

### THE PLANETS BY TANNOY

### Gustav would have approved

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TANNOY

It's hard to believe that Mr. Holst, were he alive today, would be composing with the aid of synthesisers, digital effects units and the like. But we like to think that our Planet range, the Mercury Mk II, the M20 Gold and the new Eclipse, has received his celestial nod of approval.

Quite simply, we sought to combine our acoustic engineering expertise in cabinet design and loudspeaker manufacture into cost effective systems that would gratify even the unforgiving ears in the hi fi press test labs. That our design standards were strictly adhered to has been demonstrated in the Mercury Mk II, a 1986 Hi Fi Choice Award Winner that follows three consecutive annual Awards from Hi Fi Choice for the Mercury Mk I.

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Mr. Holst has introduced many to the beauty of music. We like to think that the Planet range will increase their enjoyment of it too.



Tannoy Ltd., The Bilton Centre, Coronation Road, Cressex Industrial Estate, High Wycombe, Bucks HP12 3SB. Tel: (0494) 450606. Telex: 83251 TANNOY G. Telefax: (0494) 37431. HIFT CHOICE The Best Buy Guide

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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 © 1987, Felden Productions. his 1987 Best Buy Guide is the ultimate survey on all that's best in popularly priced hi-fi components, based on the top models from a year's editions of the uniquely respected *Hi-Fi Choice* buyers' guides, up to August 1987. The more expensive hi-fi equipment is now brought together in *The Collection*, last published April '87 and due for revision May '88, leaving the *Best Buy Guide* to concentrate on the value for money end of the market, which now includes CD midi systems in addition to the traditional hi-fi separates. 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 109).

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GETTING IT TOGETHER 2 This short feature discusses the mixing and matching of components in simple terms.

### TURNTABLES ARMS & Cartridges

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GLOSSARY 173 A non-technical explanation of the technical terms.

# **GETTING IT ALL**

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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' hifi.

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 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 a hi-fi a medium cassette suffers from pre-recorded material which has been improving but is still patchy in quality, and can usually 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 onto 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 probably 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), but dropping. However, disc prices are still nearly 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 these are used all the time whatever the source.

# TOGETHER







Ånd such an argument applies just as strongly to those who wish to record their LP records on to cassette, for convenience and use elsewhere.

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### 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, so one solution may be to use a wall bracket, but these do not sound as good as a floorstanding table as a rule. It may sound unlikely, but amplifiers and CD players (and presumably cassette decks too) can also benefit sonically from carefully stand- or bracketmounting 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 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 have fewer consistency problems than 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 and a poorly aligned machine may give poor disc tracking.

### 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 prejudices 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 guestion 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 For over 700 years the Samurai were part of the ruling elite in Japan. Respected and feared as warriors – they played many powerful roles. Commander on the battlefield, keeper of the peace and avenger of their War Lord or Emperor. They came to represent the highest qualities of leadership in Japan: strength, integrity and respect for beauty.

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# CHOOSING AND USING.. TURNTABLES, ARMS AND CARTRIDGES

espite 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 its continued importance 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. FROM THE INVENTORS OF COMPACT DISC, THE PHILIPS CD 473. A NEW BRILLIANCE IN DESIGN.

### BRILLIANCE

ith compact disc, Philips introduced new levels of fidelity to sound reproduction. > Now with the CD 473, they combine technological flair with the designer's art. 🕨 It offers a specification so complete, no other player matches it at the price. > The brilliance of its sound comes as no surprise. > Philips' own 16 bit 4x oversampling where each piece of digital information is checked four times, sees to that. 🕨 Less expected, perhaps, is the wealth of features designed into the machine. Philips' unique Favourite Track Selection system, for example, is included. So you can edit a disc to play only the tracks you like, in the order you like, as often as you like. > Full remote control is specified with key pad and, unusually, a volume control. > A beautiful shape where form follows function is also part of the deal, with controls placed logically for easy operation. It is a shape, moreover, that fits in totally with Philips' new range of hi-fi separates, allowing you to build yourself a perfectly matched system. > Other niceties abound. > A volume control on the headphone socket. > An uncannily quiet loading tray. > And a price that takes some believing - £250. > The most brilliant touch of all, perhaps? >







TAKE A CLOSER LOOK





### ACOUSTIC RESEARCH EB101



ollowing the successful relaunch of the classic AR deck (now the *Legend*), Acoustic Research UK developed this further *EB-101* model, with 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 £220, 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 33<sup>1/3</sup> 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 a 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, 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.

### 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
Туре	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 sign	na 2) 0.09%
Wow and flutter (lin peak wtd 0.2-6)	Hz/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 screw	s, excl cartridge13.5g
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 ellip	otical)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 res	onances 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	£.22.0

### **ALPHASON OPAL**

ALPHASON, 190-192 WIGAN ROAD, EUXTON, NEAR CHORLEY, LANCS PR7 61W. 

omfortably 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 mediummass 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 counter-



weight at 250Hz and first beam modes at 675 and 950Hz.

### Sound Quality

The Opal gave a good account 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, ex	cl cartridge10.0g
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/descentne	egligible, 2.0 secs/4.5 secs
Arm resonances	good+
Subjective sound quality	good
Arm damping	none
Estimated typical purchase price	£95
For graph references see issue	No 43



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his new Ariston subchassis turntable is available as a £200 player with the *Enigma* arm fitted. Neat, compact and attractive in appearance, in many senses it is a 'slimmed down' economy version of the *RD90*, and again the detail design left something to be desired.

The plinth is textured Q-board, whereas the subchassis is MDF, while the moulded base is fitted with sprung feet. The slim plinth and substantial composite work leave restricted space for the inverted top-adjustable springs, which consequently lack excursion. The single piece aluminium platter is driven by a decent square section belt, with manual speed change via the grooved stepped pulley. The lid, hinged with countersprings, is lightweight styrene, the arm mounting plate overlapped the subchassis by some 40%, and the armlead terminal board had been cracked when fitting.

For the 1986/87 edition Ariston supplied the £126 *Enigma* arm, which is also applicable to any Ariston or other motor units. It is a conventional high quality fixed head arm of moderate effective mass, well suited to almost any cartridge.

### LAB REPORT

Encountering the arm for the first time, it is a decent quality item, typical of its class, with good apparent rigidity and well chosen effective

mass. Bearings were tight and friction levels low, the only minor complaint being the out of kilter bias compensation, which should increase towards the middle of the disc. The resonance graph was a bit scrappy through the midband, and the treble energy level was suppressed. The high quality *Belden* signal leads were susceptible to hum pickup, and needed careful siting.

Rumble was above average, but the spectrogram showed a substantial -33dB 100Hz component, and perturbations between 50 and 100Hz. Absolute speed was a high +0.75% and drift was on the high side too. 0.18% wow and flutter represents marginal high fidelity, and reflects the weak subchassis dynamics. The disc impulse damping was satisfactory enough, while both acoustic and vibration breakthrough gave eminently satisfactory results.

### SOUND QUALITY

Despite the technical criticisms, the *RD60* squeezed a 'good' rating, falling only slightly short of the more expensive '90. The sound was lively, with good frontal detail and a 'tidy' top end. The bass lacked some weight and scale, and the midrange also lacked the transparency and focus of top designs, yet it remained balanced and communicative.

### CONCLUSIONS

Despite giving the impression that a potentially

better turntable is trying to get out of the *RD60*, the overall performance for the price is still good, rating Best Buy with the decent quality *Enigma* arm.

### **TEST RESULTS**

Motor coatio

Туре	manual, belt-drive, subchassis
Platter mass/damping	1.73kg/very good
Finish and engineering	good
Type of mains connecting leads	2 core
Speed options	33¼/45rpm
Wow and flutter (DIN peak wtd sigma	a 2)0.18%
Wow and flutter (lin peak wtd 0.2-6H	z/6-300Hz)0.21%/0.08%
Absolute speed error	+0.75%
Speed drift, 1 hour/load variation	+0.42%/-0.1%
Start-up time to audible stabilisation	3.5 secs
Rumble, DIN B wtd, L/R average (see	spectrum)72/74dB
Tonearm section	
Approximate effective mass	11.5g
Type/mass of headshell	fixed
Geometric accuracy	v good
Adjustments provided	height, overhang, lateral
Finish and engineering	v good
Ease of assembly/set-up/use	v good/good
Friction, typical lateral vertical	20mg/20mg
Bias compensation method	dial spring
Bias force, rim/centre (set to 1.5g ellip	otical)250mg/150mg
Downforce calibration error, 1g/2g	
Cue drift, 8mm ascent/descent	slight, 1 secs/2.5 secs
Arm resonances	average +
Subjective sound quality	average +
Arm damping	c/wt decoupling
Size (w×d×h)/clearance for lid rear	41×34.5×13cm/5cm
Ease of use	good
Typical acoustic breakthrough and res	onancesgood
Subjective sound quality of complete	systemgood
Hum level/acoustic feedback	good/very good
Vibration sensitivity/shock resistance	very_good/fairly_good
Estimated typical purchase price	£220
F .1 (	NI 40



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



n 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, the current models featuring a higher spring rate than the samples reviewed here. 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 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 505's 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 is still managing to maintain a reasonably competitive position despite price rises, and provides a competent hi-fi sound. It may therefore continue to be recommended as a complete package with the OM10 cartridge.

### TEST RESULTS

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 s	igma 2)0.075%
Wow and flutter (lin peak wtd 0.2	-6Hz/6-300Hz)0.95%/0.08%
Absolute speed error	
Speed drift, 1 hour/load variation	+0.065%/-0.2%
Start-up time to audible stabilisati	on 2.4 secs
Rumble, DIN B wtd, L/R average	(see spectrum)72/-74dB
Arm section	
Approximate effective mass, inc s	crews, excl cartridge10g
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 re	ar43.5×37×14cm/7cm
Ease of use	good
Typical acoustic breakthrough and	resonancesaverage+
Subjective sound quality of comp	lete systemaverage
Hum level/acoustic feedback	good/good
Vibration sensitivity/shock resistant	ncegood/good
Estimated typical purchase price	£125 (Deluxe, £145)



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

### SOUND QUALITY

Comparative listening 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.

### **TEST RESULTS**

Arm section	
Approximate effective mass, inc screws, excl	cartridge13g
Type/mass of headshell	fixed
Geometric accuracy	very good
Adjustments provided	_height/overhang/offset
Finish and engineering	very good
Ease of assembly/set-up/use	very good
Friction, typical lateral/vertical	35mg/10mg
Bias compensation method	/internal_spring
Bias force, rim/centre (set to 1.5g elliptical) .	2 30mg/260mg
Downforce calibration error, 1g/2g	+0.1g/+0.15g
Cue drift, 8mm ascent/descent	1.0 secs/3.5 secs
Arm resonances	good
Subjective sound quality	good+
Arm dampingde	ecoupled counterweight
Estimated typical purchase price	£129

For graph references see issue No. 40



inn felt that the detachable head-

shell fitting on their LVX represented a weakness, so decided to pro-

duce the Plus. Here the headshell

has been rigidly and permanently

factory fitted and is rigidly as well as

permanently fixed. A feature of this relatively

inexpensive Japanese-made product is the in-

clusion of the current Basik cartridge, a

competent performer which retails at £18 when

**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, and a current

sample showed fine friction levels. The bias

correction was estimated at an appropriate

Downforce calibration was fine, though cue

purchased as a separate item.

230mg rim and 260mg centre.



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### LINN AXIS

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oubtless driven bv the of a decade's healthy growth, Linn have finally released a medium priced integrated turntable, their unparalleled reputation ensuring that it recieves considerable attention. From first sight the £300 Axis is immediately and obviously a Linn, neater, smaller, more compact and modernlooking than the timeless Sondek. The plinth is finished in a classy textured 'black ash' vinyl; the top plate is a chameleon grey piece of 12mm MDF; and the lid is a cheap polystyrene affair. The arm is the familiar detachable-head Basik LVX model, with a neat leadout wire clip on the plinth.

Internal design and engineering shows a thoroughly impressive combination of innovation, cost effectiveness and excellence. The motor (a series wound version of that used in the LP12) and elaborate power supply are PCBmounted with heatsink cooling at the rear of the plinth. The 33/45 supply uses a bi-phase oscillator and voltage ramping to provide high initial start-up voltage, reducing the power and consequent vibration when the player is up to speed. The crown wheel pulley, hub, bearing and platter are all familiar to those who know the *LP12* – the only significant compromise being the substitution of less dense aluminium for Mazak in the platter/hub.

Instead of Sondek's classic suspended subchassis operating below the arm/cartridge resonance, Axis has a clever system which isolates the top plate, platter and arm above about 20Hz, using a self-centring rubber membrane arrangement, a foolproof (even dealerproof) arrangement that should ensure a long term accurate set-up.

### LAB REPORT

The arm has been covered extensively in the past. The detachable head comprises tube rigidity and resonance behaviour compared to the Basik Plus and others in its class, but bearing quality, geometry, calibration and the like are all up to the mark.

Rumble measured well enough, higher frequency motor breakthrough being notably absent. Start-up time was slow, and slowing under load only reasonable. Weighted wow and flutter was very good, but linear wow measured a poorer than average 0.24%. The disc impulse showed the expected felt mat effect on the initial transient, with only slight, low amplitude ringing thereafter. The breakthrough results were both very good, except at very low frequencies.

### Sound Quality

Axis not only looks like a Linn, it sounds like one as well, rating 'good' overall, which is impressive for the price. Lacking the full weight and authority of the LP12, the bass was still very even and tuneful.

Essentially lively in character, with good dynamics, 'speed' and timing, there was slight treble 'coarseness' and midband 'thickening'. Stereo imaging was a little 'forward', but with decent focus and depth.

#### CONCLUSIONS

cleverly engineered and thoroughly competent performer has a sound quality that is not far behind the LP12 in many respects. The hassle free set-up is a major consistency benefit, and the competitive price could give new impetus to the vinyl disc medium. Frankly, it deserves the Basik Plus tonearm, but is strongly recommended nonetheless.

### **TEST RESULTS**

M . . . . .

wotor section	
Туре	_electronic, belt, semi-subchassis
Platter mass/damping	1.5kg/good
Finish and engineering	v good
Type of mains connecting leads	3-pin socket/phonos and earth
Speed options	variable, 331/3/45rpm
Wow and flutter (DIN peak wtd sig	gma 2)0.05%
Wow and flutter (lin peak wtd 0.2-	6Hz/6-300Hz)0.24%/0.07%
Absolute speed error	+0.47%
Speed drift, 1 hour/load variation	0%/-0.2%
Start-up time to audible stabilisation	on10 secs
Rumble, DIN B wtd, L/R average (	see spectrum)74/-78dB
Arm section	
Approximate effective mass	12.5g
Type/mass of headshell	special detachable/7g
Geometric accuracy	v good
Adjustments provided	height, overhang, lateral
Finish and engineering	v good/good
Ease of assembly/set-up/use	good/v good
Friction, typical lateral vertical	50mg/10mg
Bias compensation method	dial spring
Bias force, rim/centre (set to 1.5g e	lliptical)150mg/150mg
Downforce calibration error, 1g/2g	0.1g/-0.1g
Cue drift, 8mm ascent/descent	negl, 1 secs/3 secs
Arm resonances	good
Subjective sound quality	good
Arm damping	c/wt decoupling
System as a whole	
Size (w×d×h)/lid at rear	44.5×14.5×36cm/6cm
Ease of use	v good
Typical acoustic breakthrough and	resonancesv good
Sound quality	good
Hum level/acoustic feedback	good+
Vibration sensitivity/shock resistan	cev good/good
Estimated typical purchase price .	£313

Setting new performance standards for £300 this For graph references see issue No. 48





### LOGIC TEMPO/ELECTRONIC/DATUM II



ack after a brief absence, Logic have revived the *Tempo* as their popularpriced turntable, and offer it with mains or electronic drive, and with *Datum II* or *Datum* S arms, at a corresponding range of price points, none of which makes reviewing any easier.

Tempo is unusual in having a large solid plinth which floats on softly sprung legs. This confers slightly inebriate handling qualities but also gives good vibration rejection. And fine arm termination afforded by inch thick MDF. The plinth-mounted motor is carefully decoupled at its mounting, and the lid is good quality vinyl with sensible hinges, but the main bearing did allow 1mm play at the platter edge. Suspension adjustment is straightforward.

Datum 11 has a highish effective mass better suited to lowish compliance cartridges. If lacking some of the engineering subtlety of the *S*, it offers the same rigid tube and bearings with a substantial headshell and tightly decoupled counterweight. The compact base matches a Linn cutout.

