keys, or similar, to aid memory programming.

Variable level output can be useful in matching CD player to other inputs. Can also be used directly into a suitable power amplifier.

Some machines feature sound during fast forward and review. Track Skip On and Skip Back is a helpful feature.

Repeat function for Tracks, Programmes, whole Discs or sections between user-programmed points.

Some players can be pre-paused?

Fixed level output for connection to any line level input (tape, aux/CD, tuner, but 'phono') on amplifier.

Subcode output gives signal for CD graphics — provision for developments yet to come.

Headphone socket with variable level. This control sometimes sets the level of the variable output phono sockets on the back panel as well.

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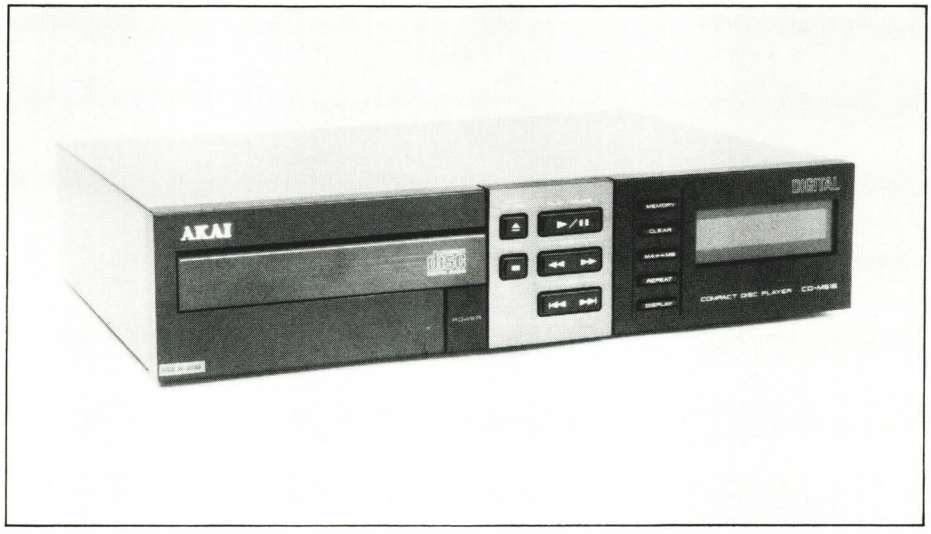
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AKAI CDM515

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In the last edition Akai achieved notable success with their current *CD-M88* player and its full sized brother the *CD-A7*. However, such is the pace of CD development that Akai were able to supply two new models for this issue, namely the midi-size *CD-M515* reviewed here and its close relative the *CD-A30B*, each of which costs less than half the price of the '88; understandably, some of the earlier model's features have been omitted, notably the remote control. A further economy measure is seen in the lack of the usual line output RCA phono sockets, and instead, a short output cable is permanently fitted. This may well be convenient in the case of a matching stack system, but it prevents the use of audio cables of known quality.

An up-to-date feature is the liquid crystal display (LCD), a feature first seen on the Revox player and nicely backlit here. Via the appropriate buttons this visually restful display can show a comprehensive array of figures including residual track numbers, the track total and timings, indexing and the total play time.

Track programming of up to a total of 36 is provided, this permissible in sequence or in random order. Repeat is possible for the whole disc or over selected A-B start-stop points. The skip button provides rapid access to tracks and the cueing operates at two automatically-selected speeds with audible discontinuous music output. Unusually at this price level, the deck also includes indexing. All the controls were easy to operate, in contrast to the idiosyncratic sequences required for the '88.

While no headphone socket or remote control are present, the rear panel does carry a synchro-start terminal for operation with the matching Akai system stack, particularly for auto-start recording from disc. Another socket carries the sub-code data terminal for connection to video displays and information systems.

Inside, is a straightforward machine using 16 bit linear conversion with a time shared D/A convertor followed by a standard 'brickwall' filter. The laser head has a fast access time, with reliable locking achieved by a tri-beam system for data read, tracking and focus.

LAB REPORT

Essentially flat, very careful listening would be required to identify the minor frequency response deviations. A mild 0.2dB lift can be seen in the low treble (the 'presence' range) while at 18kHz the two channels were out of step by just 1dB. Over most of the range the balance was held to 0.4dB while very good separation was achieved at low and mid frequencies, this deteriorating to a below-average result of 60dB, worst case, at 20kHz. The time shared convertor showed the usual differential channel delay giving rise to a phase difference of 77° by 20kHz — only of significance if mono use is envisaged.

A decent 15 ¾ bit resolution was indicated by the modest level error at −90dB modulation and the generally good distortion performance. At full modulation, mid-band distortion products were typically 0.007%, and even at 20kHz the downband modulation signals were better than 74dB down. However above 20kHz the 24kHz beat component was suppressed by just 24dB. At −80dB, 1kHz, the −25dB distortion figure was fine. The intermodulation was very good, though mild slewing was noted on full-level white noise.

Signal to noise ratios were fine, and the output level close to the standard 2V, derived from a low source impedance. No problems were encountered with error correction or pre-emphasis and track access was rapid. Mechanical noise was low.

SOUND QUALITY

Performing well on audition, this machine was not far behind the '88. The bass was considered to be solid and dynamic, though the midrange was a little lightweight, even thin, but this did not detract from the performance since pleasing depth and detail was maintained in this region. The treble showed some brittleness and edge, but fair definition and perspective was still present in this range. It was lively with a stable confident stereo focus.

CONCLUSION

While I would have liked audio sockets on the rear I can't argue with the fine all round performance of this compact and tidy machine. It represents very good value, and well deserves its Best Buy rating..

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.39dB	0.38dB	0.46dB
Stereo separation	−92.3dB	−89.6dB	−62.5dB*
Channel phase difference	0°	5°	77°
Total harmonic distortion, 0dB	−90.7dB	−83.5dB	−73.8dB
Total harmonic distortion, −10dB	—	−87.4dB	—
Total harmonic distortion, −60dB	—	−50.0dB	—
Total harmonic distortion, −80dB	—	−25.3dB	—
Intermodulation, 19kHz/20kHz, 0dB	−89.1dB		
Intermodulation, 19kHz/20kHz, −10dB	−90.5dB		
Frequency response, left channel	+0.02dB, −0.65dB		
Frequency response, right channel	+0.02dB, −0.64dB		
Signal-to-noise, 20Hz-20kHz unweighted	−95dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−88dB		
Output level, 0dB, left/right	1.9V		
Output impedance	225ohms		
De-emphasis	correct		
Track access time	3.0secs		
Error correction capability	>900µm gap, >800µm dot		
Mechanical noise	moderate		
Spuriae up to 100kHz	−104dB		
Resolution at −90dB	left +3.25dB, right +2.57dB		
Headphone socket	no		
Dimensions (w × d × h)	35 × 26 × 7.5 cm		
Estimated typical purchase price	£199		

**Left channel −56dB separation, −93.1dB intermod*

For graph references see issue No 45

AKAI CD-M88

AKAI (UK) LTD, UNIT 12, HASLEMERE HEATHROW ESTATE, SILVER JUBILEE WAY, HOUNSLOW, MIDDLESEX. TEL: 01 897 6388



Features of the '88 include a full numeric keyboard, direct track access, audible music cueing plus a large fluorescent display showing all available information, including indexing.

Track access was rapid in operation, though the machine did emit the odd chirp, plus a constant high pitched 'swish' that I found a nuisance, although others failed to notice it. Akai's comment was to suggest location away from the listening position, thereby exploiting the remote control facility.

Internally, the circuitry was fairly conventional, with a single time shared 16 bit digital to analogue convertor chip, this the popular Burr Brown type. In the output circuitry, the low impedance output is directed around the box to the front panel variable level control, then routed back to the rear panel socket; all the results in this review relate to the factory-built as supplied, but we also checked the effect of bypassing the level control and short wiring the output socket to the final integrated circuit output. I am sure that the resulting improvement would be considered worthwhile by an audio enthusiast — we judged about 0.6 of a point in 8 on subjective scores. When direct wired a much lower and constant output impedance is obtained, to better drive the interconnect cable.

Lab Report

Channel matching and balance were excellent while the frequency response showed that a hint of treble lift — about 0.4dB rise in the final 1½ octaves to 20kHz.

Channel phase shift showed the usual 70-80° difference at 20kHz, due to the shared converter. Slight compression was shown at peak level, but this was hardly seen in the −93dB distortion at 1kHz, full level. Good distortion results were maintained at 20kHz, and at reducing output levels, mid band. The −24dB result at −80dB signal level showed close to 15½ bit linearity while an odd −90dB level offset was noted as −4dB left and −1.5dB right, a reversed curvature at the resolution limit. The intermodulation results were about average — very good nonetheless, at −89dB for the full modulation, difference tone product.

Error correction proved excellent. Signal-to-noise ratios were quite typical, while spurious signals up to 100kHz were well rejected by 108dB or more.

Sound Quality

Rated well above average, this player was much liked on audition. Despite a hint of brightness and forwardness in tonal perspective, it proved clear and clean throughout the frequency range. Good stereo depth and transparency were its hallmarks, while the bass showed a pleasing extension as well as precise control. By CD standards the treble was also sweeter than usual. Stereo images were well focused and worn discs were played with confidence. The player also showed good vibration resistance.

Conclusion

Originally rated a Best Buy model on the basis of good sound quality, even by the standards of the latest decks the 'M88 merits firm recommendation for 1986. The lab performance shows a basically good design with a stable, precise optical transport, albeit some minor mechanical noise, and the overall package remains fully competitive.

Test Results

	20Hz	1kHz	20kHz
Channel balance	0.02dB	0.02dB	0.02dB
Stereo separation	−85dB	−86dB	−77dB
Channel phase difference	0°	0°	76°
Total harmonic distortion, 0dB	−96dB	−93dB	−82dB
Total harmonic distortion, −10dB		−84dB	—
Total harmonic distortion, −60dB		−50.1dB	—
Total harmonic distortion, −80dB		−24.7dB	—
Intermodulation, 19kHz/20kHz, 0dB	−89.5dB		
Intermodulation, 19kHz/20kHz, −10dB	−88dB		
Frequency response, left channel	+0.37dB, −0dB		
Frequency response, right channel	+0.37dB, −0dB		
Signal-to-noise, 20Hz-20kHz unweighted	−98dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−92dB		
Output level, 0dB, left/right	2.01V/2.01V (variable)		
Output impedance	100 ohms		
De-emphasis	correct		
Track access time	3.8 secs		
Error correction capability	>900µm gap, >800µm dot		
Mechanical noise	mild chirps, high pitched 'swish'		
Spuriae up to 100kHz	−108dB		
Resolution at −90dB	+1.5dB		
Headphone socket	yes (variable output)		
Dimensions (w×d×h)	35×26×7.1cm		
Estimated typical purchase price	£399		

REASSESSED

For graph references see issue No 45

BEST BUY

AKAI CDA 30

AKAI (UK) LTD, UNIT 12, HASLEMERE HEATHROW ESTATE, SILVER JUBILEE WAY, HOUNSLOW, MIDDLESEX. TEL: 01-897 6388



Where the *CDM515* is a midi-sized budget player, the *CDA 30* is its full sized equivalent, selling at a higher price. On the face of it, there seems little to choose between the two, with both technical as well as listening tests suggesting a very similar performance.

The 44cm wide *CDA 30* drawer-loader uses a tri-beam laser pickup, and has a large random order programming system allowing the selection of up to 36 tracks. Facilities exclude remote control or a headphone socket, but include programmable A to B selective repeat plus normal repeat modes, access to index points, rapid track skip, and audible music search. A rear subcode outlet is available for future CD applications. The liquid crystal display has four operating modes: track and index numbers may be simultaneously displayed, but the mode must be altered to show timing; individual track and total times can also be shown. Like the *CDM 515*, the technology is straightforward 16 bit linear, with a time-shared decoder and 'brickwall' analogue filtering.

SOUND QUALITY

Rated a little above average, the *CDA 30* did well in the listening tests. Sound stages had good width and respectable depth. The bass was quite solid and 'tuneful', and the mid and treble showed fine detail resolution, albeit with 'edge' and mild sibilance. Stereo images were well focused and stable.

CONCLUSION

The *CDA 30* has certainly made the grade, offering a competitive combination of technical performance, sound quality and value. A 'Best Buy' rating is therefore appropriate.

For graph references see issue No 45

BEST BUY

DENON DCD 1000

HAYDON LABORATORIES LTD, HAYDON HOUSE, CHILTERN HILL, CHALFONT ST. PETER, BUCKS. TEL: (0753) 888447



The midi-sized *DCD 1000* and full-width *DCD 1100* machines are very similar on technical grounds. Indeed the official differentiation of these two decks is simply the comprehensive remote control of the *'1100*, at extra cost of course.

However, on test the *'1000* supplied for review lagged slightly behind the *'1100*. This shortfall continued through to the listening test results, and we were left wondering whether there was in fact an intended quality difference, or whether this was simply the result of small sample variations.

The most obvious difference between the two models is perhaps their size, the *'1000* being the 33.5cm midi-sized model, while the *'1100* is 43.3cm wide. The variable level headphone socket and the comprehensive range of operating features are retained. Technically the *'1000* is a 16 bit design with an enhanced linearity convertor and a digital delay to synchronise the outputs of the two channels. On test it gave somewhat higher distortion and more channel inequalities than the *'1100* — sufficient to differentiate them according to price.

SOUND QUALITY

The *'1000* possessed a lively dynamic quality, with good stereo focus especially in the mid-range. The bass was well above average, tuneful and well defined, while the player also provided satisfying depth and ambience. The treble was considered a bit 'bright' — somewhat 'obvious' and forward — but not sufficiently to disturb a sonic rating which was firmly above average. Tonally the mid register was 'thinned', with a hint of roughness.

CONCLUSION

Despite the observations concerning the poorer performance than its larger *'1100* brother, the *'1000* performed very well, offering a combination of operating features and overall quality which amount to good value, sufficient to merit a Best Buy rating.

For graph references see issue No 45

BEST BUY

DENON DCD1100

HAYDON LABORATORIES LTD, HAYDON HOUSE, CHILTERN HILL, CHALFONT ST PETER, BUCKS.
TEL: (0753) 888447



In common with several other Japanese companies, Denon have immersed themselves in original CD player design. Now that sales justify the investment, the days of bought-in, 'badge engineered' players are over, for Denon at least. The *1100* is a full-width machine at £300, offering an advanced specification and including a full feature remote control. The latter includes a 10-button keypad for direct entry of track numbers, this facility being absent from the machine's own control panel. Here, the usual controls are all provided, and the headphone socket is accompanied by a level control. Programming facilities are extensive with sequential or random memory. A particular feature is the facility to programme while the disc drawer is open, allowing the user to read the desired tracks from the disc label itself.

Indexing, track skip and audible cue-search are all provided, and the multi-function display shows track timings. You will need very good eyesight though, to read the numbers from a sensible remote control distance! Signal output is from the standard RCA phono sockets at a fixed level.

A sub-code output terminal is also provided for the connection of video accessories.

Although the *DCD1100* has only a single 'time shared' 16 bit D/A convertor it avoids the usual delay (measurable as a phase difference increasing with frequency) between the output channels. This is achieved by employing a delay sampling technique before the audio output is reconstructed and filtered. High conversion linearity is claimed, due to the use of an auxiliary loop around the D/A convertor circuit. Errors in the main loop are dynamically monitored, and corrected before appearing in the D/A output. Full 16 bit performance should be attained. The output filter is a standard 'brick-wall' type and the conversion system is 16 bit linear.

LAB REPORT

Channel balance was very good, and held to 0.15dB over the measured frequency range. Fine channel separation figures were recorded, though this differed between the measurements for right-on-left and left-on-right. An average of 80dB was attained at 20kHz, nonetheless. As promised, the interchannel phase difference was held to a low level reaching a negligible 5° by 20kHz.

This design demonstrated fine linearity with a mid and low frequency distortion approaching −96dB at full modulation, this some 0.0015%. At 20kHz, the downband noise averaged −74dB an unexceptional result. Some difference was observed between channels and this was also evident for the full level high frequency intermodulation readings. The left channel produced a good −87dB, with the right a less secure −71dB! A notable improvement was seen at the lower 10dB test level, the result being −84dB.

Output was close to standard at 2.1V from a higher-than-average 990 ohm output impedance. On frequency response, it proved to be flat up to 10kHz while at higher frequencies a minor 0.3dB ripple was observed.

Supporting the good results for the midband linearity, the step error at the −90dB modulation level was almost zero, a full 16 bit resolution. While track access was fairly rapid, the error correction, although fine for discs in decent condition, was not of the highest calibre, and baulked at surface dots above 500μm width, as well as the test gaps above 700μm. Good signal to noise ratios were demonstrated with excellent spurious rejection.

SOUND QUALITY

Decent scores were obtained from the beginning. Images were well focused, and more stable than usual, holding over a wide frequency range. Bass appeared solid and tuneful, while the mid was tonally well balanced and more natural than average. The treble was a little 'soft' though of a pleasant nature. A major plus was the basically lively, detailed and dynamic nature of the sound, allied to a fine level of stereo ambience and depth.

CONCLUSION

This player showed minor weaknesses in error correction and channel consistency, but balanced these problems with a substantially good overall total performance, coupled with a highly competitive sound quality and particularly good stereo. Given the luxury facilities — headphone socket and level, plus the versatile remote control, this is a good machine, and Best Buy status is indicated.

TEST RESULTS

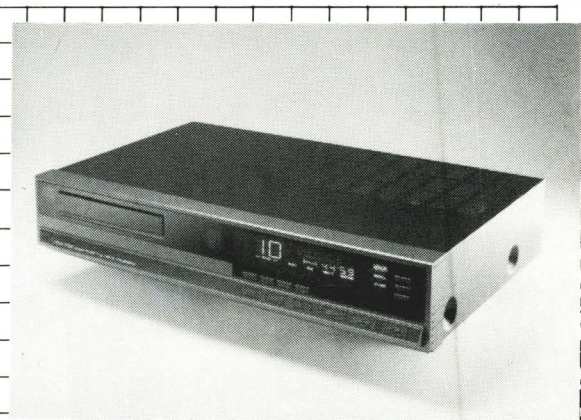
	20Hz	1kHz	20kHz
Channel balance	0.15dB	0.15dB	0.13dB
Stereo separation	−83.4dB	−86.8dB	−85.5dB*
Channel phase difference	1°	1°	5°
Total harmonic distortion, 0dB	−95.8dB	−93.8dB	−76.5dB
Total harmonic distortion, −10dB	—	−89.8dB	—
Total harmonic distortion, −60dB	—	−45.2dB	—
Total harmonic distortion, −80dB	—	−27.1dB	—
Intermodulation, 19kHz/20kHz, 0dB			−87.9dB
Intermodulation, 19kHz/20kHz, −10dB			−89.3dB
Frequency response, left channel			+0.11dB, −0.15dB
Frequency response, right channel			+0.11dB, −0.17dB
Signal-to-noise, 20Hz-20kHz unweighted			−96dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−90dB
Output level, 0dB, left/right			2.1V
Output impedance			990ohms
De-emphasis			correct
Track access time			5.0secs
Error correction capability			>700μm gap, >500μm dot
Mechanical noise			fairly low
Spuriae up to 100kHz			−110dB
Resolution at −90dB			left −0.8dB, right −0.78dB
Headphone socket			yes (variable output)
Dimensions (w × d × h)			43.5 × 35 × 9 cm
Estimated typical purchase price			£299

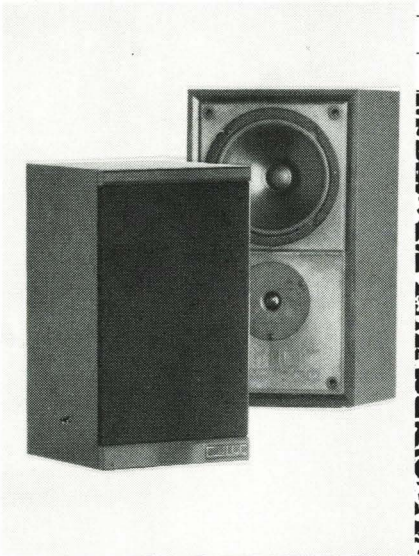
**Left channel 114.2dB, 95.5dB, 73.6dB*

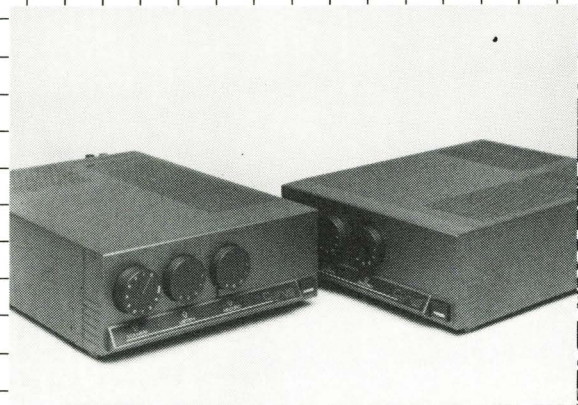
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MARANTZ CD45

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While the long awaited 16 bit machines are not yet available, Marantz have been making continuous headway in the budget market with their *CD45* — a loose equivalent to the Philips *CD150* but made in Japan and with many different components and case details. A price around £220 holds at present, but I have also seen this model discounted occasionally.

While it works fine as a manually operated, stand alone player, there are also certain system remote control capabilities. Though the deck itself is not remote controlled, when linked by a connector to a matching digital tuner, the pair become remote controlled. Moreover, when used in the Marantz audio system with a matching amplifier, the sources are linked up by a system labelled 'easy bus', which provides some 'system intelligence', and will automatically transfer the amplifier input selector to the CD position when the CD player is started.

This is a midi-sized player, nicely finished and provided with an up-to-date set of features. Of two display indicators, one shows track numbers up to 99, the other time, 'elapsed' or 'remaining'. The audible music cue buttons have three sequential search speeds and are confusingly labelled 'index plus' and 'index minus'. No direct index point access is provided, though these points can be found by monitoring the elapsed time display.

Random order programming allows up to 20 selections to be entered into the memory. Repeat mode is also possible for the whole disc, or for a programmed section. Normal RCA phono sockets provide the standard 2V CD output level.

Following the established Philips system, the player achieves virtually 16 bit resolution by means of a four-times oversampling system with digital filtering. Double 14 bit D/A convertors guarantee a close phase match between the channels, while a gentle analogue filter at the final stage preserves the good transient characteristics which reflect the phase linearity.

LAB REPORT

We have seen this frequency response so often, it hardly seems worth discussing it again! Classic 14 bit Philips, the response is essentially flat, and the minor ripples at the high frequency end are generally considered pretty harmless; the latest 16 bit Philips decks will avoid even these minor effecs. Channel balance was fine, coupled with perfect phase correspondence between the two channels. Channel separation figures were excellent, stable at around 110dB, and total harmonic distortion was comfortably low, meeting the 0.004% claim at 1kHz, 0dB. Downband distortion from the 20kHz, 0dB signal was a low 0.005%, and good results were also obtained for the two high frequency intermodulation measurements. Harmonic distortion remained in good order at lower signal levels, though some evidence of hum modulation in the DAC was noted at −60dB, and this explains the final resolution figure of 15.4 bits.

The output was virtually to standard from a low 200ohm source impedance, track access was fairly rapid at 4.5 seconds, and the mechanical noise levels were very low. Very good error correction was demonstrated — better, in this instance, than our sample of the Philips *CD150*. Signal-to-noise ratios were excellent, as usual.

SOUND QUALITY

Scoring rather above average, the *CD45* has done very well in its price category. Overall performance was tidy and coherent, the bass firm and articulate, the midrange 'open' with very good presentation of detail in the forward soundstage. Ambience and depth were good, and the stereo image showed solid stable focus. The treble was tidy, 'sweeter' than usual, and well balanced. The mid was also rated well on vocals despite a slight tonal 'thinning'. Transients were commendably clean.