### LAB REPORT

The *II* had tight bearings and negligible friction. Geometry and downforce calibration were both accurate, but bias compensation was a little high and cue descent rather slow. The resonance trace shows the first main mode at a high c900Hz, with quite good control through the midband, and rather 'peaky' but well maintained treble energy.

Rumble was quite respectable, on figures and analysis. Wow and flutter was good though linear wow could be improved. Slowing under load was also below par, and recovery caused some overshoot. The system's good stability and the vinyl damping effectiveness of the phenolic platter is seen in the disc impulse spectrogram. Both acoustic and vibration breakthrough were very good, and largely comparable with a good subchassis design.

### SOUND QUALITY

The various *Tempo* variations ranged from 'above average' through to 'good,' largely according to price but also depending upon personal preferences — the turntable upgrade tending to improve bass and mid, the arm change mid and top. The general character is lively and exciting, a little 'full' perhaps, but with a solid, clear and open midband, with good stereo staging. Treble was a bit 'tizzy' and lacked a little 'crispness' (*Datum II*), but was still better than most at its price.

### CONCLUSIONS

The complications of permutations are made easier to handle when it is clear that all work very well at their respective price points, and the various upgrades were logical and effective. Good engineering and presentation, simple setup, decent measured performance and fine sound quality for the price merit Best Buy rating, each and severally . . .

### **TEST RESULTS**

Motor section	
Туреп	anual electonic belt, decoupled plinth
Platter mass/damping	1.5kg/good
finish/engineering	v good
Mains/connecting leads	2 core/phonos and earth
Speed options	variable, 331/3/45rpm
Wow & flutter (DIN pk wtd)	0.06%
Wow/flutter (lin pk wtd)	0.18%/0.06%
Absolute speed error	+0.05%
Speed drift/load variation	negl/0.3%
Start-up to stability	3.5 sec
Rumble L/R (DIN B wtd)	72/-76dE
Tonearm	
Effective mass (approx)	15
Type/mass headshell	fixed
Geometric accuracy	v good
Adjustments provided	height overhang,lateral
Finish/engineering	excellen
Ease of set-up/use	good
Friction (typical lat/vert)	20mg/10mg
Bias method	dial spring
Bias force (rim/centre, 1.5gE)	225mg/275mg
Downforce error 1g/2g	0/+0.1
Cue drift, 8mm up/down	mild, 1 secs/4 sec
Arm resonances	f good
Subjective sound quality	good
Arm damping	non
Whole system	
Size (w×d×h)/lid at rear	46.5×36×15cm/5.5cm
Ease of use	f good
Acoustic breakthrough, resort	v goo
Sound quality	above average good+ (see text
Hum/acoustic feedback	v goo
Vibration shock sensitivity _	v good/fai
Testevlasia	from £240 manual inc DI



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### **MANTICORE MANTRA**

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anticore is a new name to Hi-Fi Choice, though their principals have had a somewhat chequered history over a number of years, and the Mantra too has evolved over several years. This £330 integrated subchassis player has a version of the fine Rega RB250 tonearm, and was also supplied with an AT95E cartridge. While the black wood veneer finish is rather bulky and severe, initial inspection was very promising from an engineering point of view. Rega's influence is again seen in the thick plate glass platter and felt mat. These rest on three metal studs in the top of the belt-carrying plastic inner hub; the tight main bearing is a hardened steel shaft running on a thrust ball in a brass housing.

The motor has a stepped crowned pulley, allowing manual speed change by moving the fairly elastic flat belt. The subchassis is metal, with additional girder reinforcement, and was properly set-up with generally favourable spring characteristics. The armboard is MDF wood composite, the lid heavy, non-resonant PVC, and the overall standard of finish entirely

#### presentable.

### LAB REPORT

The arm is already well known. It has fine, tight, low-friction bearings and good calibration and ergonomics. The single-casting headshell/beam/ bearing housing shows impressive rigidity with good resonance properties, albeit with minor awkwardness in adjusting arm height. An effective mass of 12g suits most good cartridges.

Most of the rumble spectrum spikes are humrelated and due to the test rig, but the motor contributed a - 46dB component at 200Hz. In other respects the rumble performance was very competent. Though start-up is quite slow, variation under load is commendably slight, indicating good motor torque characteristics. Absolute speed is very slightly slow, while wow and flutter speed variations measured very well.

The acoustic breakthrough spectrum is very good indeed, while the vibration breakthrough is also good though it is possible to detect some spring harmonics of the main 3-5Hz subchassis modes. The mechanical disc impulse test shows an initial behaviour typical of a felt mat system, plus some continuing mild platter rocking.

### Sound Quality

Used 'straight from the box', the results were surprisingly good, considering the very modest cartridge fitted. Replacing the latter (with something costing about 100 times the price!) confirmed the favourable initial impressions. All listeners commented on the clarity and openness of the sound, particularly in the midrange, where detail and focus are pretty good by even the best standards. The bass received a little criticism, 'speed' and 'slam' being rated a trifle below the best.

### CONCLUSIONS

Whatever water may have run under the bridge, it is clear that the Mantra is a very fine package,

deserving strong recommendation. Sound and sensible engineering is reflected in the competent lab performance, while its own particular character gives a sound quality as good or better than its immediate price competition, and better than a number of more costly designs. The fine tonearm completes the player.

### Test Results

Motor section

Type	_manual, belt-drive, subchassis
Platter mass/damping	2.46kg/average
Finish and engineering	very good
Type of mains connecting leads	3 core/phonos
Speed options	33¼/45rpm
Wow and flutter (DIN peak wtd sigm	a 2)0.05%
Wow and flutter (lin peak wtd 0.2-6H	Iz/6-300Hz)0.16%/0.08%
Absolute speed error	038%
Speed drift, 1 hour/load variation	
Start-up time to audible stabilisation	5 secs
Rumble, DIN B wtd, L/R average (see	e spectrum)72/-76dB
Arm section	
Approximate effective mass, inc screw	vs, excl cartridge12g
Type/mass of headshell	
Geometric accuracy	very good
Adjustments provided	overhang, lateral angle
Finish and engineering	excellent
Ease of assembly/set-up/use	very good/good
Friction, typical lateral vertical	<20mg/<20mg
Bias compensation method	magnetic
Bias force, rim/centre (set to 1.5g elli	ptical)150mg/220mg
Downforce calibration error, 1g/2g	<0.15g/<0.2g
Cue drift, 8mm ascent/descent	low, 1 sec/3 secs
Arm resonances	good+
Subjective sound quality	good
Arm damping	some c/wt decoupling
System as a whole	
Size (w×d×h)/clearance for lid rear	46×78×15cm/7cm
Ease of use	average
Typical acoustic breakthrough and re	sonancesvery good
Subjective sound quality of complete	systemgood
Hum level/acoustic feedback	good+/very good
Vibration sensitivity/shock resistance	good/good
Estimated typical purchase price	£330



NAD 5120



ith its price slashed a further 20 per cent, the Czech-built NAD 5120 is now significantly cheaper than its obvious German tival, the Dual

505. The NAD is now £90, including an Ortofon OM10 cartridge. We have re-auditioned it and checked the earlier arm friction problem incorporating the results in the existing review.

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 stillmodest 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; stop and lift-off are automatic. The non-resonant lid is acrylic and 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 slowing under load a 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 a 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

Rating below average, this is still a fine result for the price, and comfortably better than the immediate competition. There is some sense of scale, and balance, coloration and articulation are quite competent. The bass is bouncy enough, but also in a 'rubbery' sense, and imagery and focus are rather 'softened'.

### CONCLUSIONS

Clearly a Best Buy offering 'near hi-fi' sound quality at an almost ludicrously low price, the reservations are the rather indifferent build quality and poor horizontal arm friction, which the customer should try to personally check. (Get the arm zero-balanced, using the stylus guard, and Blu-tack if necessary, and check for lateral freedom from friction.)

### Test Results

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 s	igma 2)0.1%
Wow and flutter (lin peak wtd 0.2	-6Hz/6-300Hz)0.12%/0.12%
Absolute speed error	+0.25%
Speed drift, 1 hour/load variation	synchoronous/-0.28%
Start-up time to audible stabilisati	on2.5 secs
Rumble, DIN B wtd, L/R average	(see spectrum)68/-64dB
Arm section	
Approximate effective mass, inc se	crews, excl cartridge9.0g
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 re	ar42×35.5×11cm/3cm
Ease of use	verv good
Typical acoustic breakthrough and	resonancesaverage+
Subjective sound quality of comp	lete systembelow average
Hum level/acoustic feedback	good/good
Vibration sensitivity/shock resistar	ncegood/fairly_good
Estimated typical purchase price	£89 (inc. OMIC cart.)



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QED R232EN



ssentially unchanged from the year before, the 1987 *QED* does show clear all round improvements in manufacturing tolerances, to the benefit of its performance and appearance. Available in standard and electronic versions, we have re-auditioned the *R232EN*.

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 a 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 the major mode of 600Hz. 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

With some panel disagreement, the 232EN just scraped into this year's above average category (a rather tougher task than it was a year ago). The sound was impressively 'tight' and tidy, with good focus, imagery and transparency. Slightly 'splashy' in the treble, the bass was lively and well-differentiated, lacking a little in weight and extension.

### **CONCLUSIONS**

Scoring only fractionally behind the top marks in its class, the *QED* is a decent well-balanced and nicely presented all-rounder. This latest sample shows fine finish and build quality, so our recommendation continues, with the nonelectronic version representing the better value.

### **TEST RESULTS**

Motor section	integrated turntable
Туре	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/6-30	0.20%/0.10%
Absolute speed error	
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 spect	rum)70.5/-69.5dB
Arm section	
Approximate effective mass, inc screws, exc	l cartridge12g
Type/mass of headshell	fixed
Geometric accuracy	very good
Adjustments provided	none
Finish and engineering	good/good
Ease of assembly/set-up/useexce	llent/excellent/very good
Friction, typical lateral vertical	30mg/<20mg
Bias compensation method	thread and lever
Bias force, rim/centre (set to 1.5g ellitical)_	100mg/180mg
Downforce calibration error, 1g/2g	uncalibrated
Cue drift, 8mm ascent/descentneg	gligible, 1.5 secs/4.0 secs
Arm resonances	average+
Subjective sound quality	good
Arm dampingc	lecoupled 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 resonance	esfairly good
Subjective sound quality of complete system	nabove average
Hum level/acoustic feedback	good/average+
Vibration sensitivity/shock resistance	average+/average
Estimated typical purchase price	inc cartridge £199, £149
For graph references see issue 1	No. 43



### **REGA RB300**

his 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.

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.

### LAB REPORT

Tests showed the *RB300* has 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. A wide range of cartridges are judged suitable in the 8-22cu range.

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

### SOUND QUALITY

It was clear after only a few minutes audition,

comfortable in the company of other reference to nearms in the £250-£400 range.

The sound was notably dry and neutral with excellent control throughout the range. Transients were judged excellent, while it offered a very well-focused sound stage with very good depth. 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.

### **TEST RESULTS**

Approximate effective mass, inc screw	vs, excl cartridge10-11g
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 elli	pical)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 is.	sue No. <b>4</b> 3





### **REGA PLANAR 2 and 3**

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



ince 1984 the RB300 arm has been a standard fitting on the Planar 3 deck. 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 suppress vibration 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 using a conventional rotating 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 wall mounted shelf, 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 metalwork 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. Startup was average for a belt-drive at 4.5 seconds.

Rumble levels were just satisfactory for the price averaging -71dB with the motor off. Acoustic breakthrough was about average and the lid was found to be influential here; results were better when it was entirely removed. 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 welldeveloped, subjectively-assessed balance of performance counts for more than technical excellence with regards to any one parameter. On the debit side the Rega did suffer from a modicum of programme wow, particularly on rock programme, but this was not considered serious at this price level; a mild loss of stereo depth was also noted, together with an accompanying impairment of low bass definition and evenness. Conversely it sounded 'musical' in a balanced and coherent manner.

With the latest arm the Planar 2 sounded more confident. In the upper bass it was sur- For graph references see issue No. 43

prisingly 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, though a Best Buy rating is also appropriate here, noting the excellent RB300 arm.

### Test Results

Motor section	Integrated turntable
Туре	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 cartridge11.5g
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/usev	ery 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 ellipi	cal) 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 70	PpF/counterweight decoupling
System as a whole	
Size (w×d×h)/clearance for lid rear	45×36×12.3cm/7cm
Typical acoustic breakthrough and reso	nancesaverage
Subjective sound quality of complete s	ystemabove_average
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 ma	ut.





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eeking to lower the entry price for serious turntables, Systemdek introduced the II a few years ago. But its 'kitchenware' styling was not an overwhelming success, so along came the IIX, with conventional plinth and cover and an improved 'hanging' suspension. Whether it was the changed appearance or the improved subchassis performance that did the trick is impossible to say, but the IIX performed comfortably better, in the marketplace and the listening room. So now they've transferred the X suspension onto the relaunched II. An electronic power supply is an optional extra, and you can now have a new Systemdek arm to round out the package. We have fully auditioned and partly retested a new II, grafting the results into the original IIX review.

This player has a plate glass turntable with felt mat, and uses a steel subchassis suspended from longish, foam-damped, top-adjustable springs, driven from a synchronous motor via an O-ring, with manual (or electronic) speed change. The Japan-sourced arm is typical of a number offered by various manufacturers, usually at under £100, with fixed headshell, open gimbal bearing and quite substantial main beam. Effective mass is quite high, so low compliance cartridges should be used.

### LAB REPORT

The new subchassis was not quite as stable as

the *IIX*, so wow and flutter is up a bit, but is still not serious. A similar impression is gained from the disc impulse spectrogram, where the initial transient is damped in a typicical felt mat manner, but some LF rocking follows. The other speed characteristics and rumble are fine, while acoustic breakthrough was good, vibration pretty good, with some below 100Hz and a few higher spring modes. The arm was a good example of the type, with tight bearings and low friction, good calibration and reasonable resonance behaviour — fairly lively but well balanced with a mildly 'brash' upper range, with the first main break around 800Hz-1.3kHz.

### Sound Quality

Rating a solid above average, the 1987 *II* set a very decent standard for its price. The sound was quite open and clear with some life, but bass and focus were both a little softened, and the system seemed to become a little congested when dealing with very complex material.

### CONCLUSIONS

The *II/IIX* continues to improve in detail and so has managed to remain fully competitive in this fast changing market. The new arm is good value for low compliance cartridges, and the basic synchronous motor unit is particularly good value, if a rather spartan appearance.

### Test Results

lotor	section	(IIX	figures	bracketed)

lype	_manual or elec., belt, subchass
Platter mass/damping	1.8kg/f goo
Finish/engineering	v goo
Mains/connecting leads	3 core/phonos and eart
Speed options	33½/45rpi
Wow and flutter (DIN pk wtd)	0.14% (0.08)
Wow/flutter (lin pk wtd)	0.16 (0.14)%/0.17 (0.05)9
Absolute speed error	-0.25% (+0.05)
Speed drift/load variation	
Start-up to stability	4 (4.3) see
Rumble L/R (DIN B wtd)	(-76dB/-78dB
Tonearm	
Effective mass (approx)	15
Type/mass headshell	fixe
Geometric accuracy	
Adjustments provided	height, overhang, lateral, ti
Finish/engineering	v got
Ease of set-up/use	v goo
Friction (typical lat/vert)	20mg/40m
Bias method	dial sprin
Bias force (rim/centre, 1.5gE)	130mg/170m
Downforce error 1g/2g	Og/C
Cue drift, 8mm up/down	slight, 1 secs/2 sec
Arm resonances	f goo
Sound quality	above averag
Arm damping	slight c/wt decouple
Whole system	
Size (w×d×h)/lid at rear (IIX)	41×34×16.5cm/16.5cm
Ease of use	v goo
Acoustic breakthrough, resonances	v goo
Sound quality	above averag
Hum/acoustic feedback	v good/exceller
Vibration, shock sensitivity	good (excellent)/f goo
Typical price	£199/£19
* II is skalatal	



### **TECHNICS SLBD-22**

PANASONIC (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS SLI 6JB. TEL: (0753) 34522-



echnics is the hi-fi division of Matsushita, who probably make more turntables than the rest of the world put together. The SL-BD22 is a straightforward budget (£85) semi-automatic player, traditionally finished in Technics' grey/brown, of traditional size and with a traditional pivoted arm - albeit with a Pmount fitment incorporating an EPS-24CS cartridge. Finish and appearance are to the expected high standards, and the simple controls are placed on a front ledge, giving speed selection and pitch adjustment, cueing and stop; start is initiated by removing the arm from its rest, automatics handling stop and return.

Having a P-mount cartridge, downforce and bias compensation are factory set. The arm is a fairly low mass affair, but showed quite good bearing integrity considering the low cost of the unit. The cast aluminium platter has a beautifully cut rim strobe to confirm speed, but is inclined to ring and the mat is very thin. The main bearing mounting showed some rocking tendency too, though the bearing itself was good. The main plastics moulded plinth and tinny resonant cover are coupled direct to the platter and arm, the whole sitting on four vestigial sprung feet. Set-up was nice and simple, straight from the box.

### LAB KEPORT

The arm bearings were impressively free of play and also gave low friction, but the lightweight

construction - giving an estimated effective mass of 6g, suited to highish compliance T4P cartridges - certainly contributed towards the fairly poor resonance performance, which showed plenty of discontinuities and a suppressed treble.

The basic rumble figures are respectable, but the spectrogram shows numerous motor harmonics and 100Hz interference, probably from the mains transformer. Wow and flutter was average, with significant slowing under load. Neither breakthrough test gave good results, the structure being unusually 'live' acoustically in the midband, and very susceptible to vibration at low frequencies: sometimes you just can't win. The disc impulse test was similarly traumatic, with substantial complex rocking.

### Sound Quality

Notwithstanding the indifferent results on our more complex lab tests, the sound of the SL-BD22 was not badly received. It did not quite attain the standards of the two '33 models, but left the L20 for dead. Though rated well below average, this is still not a bad result for an £85 player, and is probably better than most or all at a similar price. It received the criticisms expected at this level, a degree of coarseness, coloration and constricted depth, with high frequency untidiness, but did at least convey a little atmosphere and 'air', and only started to become unpleasant with heavy rock sources.

### CONCLUSIONS

Though this player did not perform well enough to qualify for Best Buy rating, it still did a decent enough job for the price to merit Recommendation, bearing in mind the high standards of finish and build, despite the sonic weaknesses.

### Test Results

Motor section	
Typesemi auto, elect	tronic, belt-drive, solid
Platter mass/damping	0.52kg/poor
Finish and engineering	very good
Type of mains connecting leads_Sockets: 2	core/phonos and earth
Speed options	331/3/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.07%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300	Hz)0.2%/0.15%
Absolute speed error	+ 0.01%
Speed drift, 1 hour/load variation	0.17%/-0.4%
Start-up time to audible stabilisation	1.5 secs
Rumble, DIN B wtd, L/R average (see spectru	im)72/-73dB
Arm section	
Approximate effective mass, inc screws, excl of	artridgeapprox 6g
Type/mass of headshell	P-mount
Geometric accuracy	excellent
Adjustments provided	none
Finish and engineering	very good
Ease of assembly/set-up/use	excellent
Friction, typical lateral vertical	20mg/30mg
Bias compensation method	spring
Bias force, rim/centre	100mg/170mg
Downforce	fixed at 1.25g
Cue drift, 8mm ascent/descent	negligible, 1 sec/3 secs
Arm resonances	below average
Subjective sound quality	well below average
Arm damping	_some c/wt decoupling
System as a whole	
Size (w×d×h)/clearance for lid rear	43×38×9.5cm/4cm
Ease of use	very good
Typical acoustic breakthrough and resonances	poor
Subjective sound quality of complete system	well below average
Hum level/acoustic feedback	good/below average
Vibration sensitivity/shock resistance	poor/fairly good
Estimated typical purchase price	£85
For math references see issue N	0.48







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OPENING HOURS TUES–SAT 10-6 THURS 10-8 CLOSED MONDAYS (EXCEPT IN DECEMBER)





hese two low-cost integrated players are virtually identical apart from the motor systems used. The DD model costs £110 and has a conventional direct drive motor, whereas the £140 QD has quartz crystal speed reference. Compared with specialist hi-fi products they simply bristle with features. Automatics include start, stop and return, with plinth front selection of cueing, auto-repeat, and two (fixed) speeds. The platter rim has beautifully machined strobe markings - of no apparent value as the speeds are fixed. The platter also has disc size sensing to assist the automation and make sure that nasty mistakes (cueing the mat) cannot happen.

This player comes complete with a Technics *P30S* cartridge, and has a P-mount type arm which is not suitable for traditional half-inch screw-mount cartridges. An advantage is that the tracking weight is standardised at 1.25g, so both downforce and bias can be factory set. The low mass arm has good gimbal bearings with no evidence of play, and plinth phono sockets replace the arm lead.

Finished to a high standard in Technics' traditional dark brown/grey, high production volume encourages the extensive use of plastics mouldings, so the plinth and base are determinedly lightweight. The platter is a lightweight aluminium casting, covered in a ribbed mat, but the main bearing is a quality item, with no sign of play. The whole unit stands on fixed, spring/ rubber feet, and the lid is a resonant affair.

Despite obvious cost-conscious manufacturing, there was also evidence of sound engineering.

### LAB REPORT

Tight arm bearings plus good geometry and calibration suggest a quality arm, but it was very difficult to check the lateral friction because of the fixed bias compensation, and there seemed to be some suggestion of sticking here. The tough resonance sweep test is slightly scrappy, with unwanted activity at 500Hz, but the overall result is quite well-damped and balanced.

Rumble is pretty good, and both units showed fine speed stability and control — ironically the DD model (bracketed in data) giving the superior wow and flutter. Acoustic breakthrough was only fair, vibration isolation quite poor at low frequencies, while the disc mechanical impulse showed good initial damping, followed by severe platter rocking.

### Sound Quality

While the Technics 33s fall short of the standards achieved by models whose main emphasis is on sound quality, they at least make a reasonable attempt. The sound is generally quite well controlled, with fair focus and a little depth, but some 'hollow' and 'nasal' midrange coloration. Bass is below average, slightly soft and 'thick', while the treble is rather untidy, if balanced, emphasising surface noise.

### CONCLUSIONS

Though these players stress appearance, build

quality and features at the expense of sound quality, there is good sound engineering in many places, good lab performance, and a sound that is respectable enough, if rather uninvolving. The *DD* version clearly offers the better value for money, but both merit recommendation.

### **TEST RESULTS**

Motor section (DD33 in brackets)

motor section (DD35 in blackets)
Typeautomatic, electronic, direct drive, solic
Platter mass/damping1kg/below average
Finish and engineeringvery good
Type of mains connecting leads_2 core/phonos and earth (sockets)
Speed options331/3/45rpm
Wow and flutter (DIN peak wtd sigma 2)0.15% (0.04%)
Wow and flutter (lin peak wtd)0.13% (0.08%)/0.12% (0.08%)
Absolute speed error0.2% (-0.17%)
Speed drift, 1 hour/load variation0% (0%)/0% (0%)
Start-up time to audible stabilisation2 (1.5) sees
Rumble, DIN B wtd, L/R average (see spectrum)75/-79dB
Arm section
Approximate effective mass, inc screws, excl cartridge7.5g
Type/mass of headshellfixed, P-mount
Geometric accuracyvery good
Adjustments providednone
Finish and engineeringvery good
Ease of assembly/set-up/useexcellent
Friction, typical lateral verticalsee text/20mg
Bias compensation methodfixed spring
Bias force, rim/centre130mg/190mg
Downforce0.1g/0.03g
Cue drift, 8mm ascent/descentvery slight, 1 secs/1 secs
Arm resonancesabove average
Subjective sound qualitybelow average
Arm dampingslight counterweight decoupling
System as a whole
Size (w×d×h)/clearance for lid rear43×38×10cm/3cm
Ease of useexcellent
Typical acoustic breakthrough and resonancesaverage
Subjective sound quality of complete systembelow average
Hum level/acoustic feedbackgood/average
Vibration sensitivity/shock resistancebelow average/good
Estimated typical purchase price£110, 140



### **THORENS TD166III**



horens are always trying to kill off the '166, but the market won't let them. Now it's revived again as a £179 integrated player, based on a low cost version of the classic TD150/160 subchassis motor unit plus Thorens' own arm. It provides auto stop/lift and has cue and speed control along the front of the top plate. The arm is a low mass affair, better suited to more compliant cartridges, and is a cross between fixed and detachable heads - the wires remain continuous and in situ, but a strong collar releases the head for cartridge mounting. The complex gimbal bearings were set slightly loose, and armheight can only be adjusted using shims.

The motor is essentially the same as that produced over many years, albeit now using a low voltage motor fed via a transformer. The metal platter sits on a plastic hub, driven by a compliant belt from a plastic clutch pulley, while the rubber mat surface is now flat (the ribs are found on the underside!). The subchassis springing has foam damping, the lid is cheaper polystyrene, and finish is spartan but clean.

### LAB REPORT

The arm bearings were a bit sloppy, but showed

good friction levels and geometry. Downforce calibration was 20 per cent light, but bias was about right. Resonances included the main, quite severe, torsional mode at around 600Hz, plus an isolated high Q peak at 3kHz, while high frequencies were suppressed.

Based on earlier findings, the motor section has a generally decent lab performance in all departments, including breakthrough, rumble and speed stability.

### Sound Quality

Though the competition is now much tougher, this latest *TD166* reincarnation still delivers the sonic goods, rating firmly above average with the new arm. This has clearly raised the standard a little, though it is still probably the weakspot, and contributed to a degree of treble 'roughness' and 'splash' that might be ameliorated with a kinder moving magnet cartridge. Depth, focus, ambience, resolution and dynamics were all liked, bass was pretty good, though some mid coloration was criticised.

### CONCLUSIONS

Old turntables never die, and fortunately Thorens are persuaded of the fact. This revived '166 yet again takes its place near the top of its class, as a practical, sensibly engineered, and well balanced player.

### TEST RESULTS

Motor section	
Туре	_auto-lift, belt-drive, subchassi
Platter mass/damping	2.5kg/below average
Finish and engineering	goo.
Type of mains connecting leads	2 core/phonos and earth
Speed options	331/3/45rpm
Wow and flutter (DIN peak wtd sign	na 2)0.08%
Wow and flutter (lin peak wtd 0.2-61	Hz/6-300Hz)0.15%/0.06%
Absolute speed error	+1.4%
Speed drift, 1 hour/load variation _	%/-0.18%
Start-up time to audible stabilisation	3.5 sec
Rumble, DIN B wtd, L/R average (se	e spectrum)72dF
Arm section	•
Approximate effective mass, inc scree	ws, excl cartridge7
Type/mass of headshell	fixed
Geometric accuracy	very good
Adjustments provided	overhang, lateral, til
Finish and engineering	2000
Ease of assembly/set-up/use	very_good/good/good
Friction, typical lateral vertical	20mg/20mg
Bias compensation method	thread & weigh
Bias force, rim/centre (set to 1.5g elli	iptical)120mg/170mg
Downforce calibration error, 1g/2g _	-0.2g/-0.4g
Cue drift, 8mm ascent/descent	negligible, 1 secs/2 sec
Arm resonances	above average
Subjective sound quality	average
Arm damping	some c/wt decoupling
System as a whole	
Size (w×d×h)/clearance for lid rear	43×35×15cm/8.5cm
Ease of use	very good
Typical acoustic breakthrough and re	sonancesgood
Subjective sound quality of complete	systemabove_average
Hum level/acoustic feedback	very good/good
Vibration sensitivity/shock resistance	good/fairly good
Estimated typical purchase price	£179
# **THORENS TD316**

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

his new turntable is a higher-quality replacement for the old TD166, a deck which offered excellent value and has since been resurrected. 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 plinthmounted 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.

#### CONCLUSIONS

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.

### TEST RESULTS

Motor unit/integrated player
Typebelt-drive, subchassis, manual
Platter mass/damping3.0kg/good
Finish and engineeringexcellent/very good
Type of mains connecting leadsremote transformer/plus earth
Speed options33/45rpm
Wow and flutter (DIN peak wtd sigma 2)0.06%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)0.14%/0.14%
Absolute speed error0.5%
Speed drift, 1 hour/load variation<0.1%/-0.34%
Start-up time to audible stabilisation7.0 secs
Rumble, DIN B wtd, L/R average74/-76dB
Arm section
Approximate effective mass, inc screws, excl cartridge4.5g
Type/mass of headshellfixed
Geometric accuracyvery good
Adjustments providedheight/overhang/lateral
Finish and engineeringgood/good
Ease of assembly/set-up/use very good/very good/very good
Friction, typical lateral vertical45mg/<15mg
Bias compensation methodthread and weight
Bias force, rim/centre (set to 1.5g elliptical)200mg/160mg
Downforce calibration error, 1g/2g0.075g/-0.15g
Cue drift, 8mm ascent/descentgood, 1.5 secs/3.5 secs
Arm resonancesgood
Subjective sound qualitygood
Arm dampingsome counterweight decoupling
System as a whole
Size (w×d×h)/clearance for lid rear44×37×16cm/6.5cm
Ease of usegood+
Typical acoustic breakthrough and resonances very good
Subjective sound quality of complete systemgood+
Hum level/acoustic feedbackvery good/very good
Vibration sensitivity/shock resistancevery good/average+
Estimated typical purchase price£219
For graph references see issue No. 43

THORENS TD320 PORTFOLIO MARKETING LTD, RIVER WALK, TONBRIDGE, KENT TN9 IDT. -TEL: (0732) 365071-

he 320 is the top model in Thorens' new series, and is also available without arm (321). 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.

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.

#### CONCLUSIONS

The 320 series improves on the traditional strengths of the TD160 and offers a welcome advance in engineering, performance and finish. Competitive in their price category, this range of models is recommended.

#### Test Results

wrotor unit/integrated player	
Туре	_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	
Speed drift, 1 hour/load variation	<0.1%/-0.25%
Start-up time to audible stabilisati	on8.7 secs
Rumble, DIN B wtd, L/R average	
Size (w×d×h)/clearance for lid re-	ar 44×37×16cm/6.5cm
Ease of use	good
Typical acoustic breakthrough and	resonancesvery good
Subjective sound quality of compl	ete systemvery good
Hum levěl/acoustic feedback	very good/very good
Vibration sensitivity/shock resistar	ice very good/fairly good
Estimated typical purchase price	£319
*supplied without arm (TD321BC)	

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#### С ARTRIDGE S



# A&R C77

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

&R's 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 mildly impressive, with plenty of 'bounce' and an 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**

lype, mass	moving magnet 6g
Stylus type	spherical
Stylus inspection resultco	onfirmed, well mounted
Output Level (1kHz, 5cm/s)	3.75mV
Relative output (OdB = 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, 10k	Hz 22, 31, 22dB
Stereo Separation R on L 100Hz, 3kHz, 10k	Hz28, 24, 22dB
Channel diff. from graph, 100Hz, 1kHz, 10k	Hz0.5, 0.5, 1dB
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	n 43

# A&RCAMBRIDGELTD, DENNY END INDUSTRIAL CENTRE, WATERBEACH, CAMBRIDGE CB5 9PB.

-Tel: (0223) 861550-

opular on the UK market for a number of years, A&R have just introduced alternative versions of their C, E and P77s, the Mg suffix denoting a cast magnesium mounting section replacing the standard plastic - shades of the K9! This is a £10 price loading; existing '77 users can upgrade the body alone for £23, and standard models will continue to remain available in parallel.

This is a conventional - even slightly oldfashioned — moving magnet design, majoring on such virtues as a strong square body and lugs with plenty of headshell contact, and a wellfitting stylus assembly. Electrical output is quite normal, and changes in input load capacitance are not dramatic: given the option, 400pF is preferred.

Compliances measured higher this year than before, which is rather a pity as the choice of ideally compatible arms is now more restricted, to low and low/medium mass types. The two models were quite similar, the slightly higher *E* suggesting a typical production tolerance. Under the microscope, the P had a fine fourfaceted 'line' grind on a small nude stone; finish and alignment were both very good. Our review sample of the *E* had a poor quality diasa-shank pseudo-elliptical tip, virtually unpolished and poorly aligned, though we would be surprised if this was not an isolated aberration.



#### LAB REPORT

Tracking abilities are fine. The *P* gave the better separation measurements, but the spectrograms were very similar, showing slight internal asymmetry. The response graphs were also pretty close, and had an old-fashioned characteristic which gave a quite pronounced dip in the presence band around 7-9kHz, with a quite sharp recovery beyond. Such a departure from neutrality invites censure, but history suggests this balance is often well suited to the midpriced system such cartridges partner. Channel balance was quite poor.

#### SOUND QUALITY

Fair consistency between listeners placed the Eat average and the P above average, the latter a pretty fair placement considering the price and the rather 'laid back' balance didn't do the scoring any favours. The difference between For graph references see issue No. 48

TIREDUNIENTING good and poor tip was quite clearly audible in the smoothness (or not) of the top end. Listeners liked the 'scale', richness and good transparency, but focus and dynamics seemed 'softened' somehow, and the sound seemed less 'bouncy' and lively than recollections of earlier '77s.