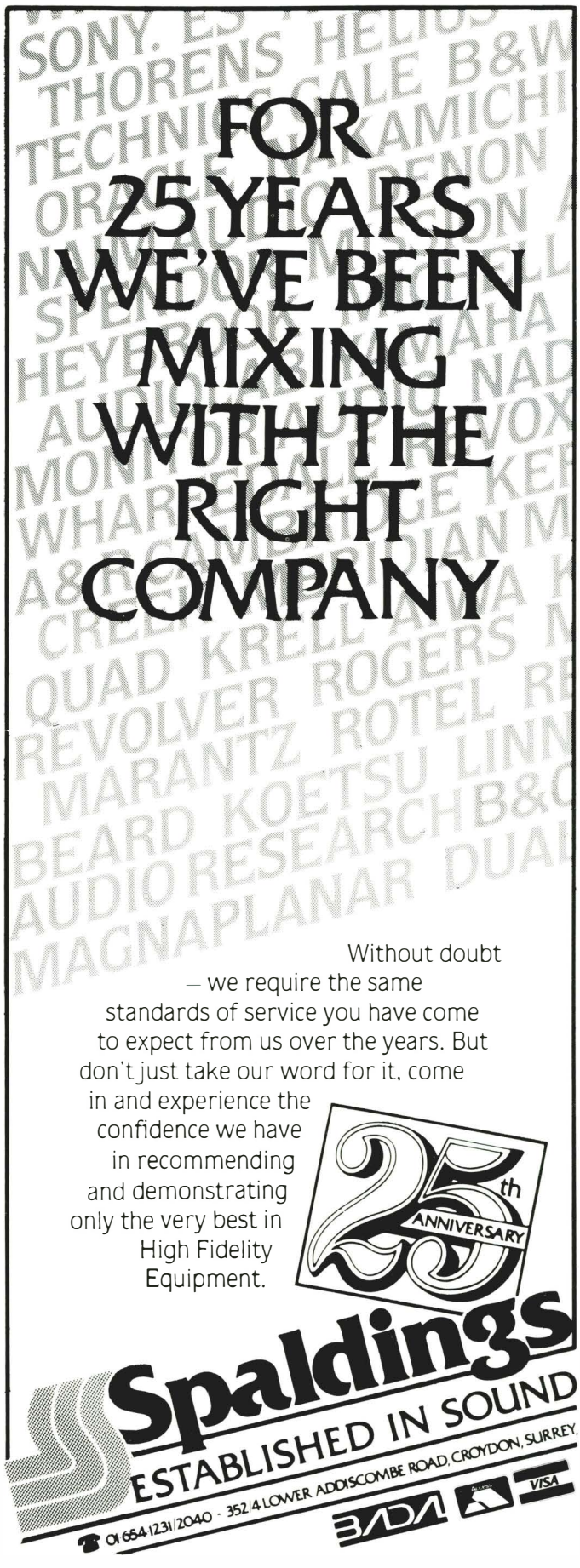
CONCLUSION

This well made and finished player was easy to operate and performed well in the laboratory. In combination with other Marantz components, various levels of interfacing can be arranged, including remote control. The sound quality was fine, rather beyond that expected in its price category, so ensuring a Best Buy rating.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.30dB	0.30dB	0.30dB
Stereo separation	−109.0dB	−112.0dB	−106.4dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	−91.1dB	−87.0dB	−86.3dB
Total harmonic distortion, −10dB	—	−84.5dB	—
Total harmonic distortion, −60dB	—	−41.3dB	—
Total harmonic distortion, −80dB	—	−22.0dB	—
Intermodulation, 19kHz/20kHz, 0dB	−84.5dB		
Intermodulation, 19kHz/20kHz, −10dB	−81.9dB		
Frequency response, left channel	+0.06dB, −0.43dB		
Frequency response, right channel	+0.05dB, −0.44dB		
Signal-to-noise, 20Hz-20kHz unweighted	−106dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−108dB		
Output level, 0dB, left/right	2.12V/2.05V		
Output impedance	200ohms		
De-emphasis	correct		
Track access time	4.5 secs		
Error correction capability	>900μm gap, >800μm dot		
Mechanical noise	very low		
Spuriae up to 100kHz	−72.3dB		
Resolution at −90dB	left −3.65dB, right −4.36dB		
Headphone socket	no		
Dimensions (w×d×h)	32×30×8.5cm		
Estimated typical purchase price	£200		

For graph references see issue No 45



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This player has recently been reduced in price, and now offers a nicely competitive package for a typical £200. A cursory examination shows the machine actually comes from the Yamaha OEM stable, and is one of the *CD-X1* generation. Since these players were highly regarded a year ago when they cost well over £300, the outlook for the *107* is promising. Mitsubishi have chosen to say nothing about the oversampling system employed, which is in fact the Yamaha two-times process, though they do confirm the digital filtering coupled with third-order active analogue filtering after D/A conversion. The deck uses a 16 bit linear converter, time-shared between the two channels.

Despite its modest price, the machine includes a headphone socket with its own level control. The large LED display comprises four numerals and can alternately display track numbers, times, or index points. Index access involves engaging 'stop', and then using the audible music cue buttons labelled 'search' to dial the index points, assuming that these are coded into the disc in question. The display also shows 'elapsed' and total time. When cueing, first pressure gives fine slow search for 3 seconds, while prolonged pressure engages the faster search speed. Other features include fast track-skip, programming for up to nine tracks, and repeat, operating on the programmed section or the whole disc. In addition, the *DP107* can be automatically switched into play mode using an external timer.

LAB REPORT

We have become accustomed to a substantially good performance from the 'CX series chassis and this Mitsubishi version proved no exception, except in terms of the selection of the D/A convertor which was not of the highest resolution category.

The level error was around 6dB at −90dB, and the harmonic products measured at −60dB modulation 1kHz were 22dB down compared with the 26-28dB that is typically available, and both these factors indicate resolution closer to the 15 than 16 bits. Nevertheless it has not yet proved possible to associate sound quality differences with bit-resolutions of 15 and over, so this point is rather academic at present.

The player showed excellent channel balance, and the frequency response was most uniform below 5kHz; at high frequencies the response lifted to +0.5dB at 16kHz before falling to −1.8dB nominally at the exact 20kHz measured frequency. These are larger than the usual deviations, but will not materially affect the sound quality. At full modulation level the total harmonic distortion including noise averaged −83dB, or 0.07%; this value held even at 20kHz, while the high frequency two-tone intermodulation results were also very satisfactory.

A slightly low output level was recorded, measuring 1.9V from a higher than average 1kohm source impedance, so A/B comparisons using low input impedance pre- or power amplifiers would produce a further loss in level. For instance, several amplifiers have a 10-20kohm input; with the *'107* the attendant 1dB level loss would upset any A/B comparison against a lower output impedance player of standard output.

Track access times were fast, and mechanical noise was nearly inaudible. Gap errors were handled very competently, but the machine was less happy with surface dots; it just exceeded the 500μm limit here, while in practice behaving well with the test discs. Economies in the output filtering gave a good phase-correct impulse response but with appropriately reduced ultrasonic rejection at around 45dB.

SOUND QUALITY

The *'107* performed well on the listening tests, and proved to be a front rank performer in its price category. Though slightly on the 'bright' side of a perfect tonal balance, the sound was persuasive, with a strong well-defined sound stage, fine focus, and very good detail. Quite good depth and ambience effects were heard, though this was not as striking as the obvious clarity in the frontal image plane. The bass was firm and articulate, and the treble also achieved a good standard.

CONCLUSION

This player is well equipped for the money, and includes a worthwhile headphone socket. It worked well, was easy to use, and delivered an impressive standard of sound quality. Clearly the *'107* rates inclusion in the Best Buy category.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.07dB	0.07dB	0.18dB
Stereo separation	−78.1dB	−90.6dB	−76.8dB
Channel phase difference	1°	3°	45°
Total harmonic distortion, 0dB	−84.6dB	−83.6dB	−83.1dB
Total harmonic distortion, −10dB	—	−79.5dB	—
Total harmonic distortion, −60dB	—	−40.9dB	—
Total harmonic distortion, −80dB	—	−21.8dB	—
Intermodulation, 19kHz/20kHz, 0dB	−83.4dB		
Intermodulation, 19kHz/20kHz, −10dB	−87.0dB		
Frequency response, left channel	+0.07dB, −1.61dB		
Frequency response, right channel	+0.07dB, −1.85dB		
Signal-to-noise, 20Hz-20kHz unweighted	−87dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−90dB		
Output level, 0dB, left/right	1.9V		
Output impedance	1kohms		
De-emphasis	correct		
Track access time	3.5 secs		
Error correction capability	>900μm gap, >500μm dot		
Mechanical noise	very low		
Spuriae up to 100kHz	−45.3dB		
Resolution at −90dB	left +6.23dB, right +6.41dB		
Headphone socket	yes (variable output)		
Dimensions (w×d×h)	42.5×30×8cm		
Estimated typical purchase price	£199		

For graph references see issue No 45

RECOMMENDED

MITSUBISHI DP-409R

MITSUBISHI ELECTRIC (UK) LTD, OTTERSPOOL WAY, WATFORD, HERTS WD2 8LD.
TEL: (0923) 34618



We were lucky to receive this newly-launched machine at the last possible moment for inclusion in this issue. Offering autochanger or 'multi-play' facilities, it remains competitively priced.

Up to five discs may be pre-loaded into a fairly bulky housing, rather like a large video-cassette. Once loaded, this housing is posted into the appropriate slot on the front of the machine, and programming can begin. Given a 50 minute typical disc play time, a total of over four hours music can be put in the deck and repeated continuously if necessary — useful for many commercial premises. Any track on any disc can be programmed in any order, and you can do this via the comprehensive remote control if you wish. It is necessary to learn the difference between selecting a particular disc and then the track on that disc, but once mastered, the programming presented no problems. The remote control has more limited facilities than the main machine panel, and lacks special cueing as well as display features; in this respect the Pioneer multi-play equivalent is both more logical and more comprehensive.

Single discs can also be played, but the automatic drawer feature of most machines is absent. Aside from the autochanger the '409 has all the usual features including a multi-function display, and audible music cueing at two rates. No headphone socket is provided, though. The audio output is via the usual phono sockets, in this case at a higher than usual level of 2.3V from a 1.6kohm output impedance, this also higher than usual.

Technically, this is a 16 bit linear deck, non-oversampled, with a time-shared convertor and the conventional 'brickwall' output filtering. A diverse selection of integrated chips are used, including those from Sony for error correction, Hitachi for the control system and Sanyo for the convertor.

LAB REPORT

On frequency response the '409 showed very good channel matching with a slight treble lift and still slighter bass loss. Both effects were negligible. Good separation results were achieved with the 20kHz figure differing a little between the two channels, but averaging 82dB nonetheless. With the time-shared convertor there was the usual small time delay between channels, resulting in the typical 90° difference by 20kHz.

An interesting contrast can be seen between the suppression of the down-band distortion product of 20kHz, which was weak at −64dB, and the high frequency intermodulation results, both of which were very good. At better than 90dB down for the two test levels, the Mitsubishi did well here. A good linearity was maintained over the lower frequency ranges and modulation levels, which, taken with the moderate step error at −90dB, suggested a good 15¾ bit resolution.

The impulse response was in phase, with the usual overshoot and prolonged ringing. Spuriae were quite well rejected while the signal to noise ratios were to a satisfactory standard. Track access was on the slow side, but the error correction was very good and coupled with fine shock resistance. The higher-than-standard output level could confuse the listener in 'A/B' comparison tests, and this should be noted when listening to demonstrations.

From a spectrum analysis taken at 1kHz, −60dB, the output showed that spurious digital signals were well rejected and in fact the measured distortion of −52dB was virtually on the noise floor.

SOUND QUALITY

On audition the '409 held up well, giving an above average sound quality. Basically tidy, first impressions were of a lively sound, lacking the old fashioned mid range hardness. Indeed the sound bordered on 'sweet' though with a slight imprecision in the treble. In the bass some mild upper-range emphasis was noted, but it was thought tuneful, with good definition. The mid was easy and 'uncompressed' while the treble seemed a touch vague, although this did not upset the sound stage. Quite good stereo depth and focus were obtained, with acceptably lively dynamics.

CONCLUSION

This is a well balanced all rounder with a good lab performance allied to an above average sound. Given its remote control and five disc autochange facility it represents good value, and is recommended despite some operational awkwardness.

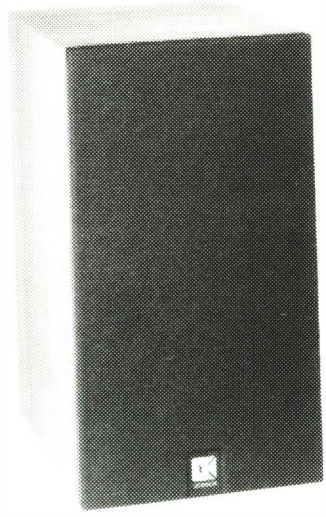
TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.31dB	0.32dB	0.25dB
Stereo separation	−82.6dB	−93.4dB	−81.7dB
Channel phase difference	0°	5°	90°
Total harmonic distortion, 0dB	−86.7dB	−85.9dB	−63.7dB
Total harmonic distortion, −10dB	—	−86.8dB	—
Total harmonic distortion, −60dB	—	−51.5dB	—
Total harmonic distortion, −80dB	—	−25.8dB	—
Intermodulation, 19kHz/20kHz, 0dB	−90.9dB		
Intermodulation, 19kHz/20kHz, −10dB	−92.4dB		
Frequency response, left channel	+0.08dB, −0.43dB		
Frequency response, right channel	+0.08dB, −0.37dB		
Signal-to-noise, 20Hz-20kHz unweighted	−94dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−88dB		
Output level, 0dB, left/right	2.3V		
Output impedance	1.6kohms		
De-emphasis	correct		
Track access time	12.0secs		
Error correction capability	>900μm gap, >800μm dot		
Mechanical noise	very low		
Spuriae up to 100kHz	−80.5dB		
Resolution at −90dB	left −2.12dB, right −3.25dB		
Headphone socket	no		
Dimensions (w×d×h)	42×35×10.5cm		
Estimated typical purchase price	£299		

For graph references see issue No 45

Image Hi-Fi

Hi-Fi Choice is renowned for giving an unbiased point of view on a great range or products from different manufacturers. We at Image Hi-Fi hold the same standards as this magazine. We audition equipment extensively so that we know when we recommend our equipment that it is the best for you.



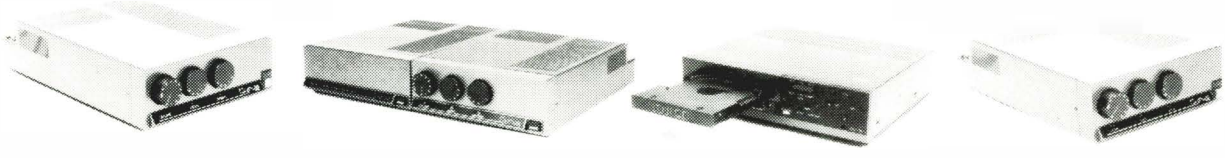
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RECOMMENDED

NEC 509E

NEC HOME ELECTRONICS, 164-166 DRUMMOND STREET, LONDON NW1 3HP.
TEL: 01-388 6100



Though not very well known in the UK audio field, *NEC* were in fact pioneers in CD, and their first machine was internationally rated. We are now in a particular CD marketing phase where a given manufacturer can fill a gap in its range with a machine sourced from another maker. In the case of the *CD509E*, the deck is derived from the established Yamaha 'CD-X' series. However, NEC are a major semi-conductor company and so far as audio is concerned have chosen to specialise in the laser heads and some of the control processors needed for CD players — these components are used in the *'509E*, so it does carry some original NEC parts.

A basic drawer loader, the *'509E* lacks remote control but does provide a headphone socket with a level control. A clear red LED display shows the usual information on track timings, number of tracks and remaining times, while access to indexed discs is possible, and the useful audible music cueing function is set to run at two speeds, the second high speed attained after the search button is held down for a period. Up to 15 tracks can be user-programmed, while both programmed 'A-B' repeat and normal-mode repeat are possible.

On the technical side, NEC describe the deck as a conventional 16 bit linear machine, thus omitting to take promotional advantage of its oversampled design. Whatever the reason for this, the deck is in fact a twice-oversampled model to the current Yamaha format, with a combination of digital and analogue filtering. The loosely-worded specification indicates a modest 0.007% distortion at 1kHz and a 5Hz-20kHz frequency range, this quoted without amplitude limits.

Lab Report

General conformity to the Yamaha models' performance was apparent, while NEC appear to have tailored certain aspects of the design, perhaps to reinforce a 'house sound.' This is clearly evident in the frequency response which showed a drift in the direction of a richer tonal quality. Below 300Hz there was a mild shelf lift, while the oft-encountered rise in the high treble was completely avoided.

Interchannel phase shift increased with frequency to a moderate level of 40° at 20kHz, this being the result expected from twice oversampling and a time shared D/A convertor. In the context of other models tested, the channel separation figures were below average but were still sufficiently good for this to be of no importance.

The impulse response showed the typical Yamaha result, generally tidy, absolute phase correct and clear of extended or asymmetric ringing. Unusually, NEC have set a lower-than-standard 1.54V output level, which would result in misleading results on comparative listening tests against other players if the volume settings were not properly equalised.

Resolution was estimated at a very good 15 ¾ bit, with the 90dB step error just 2.5dB high. Slight compression was seen at full level, though the 0dB, 1kHz distortion result was considered to be very good at −82dB, or better than 0.01%. Spuriae were well rejected, though the upband result for the 20kHz full level signal was poorer than average at −26dB. The transport was quiet and gave pretty rapid access, with very good error correction.

Sound Quality

While some resemblance to current Yamaha series could be heard, the *'509E* managed to offer its own flavour, one which the listeners liked. Notably above average, it sounded sweeter and more relaxed than usual. Bass was fairly good, the treble unobtrusive and the stereo images were portrayed with a pleasing depth as well as pretty good focus. In some respects the *'509E* could be regarded as an economical counterpart to the Meridian *MCD*.

Conclusion

This machine is well priced and performed very well on lab test. It offered all the usual facilities with slick, reliable controls. The sound may not be as immediate as some, but it was pleasant and relaxed, and may well appeal to many purchasers. Taken overall the deck can be strongly recommended.

Test Results

	20Hz	1kHz	20kHz
Channel balance	0.14dB	0.14dB	0.01dB
Stereo separation	−80.7dB	−81.7dB	−62.1dB
Channel phase difference	0°	3°	40°
Total harmonic distortion, 0dB	−82.8dB	−81.2dB	−83.8dB
Total harmonic distortion, −10dB	—	−80.9dB	—
Total harmonic distortion, −60dB	—	−40.0dB	—
Total harmonic distortion, −80dB	—	−27.5dB	—
Intermodulation, 19kHz/20kHz, 0dB	−79.0dB		
Intermodulation, 19kHz/20kHz, −10dB	−83.2dB		
Frequency response, left channel	+0.39dB, −0.89dB		
Frequency response, right channel	+0.40dB, −0.75dB		
Signal-to-noise, 20Hz-20kHz unweighted	−98dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−92dB		
Output level, 0dB, left/right	1.54V		
Output impedance	300ohms		
De-emphasis	correct		
Track access time	5.5secs		
Error correction capability	>900µm gap, >800µm dot		
Mechanical noise	moderate		
Spuriae up to 100kHz	−102dB		
Resolution at −90dB	left +2.25dB, right +2.90dB		
Headphone socket	yes (variable output)		
Dimensions (w × d × h)	43 × 33 × 9.5 cm		
Estimated typical purchase price	£249		

For graph references see issue No 45

PHILIPS CD150

PHILIPS ELECTRICAL LTD, CITY HOUSE, 420-430 LONDON ROAD, CROYDON, SURREY CR9 3QR.
TEL: 01-689 2166



This new-generation Philips machine comes with a remarkable £200 price tag, and yet employs a newly developed and powerful set of integrated circuits offering 16 bit resolution via the Philips 14 bit four times oversampled scheme, noted for its good sound quality.

With the *CD150*, Philips have decided to join the Japanese in offering a slim, midi-sized machine with a fast front loading mechanism and the now familiar array of push buttons. Audible music cueing is also provided at two speeds, with track skip and comprehensive track programming. The basic deck is described as 'remote ready' and the infra-red hand control can be added at any time, at an extra cost of £40 or so. Another rear panel facility connects to the matching Philips midi system providing a centralised system remote facility.

Like the Far Eastern competition, the *'150* also has a fluorescent display, rather larger than the pea sized version fitted to the earlier Philips machines. Track numbers and timings may be displayed, with tracks entered for programming via successive key entries, and the data is acquired quickly. The audio output is at standard level from the usual nickel plated phono sockets. At best, the Philips owner can make his own choice of interconnect.

As regards its construction, the *'150* feels rather lightweight, with extensive use of plastic mouldings. Conversely, its construction is quite accurate. The number of printed circuits has also been reduced, and a new laser head has been fitted. This and the new central circuitry are jointly responsible for the decent track access speed shown, an improvement on previous Philips models. Power consumption has also been reduced sufficiently to allow the inclusion of the version of this player in the '555 transportable. A special low-consumption mechanism has already been designed for the *CD10* personal player; I have seen samples of this miniature design, but none were available in time for review, and it is not known whether the production *CD10* will use oversampling.

LAB REPORT

Despite lower prices and a new chip set, the full Philips CD player performance has been broadly maintained in this budget model. The fine frequency response shown here will be familiar to regular readers, its characteristic mild high frequency ripples generally felt to be subjectively harmless. Limits of ±0.2dB sufficed for the whole range while excellent results were also obtained for channel separation; for example, 108dB was quite typical. With the use of dual D/A convertors, interchannel phase shift was essentially zero.

On harmonic distortion at full level it measured very well, this including the in-band products of 20kHz, at an excellent −88dB. Good linearity was shown at lower signal levels, though by −60dB there was evidence of wideband hum modulation — probably mild supply ripple on the D/A convertor lines. In consequence the distortion at −80dB was a little higher than average with a −90dB level error of around +5dB. The practical resolution was estimated to be 15¼ bit. Fine results were obtained for intermodulation distortion at both test levels. With a standard 2V output, its source impedance was low at 200 ohms. Track access times were fairly rapid, mechanical noise was quite low and no problems were encountered with respect to error correction. The usual exemplary signal to noise ratios were obtained.

SOUND QUALITY

Scoring above average, and thus doing very well at the price, the *CD150* rewarded us with a fine standard of bass precision and power. Mid definition was very good though tonally speaking the mid was a touch lean and thin, presented a little forward in the stereo image. The latter was well focused and stable with respectable depth and above average transparency. The treble also attained a good standard.

CONCLUSION

Philips have brought their classic CD sound down to a bargain price level, and despite its 'plastic' feel, the *CD150* was one of our favourite budget players, easily acquiring 'Best Buy' status.

(Note: At the time of writing, discounted CD104 and Marantz CD54 machines are still available and offer a similar sonic standard.)

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.02dB	0.02dB	0.05dB
Stereo separation	−108.6dB	−111.8dB	−108.2dB
Channel phase difference	0°	0°	1°
Total harmonic distortion, 0dB	−89.5dB	−90.4dB	−87.5dB
Total harmonic distortion, −10dB		−83.6dB	
Total harmonic distortion, −60dB		−42.0dB	
Total harmonic distortion, −80dB		−21.9dB	
Intermodulation, 19kHz/20kHz, 0dB			−85.8dB
Intermodulation, 19kHz/20kHz, −10dB			−88.0dB
Frequency response, left channel			+0.04dB, −0.50dB
Frequency response, right channel			+0.04dB, −0.42dB
Signal-to-noise, 20Hz-20kHz unweighted			−98dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−115dB
Output level, 0dB, left/right			2.0V
Output impedance			200ohms
De-emphasis			correct
Track access time			4.5secs
Error correction capability			>800µm gap, >800µm dor
Mechanical noise			very low
Spuriae up to 100kHz			−72.5dB
Resolution at −90dB			left +4.0dB, right +4.89dB
Headphone socket			no
Dimensions (w × d × h)			32 × 30 × 8.5 cm
Estimated typical purchase price			£200

For graph references see issue No 45

BEST BUY

PHILIPS CD104B

PHILIPS ELECTRICAL LTD, CITY HOUSE, 420-430 LONDON ROAD, CROYDON, SURREY CR9 3QR
TEL: 01-689 2166

Philips' early top-loading player was substantially built on a large die casting, and the *'104* is distinguished by the same quality of construction. The transport and laser system are also founded on precision castings, these isolated from the outside by a rubber decoupling system.

The decoding system is original to Philips, and consists of four times oversampling, operating with dual 14 bit digital to analogue convertors and a mixture of high slope digital filtering plus low slope analogue output filtering. Many other manufacturers have adopted or adapted this system, which so far has given a competitive edge to reproduced sound quality.

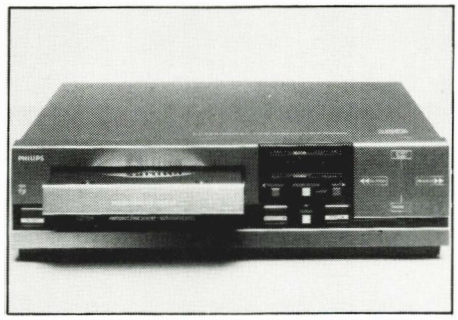
Operation is relatively simple and straightforward, with low mechanical noise levels.

LAB REPORT

Channel separation exploited the dual convertors to the full, while interchannel phase difference was virtually zero.

With reducing level, the midband distortion increased correctly, reaching −22.6dB at a −80dB recorded level. For a −90dB level the gain error was mild at 3.4dB and the overall resolution was close to 15½ bit, showing the improvement afforded by oversampling.

The high frequency two tone 19/20kHz intermodulation results rated about average taking, for example, the spectrum analysis at −10dB test level. Here, downband clutter could be seen below 5kHz, while the 24kHz component was around −53dB. The higher



frequency components were not well rejected, and similar signals appeared on lower frequency signal tones as well, a feature typical of the Philips system.

Frequency response met +0, −0.35dB limits from 20Hz to 20kHz, both channels, and the ripple is regarded as inaudible.

Track access from a cold start was slow, but once in play mode it skipped to the 15th test track in just 2.5 seconds. As usual with Philips machines the error correction was excellent.

SOUND QUALITY

Following the Philips tradition for good CD sound, the *'104* scored rather above average, in spite of the generally improving sound quality of the new generation of players. The sound was lively and clear with good focus, convincing transients, and a fair presentation of stereo depth. Stage width was fine, while the mid was slightly forward and nasal in tonal quality. The bass was pretty good, and the treble basically tidy and well defined.