#### **CONCLUSIONS**

If the metal body has made an improvement, then the generator is showing its age, or the increase in compliance had some influence. Either way, the '77s did not seem as competitive as in earlier years, though the P77 did enough to merit cautious recommendation.

#### Test Results

A&R P77 (E77 in brackets where different)

Type, mass	high o/p m-m, 7g
Stylus type	nude (diasa) detachable
Stylus tip geometry	line (pseudo-elliptical)
Stylus finish/alignment	_v good/v good (poor/skew)
Output Level (1kHz, 5cm/s)	3.9mV
Relative output (0dB = 1mV/cm/s)	2dB
Tracking ability (L,R)	>80, >80μm
Distortion 300Hz (lat+9dB, vert+6dB)_	48/-34 (-35)dB
Frequency response 100Hz-5kHz	+1, -2 (-2.2)dB
Frequency response limits 30Hz-20kHz	+3, -2.3 (+2, -2.6)dB
Stereo Separation 100Hz, 3kHz, 10kHz_	_32, 30, 29 (27, 30, 25)dB
Channel difference 1kHz, 10kHz	1, 0.6, (0.8)dB
Test tracking weight, loading	1.8g, 250-400pF
LF resonance frequency, 11g arm	7.3 (7)Hz
Estimated compliance	24 (26)cu
Recommended arm mass/damping	4-9g (3-8g)/none
LF resonance rise, 11g arm	15 (13)dB
Typical selling price	£57.50 (£47.50)
En much unformance and income	- N 19

# **AUDIO TECHNICA AT95E**

his cartridge is awkwardly not a catalogue item — it's only sold in bulk — and appears on dealers' shelves at various prices. Sitting just above the £18 Linn Basik (AT93) on the AT ladder, the 95E costs £20, or £15, or whatever. Paradoxically, the margin on a £20 '95 is similar to most £40 cartridges, so the dealer doesn't mind which he sells, and the customer is happy to take the half price option.

Cheaply made by robots to fine tolerances, this high output magnetic cartridge has a simple body of reasonable integrity with good stylus assembly fit. The generator is properly located and has just the right compliance to match most popular arms. The cheap shank-mount elliptical stylus is decently finished and well aligned.

#### LAB REPORT

Tracking abilities were reasonable, and separation quite good. The response is a sort of triple-humped rollercoaster of a ride, from +3dB at 20Hz to -2dB at 15kHz — not exactly neutral or extended, but controlled for all that.



High capacitance loading will 'brighten' the treble a little.

#### SOUND QUALITY

Without direct comparison with *Basik*, *AT105s* etc, the 95E sounded pretty good: lively and dynamic, a bit rich and 'heavy', but also quite clear and open. Treble lacked refinement and extension, but the overall balance still deserved an average rating, which is fine for the price.

#### CONCLUSIONS

Ramming home the message that it may be

better to spend a little more on turntable and tonearm and a little less on the cartridge, the 95E is an ideal 'starter model' that responds well to good players. After all, a cartridge with a rather limited and coarse top end isn't going to stand out until the coarseness is out of the record player top end —and that don't come cheap. A clear Best Buy, with the invitation to haggle on price.

#### **TEST RESULTS**

Type, mass	high o/p m-m, 7.2g
Stylus type	_shank mount, detachable
Stylus tip geometry	medium res elliptical
Stylus finish/alignment	good-/good+
Output Level (1kHz, 5cm/s)	4.7mV
Relative output (0dB = 1mV/cm/s)	OdB
Tracking ability (L,R)	80, 75µm
Distortion 300Hz (lat+9dB, vert+6dB)	-45dB/-36dB
Frequency response 100Hz-5kHz	+1.5, -1.6dB
Frequency response 30Hz-20kHz	+1.5, -6dB (see text)
Stereo Separation 100Hz, 3kHz, 10kHz _	30, 32, 26dB
Channel difference 1kHz, 10kHz	0.2, 0.4dB
Test tracking weight, loading	1.8g, 250pF
LF resonance frequency, 11g arm	8.8Hz
Estimated compliance (vert, lat)	18cu
Recommended arm mass/damping	8-14g, none
LF resonance rise, 11g arm	14dB
Typical purchase price	see preamble
For graph references see issue	No. 48

#### AUDIO TECHNICA ATTIOE Audio Technica (uk) Ltd, Technica House, Lockwood Close, Leeds Lsii 500

his 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 mildprofile 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. 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 mgnet 7.2g
Stylus type	elliptical
Stylus inspection result	spherical!
Output Level (1kHz, 5cm/s)	4.0mV
Relative output (OdB = lmV/cm/s)	OdB
Channel balance	1.1dB
Channel separation (L,R)	
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
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

HEST

# AUDIO-TECHNICA AT3200XE II

Audio-Technica (uk) Ltd. Lockwood Close, Leedslsii 5uu.

he '3200XE II is a high output model, though our computer seemed to become confused and came up with what was presumably a spurious reading indicating a 'mid-output', this was not corroborated in practice. The body is fashioned in a polystyrene regrettably redolent of the unpainted toys which fall out of cereal packets, and 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 downforce, 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 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, which is a more than reasonable result considering the price.

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**

RESCONDENDED

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, masshigh ou	tput moving coil 4.3g
Stylus type	elliptical
Stylus inspection resultindiff	erent shape/alignment
Output Level (1kHz, 5cm/s)	0.9mV
Relative output (OdB = 1mV/cm/s)	
Channel balance	0.4dB
Channel separation (L,R)	30, 24.1dB
Tracking ability (L,R)	76, 73μm
Frequency response limits 100Hz-5Hz	+1.5, -2dB
Frequency response limits 30Hz-20kHz	+ 1.5, - 2dB
Stereo Separation L on R 100Hz, 3kHz, 10kH	lz32, 52, 38dB
Stereo Separation R on L 100Hz, 3kHz, 10kH	z28, 32, 27dB
Response limits ref computer mean, 1kHz-15kl	Hz+1.5, -1.5dB
Response limits ref computer mean, 1kHz-20k	Hz+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	.6-18
LF resonance rise, 13.5g arm (vert, lat)	16, 16dE
Typical selling price	£43
	42

For graph reference see issue No. 43

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his newish low output movingcoil model (£70) from Audio Technica has no resemblance to earlier models they have marketed. The stylus assembly is fixed in the generator system, which is glued together from high quality, tough plastic mouldings. This is then fixed in a small cast-metal mounting bracket with full circular lugs to enable tight headshell mounting.

Output is on the low side, even by movingcoil standards, so it is prudent to check for preamp compatibility before purchasing: high gain and low noise are both required. Compliance is quite moderate, though a little on the high side for some of the heavier arms around. A beautiful tiny naked diamond tip was properly finished and fitted, its true elliptical form accurately aligned.

#### LAB REPORT

Tracking abilities were fine with scope for additional improvement if need be. Distortion measured very well, but channel separation was average, if reasonably consistent. Substantial ultrasonic spuriae were generated. The response trace showed a channel discrepancy of 0.5-1dB



over much, but not all of the band. The presence droop was held to just 1dB while the recovery peaks a little early at 10kHz, which will be inclined to add a little treble 'sting'.

#### SOUND QUALITY

Despite one dissenter, the *ATF3* attained a 'good' rating, which indicates a very fine performance for the price. The anticipated high frequency 'untidiness' received comment, as did a certain lack of bass authority. But the overall

sound was big and generous, with a lively pace, good frontal focus and width, and quite good depth and transparency. Appealingly informative, it could also sound a little 'coarse'.

#### CONCLUSIONS

Combining fine subjective performance with good build and tip quality, one can overlook the slight technical weaknesses and firmly recommend this model, as offering a near ideal balance for the price. Some care should be taken to ensure tonearm and pre-amp compatibility.

#### TEST RESULTS

Type, mass	low o/p m-c, 5g
Stylus type	nude low mass, fixed
Stylus tip geometry	true elliptical (0.2×0.7)
Stylus finish/alignment	v good/excellent
Output Level (1kHz, 5cm/s)	0.25mV
Relative output (OdB = 1mV/cm/s)	
Tracking ability (L,R)	>80, >80µm
Distortion 300Hz (lat+9dB, vert+6dB)	- 50dB/- 36dB
Frequency response 100Hz-5kHz	+0.5, -0.2dB
Frequency response 30Hz-20kHz	+1, -0.3dB
Stereo Separation 100Hz, 3kHz, 10kHz	21, 25, 21dB
Channel difference 1kHz, 10kHz	0.2, 0.8dB
Test tracking weight, loading	1.5g, n/a
LF resonance frequency, 11g arm	8Hz
Estimated compliance	22cu
Recommended arm mass/damping	4-12g, none
LF resonance rise, 11g arm	14dB
Typical selling proce	170

For graph references see issue No. 48

RESTRUCT

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#### R T R I D G С Α E

# **DENON DL110**

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

enon were busying away making '103 moving coil cartridges for Japanese domestic and broadcast customers while throughout the rest of the world only Ortofon stuck doggedly to the m-c principle.

Now we have two very competitively priced high(ish) output models. The £60 DL110, finished in an attractive maroon tortoiseshell 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 £60 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 disassociated 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.

HEST HUT

#### **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, masshigh_outp	ut moving coil 4.8g
Stylus type	_advanced elliptical
Stylus inspection resultsmall nude	stone, well aligned
Output Level (1kHz, 5cm/s)	1.5 mV
Relative output (OdB = 1mV/cm/s)	
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
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

# **DENON DL103**

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

ne 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.

It is a large but quite solid and heavy cartridge, with large headshell contact area but halfcircle 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.

#### 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 900 Hz'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 For graph references see issue No 43

can be inconsistent, and generally sounded a little rolled off, while the midrange extended the good clarity established through the bass.

#### CONCLUSIONS

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 DI 103

DERION DEROS	
Type, masslow output	it moving coil, 8.5g
Stylus type	spherical
Stylus inspection resultsmall v. short	shank, diagonal set
Output Level (1kHz, 5cm/s)	0.44mV
Relative output (0dB=1mV/cm/s)	
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
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	690

THE CONTENTED

# DYNAVECTOR DV10X IV

Dynavector UK, 117 Kings Road, Long Ditton, Surbiton Kt65je.

his 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.

NICONNESSION

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.

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

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
Styus type	nude elliptica
Stylus inspection result	_good small rectangular sectior
Output Level (1kHz, 5cm/s)	2.35mV
Relative output (0dB = $1mV/cm/s$ )_	
Channel balance	0.4dE
Channel separation (L,R)	26.1, 30dE
Tracking ability (L,R)	80, 77µm
Frequency response limits 100Hz-5H	Iz+1.5, -1dE
Frequency response limits 30Hz-20kl	Hz+2, -2JE
Stereo Separation L on R 100Hz, 31	kHz, 10kHz23, 32, 23dE
Stereo Separation R on L 100Hz, 31	kHz, 10kHz35, 35, 30dE
Channel diff. from graph, 100Hz, 11	kHz, 10kHz0.5, 0.5, 0.5dE
Test tracking weight, loading	1.7g, n.a
LF resonance frequency, 12.5g arm (	(vert, lat)11, 12H
Estimated compliance (vert, lat)	12, 10cu
Recommended arm effective mass	
LF resonance rise, 12.5g arm (vert, l	lat)well damped
Typical selling price	£60
For graph references see is	ssue No 43

# **GLANZ MFG 110EX**

PRESENCE AUDIO, THE OLD POST HOUSE, PLUMMERS PLAIN, HORSHAM, WEST SUSSEX.

PRESENCE AUDIO PRESENCE AUDIO Presence AUDIO provide the set of the set of

> Substantial in size, construction seems wellfounded, 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 cunous 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 pro-



duced 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 overemphasis 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

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

#### ARTRIDG C E S

# **GOLDRING EPIC**

GOLDRING PRODUCTS LTD, UNIT 8, GREY FRIAR'S RD, MORETON HALL IND EST, -Bury St Edmunds 1932 7dx. Tel: (0284) 701101-

his well established budget cartridge from Goldring attracted much interest and favourable comment from its introduction. The body is rather large, though it can be mounted tightly with good contact area.

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.

HEROMOTICS DE LA COMPANY

#### 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. The generally decent performance indicates cautious recommendation in the right system context.

#### Test Results

Type, massmov	ing magnet 6.5g
Stylus type	elliptical
Stylus inspection resultneat	simple elliptical
Output Level (1kHz, 5cm/s)	3. 8mV
Relative output (OdB = 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, -3dE
Frequency response limits 30Hz-20kHz	+1.5, -6/7dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	21, 27, 29dE
Stereo Separation R on L 100Hz, 3kHz, 10kHz	18, 23, 25dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0.5, 0.5, 1dE
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	£18
For graph references see issue No. 4	3

**GRADO MT** MOTH MARKETING, 47 ARMSTRONG CLOSE, WILSTEAD, BEDFORD. -TEL: (0234) 741152-

ike 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.

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 indifferent 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 For graph references see issue No. 43

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. A fine potential performer, it needs, more than most, to be checked out in the prospective system.

#### **TEST RESULTS**

lype, mass	moving magnet 5.5g
Stylus type	not specified
Stylus inspection result	mild elliptical
Output Level (1kHz, 5cm/s)	3.5mV
Relative output (OdB = 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, 10kH	łz26, 31, 29dB
Stereo Separation R on L 80Hz, 3kHz, 10kH	lz 32, 34, 31dB
Test tracking weight, loading	1.5g, n/apF
LF resonance frequency, (13.5g arm) (vert, la	t)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

BESTERIS

### LINN BASIK

LINN PRODUCTS LTD, FLOORS ROAD, WATERFOOT, EAGLESHAM, GLASGOW G76 VEP

onceived originally by Linn as a giveaway with the arm of the same name, to drive home the company's view that the turntable and arm are infinitely more important than the cartridge, the current model *Basik* is now available as a separate £18 item, a price which leaves generous margins for all concerned. It is made in Japan by Audio Technica and based on the AT93, 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  $\pm 1$ dB 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 well-padded 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 (OdB = 1mV/cm/s)	
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,	10kHz20, 23, 19dB
Stereo Separation R on L 100Hz, 3kHz,	10kHz20, 19, 16dB
Channel diff. from graph, 100Hz, 1kHz,	10kHz1.5, 1.5, 1.5dB
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

# LINN K9 LINN PRODUCTS LTD, FLOORS ROAD, WATERFOOT, EAGLESHAM, GLASGOW G76 0EP

inn have 'tweaked' the K9's tail for 1987, stiffening compliance slightly. We have run it through the listening, checked the data, and updated the review. K9 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,  $\pm 1.5$  dB 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

Auditioned on neutral ground (ie outside a Linnbased system), K9 still confidently delivered the goods. Rating 'above average' (one dissenter short of 'good'), it delivered a strong, powerful sound, a little lacking in subtlety and depth, but crisp and well defined. Lacking some space, 'air' and transparency, it could sound a bit relentless, but had good 'speed' and timing, and a fairly sweet, slightly bright treble.

#### **CONCLUSIONS**

K9 continues to provide a finely balanced, energetic sound in a moving magnet context, giving strong competition for many moving coils. Good lab performance, high output and good arm compatibility ensure a continuing Best Buy rating.

#### TEST RESULTS

Type, massmov	ing magnet 7.2g
Stylus type	_'vital' elliptical
Stylus inspection resulthigh quality	vital confirmed
Output Level (1kHz, 5cm/s)	3.3 mV
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 _	<u>+</u> 3, -0.5dB
Response limits ref computer mean, 1kHz-20kHz _	<u>+3</u> , -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	£65



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which we took on board.

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# CARTRIDGES

# NAGAOKA MP10

ery much the 'baby' of the Nagaoka moving magnet range, the *MP10* shares the same impressive rigid body structure, albeit an unattractive dull red plastic moulding, as the 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 sensible, nicely symmetrical, 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 disc 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

Spherical tip apart, the *MP10* is clearly substantially well balanced. 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 (lkHz, 5cm/s)	3.75mV
Relative output (OdB = 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, 10kH	z27, 29, 24dB
Stereo Separation R on L 100Hz, 3kHz, 10kH	z32, 30, 25dB
Chrannel diff. from graph, 100Hz, 1kHz, 10kHz	e.5, 0, 0dB
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	£17
For graph references see issue No	43



NICONNESSION

# NAGAOKA MP11 BORON

he *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*. However, Nagaoka now have a *Boron* version, featuring a cantilever made from this exotic material. This large cartridge is also on the heavy side, but 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  $\pm 0.5$ dB to 12kHz, rolling off thereafter. 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

lype, mass	_moving magnet 6.8g
Stylus type	elliptical
Stylus inspection result	mild elliptical
Output Level (IkHz, 5cm/s)	4mV
Relative output (OdB = 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
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	£38

NAGAOKA MP11 GOLD

his new variation upon a familiar Nagaoka theme capitalises on the formidable reputations of the standard MP11 and last year's Boron (cantilevered) derivative. There's no evidence of a solid gold cantilever fortunately, merely a rather large and unappealing sludgegrey/brown body, albeit sensibly designed for good rigidity, good headshell contact and stylus fit, despite semicircular mounting lugs.

Historically *Choice* preferred the *MP10* and *Boron* to the standard '11 because of the latter's high compliance, but the *Gold* seems to be letting it rise, 27cu restricting arm choice to low mass models only. Substantial internal damping does at least help matters here. And despite the prestige implied by its title, the *Gold* turned out to have a very ordinary diamond, a shankmounted pseudo-elliptical of indifferent polish. Output level is bang on the moving magnet target.

#### LAB REPORT

The high compliance ensures good tracking abilities, but may have contributed to the indifferent separation figures. There was significant asymmetry here, and a suggestion



that the first treble irregularity occurred below 10kHz, but the response trace confirmed good control. The response itself is reasonably flat, losing 1.5dB up to 8kHz and then peaking at 16kHz, with some extreme top irregularity. Channel balance is quite close, but there was some overall uneveness throughout the trace.

#### SOUND QUALITY

So far, not so good, but the *Gold* then proceeded to turn in as strong a listening test performance as the *Boron* had a year earlier, scoring above average at a distinctly average price. Fairly mild criticisms were directed at most areas, but the overall package seemed to balance well subjectively, and rock came over well. The sound tended towards the bland, and dynamics were muted with low level information and depth curtailed, but the sound generally remained clear, open and even.

TIPE CONTRACTOR

#### CONCLUSIONS

The disappointing stylus and unexceptional measured performance is offset by the decent listening results. But the highish compliance has come back, so the cheaper *Boron* remains much the most sensible of the *MP11s*.

#### **TEST RESULTS**

Type, mass	high o/p m-m 6.8g
Stylus type	_shank mount, detachable
Stylus tip geometry	pseudo-elliptical
Stylus finish/alignment	fair/v good
Durput Level (1kHz, 5cm/s)	5 mV
Relative output (0dB = lmV/cm/s)	OdB
Fracking ability (L,R)	>80, >80μm
Distortion 300Hz (lat+9dB, vert+6dB)	
Frequency response 100Hz-5kHz	+0.2, -0.2dB
requency response 30Hz-20kHz	+1.2, -0.2dB
Stereo Separation 100Hz, 3kHz, 10kHz _	22, 25, 20dB
Channel difference 1kHz, 10kHz	0.1, 0.1dB
Test tracking weight, loading	1.7g, 200pF
.F resonance frequency, 11g arm	7.3Hz
Estimated compliance	27cu
Recommended arm mass/damping	3-8g, none
F resonance rise, 11g arm	10.5dB
Typical selling price	£45

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Published in the interests of a revival of competence and ethical standards in Hi-Fi.

# **ORTOFON OM10**

ORTOFON UKLTD, DENMARK HOUSE, TAVISTOCK INDUSTRIAL ESTATE, RUSCOMBE, TWYFORD, BEDICE DECIDIONIL TEL (02.34) 343621

–Berks rg109nj, Tel: (0734) 343621—

his 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.

HIST

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, 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 opensounding, 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, massmov	ing magnet 5g*
Stylus type	'E'
Stylus inspection resultneatly mounted	simple elliptical
Output Level (1kHz, 5cm/s)	3.6mV
Relative output (OdB = 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, -1dB
Frequency response limits 30Hz-20kHz	+15dB
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
Test tracking weight, loading	1.5g, 400pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 7.6H:
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	£2
*includes 2.5g ballast	
**if arm can be re-balanced with ballast removed	
For graph references see issue No. 4	3



his is the £45 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. 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



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, massmd	ving magnet bg
Stylus type	`E
Stylus inspection resultmild elliptica	al, decent quality
Output Level (1kHz, 5cm/s)	3.6mV
Relative output (OdB = 1mV/cm/s)	
Channel balance	0.23dE
Channel separation (L,R)	23.6, 21.6dE
Tracking ability (L,R)	80, 80µm
Frequency response limits 100Hz-5Hz	+1, -0dE
Frequency response limits 30Hz-20kHz	+1.5, -OdE
Stereo Separation L on R 100Hz, 3kHz, 10kHz	30, 26, 25dE
Stereo Separation R on L 100Hz, 3kHz, 10kHz	35, 36, 28dE
Channel diff. from graph, 100Hz, 1kHz, 10kHz	1, 1, 1.5dE
Test tracking weight, loading	1.25g, 400pH
LF resonance frequency, 12.5g arm (vert, lat)	9, 7.6H
Estimated compliance (vert, lat)	21, 25cu
Recommended arm effective mass	5-16g**
LF resonance rise, 12.5g arm (vert. lat)	7. 11.7dE
Typical selling price	£4
* 11 25 1 11 .	

\*\*if arm can be re-balanced with ballast removed

# **ORTOFON MC10 SUPER**

rtofon deserve considerable respect for their singlehanded bearing of the moving coil torch through the dark years of moving magnet domination.

The MC10 Super set out to change all that, providing a fully competitive and comparable £65 model. 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, 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- and medium-mass arms. Although the tracking reserve is not great, it will still be sufficient for most 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.

THESTATION

#### **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, 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 $(OdB = 1mV/cm/s)$	
Channel balance	0.1dB
Channel separation (L,R)	
Tracking ability (L,R)	75, 74µm
Frequency response limits 100Hz-5H	lz+1.5, -1dB
Frequency response limits 30Hz-20k	Hz+1.5, -2dB
Stereo Separation L on R 100Hz, 3	kHz, 10kHz22, 26, 20dB
Stereo Separation R on L 100Hz, 3	kHz, 10kHz24, 28, 21dB
Channel diff. from graph, 100Hz, 11	Hz, 10kHz0.5, 0.5, 0.5dB
Test tracking weight, loading	1.5g, n.a.
LF resonance frequency, 12.5g arm	(vert, lat)9, 9Hz
Estimated compliance (vert, lar)	15, 15cu
Recommended arm effective mass	5-15g
LF resonance rise, 12.5g arm (vert,	lat)14, 12dB
Typical selling price	£65
E d (	NL 42

#### For graph references see issue No. 43

# RATA RP20

RUSS ANDREWS TURNTABLE ACCESSORIES, EDGEBANK HOUSE, SKELSMERGH, CUMBRIA LA89AS.

he RATA *RP20* is built for Russ Andrews by Goldring, and in fact shares a common body with the Goldring *Epic*. The body design is inherently good, 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 matches a sensible range of lowand medium-mass arms, but damping is light, so the heavier arms are better avoided.

#### 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 shows the treble flattening out at around 5kHz and then building up to a substantial peak on one channel, though the other channel is very impressively controlled. A slight 800Hz 'glitch' is visible, though the trace is nice and steady otherwise. Tracking



abilities and groove stability seemed reasonable.

#### 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**

lype, mass	moving magnet (.bg
Stylus type	simple elliptical
Stylus inspection result	_confirmed neat mounting
Output Level (1kHz, 5cm/s)	3.55mV
Relative output (OdB = 1mV/cm/s)	
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,	10kHz26, 41, 27dB
Stereo Separation R on L 100Hz, 1kHz,	10kHz19, 24, 27dB
Channel diff. from graph, 100Hz, 1kHz,	10kHz1, 1, 0dB
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	£22

For graph references see issue No. 43

TITE ON NITRICITI

#### С R Т I D G E S Α R

# RATA RP40

RUSS ANDREWS TURNTABLE ACCESSORIES, EDGEBANK HOUSE, SKELSMERGH, CUMBRIA LA89AS. -TEL: (053 983) 247-

he 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.

NICOM DADAD

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 lightly damped. Tracking abilities were good, and channel balance 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 generator, 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 unusually 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

lype, mass	_moving magnet 7.1g
Stylus type	elliptical
Stylus inspection result	good quality elliptical
Output Level (1kHz, 5cm/s)	3.7mV
Relative output (OdB = 1mV/cm/s)	- 1JB
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, 39JB
Stereo Separation R on L 80Hz, 3kHz, 10kH:	z33, 37, 40dB
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	£44
For graph references see issue No	o. 43

#### KEGA KB100 REGA RESEARCH LTD, 119 PARK STREET, WESTCLIFF-ON-SEA, ESSEX 5507PD. -TEL: (0702) 333071-

INCOMPANIEM lain and simple, this £38 moving magnet model is unusual in having a fixed stylus; in some senses it is 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

#### 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 evidence of excellent cantilever control; the bass started at 35dB and improved to a remarkable 40dB at 10kHz.

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 (OdB = 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-2	20kHz+1, -4dB
Stereo Separation L on R 80Hz, 3kH	z, 10kHz36, 45, 40dB
Stereo Separation R on L 80Hz, 3kH	z, 10kHz35, 37, 39dB
Test tracking weight, loading	1.8g, 150pF
LF resonance frequency, 13.5g arm (ve	ert, 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

# SHURE M92E

his 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



#### 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.

they are nevertheless adequate.

#### CONCLUSIONS

Capable of a respectably decent sound for a respectably low price, the 92*E* 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 confirm	ned, neatly 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-15kH	z+0, -4dB
Response limits ref computer mean, 1kHz-20kH	z +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

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TEREOIDIAN AND

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

This £44 moving magnet model features Shure's stabiliser/brush, which dampens the vertical low frequency resonance completely. The additional stability ensures that the '97*HE* 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 '97*HE* 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 '97*HE* 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.

#### **TEST RESULTS**

lype, mass	_moving magnet 6.6g
Stylus type	_nude hyperelliptical
Stylus inspection result	_tip obscured by glue
Output Level (1kHz, 5cm/s)	4mV
Relative output (OdB = 1mV/cm/s)	OdB
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
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 purchase price	£44

\*excluding stabiliser, see text





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# AMPLIFIERS

liché 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, convenience 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 many readers 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 preamplifier 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. Ten years ago 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 have since 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 digital 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.

G.

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 improvements in 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.



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# AMPLIFIERS



**A&R ARCAM ALPHA** 



hough now rumoured to carry a 'Plus' suffix, there was no sign of such designation upon either the amplifier or its carton, though a number of changes have been made over the original *Alpha* which was first introduced three years ago. Our 1987 sample was now in an all black finish, emphasised rather effectively in pale blue legends and highlights. We carried out full re-auditioning and updated the measurements where necessary, most of the changes relating to the power supply and detail component selection for enhancing sound quality.

The *Alpha* shows a slight but worthwhile increase in power over its predecessor, maintaining its good load tolerance and power bandwidth, and with a significant increase in peak current capability.

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 moving magnet disc, and the well-laid out controls incorporate bass and treble. Ergonomically, however, the five identical knobs do not make for the easiest, most instructive operation.

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.

#### LAB REPORT

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 bipolar direct coupled, and the earlier stages use high quality (and improved) 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.

Attaining a comfortable 101dBA maximum loudness on test, the peak 80hm power delivery reached 17dBW (50W) and rated power was comfortably achieved into 20hms 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

Rating a solid above average, the *Alpha* continues to maintain its competitiveness on sound quality. Unanimously described as 'nice-sounding', this is both praise and criticism, but more than most it should fit unobtrusively into almost any system context. The sound was a little 'small', somewhat 'softened' and lacking a little speed, 'sparkle' and transparency. But it was also refreshingly free of 'hi-fi-ish' qualities in the perjorative sense, staying well under control and giving good musical involvement.

#### CONCLUSIONS

Comfortably continuing to merit recommendation, the *Alpha* is a fine and essentially musical allrounder, with sound lab performance, sensible facilities, fine build quality and attractive presentation. Though it showed some sonic limitations in the context of the very highest quality ancillaries, the overall balance has been very well judged to make the most of the lesser components its price indicates will be likely partners.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=IW), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ec	30W/(=	=15dBW/)
Power output	20Hz	1 kH2	20kHz
One channel, 80hm load	16.4dBW	16.8dBW	16.8dBW
Both channels, 40hm load	13.1dBW	14.1dBW	14.1dBW
One channel, 20hms, pulsed	-dBW	14.9dBW	– dBW
Instantaneous peak current		+13A	-12.5A
Distortion			
Total harmonic distortion,	20Hz	1 kHz	20kHz
at rated power, aux input	-73.7JB	-73.1dB	-66.2dB
Intermodulation, 19/20kHz, rated po	wer, aux	input	77.9dB
Intermodulation, 19/20kHz, at 0dBW	/, disc (m	m)	-73.7dB
Noise			
Disc (mm) input (IHF, CCIR weighted	ed)		73.0dB
Aux/CD input (IHF, CCIR weighted	)		76.9dB
Residual, unweighted (volume control	ol at min)		78.9dB
DC output offset	left	-8mV, rig	ht +6mV
DC offset, pre-amp	left n	/a mV, righ	it 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)	0.270hm	0.270hm	0.330hm
Channel balance, disc, at 1kHz			1dB
Volume/balance tracking	0dB	-20dB	-60dB
Aux input	0.06dB	1.05dB	1.07dB
Input data socket type so	ensitivity	loading	
Disc (mm) inputPhono	0.42mV	46kohms	110pF
Disc (mc) input* n/a	n/a mV	n/a kohms	n/a nF
Aux inputPhono	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		+ 0 d B	8, -1.5dB
Size (width, height, depth)		40>	<8×22cm
Typical price inc VAT			\$15.0

#### M P L IFIE R S Α

AUDIOLAB 8000A

CAMBRIDGE SYSTEMS TECHNOLOGY LTD, 26 ROMAN WAY, GODMANCHESTER, HUNTINGDON, -CAMBS PE189LN. TEL: (0480) 52521-



ow a well established model, the 8000A has undergone extensive sound quality revisions for 1987, through subtle development and refinement. 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 switchon 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 highcurrent, 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 is a particularly careful design, and; 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 80hms. The 40hm 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 40hms 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 produced into the severe load.

#### CONCLUSIONS

For '87, Audiolab have further enhanced the For graph references see issue No. 50

sound quality, by subtle improvements to the interior circuitry, so fully maintaining the model's keen competition. The 8000A is a fine integrated amplifier of very good power delivery with 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 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### TEST RESULTS

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	nec	50W(=	= 17dBW)
Power output	20H:	1 kHz	20kHz
One channel, 80hm load	19.4dBW	19.5JBW	19.0dBW
Both channels, 40hm load	17.2dBW	17.6dBW	17.0.JBW
One channel, 20hms, 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	-80JB
Intermodulation, 19/20kHz, rated po	ower, aux i	nput	
Intermodulation, 19/20kHz, at 0dBV	W, disc (mi	n)	85dB
Intermodulation, 19/20kHz, at 0dBV	W, disc (me	.)	- 80dB
Noise			
Disc (mm) input (IHF, CCIR weight	ted)		
Disc (mc) input (IHF, CCIR weight	ed)		73dB
Aux/CD input (IHF, CCIR weighter	d) (b		
Residual, unweighted (volume contr	ol at min)		
DC output offset		left 2mV, r	ight 3mV
Input overload	_ 20H:	1 kH:	20kH:
Disc (mm) input (IHF)	29JB	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	-77JB	— 56JB
Output impedance (damping)	0.030hm	0.040hm	0.12ohm
Channel balance, disc, at 1kHz			0.04dB
Volume/balance tracking	OdB	— 20dB	-60dB
Aux input	0.04dB	0.0dB	3.6dB
Input data socket type	sensitivity	loading	
Disc (mm) inputDIN	0.3mV	47kohms	35pF
Disc (mc) inputDIN	0.007mV	100ohms	4.7nF
Aux inputDIN	12mV	20kohms	70pF
Output, pre-amp (tape)		.7.7V max,	600ohms
Disc equalisation error, 3CHz-15kHz		+0.1dE	8, -2.2dB
Size (width, height, depth)		44.5×7	.4×34cm
Typical price inc VAT			£325
First reviewed: 1983. Retested 1985.			