CONCLUSION

Though now keenly priced, the Philips nonetheless faces strong competition from the Japanese machines — but this aside, the *'104* merits a Best Buy rating.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	<0.2dB	<0.2dB	<0.2dB
Stereo separation	−128dB	−123dB	−98dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	>−94dB	>−94dB	>−86dB
Total harmonic distortion, −10dB		−82.4dB	—
Total harmonic distortion, −60dB		−40.6dB	—
Total harmonic distortion, −80dB		−22.6dB	—
Intermodulation, 19kHz/20kHz, 0dB		−89dB	
Intermodulation, 19kHz/20kHz, −10dB		−79dB	
Frequency response, left channel		+0dB, −0.35dB	
Frequency response, right channel		+0dB, −0.35dB	
Signal-to-noise, 20Hz-20kHz unweighted		−106dB	
Signal-to-noise, CCIR/ARM, 1kHz ref		−106dB	
Output level, 0dB, left/right		2.055V/2.074V	
Output impedance		33 ohms	
De-emphasis		correct	
Track access time		9 secs (2 secs from play)	
Error correction capability		>900µm gap, >800µm dot	
Mechanical noise		low	
Spuriae up to 100kHz		see text	
Resolution at −90dB		+3.4dB	
Headphone socket		no	
Dimensions (w×d×h)		32×30×9cm	
Estimated typical purchase price		£200	

REASSESSED

For graph references see issue No 45

BEST BUY

PHILIPS CD 350

PHILIPS ELECTRICAL LTD, CITY HOUSE, 420-430 LONDON ROAD, CROYDON, SURREY CR9 3QR.
TEL: 01-689 2166



Based on the *CD150*, the *'350* is a more expensive machine with some additional features, including a fixed output headphone socket and remote control. The latter is usually supplied as an extra accessory, and the player needs either a small module fitter or to be wired to a matching audio system.

Approaching full width size, the *'350* uses the popular front drawer-load method with a fast-acting lightweight mechanism. Up to 20 tracks may be programmed, and the machine also displays and gives access to the index points on appropriate discs. The multiple function LED display can show track timings, 'remaining' and 'elapsed' times, as well as track numbers. Other features include audible music cueing, fast track skip, and repeat.

Given a basic lab check, the *CD350* was found to conform closely to *CD150* performance, but with error correction marginally better still. The remote control was not available for test, but the main controls appeared to work well, with logical operating sequences. The machine was then given a full audition.

SOUND QUALITY

The *CD350* was felt to improve on the *'150*, to a small but perceptible degree. Characteristics included clean well-defined transients, and a solid well-founded bass with both extension and tunefulness.

The stereo presentation was a touch forward, with some mild 'thinning' and 'hardening' of midrange tonal balance, but this was quite mild and did not upset the good sound stage impression. The *'350* showed a good standard of stereo focus, with quite good depth and ambience. Slightly untidy, the treble showed good detail but with a hint of 'edge' and 'grain'.

CONCLUSION

This player clearly reaches a standard which merits Best Buy rating, with a very good lab performance and an above average sound quality. Higher priced Philips machines will be 16 bit, 4 times oversampled, and promise a markedly improved performance.

For graph references see issue No 45

RECOMMENDED

PHILIPS CD304

PHILIPS ELECTRICAL LTD, CITY HOUSE, 420-430 LONDON ROAD, CROYDON, SURREY CR9 3QR.
TEL: 01-689 2166



Based on the *CD104*, but with extra facilities, the *CD304* will eventually be superseded by the new *CD650* model, but for the time being is still available. It was first reviewed in 1985 along with the similar model '*204*, which offered comprehensive features but without the remote control option.

The '*304*'s front panel embodies a large fluorescent tube display which can show several items of information. A linear scale shows programmed track numbers in order, with windows to indicate which mode has been selected. It also shows the total number of tracks, track timings and overall programme times. Full control is also available via the infra-red hand-held unit, though index facilities are not provided, nor is a numeric keypad. Conversely a front panel headphone socket is present complete with its own level control, and the main audio output is provided on phono jacks, the level set by another volume potentiometer.

A large satin black unit, the '*304* design is well finished and well built, with diecastings used for important chassis sections. Overall, it was surprisingly heavy.

As with the other Philips players, the decoder runs at four times the normal sampling frequency, placing unwanted alias signals and noise higher in the frequency range where they are more easily filtered. The dominant filtering is carried out by a 96 pole digital chip, which gives the player that familiar slight ripple in the high frequency amplitude response.

LAB REPORT

The player conformed to the general frequency response of the Philips CD group, with closely defined +0.1, −0.25dB amplitude limits over the full 20Hz to 20kHz audio range, and the characteristic mild high frequency ripple. Channel balance was excellent, within 0.15dB overall. On channel separation it performed very well, while the interchannel phase displacement was zero as usual.

Total harmonic distortion approached −100dB, 0.0013%, and in conjunction with the low +2.5dB level error at the −90dB modulation section suggested 15½ bit linearity. The downband noise products of a 20kHz fundamental were of average degree at −83dB. Likewise the intermodulation results were good in the absolute sense but did not match the best in the issue. At the −10dB modulation level the high frequency two tone intermodulation was 79dB down though some other components were also present. In the spectogram these can be seen below 4kHz at −74dB, with other upband components present at −52dB.

In the absence of modulation, the Philips spurious rejection seems good, but in the presence of modulation, upband signals appear which are not rejected and are no better than 50-60dB down.

Output level was the usual 2V from a 600ohm impedance. De-emphasis was fine and access to the test track 15 was moderate at 7.5 seconds. Low levels of mechanical noise were present.

Concerning error correction, the '*304* was fully on target easily meeting the 900μm gap error and the 800μm surface dot error bands. Signal to noise ratios were exemplary, rather greater than the practical bit linearity would provide in a conventional system.

SOUND QUALITY

Undoubtedly good as Philips CD players go, it was surprising to find the '*304* unit was marginally less satisfying subjectively than the basic '*104*, though it must be stressed that the difference was very slight. As regards tonal balance, the '*104* was a touch sweeter and easier on the ear; nonetheless the overall quality was good, with clean bass and treble extremes, and notably clear transients, coupled with good stereo focus and fairly good stereo depth.

CONCLUSION

Compared with the '*104*, you do pay for the extra facilities of the '*304*, and depending on how important these extras are, the value for money rating in absolute terms is not as good as the '*104*. The marking places it on the borderline and in my view, it just qualifies for the recommended category.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.15dB	0.15dB	0.15dB
Stereo separation	−110dB	−105dB	−96dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	>−98dB	−98dB	−83dB
Total harmonic distortion, −10dB	—	−83dB	—
Total harmonic distortion, −60dB	—	−42dB	—
Total harmonic distortion, −80dB	—	−24dB	—
Intermodulation, 19kHz/20kHz, 0dB	−88dB		
Intermodulation, 19kHz/20kHz, −10dB	−79dB		
Frequency response, left channel	+0.1dB, −0.25dB		
Frequency response, right channel	+0.1dB, −0.25dB		
Signal-to-noise, 20Hz-20kHz unweighted	−106dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−105dB		
Output level, 0dB, left/right	2.01V		
Output impedance	600ohms		
De-emphasis	correct		
Track access time	7.5 secs		
Error correction capability	>900μm gap, >800μm dot		
Mechanical noise	low		
Spuriae up to 100kHz	−100dB*		
Resolution at −90dB	+2.5dB		
Headphone socket	yes (variable output)		
Dimensions (w×d×h)	42×30×9cm		
Estimated typical purchase price	£329		

**With signal present, −50 to −60dB*

REASSESSED

For graph references see issue No 45

The Music Room NEWSLETTER SEPTEMBER 1986

ABSOLUTE SOUNDS LTD

All around me I sense this: people are seeking the authentic experience. Mass production and plastic substitutes leave people emotionally unsatisfied. Better one authentic product per year than one disappointment each month. The absolute Sound audio product is like a musician of rare distinction: both are instruments through which music is conveyed. Once you hear you cannot forget. True that one Koetsu Black K buys twenty Grado MT's; and that one **AUDIO RESEARCH SP-8/D-70** buys eight Quad 34/306; and that one **MAGNEPLANAR SMGa** buys almost five pairs of Tannoy Mercury loudspeakers. Our contention is this: both alternatives offer honest products and true value, but the absolute sound transports the listener into a higher orbit, emotionally and intellectually. Like the original sound, the recorded sound *can* also be *convincing;* that is my ultimate new replacement word for the equally subjective "musicality". And I believe that this is why Absolute Sounds and the Music Room work in the UK for **APOGEE, AUDIO RESEARCH, KOETSU, KRELL, MAGNEPAN** and **ORACLE.**

AUTOMATION SCIENCE CO.

The major news here is the arrival of Swiss Physics, Europe's most distinguished Pre- and Power amplifiers, made like a Swiss Watch but how do the current models sound? We look forward to hearing them soon. Remember: those who visit The Music Room know the state of the Art! Last but not least is the arrival of Martin Logan, from USA, one might be tempted to join many Americans who have found that this is the loudspeaker which actually delivers everything that electrostatic loudspeakers should be capable of doing. How do they compare with Magneplanar, Quad, Apogee? Well, they have tremendous presence and both visual and acoustic transparency. They are not cheap at £2,700, of course, but like Magneplanars they offer one enormous economy: you can drive them with your Audiolab 8000A or Mission **CYRUS** Two – both of which, incidentally, are exposed as real bargains at £299!

QUAD and KEF

Quad celebrates its 50th year with two exceptionally fine power amplifiers, the 306 (£229) and the brand new 606, 150 wpc for an economic £449. Join us at our Music Evening in Manchester to celebrate **QUAD's** success on Thursday September 4th in our second floor Concert Room. On Tuesday October 21st at the Beacons Hotel, 7 Park Terrace, Glasgow G3 we will proudly launch in Scotland the new KEF Reference series of loudspeakers with a device called the Kube. If you can budget £299, £799 or £1,799 for the 107 loudspeakers then bring your wife and bank manager along too.

THE SOURCE

Many of you thought that we were exaggerating with excessive praise what the Source turntable could do for your system. That is, until you heard one for yourself. Perhaps you thought it was our Scottish roots. Well, two years on, the world has agreed. This month, Canadian Hi-Fi Sound has rated it the best, and very good value at only $2,500. Well, even at its new price of £899 it will remain an audiophile bargain in Britain because it does not require expensive ancillary equipment. If you don't believe this, you can book your demonstration now! However, because the best deserves the best two news items from the Source now follow: one, the Power Supply is now available from us at £199, but before you complain about the price please see it and audition it. Item two: the Source now distributes the Triplanar tonearm in Britain. Price on application, but if you need to ask then please consider a budget arm such as the SME Series V or the Odyssey RP1-XG.

COMPACT DISC

We are happy to recommend Yamaha and Philips 104 plus their new 450 and 650 machines. However, the new Mission PCM 7000 at £599 is about to redefine the state of the art and deserves much praise to Mission and to British engineering. "We may not have invented it, but we made it musical!" Even JL can live with CD, now, and the cabinet and remote facilities (including volume control) are superb.

MONITOR AUDIO

The latest news from MA is the all-new metal-dome tweeter, product of a long period of research. Models 700MD (£249) and 652MD (£299) are the first to incorporate these drivers, and the sweetness, imaging and power handling place this company's products on your short list. Quality of cabinet-making and reliability have always been exemplary so we cannot imagine anything other than deserved success and lots of happy owners in the future. A very distinguished range of British loudspeakers.

MUSIC EVENINGS

We are justly proud of our Concert Room at the Music Room in Manchester which is the largest *specialist* audiophile facility in Britain. Manager Mick Bates and Assistant Manager David Speirs work hard to make it also the *best,* and are supported by a dedicated team of Steve and Louise. This shop was conveniently located in the centre of Manchester and if you are serious about music in your home, then it is worth travelling into. Please ring for a personal appointment. For our local friends and customers, our Musical Evenings continue to fain popularity so here is the calendar.

Sept. 4	**QUAD** and **CD**
Oct. 2	Systemdek turntables, Sugden amplifiers, Roger Loudspeakers
Oct. 30	**YAMAHA** – Natural Sound from Japan
Nov. 6	**MISSION ELECTRONICS**

DOMESTIC NEWS

Because this newsletter is assembled in Glasgow, we are jealous of our reputation of being one of the finest HI-FI specialists in the world. So we are aware of the need to stay ahead with some new decor, and some unique ideas to improve service and courtesy to customers such as the new assessment card to make you aware of your rights and expectations, and a confidential reply to my desk (where the buck stops) as to how pleased or otherwise you were with our people and our products. To make time for this and for other progress, it is my pleasure to welcome the appointment of Edinburgh-man John Todd as Manager of The Music Room Glasgow from mid-August. I am confident and happy that John is fully aware of what we set out to achieve, and he will offer an expertise and integrity as a matter of pride. Our Glasgow shop would not be what it is without Susan Black and John's duties will be made lighter and sweeter as mine have been. In fact, Susan will divide her time, partly on the sales side and partly continuing to assist me.

NEW SHOP

We are to open a new shop at 98 Bath Street Glasgow called Mobile Fidelity, specialising in Automotive Electronics: in-car music, security and communications. We shall have our own installation facilities headed by Les Woollard, and the showroom manager will be Ron Maclean, both of whom we are delighted to welcome to the company. Significantly, this project grew from my own experience and system (as did The Music Room itself). I recently installed a Nakamichi radio/cassette, harman kardon amplifiers and JBL (rear) and Infinity (front) speakers. The result was beyond my expectations, and I realised that careful selection and matching of quality components and very careful installation were the key concepts and in which we had experience as a company.

MUSIC ROOM PRODUCTS

We have now developed The Music Link. Costing £49 for 1.2 metres stereo pair (the optimum length to reduce standing wave resonance) this is our attempt, which we believe is successful, to equal or beat the super imported cables at a lesser cost. We use the Tiffany gold-plated RCA phono plugs, and are happy to offer a mail-order service for an additional £1, money-refunded if not delighted. What can you lose? We can lose our reputation if you dislike our Link! We also offer with confidence the ultimate tunrtablemat, costing £30 plus £1 postage it is machined, slightly concave, from polymethyl metharcrylate. Don't try it on a Pink Triangle, but on anything else we don't think you will want to do without it.

I wish that we had thought of **EMITs** (electromagnetic induction tweeters) and **ENIMS** (mid range drivers) but **INFINITY** did along with a great deal more clear thinking and I wish to re-emphasise that both in-car and in the home I beleive that you really must hear this; oops, sorry, but the RS 1b is . . . convincing.

PERSONAL CREDIT

We are not ashamed to offer you the best money can buy, but few of us have the proverbial oil-well in Texas. Yet buying the best can be the most ecomomic as well as the most satisfying so in addition to our Summer offer of interest-free credit on Automation Science products (10 monthly instalments on Conrad Johnson, Infinity, VdH, Martin Logan and Swiss Physics) we also accept the major credit cards and offer instant credit to most applicants. We have arranged with HFC Trust a highly attractive personal loan arrangement for our privileged customers. All part of the service! See you soon.

Jack Lawson

The Music Room
50 Bridge Street
Manchester M3
061-835 1366

The Music Room
221, St. Vincent Street
Glasgow G2
041-248 7221

VISA Access

BADA THE ULTIMATE IN SOUND ADVICE *founder member*

INSTANT CREDIT

PIONEER PDM6

PIONEER HIGH FIDELITY (GB) LTD, FIELD WAY, GREENFORD, MIDDLESEX UB6 8U2.
TEL: 01-575 5757



This new machine's claim to fame is its sophisticated autochanger mechanism, using pre-loaded magazines which contain up to six discs. These magazines are about as compact as it is possible to imagine and additional ones are available so you can build up a library. For example, it would be possible for the purchaser to file all the work of an artist in one magazine and label up the favourite tracks in the preferred order, thus ensuring an individual compilation. Typically a five hour playing time is possible and may be automatically repeated. Commercial background music applications immediately spring to mind and as such it must represent one of the most economical and reliable long playing music sources available. For the classical enthusiast, an evening's entertainment may be loaded up or the two discs of a longer work played in sequence, without having to leave your seat.

In other respects, this player is also well equipped, coming with a variable level headphone socket and a comprehensive remote control handset. Sensibly this offers two numeric keyboards to avoid confusion — there is one for the six discs and a separate decade array for track entry. A larger-than-usual fluorescent display makes remote control programming easier at reasonable distances. Up to 32 tracks may be programmed in any order, from any disc. Tracks may also be added to the programme as they are played, while pauses can also be inserted. The machine will also play all tracks in random order, the so-called 'Shuffle' play feature as seen on some Sony machines.

Other facilities include two speed music search, fast track skip and repeat, but no access to index points is possible. The display shows disc and track numbers independently and will also show elapsed and remaining times, while on the rear panel a subcode output is provided as well as the usual audio phono sockets. A spare single play magazine is also provided as part of the package.

In technical terms, this is a conventional design with a single time-shared 16 bit D/A convertor with normal 'brickwall' filtering. The fashionable oversampling systems are not employed.

LAB REPORT

A high uniform frequency response was measured, ruler flat for both channels over most of the range with a very mild ±0.2dB ripple at the highest frequencies. Channel balance was very good whilst the low and mid frequency results for separation were excellent, reducing to a good figure of 78dB by 20kHz. The usual inter channel time delay was present resulting in a phase shift of 85° between channels at 20kHz, which is only of real consequence if mono operation is envisaged.

Very good results were also obtained for total harmonic distortion, which was down to 0.002% at 1kHz, 0dB modulation. The downband figure of −80dB at 20kHz was also promising, and was allied to fine results for the two tone high frequency intermodulation tests — at −10dB an amazing 0.002% was scored. The output level was close to the 2V standard from a 1kohm source impedance and de-emphasis was fine. Track access was moderately fast given the complexities of the autochanger and mechanical noise levels were very low. The excellent error correction performance was largely unaffected by reasonable levels of shock and vibration.

Electrically, the signal to noise ratios were very good and close to the theoretical limits.

SOUND QUALITY

Scoring about average for sound quality, taking into account the current rising standard in CD performance, this model is actually better than earlier second generation machines. It sounded precise and well controlled but with a slightly 'forward' midrange. The bass was felt to lack full extension but was articulate and well defined, while the treble maintained a basically good standard — a little coarsened but not unpleasantly so. Stereo focusing was fine, but the images were not very deep or spacious, and dynamics were somewhat muted.

CONCLUSION

The lab performance was very good, while the sound quality was close to the average score, but good nonetheless. The autochanger function and the controls were well executed and the overall package worked fine; on balance it is hard not to recommend this model, if the features appeal to you.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.33dB	0.32dB	0.24dB
Stereo separation	−119.9dB	−103.8dB	−78.0dB
Channel phase difference	0°	5°	85°
Total harmonic distortion, 0dB	−87.2dB	−92.9dB	−79.4dB
Total harmonic distortion, −10dB	—	−88.6dB	—
Total harmonic distortion, −60dB	—	−46.0dB	—
Total harmonic distortion, −80dB	—	−23.3dB	—
Intermodulation, 19kHz/20kHz, 0dB	−88.7dB		
Intermodulation, 19kHz/20kHz, −10dB	−91.4dB		
Frequency response, left channel	+0dB, −0.64dB		
Frequency response, right channel	+0dB, −0.73dB		
Signal-to-noise, 20Hz-20kHz unweighted	−99dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−94dB		
Output level, 0dB, left/right	2.1V		
Output impedance	1kohms		
De-emphasis	correct		
Track access time	8.5secs		
Error correction capability	>900μm gap, >800μm dot		
Mechanical noise	very low		
Spuriae up to 100kHz	−102.5dB		
Resolution at −90dB	left −4.08dB, right −3.84dB		
Headphone socket	yes (variable output)		
Dimensions (w×d×h)	42×33×9.5cm		
Estimated typical purchase price	£350		

For graph references see issue No 45

BEST BUY

PROTON 830R

VENTURA LEISURE LTD, VENTURA HOUSE, THE BROADWAY, OLD AMERSHAM, BUCKS.
TEL: (0240) 34602



A new generation CD player, the *830R* is part of a new Proton *30* series. Proton is a marketing organisation which commissions fairly upmarket products from various Far Eastern sources. Their head office is in Compton, California. The *830* is a well equipped machine with a remote control and a headphone socket complete with volume adjustment. A normal width drawer-loader, the usual range of controls and facilities are all present, with random or sequential track programming for up to 30 selections. The cueing operation has three levels of operation: on first and continued pressure two rates of audible music search are provided, and fine step adjustment in one second intervals is also possible. Repeat modes cover the whole disc or the programmed selection. The four digit display can show track numbers, total time or remaining time, plus index points.

The brochure claims this is an advanced technology design, with an excellent noise level of −1000dB! (a misprint, of course!). In fact 100dB was achieved, using a four-times oversampled system with dual D/A convertors. Proton avoid saying how many bits, but in practice, the decoding system is the standard Philips 14 bit type. A single beam laser head is claimed to give low reading errors. The digital filter operates at 176.4kHz, with low order Bessel filtering applied after conversion. In fact, Proton need not have underplayed the bit issue, since the Philips type oversampling technique provides a resolution virtually at a 16 bit level from the 14 bit convertors used.

LAB REPORT

The frequency response was perfectly flat to 1kHz, above which the characteristic Philips amplitude ripples can be seen, typically harmless at +0, −0.25dB. The nominal 20kHz point was within 0.5dB of the 1kHz reference level. Channel separation results were good, though they did not meet the standards possible with this set of integrated circuits: the 76dB achieved at 20kHz was rather less than the 106dB attained by the same system in the Marantz *CD45*.

Channel balances were excellent, at better than 0.1dB on the reference disc, and the channels were also time-aligned with no differential phase. The full level harmonic distortion results were fine at low and mid frequencies, meeting the 0.003% specification claim. At 20kHz the down band noise products were well suppressed, by at least 86dB, and good distortion levels were also obtained at lower signal levels except near the noise floor. Here a hash of hum harmonics were dispersed across the spectrum analysis, showing poor power supply quality at the DACs. At −80dB modulation the 1kHz distortion measured 22dB down, which is poorer than average. A low step error was established at −90dB, so despite the hum an effective resolution of 15.6 to 15.7 bits was indicated.

Good enough results were obtained for the high frequency intermodulation tones, though again these were poorer than average. Conversely the machine sailed through the signal-to-noise ratio tests, delivering a virtually consistent −108dB *via* all test conditions, with and without pre-emphasis. Error correction was first class, comfortably meeting the 900μm gap and the 800μm dot tests and also showing a respectable immunity to vibration and shock. Spurious signals were rejected fairly well, by some 50-70dB depending on the signal modulation level. The *830R* delivered a standard output of 2.05 volts from a low 200ohms source impedance. Mechanical noise levels were fine, and no electrical clipping could be seen on the peak level white noise signal.

SOUND QUALITY

Scoring about average, the *830R* did not quite make the basic Philips grade for sound quality. First impressions were of a 'sweet', 'natural' sound with quite spacious ambient sound images, but after further listening it was felt that the stereo lacked the ultimate focus, and that the treble positioning was not as clear as usual. The bass was good in a general sense, but could have shown more subjective extension and power. Finally the upper mid had a hint of a nasal, almost 'metallic' coloration, altering the timbre of sounds in the lower treble.

CONCLUSION

This player certainly meets a basically good standard, and when the facilities like remote control are taken into consideration with the modest price level the *830R* clearly qualifies for Best Buy rating. Prior audition is, however, advisable.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.09dB	0.09dB	0.08dB
Stereo separation	−94.0dB	−100.9dB	−76.5dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	−92.0dB	−89.3dB	−85.9dB
Total harmonic distortion, −10dB	—	−81.7dB	—
Total harmonic distortion, −60dB	—	−41.5dB	—
Total harmonic distortion, −80dB	—	−22.2dB	—
Intermodulation, 19kHz/20kHz, 0dB	−83.4dB		
Intermodulation, 19kHz/20kHz, −10dB	−73.1dB		
Frequency response, left channel	+0.05dB, −0.43dB		
Frequency response, right channel	+0.05dB, −0.42dB		
Signal-to-noise, 20Hz-20kHz unweighted	−109dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−107dB		
Output level, 0dB, left/right	2.05V		
Output impedance	200ohms		
De-emphasis	correct		
Track access time	4.0secs		
Error correction capability	>900μm gap, >800μm dot		
Mechanical noise	moderately low		
Spuriae up to 100kHz	−72.3dB		
Resolution at −90dB	left −3.82dB, right −3.27dB		
Headphone socket	yes (variable output)		
Dimensions (w×d×h)	42×31×9cm		
Estimated typical purchase price	£219		

For graph references see issue No 45

SANSUI PC-V100

SANSUI (UK) LTD, UNIT 10A, LYON INDUSTRIAL ESTATE, ROCKWARE AVENUE, GREENFORD, MIDDLESEX. TEL: 01-575 1133



Scoring a 'Best Buy' in the last edition, Sansui's *PC-V100* has proved to be a highly successful model, offering good sound quality at a reasonable price. Like the earlier *PC-V300*, it is in fact built to Sansui's specification by Yamaha, using that company's twice-oversampled 16 bit D/A conversion system. Sansui have now launched a new generation model, the *PC-V750*, reviewed for the first time in this issue, which is to a completely different design. However, the *PC-V100* is still currently available and so is re-assessed for this issue.

The high production volume chassis allows various 'frills' to be added as desired for different models but in the case of the *'100*, these have been kept to a minimum. This basic machine has a red LED display showing all the required information but only one bit at a time. Thus track numbers, elapsed time, total time and track time are shown according to the mode selected by depression of the display key. Tracks can be programmed but not indexed, and no headphone socket or remote control facility is provided. Good track selection and cueing facilities are present, with audible music in search mode.

Inside, the player is well constructed, using a single 16 bit Burr Brown D/A with two times oversampling and digital filtering. The layout is nicely accessible, easy for servicing with a high level of circuit integration displayed, using custom Yamaha integrated chips.

LAB REPORT

Output level was just slightly below the nominal standard reading and averaged 1.9V. A higher than usual output impedance was noted, of 1kohm. A basically uniform frequency response was obtained, flat from 50Hz to 5kHz, and with a mild lift at higher frequencies, around 0.5dB. Channel balance was fine at 0.18dB or better.

Measured for channel separation the results were good but unexceptional, at 92dB 1kHz, for example, reducing to 83dB at 20kHz. Inter-channel phase differences were as usual for a twice-oversampling design — less than 1° at 1kHz, increasing to a modest 38° by 20kHz.

Turning to the total harmonic distortion at full linearity, at 1kHz a reasonable −87dB was recorded, while up to −103dB is possible. The −84dB downband noise at 20kHz is considered quite reasonable.

Good results were achieved at lower signal levels, indicating 15 bit resolution, while at −90dB the 7dB of level error was a little high. The machine demonstrated a good high frequency performance with respect to two tone intermodulation. For the full level, 19/20kHz tones the difference product fell to −103dB; in theory the −10dB result should have been −93dB, but in fact it was a little degraded to −86dB. The matching spectogram showed a clean downband result but the 24kHz rejection was weak at just 24dB. Upper range components were also visible, so the output filtering is not that strong. Under normal signal conditions, a reasonable −72dB of suppression is typical.

Track access times were rapid with four seconds required to reach the test track 15. Mechanical noise levels were low, while the electrical signal to noise ratios were a little poorer than average at −90.5dB, CCIR ARM (1kHz), without pre-emphasis. Error correction capability was fairly good though not up with the best examples.

SOUND QUALITY

Aligning with other twice oversampled models, this player gave good results on test, rather above average. While a touch of grain and imprecision was noted in the treble, the general tonal quality was pleasantly musical and showed good clarity, detail and stereo depth. Stereo focus was fine while the bass was slightly softened.

CONCLUSION

This player offers a good sound quality for the money, together with a competent transport claiming fast access times. But while the *PC-V100* represented outstanding value last year, in the light of newer, cheaper models — including Sansui's own *'750* — it no longer stands out quite as clearly from the competition.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.15dB	0.18dB	0.05dB
Stereo separation	−93dB	−92dB	−83dB
Channel phase difference	0°	0.8°	38°
Total harmonic distortion, 0dB	−90dB	−87dB	−84dB
Total harmonic distortion, −10dB	—	−81dB	—
Total harmonic distortion, −60dB	—	−35dB	—
Total harmonic distortion, −80dB	—	−21dB	—
Intermodulation, 19kHz/20kHz, 0dB	−103dB		
Intermodulation, 19kHz/20kHz, −10dB	−86dB		
Frequency response, left channel	+0.55dB, −0.18dB		
Frequency response, right channel	+0.55dB, −0.18dB		
Signal-to-noise, 20Hz-20kHz unweighted	−97dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−90.5dB		
Output level, 0dB, left/right	1.90V/1.87V		
Output impedance	1kohms		
De-emphasis	correct		
Track access time	4.0secs		
Error correction capability	>800μm gap, >500μm dot		
Mechanical noise	low		
Spuriae up to 100kHz	−72dB		
Resolution at −90dB	+7dB		
Headphone socket	no		
Dimensions (w×d×h)	34×29×9cm		
Estimated typical purchase price	£240		

REASSESSED

For graph references see issue No 45

RECOMMENDED

SANSUI PC-V750

SANSUI (UK) LTD, UNIT 10A, LYON INDUSTRIAL ESTATE, ROCKWARE AVENUE, GREENFORD, MIDDLESEX. TEL: 01-575 1133



Initially introduced at a lower price than the earlier *PC-V100* machine, the '750 is now actually more expensive since the price of the '100 has dropped to around £240. However no-one could really argue about this differential, since the '750 does possess a margin of sonic superiority.

Neither machine is actually made by Sansui themselves, though details of the specification and construction are unique to this company, endowing the decks with an individual performance. The *PC-V750* actually originates at the Toshiba factory and is a close relative of that manufacturer's *V-II* series. Although the *V-II* is not reviewed here, its sonic rating in my own tests suggested that Sansui are selling a superior machine.

Finished in the usual satin black, the '750 is a drawer loader, and has the normal controls and facilities, but lacks a headphone outlet or remote control. The fluorescent display is a multifunction type, showing track numbers, elapsed time and remaining time. Control buttons cover repeat programming, fast track skip, two speed audible music cueing and pause.

Technically, this player is a 16 bit linear machine, non-oversampled, with a time shared convertor followed by normal 'brickwall' analogue filtering. Most machines use a quartz crystal oscillator to reference the recovered sampling rate while this design employs an ordinary LC oscillator; in theory this is less stable and less accurate, and certainly the absolute speed was slightly out (by a negligible degree) but no other pitch stability problems were encountered. A third generation design, the '750 is constructed with a low chip count, access for servicing is easy and it should prove pretty reliable.

LAB REPORT

Our first sample worked well enough but exhibited a puzzling fault which you can see in the frequency response graph. The output fell like a stone above 11kHz even to −12dB by 20kHz. Both channels were identical. We obtained a second sample which gave the correct response (dotted trace), virtually flat to 20kHz. The fault was symptomatic of a misaligned oscillator; if running fast, the disc reference tones would replay at a higher frequency and, eventually, meet the brickwall filter.

Channel balance was fine, and generally good separation results were obtained, with 97dB at low frequencies, reducing to 68dB at 20kHz. As expected, the small time delay between channels resulted in increasing phase shift, reaching a maximum of 80° or so by 20kHz.

Distortion levels at full modulation were very good at low and mid frequencies, reducing to an average of −65dB at 20kHz. On the faulty sample, the measured intermodulation result was just satisfactory but on a normal sample the results were very good.

Output level was close to standard at 2.1V from an output impedance of 1.2kohm, this higher than usual. A fine low level linearity was shown with low distortion at −80dB modulation, and a minor level error at −90dB. A resolution of 15¾ bits was shown by these results. Track access was rapid while the mechanical noise was low. A fine error correction performance was attained, and both the 900μm gap and the 800μm dot levels were handled confidently. Spurious signals were satisfactorily rejected, and competent signal to noise ratios were established, with and without de-emphasis. The de-emphasis equalisation was fine.

SOUND QUALITY

Scoring above average, the '750 gave a good account of itself during the auditioning. Possessing a lively, dynamic nature, the sound stage was well represented, with good focus and a good measure of depth and ambience.

The bass was well controlled with both extension and impact. The treble was above average if occasionally sounding a little coarse. In the midband, the '750 showed quite good detail but also sounded a touch thinned and light. Vocals were not quite 'full' enough.

CONCLUSION

Such is the pace of CD machine development, that six months ago this would have rated as a Best Buy player, and while it remains a strong performer, delivering a substantially good sound, it must now be demoted in the light of the competition to a firm 'recommended' level.

TEST RESULTS

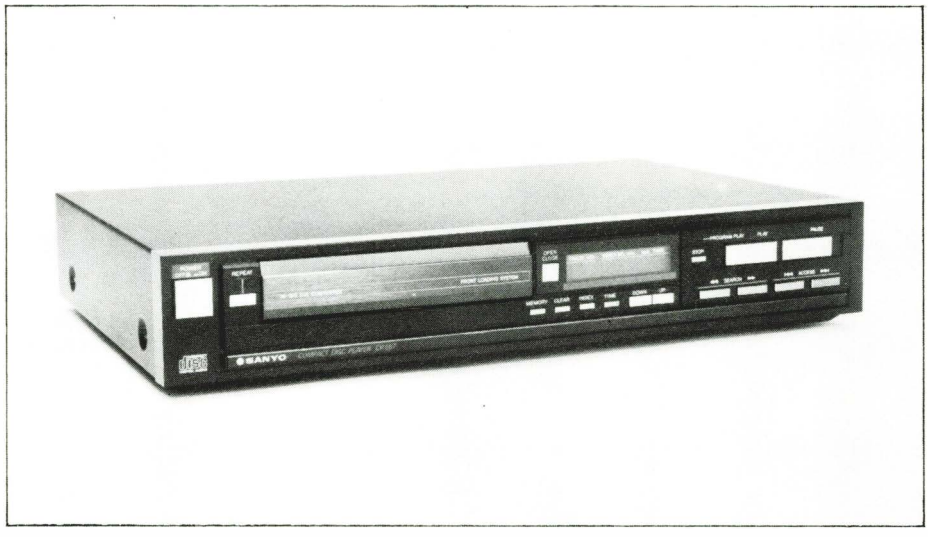
	20Hz	1kHz	20kHz
Channel balance	0.10dB	0.10dB	0.43dB
Stereo separation	−96.9dB	−89.7dB	−67.3dB
Channel phase difference	0°	5°	76°
Total harmonic distortion, 0dB	−89.9dB	−88.3dB	−68dB
Total harmonic distortion, −10dB	—	−93dB	—
Total harmonic distortion, −60dB	—	−53.3dB	—
Total harmonic distortion, −80dB	—	−39.7dB	—

Intermodulation, 19kHz/20kHz, 0dB	−93.8dB
Intermodulation, 19kHz/20kHz, −10dB	−90.5dB
Frequency response, left channel	+0dB, −1.59dB
Frequency response, right channel	+0dB, −1.49dB
Signal-to-noise, 20Hz-20kHz unweighted	−92dB
Signal-to-noise, CCIR/ARM, 1kHz ref	−88dB
Output level, 0dB, left/right	2.1V
Output impedance	1.2kohms
De-emphasis	correct
Track access time	4.0secs
Error correction capability	>900μm gap, >800μm dot
Mechanical noise	fairly low
Spuriae up to 100kHz	−86.7dB
Resolution at −90dB	left +1.91, right +2.06dB
Headphone socket	no
Dimensions (w×d×h)	43×31×8cm
Estimated typical purchase price	£299

For graph references see issue No 45

SANYO CP 667

SANYO MARUBENI (UK) LTD, SANYO HOUSE, OTTERSPOOL WAY, WATFORD, HERTS.
TEL: (0923) 46363



This full width player uses the ubiquitious drawer load system and falls in the middle price sector. However, the features are fairly spartan: neither headphone socket nor remote control is included — nor any other form of remote actuation, for example *via* an interface to the matching audio system. Previous Sanyo players have drawn from Yamaha oversampling techniques, and in fact Sanyo's related Fisher operation sells players built by Yamaha to their specifications. Surprisingly these new players are not from that series and are 16 bit linear models without oversampling.

The display for this machine has two sections, one for tracks and indexes, the other for timings, both 'elapsed' and 'remaining'. A switch engages the index mode, and points are accessed using the search buttons. Other features include audible music cueing, fast track skip, and quick entry: up/down count buttons speed the programming of up to 16 tracks in random order.

The machine will also allow the same track to put in again and again within the programmed sequence. The repeat function operates over the whole disc of the programmed sequence only.

Technically, this is a 16 bit machine, with a time-shared D/A convertor followed by analogue 'brickwall' filtering to block alias and other spurious signals above 20kHz. The player is a third generation design, making extensive use of large scale integrated circuits and featuring much simplified construction compared with earlier players. Output was a standard 2V from RCA phono sockets, and the deck was considered to be both easy and straightforward to use.

LAB REPORT

An almost perfect response was measured up to 10kHz, beyond which a small rolloff occurred. The 20kHz points were −0.9dB and −1.2dB for the left and right hand channels respectively, while channel balance was held to within 0.27dB at 1kHz. Very good channel separation was observed at this and lower frequencies, but it had typically fallen from 100dB to a still satisfactory 68.2dB by 20kHz. The time delay present between the channels as a result of the shared convertor gave a maximum phase shift of 81.7° by 20kHz.

Total harmonic distortion was very low at low frequencies, reaching −96.6dB at 20Hz, an amazing 0.0015%. Some deterioration was observed at 1kHz, and a degree of distortion imbalance was also noted between channels. A respectable −82dB was established for downband products by 20kHz, and equally decent results were obtained on the two-tone high frequency intermodulation tests. At reducing signal modulation levels, the performance showed well ordered consistency, with a good result for step error at −90dB, indicating a resolution of some 15.7 bits.

Track access times were fast, but the error correction was not up to scratch. The machine was very happy on gap errors up to 900μm, but could not cope with dots or surface blemishes greater than 300μm. Quite small specks of dust could give trouble here. Signal-to-noise ratios were average at −90dB (CCIR ARM weighted, 1kHz reference, without de-emphasis), which is still very good by normal amplifier standards, even though these are usually measured to the IHF 0.5V reference level, 12dB lower than the 2V CD output. The 667 in fact produced 1.9V from a 1kohm source, which is slightly below average. The rejection of spuriae was more than satisfactory, it did pass the simulated fingerprint error test, and showed no clipping on the white noise peak level signal.

SOUND QUALITY

On one semi-damaged record, some clicks were heard. But otherwise good results were obtained — in fact significantly above average if taken overall. Midrange sounds were reproduced with a natural balance, portrayed with fine perspectives and a good measure of depth and space. The bass was a little 'softened', while the treble was inconspicuous; in the CD context, this is a good result. Central images could have been more sharply focused with more detail, but in truth there was little to criticise.

CONCLUSION

The 667 makes no particular claims for exceptional value, and our sample was marred by poorer than average performance on the error dot test. Nevertheless it sounded good, and can be recommended provided that the error test result was not typical.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.25dB	0.27dB	0.58dB
Stereo separation	−101dB	−105.0dB	−68.2dB
Channel phase difference	0°	5°	87°
Total harmonic distortion, 0dB	−96.6dB	−89.5dB	−81.7dB
Total harmonic distortion, −10dB	—	−89.5dB	—
Total harmonic distortion, −60dB	—	−36.5dB	—
Total harmonic distortion, −80dB	—	−17.2dB	—
Intermodulation, 19kHz/20kHz, 0dB	−87.7dB		
Intermodulation, 19kHz/20kHz, −10dB	−83.6dB		
Frequency response, left channel	+0.07dB, −0.87dB		
Frequency response, right channel	+0.10dB, −1.19dB		
Signal-to-noise, 20Hz-20kHz unweighted	−96dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−90dB		
Output level, 0dB, left/right	1.9V		
Output impedance	1kohms		
De-emphasis	correct		
Track access time	2.0secs		
Error correction capability	>900μm gap, >300μm dot		
Mechanical noise	low		
Spuriae up to 100kHz	−68.7dB		
Resolution at −90dB	left +3.25dB, right +1.80dB		
Headphone socket	no		
Dimensions (w×d×h)	42×28×7cm		
Estimated typical purchase price	£299		

For graph references see issue No 45

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PROTON

Sole UK Distributor: Ventura Leisure, The Broadway, Old Amersham, Bucks. Tel: 0923 37148

SONY CDP35

SONY UK LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.
TEL: STAINES 61688



This is Sony's least costly player to date, entering the competitive lists at £200 — a far cry from the £2,000 asked for the flagship *702/552* combination! The *CDP35* is a midi-sized drawer-loading machine whose lineage derives from the original Sony *CDP101* best seller, which cost £500 not so very long ago (1983). Like the *'101*, the *'35* is a 16 bit linear machine with a single Sony D/A convertor time-shared between the left and right audio channels, and this is followed by high-slope analogue 'brickwall' filtering. In point of fact, the *101* had remote control and offered various luxury features including a headphone socket, but there was no programming facility at that time.

The *CDP35* does include programming, for up to 16 tracks. The large display can simultaneously show track numbers, tracks in memory, and timings — both 'elapsed' and 'remaining'. Fast track-skip and audible music-cue buttons are provided, and individual tracks or track sets may be repeated.

Internally the *'35* has a simplified construction, with new generation miniature integrated chips: the bulk of the player electronics, digital processing and signal are all present on a single printed circuit board. A new mass-production transport with effective anti-vibration suspension is used.

No remote control or headphone facilities are provided, but this player does have Sony's peculiar 'shuffle play' system, allowing the user to pre-programme the tracks in random order — different every time you use the facility. I suppose this might add interest for those who don't have many discs yet, but it is clearly pretty useless for the classical music buff!

LAB REPORT

The impulse response was absolute phase, non-inverting, and demonstrated the overshoot and attendant ringing typical of the 'brickwall' filter employed. The frequency response was uniform enough, though with mild shifts — a hint of bass lift, and a trace of ripple at high frequencies. The normal 20kHz points measured 0.38dB down, a small loss indeed.

Channel balance was excellent, and results for channel separation were also respectable, still better than 80dB at 20kHz. The small time delay between channels gave rise to the usual interchannel phase shift amounting to 82° by 20kHz, which is only really of consequence for mono operation when some loss will be experienced.

Low and mid frequency total harmonic distortion averaged −90dB (0.003%), with 0.1% at 20kHz, though some difference in readings between channels was noted at both 1kHz and 20kHz. Good results were obtained at lower modulation levels; for example, −48dB at the −60dB level, while the step error at −90dB was typically +4dB. At −80dB the distortion was dominated by digital noise at around −24dB, indicating a good resolution of 15.5 bits.

Track access was rapid, and the machine demonstrated very good error correction abilities coupled with fine resistance to shock and vibration. Signal-to-noise ratios were about average for CD — very good in practice — and spurious signals above 20kHz were well rejected, by some 100dB or more. The output level was slightly high at 2.1 Volts, but was fed from a rather high 1.6kohms source impedance — in A/B comparisons watch out unless the input impedance of the test amplifier is 50kohms or more!

SOUND QUALITY

Scoring a little below average, this is a fine result for the price. Vocal lines sounded a touch 'hollow' and 'enclosed', and while the treble did not intrude, there was a hint of 'zingy' emphasis on sibilant sounds. The sound was solid and powerful through the bass and midrange — something of a Sony hallmark — and the general level of clarity and detail was fine. However, depth and ambience effects were subdued, and the stereo presentation seemed 'closer' than usual.

The upper mid was a touch 'thinner' than our expectations for tonal neutrality.

CONCLUSION

On auditioning a second production sample of the *'35*, a small improvement in sound quality was noted, sufficient to tip the balance in favour of recommendation.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.06dB	0.04dB	0.02dB
Stereo separation	−101.7dB	−94.2dB	−84.0dB*
Channel phase difference	0°	5°	82°
Total harmonic distortion, 0dB	−88.8dB	−89.1dB	−77.5dB‡
Total harmonic distortion, −10dB	—	−87.6dB	—
Total harmonic distortion, −60dB	—	−48.6dB	—
Total harmonic distortion, −80dB	—	−23.8dB	—
Intermodulation, 19kHz/20kHz, 0dB			−91.5dB§
Intermodulation, 19kHz/20kHz, −10dB			−91.7dB§
Frequency response, left channel			+0.16dB, −0.37dB
Frequency response, right channel			+0.17dB, −0.38dB
Signal-to-noise, 20Hz-20kHz unweighted			−96dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−90dB
Output level, 0dB, left/right			2.1V
Output impedance			1.6kohms
De-emphasis			correct
Track access time			2.5 secs
Error correction capability			>900μm gap, >800μm dot
Mechanical noise			very low
Spuriae up to 100kHz			−102.3dB
Resolution at −90dB			left +4.03dB, right +3.53dB
Headphone socket			no
Dimensions (w×d×h)			35.5×28×7.5cm
Estimated typical purchase price			£200

**Left channel −97.3dB, −94.2dB, −81.4dB. ‡Left channel −88.8dB, −96.9dB, −83.7dB. §Left channel −77.7dB, −88.8dB*

For graph references see issue No 45

RECOMMENDED

SONY CD-P102/103

SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.
TEL: STAINES 61688



A more compact version of the *'302*, the *'102* is the replacement for the long-established *CDP101*, and is itself being replaced by the *'103* as we go to press. The original test results for the *'102* have been retained for the 1986 edition, though listening tests have been carried out on a *'103* sample, and the results have been incorporated in the text. This model is provided with a good infra red remote control, which includes the numeric keyboard that is missing from the machine itself. This adds index location but does not offer random track programming; I am uncertain how much importance to attach to the omission of this function since I cannot recall actually ever using it myself except for testing!

A fluorescent digital display shows track totals and track played, as well as index numbers and timings, while via an auxiliary button elapsed and remaining time may also be displayed. Repeat 'all' and 'A-B' functions are included. The usual precise Sony transport controls are located on a touch pad array, with a positive snap action feel.

This is a drawer loading machine and the finish is the usual satin grey-black. No headphone socket is provided, while the rear panel output is via fixed level nickel plated phonos. Additional connectors are provided for remote control via a matching stack system, and for a subcode data output. A spare switched AC outlet is also present.

The high speed optical transport is fitted together with the 'unilinear' converter. This is a twice oversampled circuit with low ripple 96th order digital filtering followed by a time shared 16 bit digital to analogue convertor plus LC analogue filtering.

LAB REPORT

Frequency responses were extremely flat, devoid of emphasis or ripple. Channel balance was held to a very close tolerance, while channel separation measured well over the whole range, reaching a high 110dB at low frequencies; 91dB was still achieved at 20kHz. Interchannel phase difference was mild at a maximum of 37° 20kHz, amounting to 5μS or so, well below audible thresholds.

Noise and distortion were very low. Even at 20kHz full level, downband noise was a remarkable 0.0015%, with 0.001% at 1kHz. Good linearity results were maintained at −80dB. The low distortion obtained at reducing modulation levels, together with the error at −90dB, indicated a resolution of a little better than 15½ bits, a good result.

For 19/20kHz intermodulation tones the results were particularly good at −100dB and −91dB for the two test levels of 0dB and −10dB. The old *'101* recorded −90dB for the peak level in the 1984 edition. The spectrum analysis for the −10dB intermodulation was beautifully clear in the audible range, while the higher order components were satisfactorily rejected at −63dB.

Output was conveniently close to the standard 2V from a moderate source impedance of 430ohms. Little deviation from the prescribed de-emphasis characteristic was observed, and track access times were almost too quick to sensibly assess — estimated at 1.8 seconds. In fact on skipping to adjacent tracks, the deck is almost instantaneous.

A top-flight error correction ability was measured and mechanical noise levels were mild. Signal to noise ratios were well up to standard, eg: −92.5dB CCIR ARM (1kHz) no emphasis.

SOUND QUALITY

Sony have achieved a logical progression of quality versus price. The *'102* falls below the *'302* and yet it comfortably achieves a good standard. In addition to the almost taken-for-granted 'CD qualities', the *'102* offered better sound than the *'101* by virtue of its sweeter mid and a more transparent and detailed top end.

Compared with the best, there was some overall softening of definition in the bass and mid register, with a touch of 'glass' also apparent in the treble. The auditioned sample of the *'103* showed a significant improvement in sound quality over its predecessors, fully maintaining the competitiveness of this model.

CONCLUSION/UPDATE

Good value at £400 inclusive of remote control, the *'102* is a solid performer whose continued competitiveness has been assured by the recent upgrading to the *'103* model. Not quite Best Buy material, it has nonetheless done well enough to secure a firm recommendation.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.16dB	0.16dB	0.05dB
Stereo separation	−110dB	−92dB	−91dB
Channel phase difference	0°	1°	37°
Total harmonic distortion, 0dB	−100dB	−100dB	−96dB
Total harmonic distortion, −10dB	—	−88dB	—
Total harmonic distortion, −60dB	—	−52dB	—
Total harmonic distortion, −80dB	—	−24dB	—
Intermodulation, 19kHz/20kHz, 0dB	−100dB		
Intermodulation, 19kHz/20kHz, −10dB	−91dB		
Frequency response, left channel	+0dB, −0dB		
Frequency response, right channel	+0.15dB, −0dB		
Signal-to-noise, 20Hz-20kHz unweighted	−99.5dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−92.5dB		
Output level, 0dB, left/right	1.934V/1.975V		
Output impedance	431ohms		
De-emphasis	correct		
Track access time	2.4secs		
Error correction capability	>900μm gap, >800μm dot		
Mechanical noise	very low		
Spuriae up to 100kHz	−102dB		
Resolution at −90dB	+1.88dB		
Headphone socket	no		
Dimensions (w×d×h)	33.5x33.5x8cm		
Estimated typical purchase price	£400		

REASSESSED

For graph references see issue No 45

BEST BUY

TECHNICS SLP100

PANASONIC (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS.
TEL: (0753) 34522



Technics have completely redesigned their CD player range of 1986, in the case of the *'100* series from the ground up. This has certainly been a successful project, and has been accompanied by a considerable reduction in price. The laser transports now use high speed linear motors with a low mechanical noise level, while the electronics have also been improved, and now use a double oversampled system with double precision filters in the digital domain.

Passband ripple has been reduced to an error of hundredths rather than tenths of a dB, as the swept frequency responses confirmed. An intriguing detail concerns the support for the laser focus system. To reduce ineretia the lens is suspended on a frame of four wires, providing a friction free system for the dynamic focus.

The *SLP 100* has a large fluorescent display which can show the programming of up to 20 tracks in an illuminated graphic. It can also simultaneously display the track numbers, index points and disc timings, 'elapsed' and 'remaining'. 'Auto space' gives a three second pause between tracks, and the repeat function covers the programmed A to B section in addition to the other usual modes. A subcode output is provided for future CD applications on the rear panel and the technical performance is similar to the *SLP300* and the *'500*.

SOUND QUALITY

Fully auditioned, the *'100* showed a clear resemblance to the more expensive models in the series, but like their previous generation, Technics have managed to engineer a subtle grading of sound quality according to price. The *'100* performed very well in its price category, scoring firmly in the 'good' class.

Essentially neutral, this player provided a solid stable sound, with fine stereo focus, consistent perspectives, and a pleasing measure of depth and ambience. Compared with top class players, there was a mild impairment of fine detail, a degree of imprecision in the bass, while the treble was innocuous.