# AMPLIFIERS



# **CAMBRIDGE AUDIO P40**



hough the name stretches back nearly two decades, Cambridge Audio products have only been intermittently available, the company changing hands and lying dormant on occasion. Now owned by an engineer who was involved back in those early amplifier years and having conspicuous current success with a state-of-the-art CD player, after some hesitancy the amplifier range is beginning to re-establish itself too. Last year's *Integer* has evolved into a *P55*, at a slightly higher price and power rating than the new £200 *P40* integrated amplifier reviewed here, itself reviving one of the names from Cambridge's past.

This being the 'eighties rather than the 'sixties, P40 is now a simple 'straight line' design with minimal facilities to clutter the signal path. Housed in a simple slimline black enclosure, finish has been significantly improved over earlier Cambridge production and is now to a high standard, though one could still pick a nit or two over the 'feel' of the controls. There are just three large control knobs and three pushbuttons, the former for volume, balance and input selection, the latter for power on/off, mono/stereo and tape monitoring. The rear panel has a single row of phono plugs for interconnection, plus 4mm sockets for loudspeakers; between the disc inputs a switch selects the extra gain needed for moving-coil cartridges.

#### LAB REPORT

The *P40* has a particularly clean and direct layout, construction being based on a single printed circuit board that has an 'audio quality' substrate. The output stage is conventional complementary direct coupled bi-polar, and high quality ICs are used for the disc input. The passive line stage provides lower sensitivity on line inputs. A generous toroidal transformer with plenty of reservoir gives shared supply to the two channels; build quality is good, and high current fuse protected transistors are used.

The *P40* comfortably beat its rated 40W/16dBW, but the 3dBW loss when driving both channels into 40hms is a little severe, indicative of the shared supply. Power bandwidth

is very good, and peak current capability a fine +/-20A, so there is plenty of reserve 'urge'. The power supply modulation test showed that spuriae were at a low level, but the background was a little 'dirty' in terms of the number of components generated at low level in the power supply.

Distortions were pretty good except at high frequencies where there was some significant deterioration: there was some question about high frequency stability when rigged up using short low inductance wiring in the lab, but this was not encountered during normal use with cables. The noise figures were reasonable except on the moving-coil input, where -55dB is barely adequate and was gently audible. Stereo separation was reasonable enough, and overload margins adequate, if a little suspect at high frequencies on the moving-coil input. Sensitivities were a little lower than average, and volume/balance tracking could have been improved at low levels. The RIAA disc equalisation curve showed quite sharp bandwidth curtailment at low frequencies, -20dB at 50Hz and -7dB at 20Hz, but a smooth, neutral characteristic elsewhere.

#### SOUND QUALITY

Our first sample delivered only mono, but still sounded very promising nonetheless: its replacement rated good overall, a fine result for the price. Particularly impressive was the subjective 'speed' and 'grip', giving a fine impression of coherence and integration with excellent dynamics. There was some criticism of a treble 'untidiness', and a certain lack of sweetness here, with some sibilant emphasis, but the soundstage was open and clear with good transparency and reasonable depth portrayal. The quality improved with CD, suggesting that the power amplifier is more capable than the pre-amp section.

#### CONCLUSIONS

Subjectively one of the better integrated amplifiers around, the *P40* still shows room for improvement, particularly on the moving-coil disc input, but at least it has this option available, and produced a sound quality which justified the step-up in price from popular £150 models, particularly for rock music listeners. The sample fault we encountered was clearly just that (late as usual, they rushed us a sample diverted from an export batch, modifying it without proper checking!), and some caution should be taken avoiding exotic loudspeaker cables and/or very short runs, but the P40 is clearly a welcome new Best Buy, even if it is still a little wet behind the ears.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output		Integrate	d amplifier
Rated power into 80hms, maker's s	pec	40W	(=16dBW)
Power output	20H:	1kHz	20kHz
One channel, 80hm load	17.5dBW	17.86dBW	17.65dBW
Both channels, 40hm load	14.5dBW	15.2.JBW	14.9dBW
One channel, 20hms, pulsed	-dBW	15.5dBW	-dBW
Instantaneous peak current		+ 20.0A	-20.0A
Distortion			
Total harmonic distortion,	20H:	1 kHz	20kHz
at rated power, aux input	-75.0dB	-74.0dB	— 51.0dB
Intermodulation, 19/20kHz, rated r	ower, aux	input	75.0dB
Intermodulation, 19/20kHz, at 0dB	W, disc (r	nm)	71.0dB
Intermodulation, 19/20kHz, at 0dB	W, disc (n	nc)	63.0dB
Noise			
Disc (mm) input (IHF, CCIR weigh	nted)		73.0dB
Disc (mc) input (IHF, CCIR weigh	ted)		55.0dB
Aux/CD input (IHF CCIR weighted	ed)		75.0dB
Residual, unweighted (volume cont	rol at min	)	78.0dB
DC output offset	le	ft 25mV, r	ight 10mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	31.0dB	30.0dB	30.0dB
Disc (mc) input (IHF)*	31.7dB	30.6dB	22.7dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	67.0dB	67.0dB	50.0dB
Aux input	76.0dB	72.0dB	50.0dB
Output impedance (damping)	0.1220hm	0.116ohm	0.118ohm
Channel balance, disc, at 1kHz			n/a dB
Volume/balance tracking	0dB	-20dB	- 60dB
Aux CD input	0dB	0.7dB	5.0dB
Input data socket type	e sensitivi	ty le	ading
Disc (mm) inputPhono	0.56mV	47kohms	115pF
Disc (mc) input*	0 062mV	47kohms	115pF
Aux inputPhono	42.5mV	7.0kohms	410pF
Output, pre-amp (tape)	1	0.25V max	, 7.7kohms
Disc equalisation error, 30Hz-15kH	z	+	JdB, −5dB
Size (width, height, depth)		43.6×6.2	25×28.2cm
Tunical price inc. VAT			£200

#### S Μ Ρ L Т F E R Α

### **DENON PMA-250**

HAYDEN LABORATORIES, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST PETER, BUCKS.

-TEL: (0753) 888447-



uilding upon the undoubted success of their 'budget' '707 model, Denon have moved a little upmarket to the next convenient price point with the £125 PMA-250. Rated at a modest 25W/channel, this offers a little more 'under the skin' engineering in an even simpler 'straight line' design which is clearly intended to accept some of the compromises necessary to achieve good sound quality. For example, there is no switching in the output to the loudspeakers, so headphone listeners will have to unplug the speakers (at the amplifier and with a little care please) if they want to avoid disturbing others.

Tone controls are still fitted, and can only be bypassed when using the CD input, but they remain the only unnecessary frills. The rest of the front panel offers only input switching (MM only disc), tape monitor and 'CD direct' pushbuttons, plus the headphone jack, volume control and on/off switch. The rear panel uses phono inputs throughout, with substantial binding posts providing high quality connection for a single pair of loudspeakers. Internally there is evidence of care and expense taken in selecting high quality components for enhanced sound quality, the sort of approach normally only adopted by smaller, more specialist manufacturers.

#### LAB REPORT

Technically this amplifier has a conventional class A/B direct-coupled complementary bipolar output, with IC driver stage. It is clearly derived from the 707, but has an improved power supply and uses more carefully selected high quality components and has a simpler, more direct signal path. Internally it is built to a very high standard, reflecting the external finish in this respect.

The '250 comfortably beat its admittedly modest power rating, the power delivery being reasonably well maintained into lower impedances, though the ultimate current capability is adequate rather than generous. Distortion was low, and signal-to-noise ratios were satisfactory. Stereo separation and input overload margins both measured very well.

Though input sensitivities are sensibly chosen, note that the disc input already has 250pF capacitance loading: add another 100pF or so for the leadout wires and the total might be on the high side for ideal matching with the odd cartridge, though most will match fine. The power supply modulation test gave a decent enough result, mains harmonics being below signal harmonics. There is a little room for improvement in volume control tracking, indicative of component tolerancing perhaps. A similar factor may explain the RIAA equalisation: the gentle undulation here will probably play a minor role in determining the overall character of the sound from disc. There is no evidence of bandlimiting on the disc input, so results may vary somewhat with different turntable systems.

#### Sound Ouality

The '250 was rated comfortably above average, good for the price, and towards the top of an increasingly varied and extensive range of 'budget plus' integrated amplifiers from both UK and Far Eastern sources. The sound was distinctively more 'open' than that found with more complex designs, with some attempt at depth portrayal and proper stereo staging, albeit at a sub-audiophile level. Dynamics were quite lively with an attractively 'bouncy' character, while remaining generally tidy and coherent, though the sound lacked a little 'sparkle' and any real sense of 'scale'.

#### CONCLUSIONS

Improving significantly on the sound quality of its '707 predecessor, though to some extent For graph references see issue No. 50

reflecting the steady forward progress of the market as a whole, the '250 turns out to be a well balanced package, sensibly conceived and attractively priced. At the £125 stated typical price, it just manages a Best Buy rating, successfully creating a blend with broad appeal across a wide range of tastes.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB = IW), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ec	25W(=	=14dBW)
Power output	. 20Hz	1 kHz	20kHz
One channel, 80hm load	16.5dBW	16.6dBW	16.6dBW
Both channels, 40hm load	13.3dBW	13.8dBW	13.7dBW
One channel, 20hms, pulsed	-dBW	13.5dBW	– dBW
Instantaneous peak current		+9.5A	-9.5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	-83dB	-87dB	-68dB
Intermodulation, 19/20kHz, rated po	wer, aux in	nput	101dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (mr	n)	75dB
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		68dB
Aux/CD input (IHF, CCIR weighted	i) (i		75dB
Residual, unweighted (volume control	ol at min)		79dB
DC output offset	left - 1	9mV, right	-18mV
Input overload	. 20H=	1kHz	20kHz
Disc (mm) input (IHF)	. 32.5dB	31.9dB	30.8dB
Aux/CD input (IHF)	. >20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	69dB	54dB	61 dB
Aux input	73dB	54dB	61dB
Output impedance (damping)	0.24ohm	0.24ohm	0.240hm
Channel balance, disc, at 1kHz			0.02dB
Volume/balance tracking	0dB	– 20dB	-60dB
Aux input	0.06dB	0.39dB	3.94dB
Input data socket type	sensitivity	loa	ding
Disc (mm) inputPhono	0.56mV	47kohms	250pF
Aux inputPhono	32.3mV	90kohms	40pF
Output, pre-amp (tape)	l	0.9V max,	100ohms
Disc equalisation error, 30Hz-15kHz		_+0.32dB,	-0,33dB
Size (width, height, depth)		43.5×8	5.5 × 26cm
Typical price inc. VAT			£125



### AMPLIFIERS

### KENWOOD KA-550



uriously, only Japan and the UK used the Trio brand name on this company's hi-fi equipment. Throughout the rest of the world they were known as Kenwood, a brand identity that was until recently considered unacceptable by a certain UK manufacturer of small kitchen appliances. Japan came into line last Summer — with a positive influence on sales to boot — and the UK is now following. From Spring '87 all Trios will now be Kenwoods.

The KA-550 is a 40W integrated model, retailing for around £130. Very smartly finished and sensibly laid out, it makes a few compromises in the interests of convenience, notably the separately switched accommodation for two sets of loudspeakers. But Kenwood have clearly made an effort to keep signal paths short for the sake of sound quality, and unlike many of its immediate rivals in this increasingly competitive sector of the marketplace, the '550 sports a moving magnet/moving-coil cartridge matching option.

Aside from the prominent power switch and volume control, the top section of the fascia provides 'CD Direct' and 'line straight' switching. The lower section has a set of large pushbuttons for input and tape monitoring selection, small pushbuttons select loudspeakers, subsonic filter, – 30dB attenuation, and mm/m-c cartridge. The rear panel uses phono sockets throughout, and generous binding posts for loudspeaker connection.

#### LAB REPORT

Differential FETs improve the performance of the disc input IC op amps to the point where the mm/m-c option is feasible. Both the 'direct' switch routes shorten internal signal paths, and some care has been taken over the circuit layout. The power amps are fully integrated hybrid ICs using conventional complementary configuration, fed from a decent size power supply with separate regulation to earlier stages.

Power delivery clearly exceeded the specification when one channel was driven into 80hms, and still held up reasonably well into lower impedances, reflecting the generous, if somewhat asymmetric current capability. The power supply modulation spectrogram shows generally good isolation and behaviour.

The various distortion and noise measurements were all good, input overload margins were ample, and stereo separation was very respectable too. The various input parameters all appear to be sensibly chosen. The RIAA disc equalisation was commendably flat and sensibly bandlimited particularly *via* moving-coil (the mm trace shows much less low frequency curtailment).

#### SOUND QUALITY

Rating comfortably above average, the '550 proved to be a gutsy performer, with decent bass 'speed' and 'attack', albeit lacking a little in 'weight' and accompanied by a little 'untidiness' in the treble. Stereo imagery was well portrayed, with fairly good focus and only mild depth curtailment. Furthermore, the moving-coil cartridge input was no also-ran of indifferent performance as has been the case with some cheaper integrated amplifiers over the years: it is genuinely as capable as the other inputs, which is to Kenwood's credit.

#### CONCLUSIONS

Deserving firm recommendation on the basis of its decent sound quality at an affordable price, the '550 has the additional bonuses of fine finish and build quality and a capable moving-coil input, the latter something of a rarity amongst its immediate competition and a definite plus point.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ec	40W(:	=16dBW)
Power output	. 20Hz	1kHz	20kHz
One channel, 80hm load	17.8dBW	18dBW	17.8dBW
Both channels, 40hm load	15dBW	15.5dBW	15dBW
One channel, 20hms, pulsed	-dBW	16dBW	-dBW
Instantaneous peak current		+13A	-17A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux/CD input	-74dB	-85dB	-74dB
Intermodulation, 19/20kHz, rated po	wer, aux i	nput	
Intermodulation, 19/20kHz, at 0dBW	V, disc (mr	n)	80dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (mo	.)	60dB
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		73dB
Disc (mc) input (IHF, CCIR weighte	ed)		
Aux/CD input (IHF, CCIR weighted	i)		74dB
Residual, unweighted (volume contro	ol at min)		-91dB
DC output offset	left	<5mV, rig	ht <5mV
Input overload	. 20Hz	1 kHz	20kHz
Disc (mm) input (IHF)	. 34dB	33dB	32dB
Disc (mc) input (IHF)*	. 33dB	32dB	28dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	67dB	71dB	48dB
Aux/CD input	80dB	70dB	50dB
Output impedance (damping)	0.150hm	0.150hm	0.25ohm
Channel balance, disc, at 1kHz			0.21dB
Volume/balance tracking	OdB	-20dB	-60dB
Aux/CD input	0.03dB	0.1dB	0.2dB
Input data socket type	sensitivity	loa	ding
Disc (mm) input Phono	0.4mV	47kohms	180pF
Disc (mc) input*Phono	0.04mV	100ohms	n/a pF
Aux/CD input Phono	26mV	57kohms	450pF
Output, pre-amp (tape)	1	3.4V max,	220ohms
Disc equalisation error, 30Hz-15kHz	1	+0dB	, -0.4dB
Size (width, height, depth)		42×10	.5×33cm
Typical price inc VAT			£130

#### A M P L F E R S

# **MARANTZ PM26**

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hough now owned by Philips, Marantz have managed to retain the individual identity of their products, and their amplifiers in particular. Models intended for the competitive UK market receive close sound quality scrutiny at the European end of the operation, and are frequently 'tweaked' in this direction before acceptance.

Simply styled with an attractive touch of individuality, preserving square and rectangular motifs throughout the front panel, the PM26 is a compact integrated model, fairly modestly priced at £110. it is rated at only 30W, though generously so as it turns out, and is smartly finished and intelligently laid out. The main on/off switch and volume controls are clearly distinguished, while tone and balance is provided on a set of sliders. Input, tape monitor and 'loudness selections are made on a row of pushbuttons. A separate button provides tone defeat, and a front panel headphone socket complements the single set of substantial loudspeaker binding posts on the rear. Rear panel source and tape connections are phono throughout, accommodating only moving magnet cartridges.

#### LAB REPORT

The PM26 uses conventional direct coupled complementary bi-polar output devices, with modular IC driver circuits. There is some evidence of careful component selection for sound quality and the single board construction shows neat, simple layout. A single power supply with generous transformer is shared between channels. Overall construction and build is to 'quality budget' standards, though internal mains wiring was unshrouded.

Power delivery measured comfortably above spec driving one channel into 80hms. Though not serious, the drop into 40hms/both channels

was larger than most, while the substantial peak pulsed rating and +12/-14A current delivery suggest that this is a fairly 'loosely' controlled supply. The rather average supply modulation spectrogram is further supporting evidence of this observation.