CONCLUSION

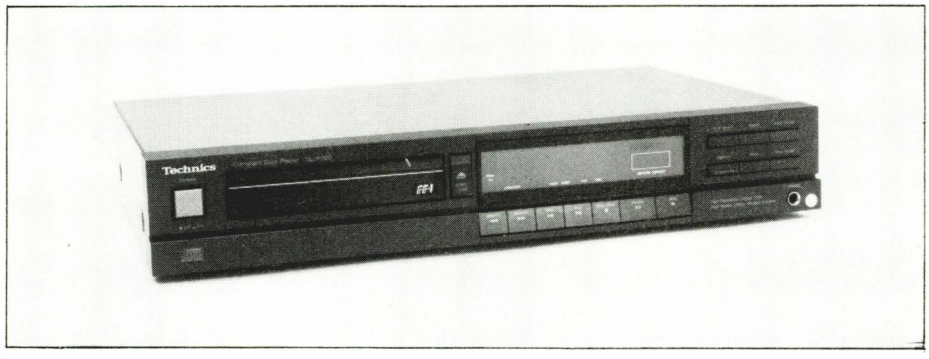
The *SLP 100* has done well in all respects, both in the laboratory and under auditioning. Despite a price in the budget category, its performance approaches that of well rated, more expensive machines. It is a delight to operate, and so merits a Best Buy rating.

For graph references see issue No 45

BEST BUY

TECHNICS SLP300

PANASONIC (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS.
TEL: (0753) 34522



In many respects the *SLP300* has more in common with the *'500* (see full review) than the *SLP 100*, sporting for example, a fixed level headphone socket and full remote control. The latter is neat, covers all functions, and has the added convenience of a ten button numeric keypad for rapid track entry. Other buttons control programming for up to 20 selections, A to B and other repeat modes, plus indexing, track skip, and audible music search. On programmable music scan the first few seconds of each selection is played to aid programming choice. The comprehensive control panel includes a graphic display showing the programmed tracks, index and track numbers and times — elapsed, track and remaining. The control keys are angled for easy operation.

Technically the *'300* is a 16 bit twice oversampled machine, with digital and analogue filtering, phase corrected between channels. A subcode output is provided in addition to the normal audio terminals.

SOUND QUALITY

Ranked very close to the *SLP 500*, the *'300* was distinguished by a sense of control and neutrality. Some listeners might find it less exciting than other designs, but we appreciated its lack of falseness or exaggeration.

Both bass and treble registers were well above average, while the mid neutrality and tonal balance were highly rated. Stereo images were well focused, and the sound stages were wide, showing a good measure of depth and ambience.

Compared with expensive references, the *SLP 300* showed a mild dulling of transients and a touch of dynamic compression, to some degree part of its controlled and restrained character. In this sense, the programme dominates, rather than the player.

CONCLUSION

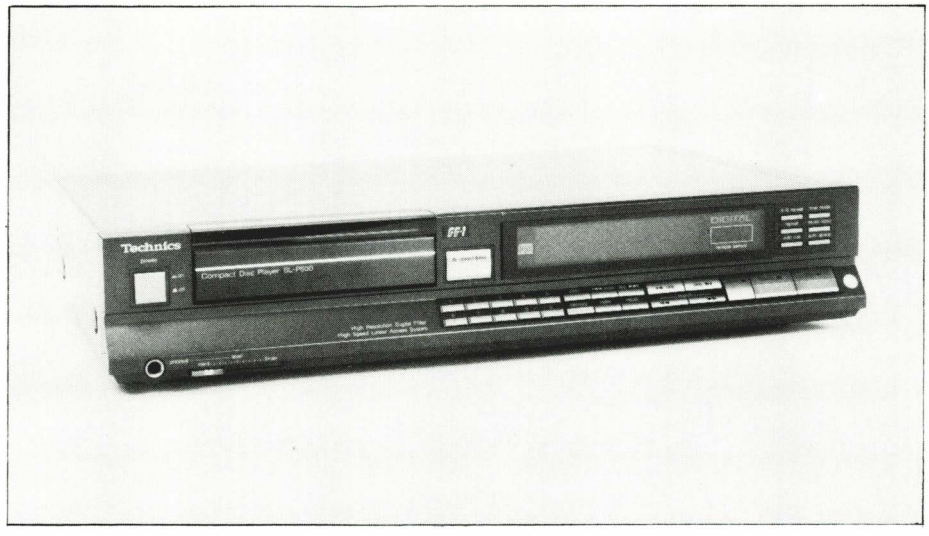
The *SLP 300* proved to be a strong performer, achieving high technical and sonic standards. It was also well finished, convenient to operate, and well equipped. A full range of facilities and features are included, yet the price is highly competitive, logically resulting in a Best Buy rating.

For graph references see issue No 45

RECOMMENDED

TECHNICS SLP500

PANASONIC UK LTD, 300-318 BATH ROAD, SLOUGH, BERKS SL1 6JB.
TEL: SLOUGH 34522



Technics have revamped their entire range of CD players for 1986. The line is headed by the remote control *SLP500*, priced at £389 which offers the specification and facilities of players around the £500 level, and looks more competitive than its predecessors. This full width front-loader has remote controllable volume, and a headphone socket with its own level control. Superbly finished in the Technics style, the main control panel is tilted to aid readability and improve ergonomics. A full manual keyboard speeds track programming up to a maximum of 20. Other features include index location, two speed audible music cueing, skip track, timer start, and a repeat function which can operate over a whole section or a selected a-to-b period of any length — even as short as one note!

The music search facility enables instant start on a given track regardless of the original disc programming, and spaces can be inserted between tracks, if so desired. A generous multi-function fluorescent display includes a chart indicating up to 20 the available tracks and whether they are programmed, the track number that is playing, index code and time. The latter can be total, elapsed, remaining, or single track. Nothing seems to have been omitted here! Both fixed and variable level outputs are available, *via* standard RCA phono type sockets.

Technically Technics have moved forward; the *SLP500* employs double oversampling with a 16 bit linear D/A convertor and digital filtering. Some analogue filtering clears the spuriae from the output, but a good impulse response has been preserved.

LAB REPORT

The frequency response was very smooth, meeting +0.1, −0.2dB over the measured range right up to 20kHz. The upper bass was very slightly depressed and the mid-treble was very slightly elevated, an interesting trend but one which was subjectively virtually harmless. Channel balance was extremely good and channel separation met very high standards, exceeding 110dB at low frequencies. Corrected by a delay network, the interchannel phase difference was very low, rising to just 10° by 20kHz.

Fine results were obtained for harmonic distortion at full level, even at high frequencies. The *SLP500* performed well on the two-tone inter modulation tests, though it should be noted that the left channel was consistently around 5dB better than the right. Given the low level distortion and the mild step error at −90dB, the overall resolution was estimated at 15.8 bits, close to the limit.

The machine produced a standard 2.05V output from a moderate 600ohm impedance. The de-emphasis characteristic was fine, and the new transport offered a very fast access time to a given track. Mechanical noise levels were very low, but the error correction on this sample was a bit off — though well within spec, Technics could do better, as the *SLP11* shows. The signal-to-noise ratios were very good, and spurious high frequency signals were excellently rejected. No problems were encountered on the error 'fingerprint' test or the white noise clipping tests.

SOUND QUALITY

No error problems were heard on tests, and the '500 provided a good sound quality — much better than its predecessors. All vital areas were rated well: good bass definition and powerful extension, focused, transparent treble, and a pleasing midrange, tonally well balanced with a good measure of space and depth.

Dynamics were slightly 'dead' and 'compressed', while the overall sound could have shown a touch more 'air' and 'sparkle'. Overall, the *SLP500* seemed tidy and consistent, well balanced, and well focused.

CONCLUSION

This new generation player has achieved a comfortable recommendation on grounds of its value, good sound quality, and generally good lab performance (this excepting the error correction which is likely to have been a sample defect). It is extremely well equipped right down to the power volume control, and is a thoroughly competitive performer.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.17dB	0.11dB	0.20dB
Stereo separation	−114.6dB	−107.5dB	−99.1dB*
Channel phase difference	0°	0°	10°
Total harmonic distortion, 0dB	−96.4dB	−93.1dB	−84.3dB
Total harmonic distortion, −10dB	—	−85.0dB‡	
Total harmonic distortion, −60dB	—	−44.4dB	—
Total harmonic distortion, −80dB	—	−25.4dB‡	
Intermodulation, 19kHz/20kHz, 0dB			−86.1dB
Intermodulation, 19kHz/20kHz, −10dB			−81.1dB
Frequency response, left channel			+0dB, −0.28dB
Frequency response, right channel			+0dB, −0.19dB
Signal-to-noise, 20Hz-20kHz unweighted			−100dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−92dB
Output level, 0dB, left/right			2.05V
Output impedance			600ohms
De-emphasis			correct
Track access time			1.5secs
Error correction capability			>600μm gap, >500μm dot
Mechanical noise			very low
Spuriae up to 100kHz			left −104.2dB, right −101.9dB
Resolution at −90dB			left −2.13dB, right −2.19dB
Headphone socket			yes (variable output)
Dimensions (w×d×h)			43×28×8.5cm
Estimated typical purchase price			£389

**Left channel −114.6dB, −101.4dB, −84.3dB. ‡Left channel −89.0dB, −21.7dB.*

For graph references see issue No 45



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TRIO DP 1000

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Trio are relatively late entrants into the CD market, but have kicked off in 1986 with a well equipped machine at the popular £300 price level. Much of its potential may be gleaned from a survey of the cleanly styled front panel, but before examining the details it is worth noting the headphone socket is complete with volume control, and that the machine is supplied with a comprehensive remote control handset with ten-key numeric entry, plus all the other facilities.

The front panel has a fine fluorescent display, indicating mode ('play', 'pause' etc.), track numbers, total tracks, index numbers and timings (elapsed, remaining and track). The usual additional features include track skip, audible music search, cue, and programming for up to 16 tracks in any order. Programming is aided by the ten numbered keys, and the various repeat modes include selected A to B passage repeat.

Physically a full width front-loader, the *DP1000* uses a 16 bit linear system, without oversampling and sharing a single DAC between the two channels. Monolithic 'brickwall' filters follow the de-glitch and de-emphasis stages. In these respects the internal technology is quite conventional; operationally the machine was very easy to use and was liked on test.

Lab Report

The impulse response showed that the deck was non-inverting, with a response characteristic of the high slope filter — some overshoot and extended ringing. Frequency response was most uniform, very well matched between the channels and with variations held to ±0.1dB from 20Hz to 18kHz; a slight rolloff occurred to 20kHz, averaging −0.45dB between the two channels.

Channel separation was very good, if not to the highest standards, with 90dB a typical result, while the interchannel phase difference reached 84° by 20kHz, the usual result for a linear, time-shared decoder. Overall distortion results were good, particularly at low and mid frequencies where the measurements approached −100dB, or 0.001%. The inband distortion accompanying a 20kHz full level fundamental was a quite good −83dB, and this is reinforced by the solid results obtained for the two-tone high frequency intermodulation test; −88dB of difference tone was noted with −10dB modulation. The distortion also proved satisfactory at reducing modulation levels. Taking into account the mild 2.7dB error at −90dB, this indicates a good 15.7 bit resolution.

The output met the standard at 2V from a 320ohm source, mechanical noise was very low, while error correction was very good. All the test bands were handled with confidence. Signal-to-noise ratios were good, though the figures are a few dB below the maximum possible for the system. However, spurious responses were handled well, with ultrasonic rejections typically 100dB or better.

Sound Quality

The *DP1000* fitted squarely into the average sound quality group — at the top of this category, which is quite good for the money. It sounded pleasant, with a generally good tonal balance and a powerful, dynamic bass. Mid vocals showed a mild 'thinning' and 'lightening' of texture, but not seriously so. A fair measure of space and ambience was reproduced through the midrange.

The treble was not particularly precise, showing a 'hazy' effect with a touch of sibilance, but was neither aggressive nor too 'obvious'. Stereo images were reproduced with good focus.

Conclusion

The sound quality was not outstanding, though it met a decent standard. When the overall performance and build are taken into consideration, with the wide range of features, the easy operation, and the versatile remote control, the value equation strengthens in Trio's favour, allowing formal recommendation.

Test Results

	20Hz	1kHz	20kHz
Channel balance	0.03dB	0.02dB	0.29dB
Stereo separation	−88.0dB	−93.1dB	−79.7dB*
Channel phase difference	0°	5°	84°
Total harmonic distortion, 0dB	−101.0dB	−96.6dB	−83.0dB
Total harmonic distortion, −10dB	—	−86.3dB	—
Total harmonic distortion, −60dB	—	−45.0dB	—
Total harmonic distortion, −80dB	—	−25.2dB	—
Intermodulation, 19kHz/20kHz, 0dB			−84.2dB
Intermodulation, 19kHz/20kHz, −10dB			−88.0dB
Frequency response, left channel			+0.10dB, −0.61dB
Frequency response, right channel			+0.11dB, −0.33dB
Signal-to-noise, 20Hz-20kHz unweighted			−94dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−87dB
Output level, 0dB, left/right			2.0V
Output impedance			320ohms
De-emphasis			correct
Track access time			5.5secs
Error correction capability			>900μm gap, >800μm dot
Mechanical noise			very low
Spuriae up to 100kHz			−95.5dB
Resolution at −90dB			left −2.90dB, right −2.34dB
Headphone socket			yes (variable output)
Dimensions (w×d×h)			44x31x8cm
Estimated typical purchase price			£299

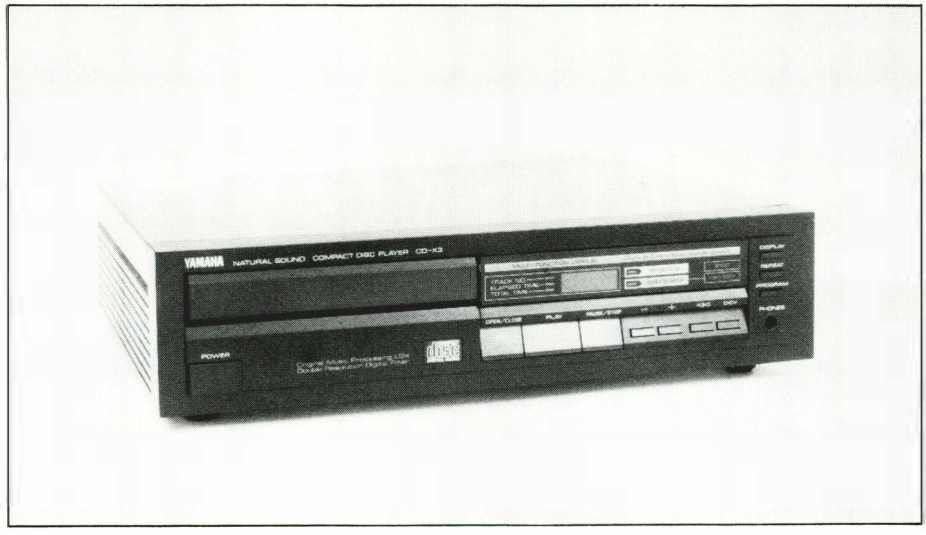
**Left channel −91.0dB*

For graph references see issue No 45

BEST BUY

YAMAHA CDX3 (CD400)

YAMAHA ELECTRONICS UK, 200 RICKMANSWORTH ROAD, WATFORD, HERTS, WD1 7JS.
TEL: (0923) 33160



Yamaha have achieved notable success with their *CX* series, both with their own brand machines and as original equipment manufacturers for brands. Having invested early in high volume CD player production, they are continuing to improve the series.

Our review *CDX 3* is closely paralleled by a range of decks of very similar performance, but of varying size and features. The *CD400*, for example, is the full width version, and the *CDX 3* the midi-sized machine, while the *CD500* adds remote control plus ten-key numeric selection to the *'400*'s facilities. The *'700* has an improved display, with 12-track programming and a numeric pad on the remote control, the *'1000* sports a heavier vibration-damped transport, and the top-of-the-line *CD-2000* adds a remote volume control, separated digital filters of improved precision, plus a subcode output terminal.

All have headphone sockets, though those on the *CDX 3* and *400* lack a level control; a suitable choice of headphone will have to be made to ensure good volume compatibility. Features include a four digit LED display, which is shared among track number, indexing and timing functions. Up to eight tracks can be programmed in random order, with repeat available for the whole or the programmed section of the disc. In 'timer play' mode the deck will enter play or power up with an external timer, or if synchronised with a recorder. Fast track access and multi level audible music scan are also available.

Technically this player uses a twice oversampled system, incorporating double resolution digital filtering and a time-shared 16 bit linear D/A convertor. Third order analogue filtering follows, and other unneccessary stages have been omitted, so the output inverts absolute phase.

LAB REPORT

Earlier Yamaha players showed a rise in extreme treble response, but this has now been tamed, at the expense of a minor 0.4dB dip at 14kHz. Channel matching was very good, while channel separation reached a similar standard, though with some imbalance between the channels. Typical of the Yamaha system, the interchannel phase difference was held to a moderate value, specifically a maximum of 40° at 20kHz.

Harmonic distortions were quite low at high signal levels, showing just a hint of mild compression. This good performance was held to 20kHz, where the downband noise was 82.6dB down. Fine results were obtained at lower signal levels; for example, distortion was still under 0.4% at signal levels 60dB below peak. The level error at −90dB was well under 1dB, results suggesting a resolution towards 15.9 bits, virtually to the full 16 bit specification.

No problems were encountered with the error correction, which showed a significant improvement over previous Yamaha players. Good results were obtained for the high frequency intermodulation tests. Like other Yamaha players, the output was slightly low, and this may be mildly exaggerated in some circumstances by the higher than usual output impedance of 1kohms. Spurious rejection was less than usual, but should not pose any problems. Very good signal-to-noise ratios were measured; for example, 96dB (CCIR ARM 1kHz) with pre-emphasis.

SOUND QUALITY

Here is a clear instance where general improvements to design and performance have resulted in an improved sound quality, classified in the 'good' class. Recognisably 'Yamaha', this player showed improved control and precision, better definition, and greater discrimination in complex passages. Bass was clean, powerful and dynamic, while the mid was basically quite neutral, with decent depth and ambience. A trace of 'grit' and 'edge' was noted in the upper treble, though in other respects treble sound quality was pretty good. Stereo focus was precise, with a good impression of stage width.

CONCLUSION

With both an improved sound and better technical performance (in particular error correction), the new Yamaha *CX* series has done very well. Since last year the price has also dropped considerably, so another Best Buy rating is appropriate for the *CDX3* and its many blood relatives.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.06dB	0.05dB	0.26dB
Stereo separation	−103.7dB	−100.0dB	−78.0dB*
Channel phase difference	0°	2°	42°
Total harmonic distortion, 0dB	−101.7dB	−84.0dB‡	−82.6dB
Total harmonic distortion, −10dB	—	−83.2dB	—
Total harmonic distortion, −60dB	—	−50.0dB	—
Total harmonic distortion, −80dB	—	−25.9dB	—
Intermodulation, 19kHz/20kHz, 0dB			−80.8dB
Intermodulation, 19kHz/20kHz, −10dB			−87.5dB
Frequency response, left channel			+0.01dB, −0.67dB
Frequency response, right channel			+0.02dB, −0.47dB
Signal-to-noise, 20Hz-20kHz unweighted			−97dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−93dB
Output level, 0dB, left/right			1.9V
Output impedance			1kohms
De-emphasis			correct
Track access time			4.0secs
Error correction capability			>900μm gap, >800μm dot
Mechanical noise			fairly low
Spuriae up to 100kHz			−37.7dB
Resolution at −90dB			left +0.15dB, right +0.63dB
Headphone socket			yes
Dimensions (w×d×h)			34×29.5×9cm
Estimated typical purchase price			£229

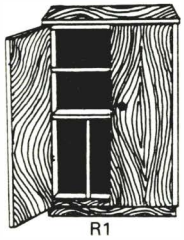
**Left channel −96.1dB, −91.8dB, −78.0dB. ‡Left channel −86.7dB.*

For graph references see issue No 45

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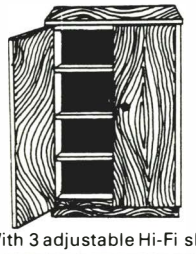
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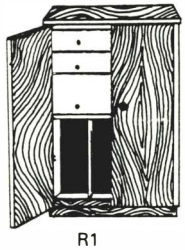
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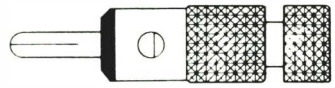
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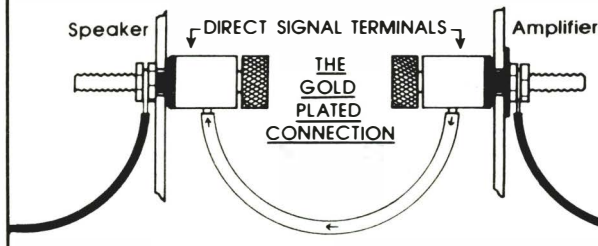
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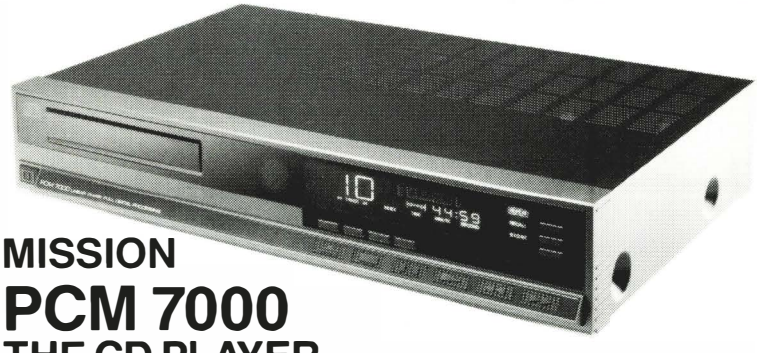
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CASSETTE DECKS

The Compact Cassette is very much hi-fi's bastard medium, at least on ethical grounds. But there is no disputing its success, its convenience, or the high standards of sound quality that can be achieved nowadays — at its best, fully comparable with CD or LP disc. The unique feature of the medium is of course the ability to record, but Musicassettes are now a major source of pre-recorded music, outselling LPs. Versatility and compactness are the twin pillars of the cassette's success. All audio systems have begun in the home, but the cassette has done for the music industry what the transistor did for radio, providing 'go anywhere' flexibility in portables, personals and in-car variations.

Happy enough to sell ever increasing quantities of pre-recorded tapes for new and old applications, the music industry still cannot come to terms with the fact that many people use their cassette machines to record friends' LPs on blank tape, or to record music programmes from the radio, so by-passing the significant copyright element in the price of pre-recorded material. The appearance of 'dubbing decks' containing twin mechanisms for copying tape-to-tape (in some instances at high speed), or for making two simultaneous copies, was greeted by hysteria which extended to the High Court, as paranoid record company representatives envisioned large scale tape piracy and counterfeiting spreading to suburbia. Yet the dubbing deck only provides a convenient package which extends to musicassettes the existing capability to 'steal' from LP, CD or radio.

Unfortunately there is no easy way to prevent or compensate for individual 'piracy' without penalising the many people who justifiably make copies of LPs, CDs or musicassettes which they have already purchased. Certainly the record companies are as blameworthy as cassette deck manufacturers. The first 'pirate' LP's were of material which the companies had failed to release, bought by fans who had happily paid copyright fees on the artists' other releases. Furthermore, the historical sound quality of musicassettes has been so poor that cassette hi-fi users were driven by desperation into sourcing their own recordings.

REPLAY

While there are still plenty of grounds for criticism, nowadays the best musicassettes can give very respectable quality, so pre-recorded material certainly deserves to be taken seriously and replay-only performance must be considered a crucial element. Theoretically, pre-recorded cassettes could be as good or even better than those made on all but the very best domestic decks, as the equipment for mass duplication ought to be superior mechanically and electrically. However, in practice quality and quantity often conflict, and the profits are created by the latter. Nevertheless the end result is often good enough to show up limitations in even the very best cassette decks, so the ability to get the best from musicassettes is a valid assessment for a cassette deck.

The task involves a good quality tape transport mechanism and careful alignment of heads and electronics. Although international tape equalisation and noise reduction standards do exist, not all manufacturers are equally good at adhering to them. The result is that many decks perform less well on replay only than they do within the 'closed loop' of record/replay, and our reviews pay close attention to this.

RECORD/REPLAY

In some ways record/replay is easier than replay only, insofar as head alignment errors can cancel out and the equalisation of one can compensate for the other. However, any inherent transport problems are likely to be exaggerated, and there is now a premium on the quality of the record head, particularly if metal tape is likely to be used. To get a decent quality recording, a deck needs to be accurately aligned electronically for a sensible range of different tape types; some machines offer variable bias for 'fine tuning' to specific tapes for those prepared to take the trouble.

Ergonomics play a part in realising the full potential of a deck. Automatic tape type selection can help prevent a silly mistake from spoiling an important recording — and the sort of two-button interactive combination switching used on non-automatic budget decks could have been especially designed to mislead the unwary or hasty. Good quality metering set to the right sensitivity level can be a boon, though in time and with practice a cassette deck owner will probably gradually come to learn the 'right' level to get the most signal without compression on to a specific type of tape. A few practice runs to explore the limits of the deck and the right meter settings for favourite tape types will be most helpful.

TAPE TYPES

A full comparative analysis of different brands and types of tape will be found in *Hi-Fi Choice: Cassette Decks and Tapes*, but is beyond the scope of this compendium edition. Though there are three formal groups of tapes, Types I, II and IV, there are subgroups within each group which further confuse. In brief, the best advice is to find a tape in each group which suits the set-up of the recorder, and then stick to it. The very cheap ferric tapes are not hi-fi quality, so it is best to choose a premium Type I ferric from a reputable brand for general use. A Type II chrome or pseudochrome will give a step up in quality, while Type IV metals can turn out to be the cat's whisker on some decks, but not work too convincingly on others.

FEATURES

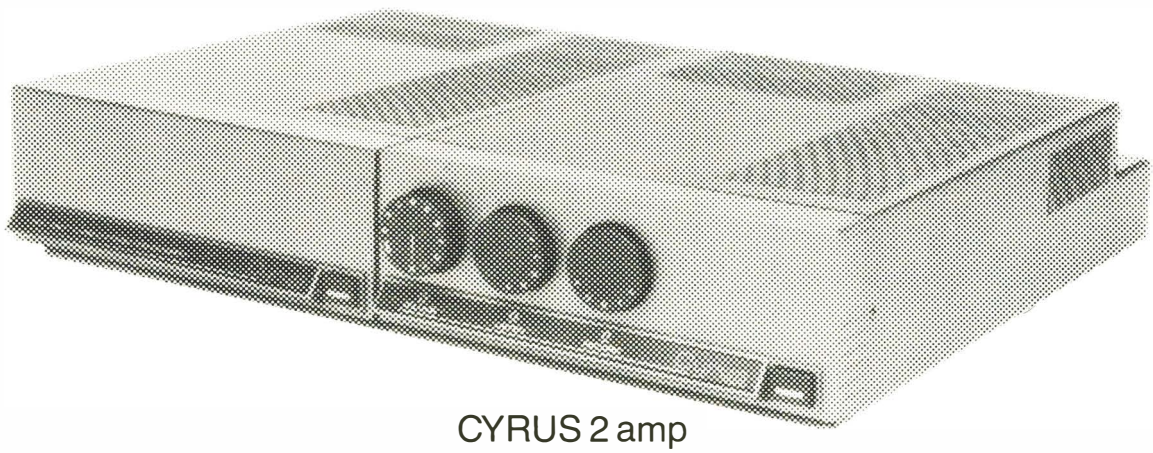
No other component fulfulls a button pusher's dream like a cassette deck. The bare essentials boil down to the transport controls, record level and metering, tape type selection (which can be automatic), and Dolby B noise reduction (necessary for musicassette replay but optional for record/replay).

A host of imaginative inessentials will either enhance the enjoyment or baffle the user, depending upon temperament. Microphone inputs are fast disappearing, but headphone sockets remain. Extra noise reduction may be Dolby C and dbx, with headroom extension from Dolby HX. Electronic logic control may supervise an almost silent transport system, giving potential for microprocessor controlled track search and programming systems, and may enable auto-reverse to extend play or record times. Bias 'tweaking' enhances tape matching, while replay EQ may be trimmed for optimun replay response on some machines. The manufacturer can choose to spend money on a better quality single transport, with a closed-loop capstan system perhaps, or slot in a second dubbing transport with all the attendant extra complexity.

Styling is clearly a matter of personal taste, but the whole gamut exists from the garish clash of multicoloured illuminated displays shouting 'buy me' off the shop shelf through to the deliberately understated or the daringly unconventional. Ergonomics vary from the crass and confusing to the subtle and effective, though take heart from the fact that a purchaser will soon learn to use his own particular deck, as he would learn to drive a new car. Having weighed up the pros and cons and studied our reviews, it's not a bad idea to audition one or two likely contenders, and a comparison with something quite exotic is a good way to establish a quality yardstick when trying to assess what level of cassette deck will give the desired performance.

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AIWA AD-R450

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This is Aiwa's least expensive auto-reverse deck, being in effect a simplified *AD-R550*. Although Aiwa have omitted some gadgets, the deck still has fast auto-reverse and the ability to record on reverse. Consequently the *R450* provides a full 90 minutes uninterrupted recording time from a C90 cassette, and same from a complete pre-recorded musicassette. Fast-reverse means that the machine doesn't attempt to play or record a cassette's leader tape — it reverses immediately upon 'seeing' it. Auto-start from an external timer is provided too.

Aiwa put the transport control buttons on a flat ledge at the front of the machine; though attractive, this layout does make the machine virtually unusable on high shelves and it also collects dust.

The deck retains automatic tape type sensing — a facility useful to the point of being vital in my opinion. It also has adjustable bias for fine tuning the performance of ferric and chrome tapes so they match properly, but the 'metal' bias setting remains fixed, unfortunately. Tape counter is mechanical and without a zero-stop. Both Dolby B and C noise reduction systems are fitted, but not HX Pro as on the *R550*.

Transport control buttons are large and linked in with logic. They were very easy to use and the machine in general worked smoothly and silently and felt well built.

Lab Report

Freedom from reverse azimuth error allowed the *R450* to give full treble output up to 10kHz from a replay test tape, in forward and reverse. Above 10kHz output falls away slowly, as the replay frequency response graph shows. Dolby B replay tracking was correct in both directions too. Pre-recorded musicassettes should not, therefore, sound dull and muffled on this deck, when played in either direction.

Speed was correct in both directions too, but replay-only speed stability deteriorated from very good forward (0.07% wow) to average in reverse (0.12% wow). Much the same effect occurred when recording, the transport exhibiting more low rate wow in reverse than when going forward, primarily at 2Hz and 6Hz. Generally though, flutter was low, as was modulation noise, and in essence this is a high quality transport.

Low noise and very low hum figures (especially at 100Hz and 150Hz) were measured in the replay amplifiers, enabling musicassettes to be played without interference from this source. Similarly, bias and record amp noise proved low so recordings will not suffer from machine-generated hiss. Chrome tape gave a low — 73dB hiss level with Dolby C in action, but Aiwa fix 0VU a bit low (−3dB below 200nWb/m) so chrome recordings made to 0VU will have about −70dB hiss with Dolby C, in practice.

Tape overload figures were, surprisingly, almost as good at 10kHz as those for the HX Pro-equipped *R550*. Frequency response for metal tape had rising treble (see graph), an effect emphasised by Dolby. Metal tapes like TDK MA and Sony *ES* will sound distinctly bright on this deck.

Bias adjustment was sufficient with ferric and chrome tapes to match the machine to awkward high performance tapes like Maxell *XL-IS* and BASF *CR-MII*, in addition to all other makes, so tape compatibility is excellent.

Sound Quality

Bright tonal balance with metal tape (TDK MA) emphasised, as usual, other small problems such as HF distortion and flutter, which combined to produce gritty high level treble, which became wearing after a while. Speed stability was fine for critical programme.

TDK SA gave very neutral tonal balance, with slightly 'fluffy' HF due to saturation; speed stability was again fine. There was enough bias adjustment range for BASF *CR-MII*, which was preferred for low hiss and excellent speed stability — even for critical organ program.

Ferric tape (TDK *AD*) gave little distortion and even tonal balance, with well differentiated treble. It was very enjoyable. The auto-reverse system proved extremely fast — less than a crochet beat I am told!

Only slight contamination by high-rate wow was discerned with musicassettes. Otherwise, tonal balance proved even and low level fine detail was retrieved with unusual effectiveness. Imaging was a bit one-dimensional but we still felt the machine made compelling listening.

Summary

The *AD-R450* is a gadget-free auto-reverse deck of excellent basic specification. In addition to its 'fast-reverse' and reverse recording, there are numerous other useful features, such as automatic tape-type sensing, plus fine bias tuning for perfect tape matching with ferrics and chromes — even the most awkward! There is no fine bias adjustment for metals though, which unfortunately didn't match too well on the review machine, sounding very bright.

Fidelity with pre-recorded musicassettes was fine in both directions of play. Recordings on ferric and chrome tape reached a high standard too, variable bias being a boon here. We felt this was an excellent machine.

Test Results

Replay of pre-recorded musicassettes		
Frequency response	24Hz-15.0kHz	very good
Speed accuracy	+0.2%	very good
Noise	−61dB	good
Record/replay using blank tape		
Frequency response, ferric	20Hz-14.0kHz	good
Frequency response, chrome	20Hz-15.0kHz	very good
Frequency response, metal	20Hz-16.0kHz	very good
Stereo separation	−45dB	average
Distortion	0.8%	good
Noise	−53dB	good
Speed variations	0.06%	good
Modulation noise	−40dB	good
Flutter energy (band level)	−35dB	very good
MOL, ferric, 315Hz/10kHz	+3.8dB/−6.0dB	good
MOL, chrome, 315Hz/10kHz	−1.0dB/−7.0dB	poor
MOL, metal, 315Hz/10kHz	−4.2dB/−1.5dB	very poor
Input/output performance		
Line in sensitivity/overload	50mV/>3V	
Mic input sensitivity/overload	−mV/−mV	
Output level	450mV	
Typical price inc VAT	£160	

For graph references see issue No 42

BEST BUY

AIWA ADR550

AIWA UK LTD, UNIT 2, DUKES ESTATE, WESTERN AVENUE, LONDON W3 0SY.
TEL: 01-993 1672



Aiwa's auto-reverse *AD-R550* has a black finish and possesses a colourful array of lights, legends and displays. It is distinguished by having Dolby HX-Pro headroom expansion in addition to the more usual Dolby B and C systems. HX-Pro is not a noise reduction system like Dolby B and C; instead it allows high frequencies to be recorded to higher maximum levels on tape, before overload occurs.

Tape types are automatically selected, which is a valuable feature. However, there's no manual over-ride so old metal tapes without sensing slots are incorrectly seen as chrome and cannot be recorded. A fine-tune bias control provides tape matching with ferric and chrome — always a very useful feature. As new tapes appear, the deck can be adjusted to suit them.

Tape position is indicated by a four-digit flourescent tape counter and a music search facility is included. Unfortunately, the tape counter reverts to zero when the machine is turned off and on again. The auto-reverse system can be set to allow once-only or continuous play or record of one side of the tape followed by the other.

Record level is adjusted with a horizontal stereo fader with a separate balance control above it. Meters are fluorescent bargraph types of −20dB to 8dB range and reasonable resolution. Tests showed they gave accurate readings of peak levels on transients.

A rear-lit cassette compartment allows the position of the tape to be seen easily. Our only reservation concerning styling was that it is necessary to operate the deck from above because the tape transport controls were situated on the protruding platform, which itself is given to collecting dust. The deck felt solidly built and operated quietly and smoothly.

LAB REPORT

Aiwa have set peak record level (0VU) to −3dB below Dolby, which is too low for modern tape and peak-read meters. This results in higher tape hiss but low distortion. Our test results bear this out, with hiss around −66dB and average distortion at 0.7%. Other tests showed that the deck is inherently no noisier than usual and that bias has been set sensibly to give balanced maximum output levels at middle and high frequencies. However, Dolby HX-Pro gave less treble improvement on this deck than it did on the *AD-F990*.

All record sensitivities were 1dB out using IEC Primary Reference Tapes. Ferric and metal settings could usefully have been better in this respect. Dolby affected frequency response badly at low levels with IEC-type ferric tapes, producing a curve humped at 300Hz and falling treble and bass either side. Low level musical passages will sound dull as a result. Results were much better with chrome and metal tapes, although slight treble lift will make high level program a bit bright. In spite of these observations though, all record/replay responses were considered good.

Replay frequency response, Dolby B tracking and speed accuracy were all well set, allowing this deck to give good fidelity with modern pre-recorded cassettes. Speed stability in the form of wow was good, but an equivalent level of −21dB (9% distortion) for flutter sidebands suggests audible muddle and was not impressive.

SOUND QUALITY

Metal tape gave a neutral tonal balance, apart from 'woofy' bass — probably caused by a subsonic peak on this deck. A degree of 'thinness' on saxophone and male voice was audible too. These effects were minor though. There was a sense of pitch 'diffusion' to sustained organ notes, due to low-rate speed variation (drift/wow). Additionally, some roughness was noticed due to flutter sidebands, which had an equivalent level of −21dB.

Using TDK *SA* chrome-bias tape, the *AD-R550* sounded 'thin' and 'cold'. Treble roughness and splash on sibilants was again detected — probably due to flutter distortion (9%). Diffuse pitch was also evident. Increasing bias usefully resulted in a warmer sound. Ferric tape again had a 'woofy' bass quality and sounded dull at normal bias. This robbed music of a sense of articulation. Again, decreasing bias improved matters.

Replay quality was bright, detailed and open. Few decks veered in this direction, so we were pleasantly surprised. Tonal balance was a bit artificially forward, but this did result in an excellent sense of attack when playing pre-recorded cassettes. Imagery was good too.

SUMMARY

As auto-reverse cassette decks go, the *AD-R550* has some substantial strengths. Dolby HX-Pro, variable bias for accurate tape matching and excellent replay performance combined to eclipse the performance of potential competitors.

TEST RESULTS

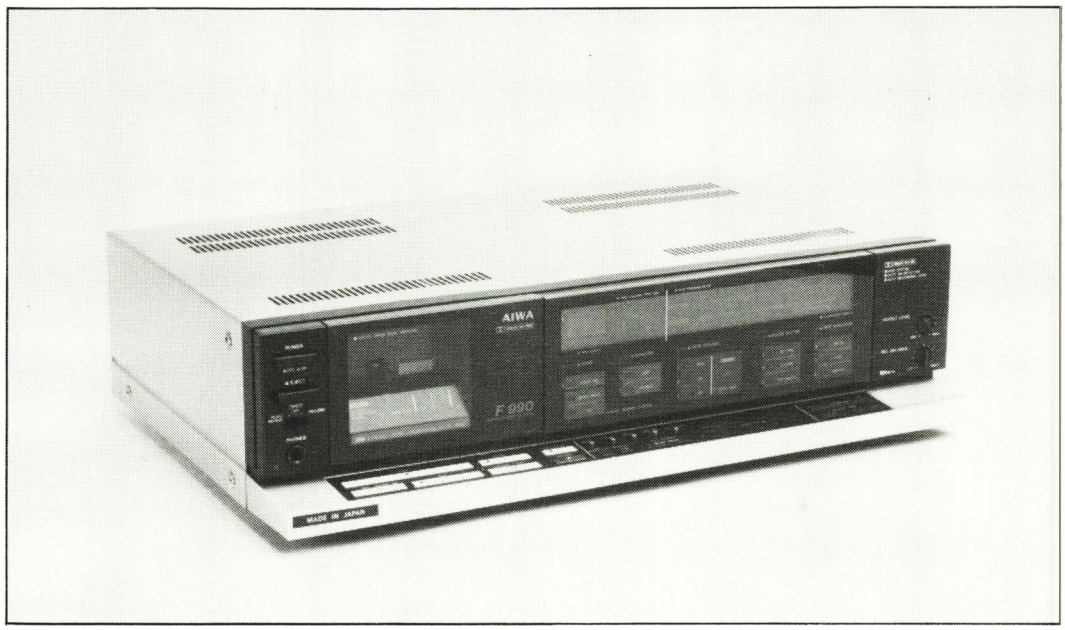
Replay of pre-recorded musicassettes		
Frequency response	20Hz-12kHz	good
Speed accuracy	+0.3%	very good
Record/replay using blank tape		
Frequency response, ferric	20Hz-15kHz	very good
Frequency response, chrome	20Hz-17kHz	very good
Frequency response, metal	20Hz-17kHz	very good
Stereo separation	−51dB	good
Distortion	0.76%	good
Tape hiss, ferric	−65dB	poor
Tape hiss, chrome	−66dB	average
Tape hiss, metal	−66dB	average
Speed variations (wow and flutter)	0.07%	good
Modulation noise	−39dB	average
Flutter energy (band level)	−24dB	average
MOL, ferric, 315Hz/10kHz	+4.5dB/−10dB	average
MOL, chrome, 315Hz/10kHz	+0.5dB/−7dB	average
MOL, metal, 315Hz/10kHz	+4.5dB/−0.5dB	average
Input/output performance		
Line in sensitivity/overload	50mV/—V	
Mic input sensitivity/overload	0.25mV/32mV	
Output level	380mV	
Typical price inc VAT	£199	

For graph references see issue No 42

BEST BUY

AIWA ADF990

AIWA UK LTD, UNIT 2, DUKES ESTATE, WESTERN AVENUE, LONDON W3 0SY.
TEL: 01-993 1672



Currently Aiwa's top-of-the-range model, the *ADF900* incorporates Dolby HX-Pro 'headroom expansion' as well as the usual B and C noise reduction systems. HX-Pro allows higher treble recording levels by dynamic variation of bias. In addition to this, the 990 has an automatic tape calibration system that records a short sequence of tones on to tape; the machine monitors these and makes a series of internal adjustments which allow it to give its best restuls with a wide variety of tape formulations.

Tape selection is automatic, catering for ferric, chrome and metal tape types. The auto tape matching system successfully accepted old metal tapes (without sensing slots) in the chrome position, giving perfect results. The adjustment range of this system is obviously very wide. Dolby selection is also automatic but this can be manually over-ridden.

Tape transport controls are positioned on a dust-collecting platform which protrudes from the bottom edge of the fascia panel. Associated logic allowed 'punch-in' recording from play mode and immediate fast reverse from record mode. Cue/review was also incorporated.

Record level is adjusted automatically but it is also possible to adjust the level manually using an electronically stepped attenuator which clicks (literally!) up, or down, in 2dB steps.

This is a stylish, well-built machine. It has an excellent tape counter which also displays time remaining on tape. Bright blue fluorescent record level meters have good resolution and tests showed that they accurately indicate transients and low and high frequency signals. The multiplicity of buttons and lights were a bit confusing at times, but Aiwa seem to have forgotten nothing on this flagship product.

Lab Report

Replay frequency response, Dolby B tracking head height and speed were all accurately set, guaranteeing good fidelity with pre-recorded cassettes.

Speed stability was excellent in all areas, except for the presence of 5Hz wow sidebands at −19dB. The ear/brain is very sensitive to wow at this frequency and it is the sort of thing that is audible on organ and piano in particular. Otherwise, little energy was lost into flutter, equivalent level measuring −31dB, or 3% distortion. This is far lower than most decks and results in improved clarity by reducing mush. Conventional distortion was otherwise extremely low at all frequencies, with an average value of just 0.6%.

Peak record level (0VU) has been set −3dB below Dolby flux, even though the meters accurately peak read. Our noise figures, being relative to 0VU, are therefore poor. Aiwa put advisory peak level legends on the record display though and if these are followed, noise levels will be no different from those of other good decks.

Due to DATA tape tuning and Dolby HX-Pro, maximum output level values in the mid-band and at high frequencies were very high. For example, the IEC I (ferric) Primary Reference Tape had +4dB extra treble headroom than is usual, with no loss in mid-band headroom. Record/replay frequency responses were extremely flat with all tape types, as the graphs show. Identical results were obtained with either Dolby B or C switched in, which is a very impressive result.

The *ADF990* had an exemplary measured performance, except for 5Hz wow with a sideband level of −19dB. This was one niggling blemish.

Sound Quality

On high level programme without sustained piano notes, it was difficult to tell the difference between the *ADF990* and Compact Disc, when using metal tape (TDK MA). The sound was generally clean and open, with excellent tonal balance. Some harshness, due to flutter sidebands, was occasionally detected. Sustained piano notes were heard to wobble too, due to 5Hz wow. In spite of these effects though, we had to be impressed by reproduction from this machine.

Type II 'chrome' tapes also gave good results, but sounded 'softer' than metal and treble compression was occasionally detected as softening 'top'. The sound was a bit less hard than that of metal and was liked.

Ferric tape sounded a bit brittle, like metal, and noise was higher, but performance was still excellent.

Replay quality with pre-recorded cassettes was excellent, but again we noticed the 'jelly-like' quality to pitch that slow-rate wow produces. Otherwise, there was good imagery, plenty of attack on transients and even tonal balance. No degradation occured at low levels with Dolby B engaged.

Finally, a faint rumble was heard, which analysis defined as If energy around 20Hz. This should rarely be annoying, but is strange for a cassette deck.

Summary

The *ADF990* gave impressive sound quality for the cassette medium, with all tape types and with pre-recorded musicassettes. It is an impressive deck. But though the '990 benefits from its dual capstan drive, Aiwa could further hone the speed stability performance to keep this deck up with the leaders.

Test Results

Replay of pre-recorded musicassettes		
Frequency response	20Hz-20.0kHz	very good
Speed accuracy	0.15%	very good
Record/replay using blank tape		
Frequency response, ferric	22Hz-18.0kHz	very good
Frequency response, chrome	21Hz-18.0kHz	very good
Frequency response, metal	25Hz-16.0kHz	very good
Stereo separation	−52dB	good
Distortion	0.6%	good
Tape hiss, ferric	−65dB	poor
Tape hiss, chrome	−69dB	poor
Tape hiss, metal	−66dB	average
Speed variations	0.1%	good
Modulation noise	−41dB	good
Flutter energy (band level)	−34dB	very good
MOL, ferric, 315Hz/10kHz	+4.0dB/−6.0dB	very good
MOL, chrome, 315Hz/10kHz	+1.0dB/−6.0dB	good
MOL, metal, 315Hz/10kHz	+4.4dB/−1.0dB	good
Input/output performance		
Line in sensitivity/overload	52mV/—V	
Mic input sensitivity/overload	1mV/65mV	
Output level	330mV	
Typical price inc VAT	£350	

For graph references see issue No 42

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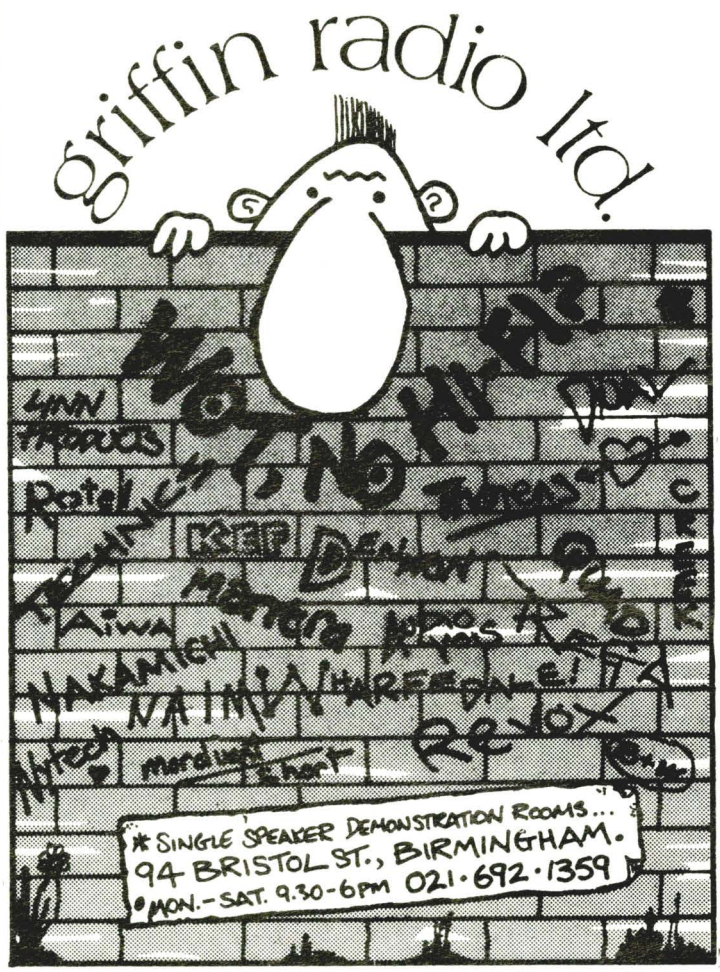
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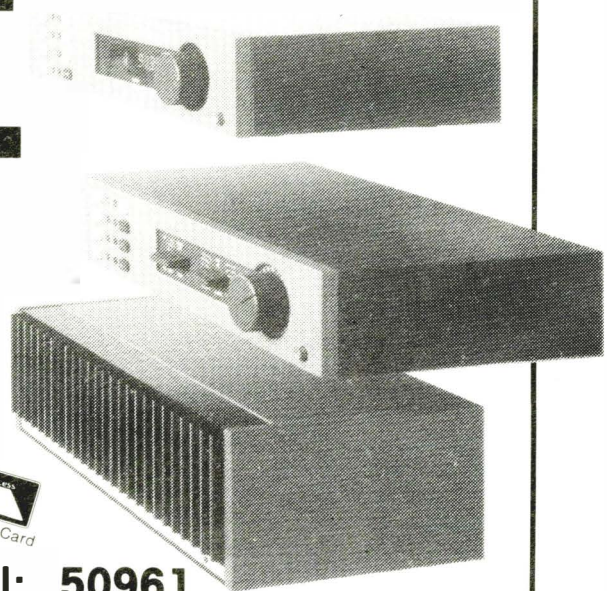
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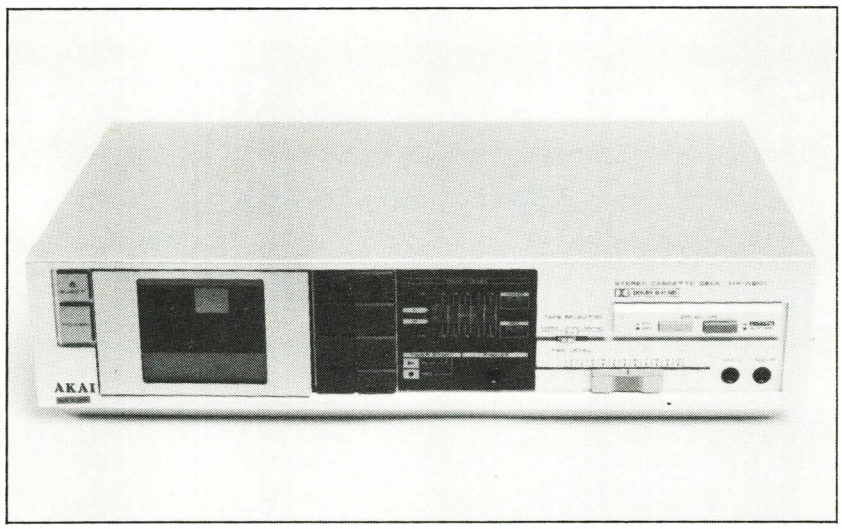
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BEST BUY

AKAI HX-A201

AKAI (UK) LTD, UNIT 12, HASLEMERE HEATHROW ESTATE, SILVER JUBILEE WAY, HOUNSLOW, MIDDLESEX. TEL: 01-897 6388



This budget Akai deck has Dolby C noise reduction, but not the logic-controlled transport of the 'A3, nor its attractive blue fluorescent displays. Instead, the transport buttons are mechanically interlinked, enabling fast reverse to be selected from fast forward, for example. However, more awkward changes, like fast reverse from recording mode are not possible, and the buttons were a bit stiff and clanky. They were poorly identified too, having symbols impressed directly into the grey plastic surface without any distinguishing colour.