Distortion and noise measurements were perfectly satisfactory, with good input overload margins. Stereo separation measured rather poorer than average at high frequencies, and the volume/balance tracking deterioration at low levels is some evidence of component economies. The input sensitivities should be fine, but the highish input capacitance on the moving magnet disc input will not ideally suit all cartridges. Add the effect of cabling and 500+pF will produce audible balance changes at high frequencies that will probably be larger than the range of RIAA equalisation curves found throughout our test programme. The '26's RIAA showed sensible bandlimiting plus a slight excess in the 'warmth' region of the spectrum.

#### SOUND QUALITY

Rating a little above average, Marantz have clearly made a serious effort with the sound quality of this model, and this was recognised by the panel, albeit without great enthusiasm. A fair degree of 'bounce' and 'liveliness' was noted, but alongside some loss of resolution, 'thickening' of textures and flattening of perspectives. The bass could have been firmer and better defined, and further criticism was levelled at the 'grip' and control, and a somewhat 'small' sound. When driven hard, there seemed comparatively little reserve of power.

#### CONCLUSIONS

This is a well built and attractively presented model which, on balance, just manages recommendation, though sonically it fell somewhat For graph references see issue No. 50

short of the best examples of its type. Technically competent, there is some evidence of economy in the power supply side, and prospective purchasers should check that the highish cartridge loading is appropriate to their system. Overall, it provides decent performance at a quite modest price.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### Test Results

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ec	30W(=	=15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 80hm load	17.1dBW	17.4dBW	17.2dBW
Both channels, 40hm load	13.7dBW	14.7dBW	14.5dBW
One channel, 20hms, pulsed	-dBW	22.2dBW	-dBW
Instantaneous peak current		+12A	-14.0A
Distortion			
Total harmonic distortion,	20Hz	1 kHz	20kHz
at rated power, aux input	-78dB	-83dB	-76dB
Intermodulation, 19/20kHz, rated po	wer, aux i	nput	63dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (mr	n)	
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		71dB
Aux/CD input (IHF, CCIR weighted	i)		
Residual, unweighted (volume control	ol at min)		-71dB
DC output offset	left	-2mV, rigl	ht +3mV
Input overload	. 20Hz	1 kHz	20kHz
Disc (mm) input (IHF)	. 32dB	32dB	31.3dB
CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	. 61dB	66dB	36dB
Aux input	. 65dB	64dB	38dB
Output impedance (damping)	0.150hm	0.150hm	0.160hm
Channel balance, disc, at 1kHz			0.41dB
Volume/balance tracking	0dB	- 206dB	-60dB
Aux input	0.03dB	0.56dB	5.66dB
Input data socket type	sensitivity	loa	ding
Disc (mm) inputPhono	0.56mV	47kohms	430pF
Aux inputPhono	31.5mV	50kohms	210pF
Output, pre-amp (tape)		_10.7V ma	x, 1kohm
Disc equalisation error, 30Hz-15kHz			_+0.33dB
Size (width, height, depth)		41.5×8	5.5×24cm
Typical price inc VAT			£110

INCOMMONDED



### A M P L I F I E R S

# MARANTZ PM45



his large and imposing integrated amplifier has a high quality black finish and looks rather more expensive than its £200 and 40W/channel rating might suggest. Furthermore, it represents a valiant effort to apply the simplification techniques which promote sound quality in the context of a fully featured package, having undergone painstaking 'tweaking' in a European context prior to introduction.

The four rotary knobs provide some visual symmetry, the pair on the left adjusting 'tone', those on the right selecting input and adjusting volume. A variety of subsidiary controls include a small balance control, switches for tone defeat, 'CD/phono direct', selection of second loudspeakers only (the main ones being permanently connected), tape monitor/copy, plus 'loudness'. Phono sockets provide interconnection, with switching for matching moving-coil or moving magnet cartridges. Substantial binding posts are used for the loudspeakers.

#### LAB REPORT

The output has a conventional complementary bi-polar configuration, fed from an IC driver stage. The protection circuitry is unusual in using a relay system instead of progressive current limitation; this is probably a preferable solution than current limiting, if still representing some compromise. ICs are used in the tone controls and disc input stages, with noise and linearity improved in both by a differential FET stage. The single power supply feeds both channels but separate regulation is supplied to earlier stages. Construction quality is good, with selection of components and layout showing clear attempts to maximise sound quality.

The 40W power rating is extremely conserva-

tive, and was nearly doubled in practice under lab measurement. Power bandwidth is very well maintained, but the simple, shared supply is shown by the significant drop into 40hms. Peak current capability is a generous  $\pm 17$  A, and the power supply modulation spectrogram shows a very clean result, devoid of mains harmonics.

Distortions were quite low, though the moving-coil disc input was rather poorer than the others on intermodulation. Noise was satisfactorily low, input overload margins ample, and separation pretty good. Input sensitivities offer good general compatibility, but 0.5+db error in channel balance was found at several volume settings. The moving-coil RIAA disc input shows a sensibly curtailed low frequency bandwidth and generally even midband, but high frequencies seem to be left wide open, which is mildly worrying.

#### SOUND QUALITY

Rating solidly above average, this is in fact an unusually good result for a full feature design such as the '45. Space, 'air' and focus were all quite good, with a decent attempt at depth portrayal. The balance was considered generally neutral through the midband, but with a touch of 'boom 'n tizz' coloration and 'untidiness' with resolution fading towards the frequency extremes. Generally pleasant and polite with above average clarity, there was some 'softening', particularly in the bass, restricting drama and dynamic impact somewhat.

#### **CONCLUSIONS**

This well balanced, fully competitive package has a sound quality which approaches some of the current 'straight line' integrated amplifiers, while offering a decent quality moving-coil disc input and some power advantage. Formal recommendation is clearly appropriate.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### TEST RESULTS

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	nec	40W(=	= 16dBW)
Power output	. 20Hz	1kHz	20kHz
One channel, 80hm load	18.8dBW	18.8JBW	18.7dBW
Both channels, 40hm load	16.0dBW	16.4dBW	16.4dBW
One channel, 20hms, pulsed	-dBW	17.0dBW	-dBW
Instantaneous peak current		+17.0A	-17.0A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	-74.0dB	-84.0dB	-81.0dB
Intermodulation, 19/20kHz, rated pc	ower, aux i	nput	92.0dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (m	m)	-80.0dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (m	c)	-61.0dB
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		-76.0dB
Disc (mc) input (IHF, CCIR weighte	:d)(b:		68.0dB
Aux/CD input (IHF, CCIR weighted	1) (E		79.0dB
Residual, unweighted (volume control	ol at min).		-90.0dB
DC output offset	left <	10mV, righ	t <10mV
Input overload	20Hz	1 kHz	20kHz
Disc (mm) input (IHF)	29.3dB	29.8dB	28.5dB
Disc (mc) input (IHF)*	. 32.0dB	31.0dB	30.0dB
Aux/CD input (IHF)	. >20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	72.0dB	84.0dB	59.0dB
Aux/CD input	82.0dB	78.0dB	53.0dB
Output impedance (damping)	0.070hm	0.070hm	0.15 ohm
Channel balance, disc, at 1kHz			0.53dB
Volume/balance tracking	. 0dB	- 20dB	-60dB
Aux/CD input	0.01dB	0.75dB	0.42dB
Input data socket type	sensitivity	loa	ding
Disc (mm) inputPhono	0.4mV	44kohms	200pF
Disc (mc) input*Phono	0.043mV	100kohms	1nF
Aux/CD input Phono	26.0mV	22.0kohms	85pF
Output, pre-amp (tape)		9.5V max,	220ohms
Disc equalisation error, 30Hz-15kHz		+ 0 d B	s, −0.8dB
Size (width, height, depth)		41.5×13	.5×37cm
Typical price inc. VAT			£200



### A M P L I F I E R S

**MISSION CYRUS ONE** 



omething of a modern classic among amplifiers now, the 1987 *Cyrus One* features revised layout and grounding, further component selection, and higher current output transistors. 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.

#### LAB REPORT

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.

The specified rating was comfortably exceeded, with a peak power of 17dBW into 80hms and a full power bandwidth 'cruising' power of almost 16dBW (40W). Fully driven into 40hms, the power supply sagged with the level down to 13dBW overall. The 12.5dBW output into 20hms was reasonably healthy coupled with a decent +11, -10A peak current.

All the distortion results were generally good.

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 40hm 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 1987, the Cyrus One continues to show detail improvements. Once warm (5-10 minutes) the amplifier establishes a reference standard for its category. Dynamic and musical, it won't compromise even an expensive audio system and is therefore a strong Best Buy, with the caution that it will not withstand the abuse of short-circuiting the loudspeaker leads.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=IW), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	nec	30W(=	14.5JBW')
Power output	20Hz	1kHz	20kHz
One channel, 80hm load	15.9dBW	16.5dBW	16.3dBW
Both channels, 40hm load	13.0dBW	13.7dBW	13.4dBW
One channel, 20hms, 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 po	wer, aux i	nput	90dB
Intermodulation, 19/20kHz, at 0dBV	V, disc (m	n)	-90dB
Intermodulation, 19/20kHz, at 0dBV	V, disc (m	2)	- 90dB
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		72dB
Disc (mc) input (IHF, CCIR weighte	ed)		
Aux/CD input (IHF, CCIR weighted	d) (b		77JB
Residual, unweighted (volume contra	ol at min)		75dB
DC output offset		left 6mV, r	ight 7mV
Input overload	. 20Hz	1 kHz	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	-47JB	-48dB
Aux input	-42dB	-43dB	-42dB
Output impedance (damping)	0.050hm	0.05ohm	0.060hm
Channel balance, disc, at 1kHz			0.2dB
Volume/balance tracking	сdВ	-20JB	-60dB
Aux input	0.05dB	1 JB	3dB
Input data socket type s	sensitivity	loading	
Disc (mm) inputPhono	0.4mV	47kohms	280pF
Disc (mc) input* Phono	0.04mV	47kohms	280pF
Aux inputPhono	64mV	-kohms	-pF
Disc equalisation error, 30Hz-15kHz		+ 0d B	8, -1.6dB
Size (width, height, depth)		21>	×9×34cm
Typical price inc VAT			£150
First reviewed: 1985.			

# AMPLIFIERS





ission'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 80hm load to 17.6dBW over the test power bandwidth. A significant 3dB loss in level was noted into 40hms, both channels driven, suggesting the transformer could be larger (a special booster pack is also available — the optional *PSX*). The pulsed rating on 20hms showed a little more than 2dB loss, confirming the worthwhile peak current rating of  $\pm$ 19.5,  $\pm$ 19A 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.

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 1987 the *Cyrus Two* performance continues to improve 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 poweramp combination of slightly greater power delivery but not necessarily better sound, since the *Cyrus Two* alone is already edging towards true audiophile territory and commands a Best Buy rating.

HESTERS.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's s	pec	50W'(	=17dBW)
Power output	_ 20Hz	1kH:	20kHz
One channel, 80hm load	18.3dBW	18.5dBW	18.4dBW
Both channels, 40hm load	15.2dBW	15.8dBW/	16.0dBW
One channel, 20hms, pulsed	-dBW	17 .0dBW	-dBW
Instantaneous peak current		+ 19.5	- 19
Distortion			
Total harmonic distortion,	20H:	1kHz	20kH:
at rated power, aux input	59dB	-68JB	-70dB
Intermodulation, 19/20kHz, rated p	ower, aux	input	_>-88dB
Intermodulation, 19/20kHz, at 0dB	W, disc (m	m)	_>-84dB
Intermodulation, 19/20kHz, at 0dB	W, disc (m	ic)	>-84dB
Noise			
Disc (mm) input (IHF, CCIR weigh	ited)		76.0dB
Disc (mc) input (IHF, CCIR weight	ed)		-69.0dB
Aux/CD input (IHF, CCIR weighte	d)		-80.0dB
Residual, unweighted (volume conti	rol at min)		-73.0dB
DC output offset	left	-26mV, ris	ght 13mV
DC offset, pre-amp	left n	ı∕a mV, righ	nt 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)	_ >20JB	>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	0.150hm	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) inputPhone	0.33mV	47kohms	260pF
Disc (mc) inputPhone	0.023mV	470ohms	7pF
Aux inputPhone	60.0mV	14.0kohms	300pF
Power amp	-mV	—kohms	-pF
Output, pre-amp (tape)		75.0V max,	700ohms
Disc equalisation error, 30Hz-15kHz	2	+0dE	8, -1.0dB
Size (width, height, depth)		21>	<9×34cm
Typical price inc VAT	£	300 (£500 v	with PSX)
First reviewed: 1985 Rating Best Bu	ν.		



### AMPLIFIERS

# **MUSICAL FIDELITY A1**

MUSICAL FIDELITY, UNIT 16, OLYMPIC TRADING ESTATE, FULTON ROAD, WEMBLEY HA90ND.



e-assessed for 1987, the rated 20W per channel, Musical Fidelity AI is one of the smallest amplifiers in *Choice* yet its price exceeds £220. 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 Al'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 directcoupled 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 80hms, but the level fell significantly into 40hms, effectively to under half power here. Peak current was a modest  $\pm 3.8A$ , which was just sufficient for 4–80hm 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 0.40hms, 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. The RIAA equalisation has been improved over the original review sample, and now shows a sensible, slightly bandlimited characteristic, still a touch depressed in the treble but generally even and properly extended on both mm and m-c disc inputs.

#### SOUND QUALITY

Still rating good overall, the improvements in the bass extension on the disc input were noted. The A1 is exceptionally 'sweet' in character almost 'syrupy' in the words of one panelist producing a well defined three-dimensional stereo image with good detail and perspective. Polite yet informative, the sound was a little 'slow' and 'thick', lacking a little transparency and 'air' but with a good impression of ambience. String tone was considered particularly attractive for an amplifier of this price level.

#### CONCLUSIONS

Comfortably maintaining its fine ranking in terms of overall sound quality versus price, and showing some improvement to the disc input, the *AI* remains a distinctive-sounding amplifier which is a trifle idiosyncratic, particularly in terms of its excessive heat output, but clearly continues to merit firm recommendation.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ec	20W(=	(3.5dBW')
Power output	20Hz	1kHz	20kHz
One channel, 80hm load	13.8dBW	13.7dBW	13.5dBW
Both channels, 40hm load	8.7dBW	8.9dBW	8.8dBW
One channel, 20hms, pulsed	-dBW	8.3dBW	– dBW
Instantaneous peak current		+4.0A	-3.6A
Distortion			
Total harmonic distortion,	20Hz	1 kHz	20kHz
at rated power, aux input	-50.0dB	-52.0dB	-50.0dB
Intermodulation, 19/20kHz, rated po	wer, aux i	nput	-62.4dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (mr	n)	-71.9dB
Intermodulation, 19/20kHz, at 0dBW	7, disc (mc	:)	-26.0dB
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		70.0dB
Disc (mc) input (IHF, CCIR weighte	d)(b		67.0dB
Aux/CD input (IHF, CCIR weighted	l)		82.7dB
Residual, unweighted (volume contro	ol at min)_		-76.2dB
DC output offset	le	ft 26mV, r	ight 4mV
DC offset, pre-amp	left n/	a mV, righ	t n/a mV
Input overload	20Hz	1 kHz	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	>20JB
Stereo separation			
Disc input (mc)	66.9dB*	92.8dB	65.8dB
Aux input	66.6dB*	93.3dB	68.4dB
Output impedance (damping)	0.37ohm	0.410hm	0.440hm
Channel balance, disc, at 1kHz			0.15dB
Volume/balance tracking	ЭdВ	- 20dB	-60dB
Aux input	0.15dB	0.12dB	1.64dB
Input data socket type s	ensitivity	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)	h	_7.5V ma	k, –ohms
Disc equalisation error, 30Hz-15kHz		+0dB,	-2.75dB
Size (width, height, depth)		41×6	.5×26cm
Typical price inc VAT			£229
*inc noise			

Reauditioned

# A M P L I F I E R S



# **MUSICAL FIDELITY A100**

MUSICAL FIDELITY LTD, UNIT 16, OLYMPIC TRADING ESTATE, FULTON ROAD, WEMBLEY HA90ND. · \_\_\_\_\_\_TEL: 01-900 2999-\_\_\_\_\_\_·



he A100 is an ultra-simple integrated amplifier that operates in class A over a substantial part of its dynamic range. Clearly based closely on the successful A1, it is only when the units are actually placed next to each other that the physical differences become apparent. Front-to-back shelf depth has been held the same, but the others have been expanded while keeping the same overall proportions — the '100 being higher and wider, not to mention heavier, with slightly more than twice the power output (50W instead of 20W), and nearly double the price (£400 instead of £209).