Simple record level meters have three green and two red LEDs on each channel to cover a recording range of −15dB to +3dB. Because of adjustment, the maximum +3dB LED was in fact about equivalent to +6dB on most machines, which is needed to show the upper recording limit for metal tapes.

Tape type selection is manual, while the counter is an unlit mechanical type without a zero stop function. Akai fit a headphone socket and twin microphone inputs, while auto-start from an external timer is also possible.

LAB REPORT

Head azimuth of the review sample had been perfectly set, which is rare at these price levels. As a result of this — and absolutely correct replay equalisation in the machine's electrical circuits — replay frequency response was virtually ruler-flat from 100Hz right up to 18kHz! Some bass boost occurs below 100Hz.

The replay amplifiers were very quiet and relatively hum-free. Head height had been set accurately enough for good track alignment, resulting in low crosstalk. Speed accuracy was adequate and replay speed stability respectable at the price. Regular but slight speed warble was obvious and spectral analysis showed this was due to capstan eccentricity (7Hz). Flutter was also seen, but both were relatively low.

Record/replay speed stability, where transport defects become additive (record plus replay) amplified the capstan wow phenomena a little and brought up flutter to a level of −28dB, which is still fairly respectable for a budget single-capstan unit.

The head suffered no more distortion than usual (1.2% overall) with the high bias and signal levels required for metal tape, and record bias noise was low. Dolby C didn't quite manage −20dB of noise reduction, so record bias noise was sub-optimal by +2dB at −71dB, with chrome (BASF *CR-EII*) tape. This is a small and acceptable degradation though, and basically, the *HX-A201* does give low noise with quiet tapes.

Tape overload figures (MOLs/SATs) showed well-set bias and reasonable head performance again. Chrome sensitivity was set (−2.2dB) for Japanese pseudo-chrome tapes such as Sony *UCX*, and record equalisation was set for them too. Such tapes should be used for best results with Dolby operative. Frequency response was flat for commonly available ferric and metal tapes, and so was sensitivity. As a result, Dolby tracking proved perfect.

The Akai *HX-A201* measured unusually well in all areas — I really could not fault it at the price.

SOUND QUALITY

Strong, deep bass gave musicassette reproduction an uncommon feeling of dimension or weight. There was obvious treble extension and a fine sense of detailing with good recordings. Loss of precision and depth was noted — but only against a Nakamichi *Dragon*! Low level musical passages were not dulled appreciably. Slight hum was noticed.

With Sony *ES* the *HX-A201* gave first class recordings, reasonably free of 'wiriness' and other vices. Slight pitch corruption was detected with violin and piano on occasion, introducing a 'broken' sound, as is to be expected with budget machines. There was the usual small loss of clarity too. Otherwise, the sound was beyond serious criticism. Hum was again evident.

Chrome tape (Sony *UCX*) gave a softer, more rounded presentation than metal, with suppressed treble and some obvious coarseness of pitch. It had a slightly 'wiry' quality. As usual, ferric tape (TDK *AD*) sounded similarly muted and vague in its upper registers, but on balance it gave very respectable results in this Akai.

SUMMARY

The *HX-A201* is a budget deck with an absolute minimum of frills, albeit retaining Dolby C noise reduction. It has a fairly attractive appearance, free from the gaudy 'lights and legends' look so common on budget products.

Measured performance was exemplary in all areas, well beyond what is normally expected at the price. It was capable of getting the best out of pre-recorded musicassettes, lacking the usual dull, muddled and imprecise sound common to budget decks.

Similarly, recordings reached a very good standard with ferric, chrome and metal tapes. If Akai can maintain this performance in production, the *HX-A201* will be an almost unbeatable bargain for those with a strictly limited budget.

TEST RESULTS

Replay of pre-recorded musicassettes		
Frequency response	32Hz-20.0kHz	very good
Speed accuracy	+0.7%	good
Noise	−59dB	average
Record/replay using blank tape		
Frequency response, ferric	20Hz-16.0kHz	very good
Frequency response, chrome	20Hz-15.0kHz	very good
Frequency response, metal	20Hz-15.0kHz	very good
Stereo separation	−51dB	good
Distortion	1.2%	average
Noise	−53dB	good
Speed variations	0.10%	good
Modulation noise	−38dB	average
Flutter energy (band level)	−28dB	good
MOL, ferric, 315Hz/10kHz	+3.0dB/−7.0dB	good
MOL, chrome, 315Hz/10kHz	−1.5dB/−7.0dB	very poor
MOL, metal, 315Hz/10kHz	+2.0dB/+0.0dB	poor
Input/output performance		
Line in sensitivity/overload	80mV/>3V	
Mic input sensitivity/overload	0.3mV/30mV	
Output level	420mV	
Typical price inc VAT	£99	

For graph references see issue No 42

BEST BUY

DENON DR-M22

HAYDEN LABORATORIES LTD, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST PETER, BUCKS.
TEL: (0753) 888447



This deck felt very like a Nakamichi in design philosophy. It had none of the gadgets or multiple music search systems that currently adorn nearly all Japanese decks — instead, there are certain key features that provide better sound quality, most notably closed-loop dual-capstan drive, user-adjustable bias, and three heads (like the Nakamichi *BX-300*). The *DR-M22* also resembles the Nakamichi in having a satin-black fascia and no microphone inputs.

Denon have very usefully incorporated automatic tape selection, but without any override to accommodate old metal tapes without sensing slots. (This means they cannot be recorded properly, but can be replayed). The transport buttons are very neatly laid out in a horizontal row and clearly identified with big symbols. Full logic allows the transport to punch-in record and to rewind straight from play mode. It worked quickly and smoothly when changing mode like this.

Double-Dolby B and C noise reduction has been fitted, plus a bright fluorescent tape counter with zero stop memory. Bright, fluorescent record level indicators read music peaks accurately and have 0VU set to Dolby flux level — a good position. Double-Dolby is needed with three-head decks so that the off-tape monitor signal can be decoded whilst another Dolby section is encoding the record signal.

The *DR-M22* was easy and satisfying to use. It is a rarity amongst Japanese decks, being clearly designed primarily to sound rather than look good.

LAB REPORT

Replay frequency response, shown in the graph, had slowly but steadily falling treble, which can marginally detract from the perceived attack and definition in music from pre-recorded cassettes. The loss at 10kHz was −2.5dB. Replay speed was fast at +1.2%, an amount that is just noticeable when a cassette has previously been played at the right speed.

Closed loop, dual capstan drive wasn't quite as effective on this machine as it was on Pioneer's *CT-A9* or the expensive Nakamichi's, but it did still eliminate sharp flutter peaks, as it should. Denon *DXM* metal tape introduced its own flutter, measuring −23dB on the *DR-M22* which is poor, but TDK *SA* took the figure down to −30dB, which is relatively good; BASF *Chrom IIS* would have been even better. Some wow was measurable too, but on the whole Denon's transport was superior to the usual standard expected.

Bias had been set to give conventional overload ceilings in the centre position of the control. Increasing bias gave rather poor treble saturation figures with ferric and chrome of −12dB or worse. Record/replay frequency responses were very flat with IEC Primary Reference tapes, bias being set at its centre detent position. Bias change had virtually no effect upon metal tape frequency response, but because metal tapes are all much alike in frequency dependent sensitivity, this doesn't matter much. All Denon tapes gave wide, flat responses, like those shown here, using just fine bias adjustment.

BASF *Chrom IIS* needed full bias, whereupon treble rose above 10kHz to +2dB at 20kHz. This will reduce its treble saturation ceiling to some extent, because centre-position bias gave IEC tape MOL's where treble saturation is fairly low to start with.

SOUND QUALITY

Using Denon *DXM* metal tape, treble had a slightly rough quality with normal bias, so full bias was used. Sound quality was particularly clear, relaxed and unfatiguing. There was plenty of insight into a performance and fine stereo imagery. Treble quality did, however, show itself tinged with flutter distortion. We felt TDK *MA* gave a slightly cleaner sound than Denon *DXM* tape, because of low flutter.

Ferric *DX-3* had neutral tonal balance but lacked real incision to attack. However, as with the other tapes, overall quality was very good and listening was pleasurable.

Replay performance wasn't as well defined as possible, muddying of strings and loss of immediacy being heard. Imagery and speed stability were good, though.

SUMMARY

Because of the very clean inherent sound this deck gave, we heard some flutter, but still felt the *DR-M22* was a fine machine. Replay-only performance could have been better, though.

TEST RESULTS

Replay of pre-recorded musicassettes		
Frequency response	20Hz-7.0kHz	average
Speed accuracy	+1.2%	average
Record/replay using blank tape		
Frequency response, ferric	25Hz-20.0kHz	very good
Frequency response, chrome	25Hz-20.0kHz	very good
Frequency response, metal	25Hz-20.0kHz	very good
Stereo separation	−51dB	poor
Distortion	4.5%	very poor
Tape hiss, ferric	−70dB	very good
Tape hiss, chrome	−72dB	very good
Tape hiss, metal	−71dB	very good
Speed variations	0.1%	good
Modulation noise	−35dB	poor
Flutter energy (band level)	−30dB	very good
MOL, ferric, 315Hz/10kHz	+3.7dB/−9.8dB	average
MOL, chrome, 315Hz/10kHz	+0.2dB/−8.8dB	average
MOL, metal, 315Hz/10kHz	+3.6dB/−1.2dB	poor
Input/output performance		
Line in sensitivity/overload	85mV/—V	
Mic input sensitivity/overload	NONE	
Output level	750mV	
Typical price inc VAT	£245	

For graph references see issue No 42

BEST BUY

DENON DR-M33HX

HAYDEN LABORATORIES LTD, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST. PETER, BUCKS.
TEL: (0753) 888447



Not surprisingly, the *DR-M33HX* sits in Denon's range between the *DR-M22* and *DR-M44HX*, borrowing features from each. It uses the dual capstan drive of the *'22*, without the *'44*'s direct drive motor. The independent but siamesed record and replay heads are employed here to good effect and the *'33HX* has Dolby HX Pro to enhance recording quality, as well as Dolby B and C noise reduction. The HX Pro circuit modulates bias according to signal conditions, in theory to increase treble overload headroom. However, manufacturers have a lot of leeway to determine what they want from this system, and it appears that Denon have increased standing bias to improve midband headroom too, trading off some potential treble benefits in the process. Bias is also user-adjustable.

The cassette compartment is usefully back-lit and tape type selection remains automatic, the latter facility, along with logic control, makes this deck very easy to use. Denon include their familiar bright blue fluorescent display panel, with its warnings and status legends, long record-level indicators and a tape counter, which reads elapsed time and has a zero-stop. Microphone inputs are not fitted.

Lab Report

The 1985 Denon had more accurate replay frequency response, giving better sound quality with musicassettes as a result. The graph for the *'33HX* shows treble output level up to 10kHz, after which a roll-off occurs. Hiss in the replay amplifiers was adequately low at −58dB, or −68dB with Dolby B, and there was negligible hum. Replay speed was correct and speed stability fine.

A small amount of wow (0.07%) affected recordings, analysis showed equal 4Hz and 6Hz components. A small flutter peak exists at 40Hz too, but there was little energy in it, flutter-band energy measuring a good −29dB. The analysis spectra clearly showed the usual low-flutter benefits of twin capstan drive. At a low −43dB, modulation noise further confirmed the value of dual capstan drive on this series of decks.

Denon have obviously set up the *'33HX* to meet IEC requirements accurately, including the unconventionally low IEC II chrome tape sensitivity value. As a result, the *'33HX* has accurate Dolby tracking with BASF *CR-EII* chrome and low sensitivity (IEC normalised) pseudo-chromes like TDK *SA*. It is not suited to high sensitivity chromes like TDK *HX-S*, *SA-X*, Maxell *XL-IIS* and the like. Metal and ferric sensitivities were exactly to IEC II and IEC IV specification.

The graphs clearly show perfectly flat frequency response with IEC-type blank tapes, at centre-bias. Bias adjustment range was just sufficient to accommodate very awkward tapes like BASF *LH-MI* (ferric) and *CR-MII* (super-chrome), both needing full bias for flat response. Dolby tracking was excellent with all tape types. Midrange overload levels were very high, especially on chrome. For treble, they were good, if not exceptional (see the MOLs in the test results). Coupled with low hiss and hum, these characteristics give the *'33HX* an excellent dynamic range.

Sound Quality

Musicassette sound quality was extremely good, with a rigid grip kept on tempo. Piano had slight 'wateriness', but this *was* slight. Rock and classical musicassettes benefitted equally, displaying little of the rhythmic vagueness so common with cassette generally. Upper treble softness was noted and the sense of razor-sharp definition was lost from images and transients.

Maxell *MX* metal gave very smooth and clear recordings, again with near perfect pitch stability. There was a small loss of inner detail on such instruments as maraccas and the delivery was just a trifle too mellifluous. Sony *ES* added some bite and verve, but with slight 'jumpiness' to treble, heard on cymbals and the like. Cymbals did, however, ring strongly and clearly, undiluted by flutter.

BASF *CR-MII* super-chrome (bias set near maximum) retained inner and transient detail better than the metals, but had some bass emphasis and lost some of the solidity and sparkle of cymbals. Results were again superb though, and right up to metal standards. All recordings were made with Dolby B.

Hiss became a bit of a nuisance with ferrics (TDK *AD* and BASF *LH-MI*), so Dolby C was used here. Quality was outstanding for ferric tape, being clearer, easier and more stable to listen to than most decks with metal tape.

Summary

A high performance dual capstan deck, the *'33HX* has a few extras compared with the *DR-M22*, most notably Dolby HX Pro, which increases overload margins and dynamic range, putting it on a par with the *'44HX* in this respect. User adjustable bias gave the deck broad tape matching, and recording performance measured well in all areas. This deck delivered excellent record/replay sound quality and, equally, it played musicassettes unusually well, providing a pitch-stable, tightly defined sound better than most competitors by a significant margin. Since the *'33HX* is also a delight to use, it rates very highly indeed.

Test Results

Replay of pre-recorded musicassettes		
Frequency response	20Hz-11.0kHz	good
Speed accuracy	+0.1%	very good
Noise	−58dB	average
Record/replay using blank tape		
Frequency response, ferric	22Hz-18.0kHz	very good
Frequency response, chrome	22Hz-18.0kHz	very good
Frequency response, metal	22Hz-19.0kHz	very good
Stereo separation	−50dB	good
Distortion	0.5%	very good
Noise	−53dB	good
Speed variations	0.07%	good
Modulation noise	−43dB	very good
Flutter energy (band level)	−29dB	good
MOL, ferric, 315Hz/10kHz	+4.7dB/−3.5dB	very good
MOL, chrome, 315Hz/10kHz	+3.0dB/−6.0dB	very good
MOL, metal, 315Hz/10kHz	+6.0dB/+0.5dB	average
Input/output performance		
Line in sensitivity/overload	80mV/>3V	
Mic input sensitivity/overload	−mV/−mV	
Output level	700mV	
Typical price inc VAT	£320	

For graph references see issue No 42

BEST BUY

JVC KD-X2

JVC (UK) LTD, JVC HOUSE, 12 PRIESTLEY WAY, ELDONWALL TRADING ESTATE, STAPLES CORNER, LONDON NW2 7AF. TEL: 01-450 3280



The JVC *KD-X2* is a budget machine, carefully built to balance performance and economy of contruction. The record level meters use individual LEDs and transport control buttons are a conventional mechanical linked array which JVC have called 'logic control', although there is no electronic logic at all, only cross-linked mechanical actions. Such mechanical arrangements are common and do allow certain awkward commands to be carried out, like fast forward from fast reverse. However, I feel that calling them 'logic controls' is stretching the definition somewhat.

JVC fit a 'music scan' system on this deck which works by searching for the gaps between tracks. Dolby B and C noise reduction systems are provided, and selected by a rather small lever switch, as is tape-type. The *KD-X2* was fairly easy to use, but had a somewhat fussily styled fascia.

Lab Report

The head contour of this deck proved inferior to many, with its frequency response undulations starting at 150Hz. Replay response displayed slight treble shelving to 10kHz, after which output falls away. This effect was slight, however, and by budget standards the *KD-X2* was well set-up to get correct tonal balance from musicassettes, without the extremely dull, vague sound that is so common. Replay noise was adequately low, and produced just very slightly hissy recordings.

Replay speed measured 2% fast, which is a discernible error if the programme has previously been heard at the correct speed. Replay speed stability was adequate, and record/replay speed instability performance figures were quite adequate; the 'X2 was as speed-stable as most good budget machines. Nakamichi standards can't be expected at this price!

Bias adjustment of the *KD-X2* was well balanced, giving around +3dB more treble headroom with ferric and chrome tapes. Sensitivity was accurately set for commercial tapes too, and all frequency responses were fairly flat.

Sound Quality

Metal tape (TDK *MA* and JVC *ME*) gave a slightly 'glassy' hard sound with a degree of 'spitching' with sibilance. Wow slightly corrupted the sound of harmonica and organ.

Treble 'feathered' with TDK *SA* and there was again a 'glassy' quality. Wow was noticed as a 'watery' quality, but we felt the overall result was fair.

Ferric tape gave very even tonal balance, but slight loss of treble detail. Cymbals were a bit 'swishy'. In general though, we felt the result was good.

Over-large, plummy bass was obvious with musicassettes and low level fine detail was weak. Being evenly balanced across the midrange though, we felt the character wasn't unpleasant and there was surprisingly convincing stereo. Generally, a nice sound.

Summary

A fairly basic budget deck with Dolby B and C noise reduction, the *KD-X2* uses LEDs rather than fluorescent displays for record level metering, and has mechanical transport controls. Although these transport buttons are mechanically interlinked, they do not in our view justify the term 'logic control'.

The performance strength of the *KD-X2* was in tape matching, and this is important with regard to the sound quality of recordings. Musicassette replay quality was judged good because of its clarity, but replay speed was too fast. Despite some weaknesses, then, the *KD-X2* must be a Best Buy at the price.

Test Results

Replay of pre-recorded musicassettes		
Frequency response	35Hz-12.0kHz	good
Speed accuracy	+2.0%	very poor
Noise	−60dB	good
Record/replay using blank tape		
Frequency response, ferric	22Hz-14.0kHz	good
Frequency response, chrome	22Hz-15.0kHz	very good
Frequency response, metal	22Hz-15.0kHz	very good
Stereo separation	−49dB	average
Distortion	0.6%	good
Noise	−53dB	good
Speed variations	0.12%	average
Modulation noise	−39dB	average
Flutter energy (band level)	−29dB	good
MOL, ferric, 315Hz/10kHz	+4.0dB/−6.5dB	good
MOL, chrome, 315Hz/10kHz	+0.0dB/−6.5dB	average
MOL, metal, 315Hz/10kHz	+3.0dB/−0.0dB	average
Input/output performance		
Line in sensitivity/overload	75mV/−>3V	
Mic input sensitivity/overload	0.34mV/22mV	
Output level	300mV	
Typical price inc VAT	£99	

For graph references see issue No 42

RECOMMENDED

NAD 6155

NAD Sales, Cousteau House, Greycaine Road, Watford WD2 4SB.
Tel: (0923) 26499



Styled to look chunky, the *6155* comes in NAD's usual rather sombre dark grey finish. Confusing styling artifices such as unnecessary legends and lines are absent, so the deck was easy to understand and use. Transport buttons actuate the cassette mechanism mechanically, so they lack logic and clang a bit. However, not much pressure is needed to operate the buttons, so the deck stood firm in use.

Innovation comes in the form of 'play trim' — a control that trims treble level to achieve flat replay frequency response, prior to Dolby deprocessing. This avoids the approximate doubling of replay errors that Dolby B introduces at low levels and is meant to combat the dull, lacklustre sound so frequently encountered with musicassettes.

Variable bias is also included, operating on all three tape types, including metal. It provides tape tuning, allowing a wide variety of blank tapes to be used. There is a switchable 19kHz pilot tone (MPX) filter. LED record level indicators cover a good range and have 0VU set to Dolby flux, as usual. They are placed after the treble boost of record-equalisation so show actual treble levels reaching tape. Finally, but importantly, Dolby HX Pro provides overload 'headroom extension'.

Lab Report

Azimuth was a bit out on my early test sample and treble output proved initially unpredictable, due to shaky head/cassette location. After use and azimuth re-alignment (it's not generally my policy to do this), the deck settled down, providing a reliably flat replay frequency response to 10kHz with zero play trim, according to the official IEC (BASF) test tape. Above 10kHz, output fell slowly to −3dB at 18kHz, as the graph showed.

'Play trim' worked well, giving around 3dB lift and cut at 10kHz, not shown in the replay graph. This is meant to trim record-equalisation errors in musicassettes, which occur quite commonly, due to a lot of misunderstanding over standards. The other common problem of incorrect recorded azimuth is also combatted. Though not aimed at compensating for the deck's head azimuth error, it does a fair (if not perfect) job of this too.

'Play trim' should be zeroed for recordings made on the machine, since they don't suffer azimuth or record-equalisation errors (with matching tape). The record/replay graphs clearly show reasonably matching to IEC Primary Reference tapes at centre-bias, and (filter out) a broad, flat frequency response characteristic.

Output at very high frequencies was stable, contributing to a low modulation noise figure of −42dB in spite of using a single capstan transport. Analysis showed that this mechanism suffers little flutter, but distributed wow was higher than usual, as one might expect from a solidly built transport with a heavy flywheel and thick capstan, but this balance is acceptable. Subjectively, flutter can be as annoying as wow, but in a different way.

Hiss and hum levels were low, although high hum harmonics were present. Dolby B and C tracked well. NAD have chosen to use Dolby HX Pro simply to improve treble overload margins. The *6155* shows some distinct traits here, ferric tape having high midrange but average treble overload ceilings, whilst chrome is the reverse; metal tape did well in both areas.

Bias adjustment was sufficient to accommodate all awkward high performance tapes like Maxell *XL-IS* ferric, BASF *CR-MII* super-chrome, TDK *MA* and Maxell *MX*, giving the *6155* excellent flexibility and the potential for very accurate tape matching. Low input sensitivity calls for a high record level setting, especially with metal tape.

Sound Quality

At centre bias TDK *MA* sounds edgy and had occasional peak distortion. Loss of clarity and 'imprecision' (slow wow) were noted too. Treble improved at '+4' bias. Maxell *MX* tape and conservative record levels (+3dB above 0VU) successfully provided a smoother, more confident sound with improved clarity; quality was judged very good, but piano remained 'watery' in pitch.

BASF *CR-MII* super-chrome (max bias) gave a very stable, even and natural sound, with fine clarity. It proved enjoyable and impressive. Slight drone (hum harmonics) was audible at high volume. There was less muddle than usual with BASF *LH-MI* ferric tape (centre bias), but high level treble was thin and indistinct, due to saturation. Overall quality was very good for ferric tape.

With musicassettes, piano again had a watery, imprecise quality to it — not offensive, but a degradation all the same. Generally though, sound quality reached a high standard, with well defined transients, a fine sense of clarity and solid bass. Imaging was good too. Play trim proved a valuable asset, limited boost often being needed to add zesst and a sense of openness.

Summary

Solidly built, but fairly simple, the *6155* lacks many minor facilities but includes some valuable ones. Dolby HX Pro gives improved tape overload performance, user adjustable bias allows good and versatile tape matching while 'play trim', can minimise the dullness often heard with musicassettes. Easy enough to use, the deck 'feels' less sophisticated than most at the price. Balancing this was a good measured performance and excellent sound quality from musicassettes and recordings, 'advanced' tapes being usable. Slight wow compromised critical programme.

Test Results

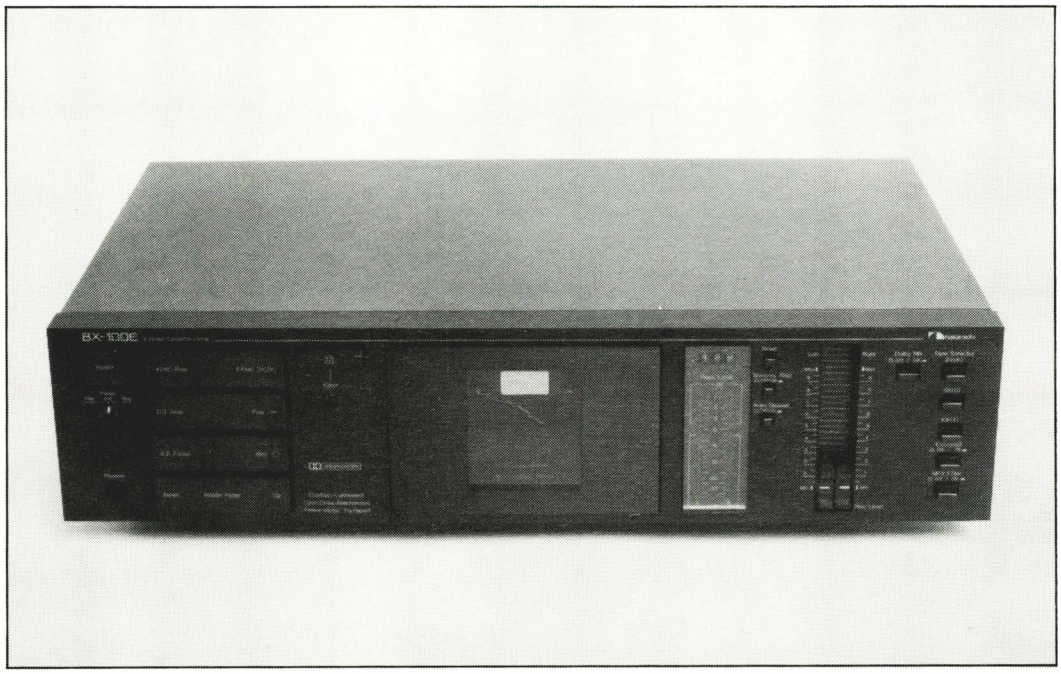
Replay of pre-recorded musicassettes		
Frequency response	22Hz-16.0kHz	very good
Speed accuracy	+1.5%	poor
Noise	−58dB	average
Record/replay using blank tape		
Frequency response, ferric	22Hz-16.0kHz	very good
Frequency response, chrome	22Hz-17.0kHz	very good
Frequency response, metal	22Hz-18.0kHz	very good
Stereo separation	−52dB	good
Distortion	1.3%	average
Noise	−53dB	good
Speed variations	0.13%	average
Modulation noise	−42dB	good
Flutter energy (band level)	−34dB	very good
MOL, ferric, 315Hz/10kHz	+4.5dB/−8.0dB	good
MOL, chrome, 315Hz/10kHz	+0.5dB/−4.0dB	average
MOL, metal, 315Hz/10kHz	+4.0dB/−2.5dB	good
Input/output performance		
Line in sensitivity/overload	130mV/>3V	
Mic input sensitivity/overload	−mV/−mV	
Output level	650mV	
Typical price inc VAT	£249	

For graph references see issue No 42

RECOMMENDED

NAKAMICHI BX100E AND BX125E

NAKAMICHI B&W (UK) LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING,
WEST SUSSEX. TEL: (0903) 750750



For this 'budget'(!) machine Nakamichi do not fit Dolby C — the *BX-100E* had Dolby B only, which provides 10dB of hiss reduction, compared with Dolby C's 20dB. However, as tapes improve and get quieter this matters less. It is possible to make almost hiss-free recordings with Dolby B providing appropriately quiet tapes are used, together with high record levels. Dolby B is necessary for musicassettes as well.

Although Nakamichi's 'baby', the *BX100E* is still equipped with the same logic-linked, light-action transport control panels seen on their more expensive models. These require only a light tap with a finger to elicit an immediate response from the transport and the *BX100E* works with the same uncanny silence and silky precision as all Nakamichi's machines. The logic allows all commands except punch-in recording.

Selection of bias and equalisation are kept apart, allowing for example 120μS chrome tapes to be made. The bias buttons are, as always, confusingly identified only by Nakamichi's own designations: EX (ferric), SX (chrome) and ZX (metal). Memory stop, timer and auto-repeat functions are fitted, but not microphone inputs.

Internally, independent bias and record-gain adjusters are fitted on left and right channels for each tape type, so the machine can be tweaked to suit any tape.

LAB REPORT

On test, the *BX-100E* had a replay response flat from 30Hz right up to 16kHz, after which output actually rises. The practical benefit is full treble output from pre-recorded musicassettes, coupled with proper Dolby B tracking, resulting in excellent clarity, detail and imaging.

Head alignment was correct and replay hiss adequately low. Spectral analysis revealed 50Hz and 150Hz hum components at −62dB, and subsequent listening tests showed these to be just audible when playing low level recordings at high volume. In my view hum should have been lower. Replay speed was slightly fast at +0.8%, which is a just-detectable error. Replay speed stability was excellent at 0.05% wow and flutter (DIN weighted). Spectral analysis of a recording showed that the transport suffered various wow components from 3Hz to 8Hz in rate, but flutter was fairly low by single capstan standards. The transport was adequately speed stable.

Bias was well set to give a balanced low/high frequency tape overload performance and record-gain (sensitivity) was accurate enough with the IEC Primary Reference tapes to give correct Dolby tracking with recordings.

Frequency response (IEC Primary References) can be seen in the graphs; ferric and chrome are perfectly flat, metal has slight plateau emphasis of treble. This means metals with extra treble sensitivity, like TDK MA, will sound a bit bright. Distortion and separation figures were good; 0VU was set low (−3dB, ref Dolby level), if adhered to, making recordings a bit hissy.

SOUND QUALITY

Transients were delivered with real definition and bite from musicassettes, treble detailing was richer than one would generally imagine possible and imaging also proved better than usual. The presence of solid, deep bass added more 'body' than is common. A relatively clear, 'wideband' sound with musicassettes was both involving and entertaining.

We found recordings with TDK MA and Sony *ES* had a glassy-hard treble quality about them, due to the plateau lift of treble noted in tests, but freedom from flutter rubbish kept the treble clean. Hiss was barely audible with Sony *ES* recorded to a high level. Other IEC-like metal tapes, like Scotch *XSM-IV* and That's MG gave a more neutral sound. There was some sense of pitch-diffusion and occasional pitch 'falter' was detected with critical organ programme, but these phenomena were slight.

Chrome tape (TDK *SA*) gave a tonally smoother, less forward and more natural sound, but it also had less well differentiated treble. BASF *CR-EII* had similar properties, but was marginally more lucid and 'solid' (pitch-stable) in its sound. The low 0VU level, when adhered to, made *SA* a bit hissy. Not bad, but not great, we felt.

Ferric recordings (TDK *AD*), like chrome, displayed even tonal balance but messier treble and more obvious hiss. Generally, though, their standard was judged to be good.

SUMMARY: BX100E

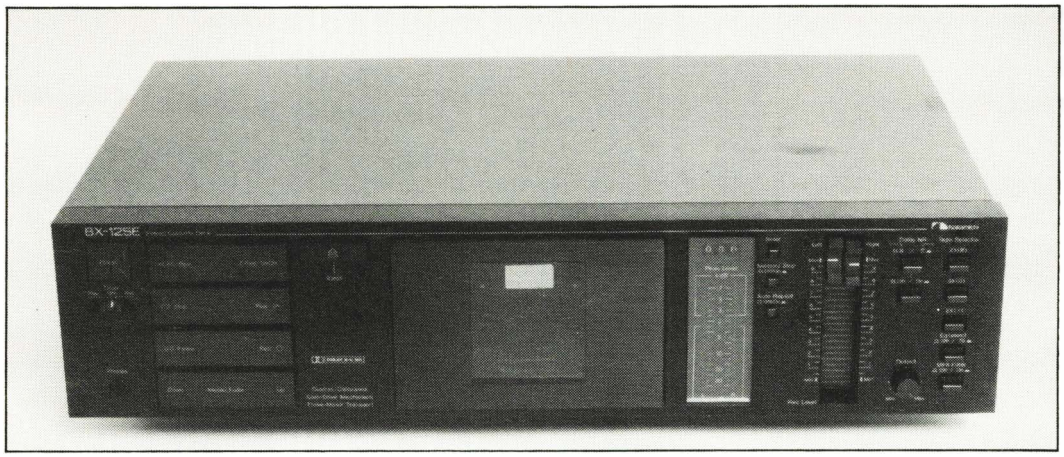
A high-performance and relatively expensive cassette deck, the *BX100E* lacks all but the most important facilities — even Dolby C is omitted. However, this deck is not a disappointment relative to its price, for those who rate sound quality highly and have enough knowledge to get the best from the machine, keeping in mind the comprehensive internal adjustment possible.

Additionally, Nakamichi's quality of build and finish, together with their slick and silent logic controlled transport system made the *BX-100E* satisfying to use, but independent bias and equalisation switching does require diligence to avoid error. Despite the lack of Dolby C, hiss wasn't a nuisance providing high quality 'quiet' blank tapes were used — such as Sony *ES* metal and BASF *CR-EII* — plus healthy recording levels.

SUMMARY: BX125E

The *'125* is basically a *BX-100* fitted with Dolby C. This makes it similar to the *BX-150*, which

BEST BUY



was previously the least expensive Nakamichi to have Dolby C in addition to B. Visually, the *'125* lacks the *'150*s illuminated red LED tape counter, and the output control is rotary instead of being a slider. Otherwise facilities are identical.

Under test the *'125* proved very similar to the *'100* and *'150* in all respects; all test results printed are for the *'100*. It had good speed stability, characterised by very low flutter for a single capstan transport, but a small amount of wow (0.08%) at 2Hz and 5Hz.

I was disappointed to see rising treble with the IEC IV Primary Reference (metal) tape. Predictably, TDK *MA* measured +4dB up at 20kHz since it has more treble than the IEC tape. It will sound very bright as a result.

With BASF *CR-EII* chrome the *'125* gave a silky-smooth and clear sound, but was restrained, or 'laid back'. There was more detail with *SA*, but it lacked *CR-EII*'s confident treble and sense of natural clarity.

TDK *AD* ferric had a slightly warm tonal balance but good clarity for ferric and was liked. The sense of solidity achieved with musicassettes played on Nakamichi's dual capstan drives was not present with the *'125*, but it did have much of their clarity and insight, plus fine imaging. Another impressive performer, the *BX125* is a 'Best Buy' while the *'100E* is still recommended.

Test Results

Replay of pre-recorded musicassettes		
Frequency response	23Hz-18.0kHz	very good
Speed accuracy	+0.8%	good
Noise	−61dB	good
Record/replay using blank tape		
Frequency response, ferric	20Hz-20.0kHz	very good
Frequency response, chrome	20Hz-19.0kHz	very good
Frequency response, metal	20Hz-20.0kHz	very good
Stereo separation	−57dB	very good
Distortion	1.2%	average
Noise	−54dB	very good
Speed variations	0.08%	good
Modulation noise	−42dB	good
Flutter energy (band level)	−36dB	very good
MOL, ferric, 315Hz/10kHz	+3.0dB/−6.0dB	good
MOL, chrome, 315Hz/10kHz	+1.0dB/−8.0dB	good
MOL, metal, 315Hz/10kHz	+4.0dB/−1.0dB	poor
Input/output performance		
Line in sensitivity/overload	52mV/>3V	
Mic input sensitivity/overload	−mV/−mV	
Output level	450mV	
Typical price inc VAT	£275, £325	

For graph references see issue No 42

Alphason

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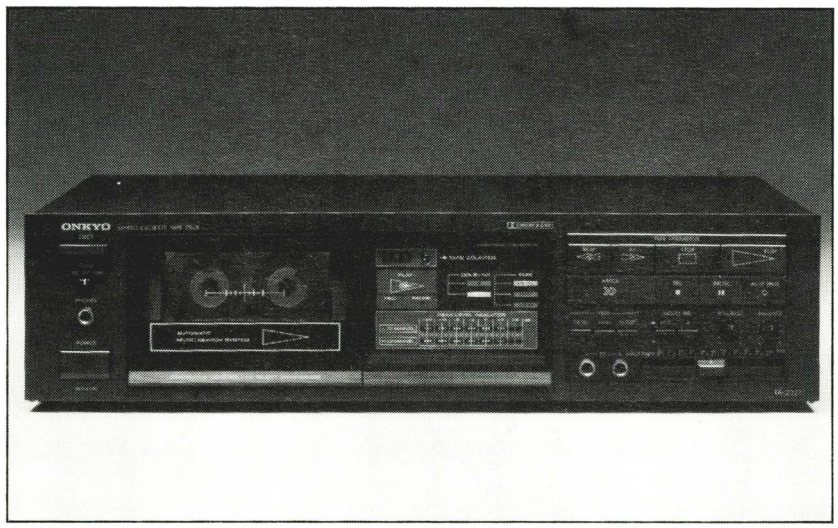
190-192 Wigan Road, Euxton, Nr. Chorley, Lancs. PR7 6JW. Telephone: Chorley (02572) 76626

USA: Music & Sound Imports, 30 Snowflake Road, Huntingdon Valley, PA 19006.
CANADA: May Audio Marketing, 646 Boul, Guimond, Longueuil, Quebec, J4G IP8

RECOMMENDED

ONKYO TA-2027

GOODMANS, 2 MARPLES WAY, KINGSCROFT CENTRE, HAVANT, HANTS.
TEL: (0705) 486344



A straightforward undirectional deck, the *TA-2027* features a logic-controlled transport and — very usefully — variable bias for tape matching. We thought the styling fussy, but the deck looks much like so many others, except for a clear acrylic panel whose lines light up blue.

Tape selection is manual, with illuminated legends clearly showing what type has been chosen — a simple but useful feature. Similar and equally useful indicators provide quick confirmation of Dolby B and Dolby C selection.

Logic control would accept all commands except 'punch-in' recording. The machine is built into a metal case, which, although strong, did induce a slightly hollow, clanky sound when the machine was mode changing. A simple mechanical tape counter, without memory, has been fitted.

Onkyo fit a music scanning system based on gap sensing, plus a DIN 'current fed' output on the rear panel, in addition to normal line outputs. This year, virtually no other deck tested had this somewhat archaic input/output standard.

Record level is shown by twin LED indicators that run from −20dB up to +6dB. Peak record level (0VU) has been set to Dolby flux, which is a common and sensible choice.

Lab Report

At central detent position on the bias adjuster, record equalisation was set to give an excellent set of flat frequency responses when recording on ferric, chrome and metal tapes — as the graphs show. The flat IEC II (chrome) trace in particular suggests that the company is well in touch with European tape standards. The compromise chrome sensitivity value of −1.2dB suggests the deck has been adjusted to suit both pseudo-chromes like TDK *SA* and true chromes like BASF *CR-EII*. Ferric and metal sensitivities were perfectly set for correct Dolby tracking and tests confirmed that Dolby introduced little response error at low levels.

It was a pity that bias was not adjustable for metal tape, but a large range of variation with ferric and chrome allowed it to accommodate awkward formulations like Maxell *XL-IS* (super-ferric) and BASF *CR-MII* (super-chrome), giving owners greater flexibility in tape choice.

The single capstan transport exhibited little flutter but had capstan wow, which was heard as a slowish warble. The effect was not serious, allowing a speed stability figure when recording of 0.09% (total DIN weighted wow and flutter). Speed accuracy was poor, the transport running +1.4% fast.

Distortion (TDK *MA*) was not especially low, yet the head had plenty of overload headroom when using metal tape, unlike so many others. It managed unusually well with ferric and chrome too, being a marginal improvement upon Nakamichi's *BX-100E* head, I note. Onkyo have used a very sensible bias level to retain good treble overload headroom (saturation) without compromising that at lower frequencies.

Hum was negligible — another plus mark. Hiss was adequately low for chrome musicassettes. There was error in the replay frequency response, due to inadequate high frequency gain. Rapid roll-off of high frequencies suggested a small degree of azimuth error too. These effects combined to produce a falling treble, as the replay graph shows. This will result in a dulled sound with musicassettes, made worse by Dolby mistracking which amplifies the problem.

Sound Quality

Metal tape (TDK MA) gave a particularly smooth and natural sound, with no tonal emphases. There was a good sense of clarity and little sign of the edginess that is common with metal tape. Slight wow was barely detectable and cymbals exhibited little flutter shimmer. This was an impressive performance.

Using BASF *CR-MII* and Dolby B (bias set to +3) the *TA-2027* delivered an unusually smooth, clear, open sound quite beyond what is normally expected in this price bracket. There was little sign of treble saturation and no hiss. The performance was marginally better than that achieved with metal tape, due to an improved sense of ease and clarity.

Using Dolby B and no bias adjustment (bias set in the detent position) with TDK *AD* ferric tape, hiss was just audible, but again there was a fine sense of natural balance and clarity. Treble sounded just slightly softened and diffuse.

Musicassettes exhibited slight softening on transients and lack of extreme treble was apparent. Good imaging and pitch stability were noted. Excessive speed was noticed as slightly frantic tempo! Generally, quality was good.

Summary

The well built *TA-2027* features logic-controlled transport and user-adjustable bias. This allows fine tuning of the machine to any tape, getting rid of frequency response errors even with the most awkward advanced formulations. Sound quality of recordings was excellent. Freedom from serious speed problems, perfect tonal balance and good headroom ensured fine results with all tape types — especially super-chromes. This deck really excelled in recording quality; musicassette replay was good, although not exceptional.

Test Results

Replay of pre-recorded musicassettes		
Frequency response	27Hz-7.0kHz	poor
Speed accuracy	+1.4%	poor
Noise	−58dB	average
Record/replay using blank tape		
Frequency response, ferric	26Hz-15.0kHz	very good
Frequency response, chrome	22Hz-15.0kHz	very good
Frequency response, metal	26Hz-15.0kHz	very good
Stereo separation	−53dB	good
Distortion	1.5%	average
Noise	−55dB	very good
Speed variations	0.09%	good
Modulation noise	−39dB	average
Flutter energy (band level)	−31dB	very good
MOL, ferric, 315Hz/10kHz	+5.0dB/−7.0dB	good
MOL, chrome, 315Hz/10kHz	+0.5dB/−7.0dB	average
MOL, metal, 315Hz/10kHz	+4.0dB/+0.5dB	average
Input/output performance		
Line in sensitivity/overload	60mV/>3V	
Mic input sensitivity/overload	0.7mV/25mV	
Output level	500mV	
Typical price inc VAT	£160	

For graph references see issue No 42

RECOMMENDED

YAMAHA K320

YAMAHA ELECTRONICS UK LTD, YAMAHA HOUSE, 200 RICKMANSWORTH ROAD, WATFORD, HERTS WD1 7JS. TEL: (0923) 33166



Yamaha's *K320* is a simple machine of sober appearance, in contrast with many Japanese cassette decks. Apart from a backlit cassette holder, nothing lights up when it is switched on (if Dolby is off) which can be a bit disconcerting. Three buttons are provided for tape type selection, an arrangement that is easier to understand than twin interdependent buttons. The type selected — ferric, chrome or metal — is not displayed, though, which can allow errors. Yamaha fit a simple mechanical tape counter which is unlit.

The tape transport is controlled by a four-way 'touch plate' rocker switch. It rocks left and right for fast reeling backwards and forwards, up to select play and down to select stop. The control looked neat and was pleasant to operate. Associated logic allowed immediate transfer from play into wind and back. An intro-scan facility is operated by a rocker switch to the left of the main function controls.

Bargraph record level meters had seven LEDs each, which gave mediocre resolution. Yamaha have not been able to resist the deceptive trick of putting a grid over them, giving an appearance of double the number of LEDs, 14 per channel. Peak record level (0VU) has been put −6dB below Dolby level. This is very low for peak reading meters; it encourages underrecording which increases tape hiss. They read transients accurately.

Both microphone inputs and a headphone socket are provided. Record level is adjusted with a friction ganged control that can be awkward if channel levels are to be altered individually.

Lab Report

An extremely flat replay response was one notable feature of the *K320*. This had the effect of minimising Dolby B replay tracking error, which results in fairly well defined, solid images from pre-recorded tapes and minimises the dullness/vagueness that is usually associated with them. Replay speed was correct.

Low 0VU level resulted in very poor noise figures, even though Dolby C is incorporated. Yamaha should put 0VU up to Dolby flux, with peak reading meters. Other noise tests did, however, show 2dB more erase noise with metal tape than is possible. Erasure of low frequencies was reasonably good.

Low 0VU level, plus lack of head saturation resulted in a very low average distortion figure of 0.7%. Bias was well set too, providing relatively high maximum output levels with all three tape types.

Record/replay frequency responses were exceptionally flat with IEC Primary Reference Tapes — as the graphs show. I have been assured that Yamaha are paying special attention to meeting IEC Standards having ensured that the *K320* matches all modern high-performance tapes, which have themselves now been reformulated to match the IEC Primary References in most respects .

Under test a regular slow wow problem was heard. Analysis showed a cyclic speed variation occuring approximately once per second (wow at 1.15Hz), with strong components at 3Hz and 6Hz. High level flutter was evident too, at around 12Hz and 18Hz. It was low frequency wow that was most obvious though and this will certainly be heard as pitch 'trembling' on instruments like piano.

Sound Quality

Low record level allowed orchestral crescendos or continuous high rock levels to be reproduced very cleanly on metal tape. There was a slightly bright tonal character and some sibilant splash, but this wasn't offensive. Unfortunately, low rate wow threatened to submerge instrumentalists beneath the pitch 'burbling' it produces.

High level programme still sounded very clean on TDK *SA*, although as usual we noticed the characteristic softer sound of this tape. Wow was less pronounced, but still discernible.

Ferric tape sounded bright in tonal balance and had a sharpness about it. Tape hiss was obvious, but recordings maintained their clean, open quality.

Replay fidelity was generally good, possessing plenty of attack and good, solid imaging. Speed instability was noticed even here though, especially on harpsichord.

Summary

The *K320* is an excellent deck, sadly marred by low indicated peak record level and slow rate wow. Without these problems, it would easily stand head and shoulders above its rivals. In fact, a second sample, which arrived just before going to press, had better speed stability, and we feel confident in recommending the *K320*.

(Note: test results in the table relate to our later production sample).

Test Results

Replay of pre-recorded musicassettes		
Frequency response	31Hz-18.0kHz	very good
Speed accuracy	+0.1%	very good
Record/replay using blank tape		
Frequency response, ferric	20Hz-20.0kHz	very good
Frequency response, chrome	20Hz-20.0kHz	very good
Frequency response, metal	20Hz-0kHz	very good
Stereo separation	−49dB	average
Distortion	0.7%	good
Tape hiss, ferric	−63dB	good
Tape hiss, chrome	−65dB	average
Tape hiss, metal	−61dB	poor
Speed variations	0.04%	very good
Modulation noise	−35dB	poor
Flutter energy (band level)	−26dB	good
MOL, ferric, 315Hz/10kHz	+3.4dB/−8.0dB	good
MOL, chrome, 315Hz/10kHz	+0.8dB/−7.0dB	average
MOL, metal, 315Hz/10kHz	+3.0dB/−1.0dB	good
Input/output performance		
Line in sensitivity/overload	40mV/—	
Mic input sensitivity/overload	0.24mV/24mV	
Output level	240mV	
Typical price inc VAT	£155	

For graph references see issue No 42

SELECTED DEALER DIRECTORY

Choosing a good hi-fi dealer is the most vital step in acquiring the system that is right for you. This uique directory gives full information on dealers in your area.

AVON

ABSOLUTE SOUND AND VIDEO, 65 Park St, Clifton, Bristol. (0272) 24975. A&R, Denon, Dual, Meridian, Mission, NAD, Quad, Rotel, Technics, Yamaha, etc (closed Weds) BADA MEMBER EXDA

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GLOSSARY

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.
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 pair of loudspeakers).
BANDWIDTH: A range of frequencies with presumed defined upper and lower limits.
BASS: Lower part of the frequency spectrum.
BELT DRIVE: The motor has its rotational speed geared down to the required platter speed (33⅓ 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 mid-range 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 lateral 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.
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 the 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 loudspeaker 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 amonst 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.
DISTORTION: Literally this can mean any deviation from the original, but usually refers to harmonic rather than intermodulation distortions when not specified.
DOPING: A technique 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, mid-range, treble or full range 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 mass-controlled 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.
ELECTROSTATIC: A principle employed in some loudspeaker 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 of 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 circuts involved, eg 70μs or 120μs (see 'Microseconds').
FM: Frequency modulated; often used to describe radio transmissions of high fidelity potential on the VHF band.
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), 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.

G L O S S A R Y

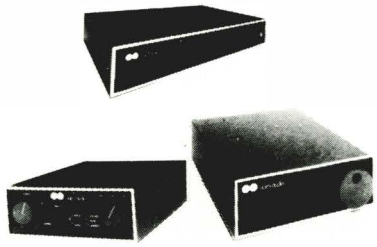
HUM: A low frequency interfering sound produced by break-through or interference from mains wiring or circuitry.
IHF: American Institute of High Fidelity, an important standards body.
IEC: An international standards body.
IMPEDANCE: Measure of resistance (and reactance) in alternating (ie audio) signals; this is of some importance in the compatibility of both cartridges and headphones with amplifiers. For convenience 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.
INTERMODULATION (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 bearings.
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 groove.
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 frequency 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 response 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 tone).
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 the arm.
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 level.
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 charactieristics 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 an 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 side-thrust 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.
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 cartridge. Should match the 20° cutter standard.
WEIGHTING: A factor or function that is applied to a measurement to increase its relevance and usefulness.
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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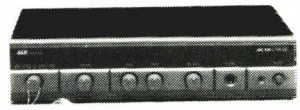


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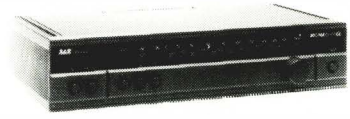


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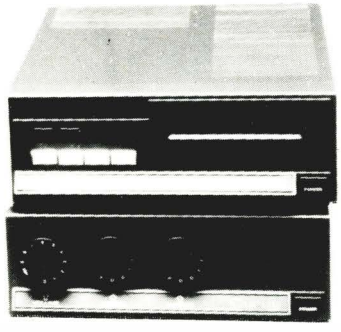
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