Highlighted by bright blue legends, the intelligently sculptured case is fabricated in ribbed black alloy to help dissipate the substantial waste heat of class A operation: on our sample the fit of these sections could have been better. A permanent internal fan further assists cooling, and this is slightly audible in quiet environments. Nothwithstanding these precautions, the high case temperature remains a matter of some concern: the thermal trip played an effective if infuriating role by interrupting our listening tests, though it refused to repeat the trick later on; rumour has it that eggs will cook slowly on the top surface!

Taking minimal facilities to its logical conclusion, A100 even eliminates the (normally rather useful) balance control in the interests of simplifying the signal path. We are left with two large knobs for volume and input selection, plus pushbuttons for power on/off and tape monitoring, all of which are a little 'clunky' in operation. Phono sockets are used on the rear, internal switching selecting MC or MM cartridge sensitivities, while 4mm sockets provide for loudspeaker connection.

#### LAB REPORT

This is very much an extension of the A1 design, but with a larger heatsink area and internal (gently audible) cooling fan. With a multi-transistor complementary low-noise MC disc input (IC) and high quality shunt/series regulation particularly in pre-amp section, the

power amplifier uses complementary bi-polar output transistors operating largely in class A. The power supply has a toroidal transformer with substantial reservoir capacity.

The power characteristics look much more like a valve than a transistor amplifier. Meeting specification without problem into 80hms, single channel, there was a substantial 5dBW loss into 40hms. Peak current delivery is restricted, so this design is clearly not ideally suited to awkward or lowish impedance loudspeaker loads, and is somewhat restricted in loudness capability. The power supply modulation spectrogram looks a little alarming, but in fact most of the lines refer to a generally high level of simple harmonic distortion rather than mains-related spuriae.

The various distortion measurements all gave poor results, though the harmonic products dropped significantly at lower drive levels. Signal-to-noise ratios and input overload margins were both quite acceptable, and stereo separation was very good. Input sensitivities should be fine, though volume/balance tracking went a little awry at low levels. The RIAA equalisation showed tight low frequency bandlimiting particularly on moving-coil, and a mild ultrasonic rise on moving coil.

#### SOUND QUALITY

Rating a very encouraging good on sound quality overall, even here there was some controversy among the listening panel. The '100's main virtues of sweet midrange and treble seemed particularly well suited to classical music while the modest bass 'drive' was felt to be something of a handicap on rock material. Violin tone was particuarly liked. Stereo imagery received high praise for a transparency, space, depth and precision that is exceptional amongst integrated amplifiers, but the impressive sense of scale generated gave a slightly 'heavy' overall character that was not to all tastes.

#### CONCLUSIONS

The fine results on listening demand recommendation, but this is something of an idiosyncratic product nonetheless, polarising opinions according to the relative importance to a listener of bass 'drive' versus treble 'sweetness'. It is fair to assume that the thermal cut-out problem was an isolated incident, but the fact that the case does get very hot in use should be borne in mind, by those with young children for example. The technical weaknesses do leave some room for improvement and suggest partnership with a 'kind' loudspeaker of highish impedance, but the fine transparency for the price demands recognition.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ec	50W(=	=17dBW)
Power output	20Hz	1kHz	20kHz
One channel, 80hm load	17.8dBW	17.7dBW	17.1dBW
Both channels, 40hm load	13.4dBW	12.6dBW	12.0dBW
One channel, 20hms, pulsed	-dBW	12.0dBW	-dBW
Instantaneous peak current		+6A	-6A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux/CD input	-36dB	— 35dB	-34dB
Intermodulation, 19/20kHz, rated po	wer, aux ii	nput	
Intermodulation, 19/20kHz, at 0dBW	V, disc (mr	n)	-46dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (me	)	
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		76dB
Disc (mc) input (IHF, CCIR weighte	ed)		68dB
Aux/CD input (IHF, CCIR weighted	i)		
Residual, unweighted (volume contro	ol at min)		- 80dB
DC output offset	left <2	20mV, righ	nt <20mV
Input overload	. 20Hz	1kHz	20kHz
Disc (mm) input (IHF)	31 dB	29.5dB	29.5dB
Disc (mc) input (IHF)*	. 34dB	27.5dB	28.5dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	68dB	75dB	67dB
Aux/CD input	70dB	93dB	76dB
Output impedance (damping)	0.4ohm	0.370hm	0.42ohm
Channel balance, disc, at 1kHz			0.04dB
Volume/balance tracking	. OdB	- 20dB	-60dB
Aux/CD input	0.3dB	0.1dB	5dB
Input data socket type	sensitivity	loa	ading
Disc (mm) input Phono	0.32mV	47kohms	n/a pF
Disc (mc) input*Phono	0.027mV	47kohms	n/a nF
Aux/CD inputPhono	18mV	47kohms	20pF
Output, pre-amp (tape)	3	.31V max,	980ohms
Disc equalisation error, 30Hz-15kHz		+ 0	dB, –1dB
Size (width, height, depth)		44 :	×9×25cm
Typical price inc VAT			£400









# a sound combination



CYRUS ONE --- BEST BUY



CYRUS TWO + PSX - BEST BUY





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# A M P L I F I E R S





hough interim versions have risen steadily in price over the years, this new *e* suffixed 3020 brings the price back down to  $\pounds 109$  — near its original launch level of some six years ago. The original 3020 swept all before it for a year or two until other manufacturers woke up to the fact that there was money in sound quality. The overall concept has been retained, so this is essentially the same simple, integrated amplifier which seeks to present better sound quality through the careful omission of some, but not all of the 'frills'.

It is neatly presented with a logical control layout and 'camouflage' dark brown finish to high enough standards. The single large volume control is backed by rotaries for tone and balance, with no tone defeat switching, while the seven pushbuttons, in three groups, provide power on/off, input selection including tape monitoring, plus mono/stereo and -20dB muting (the telephone answering switch). The rear panel connections are phonos, the disc input accommodating moving magnet cartridges only. Speaker terminals are (still) cheap springloaded types, while small switches select optimum power matching to 40hm (normal) or 80hm loudspeaker load, and optional 'soft clipping' circuitry the use of which is recommended to provide a sweeter sound when driving at continuous high levels.

#### LAB REPORT

This is the classic NAD 3020 design but with some 'streamlining' to keep costs down. Using a conventional direct coupled complementary bi-polar output configuration, component layout benefits from a single board construction, but with rather untidy wiring looping around. The circuitry is all discrete and some care has clearly been taken over bandwidth noise suppression and stage matching, but there was clearly insufficient budget available for special audiophile components. The power supply is standard enough, internal mains connections were unshrouded, and there was also some evidence of Taiwanese production economies.

Rated at only 20W, the measured power delivery was really quite generous for such a modestly priced model. It was respectably maintained into lower impedance, and current capability was again very respectable at this price level. The quality of the power supply itself is confirmed in the excellent power supply modulation spectrogram results, where mains and distortion effects are notable for their near absence.

Distortions were all low and signal-to-noise ratios very good, as were overload margins and stereo separation results. Volume tracking calibration and input sensitivities were also fine, while the RIAA equalisation curve shows sensible bandlimiting plus slight bass cut/treble boost, sufficient perhaps to 'lighten' the subjective balance of the amplifier a trifle.

#### Sound Quality

Rated securely above average, NAD have manged to keep the essential sonic character of the 3020 despite their production economies in this version, and it is further to their credit that this basic design has remained competitive for such a long time. The balance remains a little on the 'light and bright' side of neutral to be sure, but the result is attractively airy and quite transparent, if a trifle 'softened'. Though falling well short of the best, the stereo image presentation and the overall integration were praised, and the sound was reasonably lively, but listeners also noted some lack of 'weight', 'speed' and incisiveness.

#### **CONCLUSIONS**

NAD continue to brew a fine budget amplifier, and have also managed to keep the price sharp against the immediate competition, despite working from a design basis that is now several years old. At the typical £110 the 3020e is clearly Best Buy material, with a clean laboratory bill of health and generally high standards of construction. It has its own distinctive subjective character, a little light in balance and 'weight', so may not suit all tastes equally, but is undoubtedly superior to run of the mill budget amplifiers.

RESTRUT

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### **TEST RESULTS**

Power output			Integrated	l amplifier
Rated power into 80hm	ıs, maker's sp	ec	20W(=	= 13dBW)
Power output		_ 20Hz	1kHz	20kHz
One channel, 80hm loa	ad be	15.2dBW	15.7dBW	15.3dBW
Both channels, 40hm lo	ad	11.5dBW	13.3dBW	12.7dBW
One channel, 20hms, p	ulsed	-dBW	13.8dBW	-dBW
Instantaneous peak curr	ent		+12A	-11.0A
Distortion				
Total harmonic distorti	on,	20Hz	1 kHz	20kHz
at rated power, aux inp	ut	-90dB	-96dB	-73dB
Intermodulation, 19/201	kHz, rated po	wer, aux ii	nput	
Intermodulation, 19/201	kHz, at OdBW	V, disc (mr	n)	
Noise				
Disc (mm) input (IHF,	CCIR weight	ed)		75.0dB
Aux/CD input (IHF, C	CIR weighted	i)		
Residual, unweighted (v	olume contro	ol at min)		89dB
DC output offset		left ·	+1mV, rig	ht +2mV
Input overload		. 20Hz	1 kHz	20kHz
Disc (mm) input (IHF)		. 34.8dB	33.7dB	32dB
Aux/CD input (IHF) _		>20dB	>20dB	>20dB
Stereo separation				
Disc input (mm)		. 74dB	76dB	62dB
Aux input		. 75dB	75dB	61dB
Output impedance (dan	nping)	0.180hm	0.180hm	0.20hm
Channel balance, disc,	at 1kHz			0.13dB
Volume/balance tracking	1g	. OdB	- 20dB	-60dB
Aux input		0.05dB	0.03dB	0.37dB
Input data	socket type	sensitivity	loa	iding
Disc (mm) input	Phono	0.51mV	47kohms	70pF
Aux input	Phono	340mV	48kohms	80pF
Output, pre-amp (tape)		1	5.1V max,	, 1.60hms
Disc equalisation error,	30Hz-15kHz		_+0.26dB,	-0.45dB
Size (width, height, dep	th)		42>	<9×28cm
Typical price inc VAT				£110



# AMPLIFIERS

### NAIM NAIT

NAIM AUDIO LTD, SOUTHAMPTON ROAD, SALISBURY SPI 2LN.



he NAIT, Naim's inexpensive integrated amplifier, offers an 'unspecified' low output power, with a 'straightline' circuit design format. Tape tuner, and disc mm inputs are provided, the first two in DIN and the 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 40hm loading on continuous duty. The peak current delivery was fine for the size of amplifier, with the 80hm peak output level measuring 13.5dBW and still holding up well at 11.3dBW for the 'extreme' 20hm load.

Harmonic distortion was just satisfactory at 20kHz, but improved at lower frequencies. *Via* aux the full-power intermodulation was fine, but *via* disc at a lower output it was less impressive. The input signal level was closer to the disc overload point in this test. Signal-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 impedance negligible and channel balance good, except at the lowest volume settings.

While the auxiliary frequency response was essentially flat, the disc input showed a mildly rising characteristic, with fair agreement to the IEC rolloff in the bass. Mild lift around 7kHz and a subjective treble rolloff of -1.5dB at 20kHz were also apparent. Such a response may help to 'flatter' inexpensive mm cartridges.

#### SOUND QUALITY

The *NAIT* was found to produce a clear crisp sound with a surprisingly good exposition of the depth and atmosphere present on many recordings. It played louder than expected, louder in fact than the peak programme ratings suggested, due to its good subjective behaviour into mild clipping. For the normal loudspeaker load it provided 97.5dBA, with 95.5dBA into the adverse load.

Via disc the tonal balance was a trifle thin, but vocal detail was impressive with decent focus and depth rendition. The bass was not perfect, 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 favourably. Possessing an excellent build quality and good load tolerance, it also delivered a sound which stood up to its immediate competition. With little hesitation, the NAIT deserves recommendation.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where 0dB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### TEST RESULTS

Power output		Integrated	amplifier
Rated power into 8ohms, maker's spec _		15W(=	12.5dBW)
Power output	20Hz	1 kHz	20kHz
One channel, 80hm load13.0	dBW	13.3dBW	13.1dBW
Both channels, 40hm load10.00	dBW	11.6dBW	11.4dBW
One channel, 20hms, pulsed 9.4	dBW	11.3dBW	10.9dBW
Instantaneous peak current		+9A	-9A
Distortion			
Total harmonic distortion,	20Hz	1 kHz	20kHz
at rated power, aux input	68dB	-72dB	-51dB
Intermodulation, 19/20kHz, rated power,	aux i	nput	
Intermodulation, 19/20kHz, at 0dBW, dis	sc (mr	n)	
Noise			
Disc (mm) input (IHF, CCIR weighted) .			
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) 0.03	30hm	0.04ohm	0.040hm
Channel balance, disc, at 1kHz			0.3dB
Volume/balance tracking	0dB	- 20dB	-60dB
Aux input	0dB	0.3dB	8.1dB
Input data socket type sensit	tivity	loading	
Disc (mm) input Phono 0.5	2mV	46kohms	140pF
Aux inputDIN 21.	.lmV	61kohms	220pF
Disc equalisation error, 30Hz-15kHz		+0.5dE	3, -1.5dB
Size (width, height, depth)		28×1	22×7.5cm
Typical price inc VAT			£258
First reviewed 1983			

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# A M P L I F I E R S

# QED A230/240CD/240SA



his neat and simple integrated amplifier is available in three versions, offering a hierarchy of quality at different price points, with the capability of upgrading between the two 240 variants. All share the same case, but the 'entry level' £120 230 has a smaller (50VA) power supply transformer, giving less dynamic range than 100VA 240s. The latter share the same basic amplification circuitry apart from the disc input: the £150 'CD has a simple MM input based on integrated circuitry, the £200 'SA has additional boards with discrete components and integral switching between mm and m-c cartridge types.

*Choice* has auditioned all the various versions at different stages in their development, for 1987 concentrating upon the top 240SA version, but with reference to earlier findings. The measurements are based on an earlier review of the 240CD, though we have included the data and RIAA equalisation for the 'SA m-c disc input.

Our review sample was in black livery with gold legends. Offering a marginally higher rated power output at 40W, the 240 is only 1dB louder than the 230, 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 pre-amplifier for optimum sound quality.

#### LAB REPORT

Essentially, the design is based on a single board construction, the interior revealing good build quality with fine quality components. The output uses a bipolar complementary arrangement, direct-coupled to the load: integrated circuits are used for the earlier stages including the RIAA equalisation, except of course in the SA version.

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 held up well into 2ohms, reflecting the good peak current rating of  $\pm 12.75$ A. Quite a good result was obtained on the 40Hz power intermodulation test.

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 with the additional SA circuitry, the RIAA equalisation on the mm input is now flat, but still shows a slight treble shelf on m-c, though less pronounced than that of the 'CD's IC mm input, and without the latter's mildly worrying ultrasonic rise.

#### SOUND QUALITY

The 1987 auditioning confirmed the 240's good overall rating, somewhat ahead of the 230. The sound was well integrated, with tight and engagingly 'bouncy' bass reproduction. A little forward in presentation and slightly 'brittle' on the disc input, there was also some 'richness' in the lower mid region. Stereo imagery was good, the open sound lacking only a little in resolution of space and depth, and with a good sense of 'scale'.

#### CONCLUSIONS

All three QED models deserve their Best Buy rating at their respective price points, offering a sensible range of alternatives from the civilised 230 through the more dynamic 240 models, the

'SA version of which has a quite respectable moving-coil disc input. Lab performance was generally sound, and subjectively these amplifiers remain highly competitive.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

#### Test Results

Power output			A240CD
Rated power into 80hms, maker's spec	c	40W(=	= 16dBW)
Power output	20Hz	1kHz	20kHz
One channel, 80hm load10	6.9dBW	17.3dBW	15.9dBW
Both channels, 40hm load1	3.4dBW	14.8dBW	14.5dBW
One channel, 20hms, pulsed	-dBW	15.5dBW	-dBW
Instantaneous peak current		+13A	-12.5 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	-71.6dB	-76.9dB	-63.1dB
Intermodulation, 19/20kHz, rated pow	er, aux	input	-79.6dB
Intermodulation, 19/20kHz, at 0dBW,	disc (m	m)	- 50.0dB
Intermodulation, 19/20kHz, at 0dBW,	disc (m	c)	- 30dB
Noise			
Disc (mm) input (IHF, CCIR weighted	d) (b		72.0dB
Disc (mc) input (IHF, CCIR weighted	)		68dB
Aux/CD input (IHF, CCIR weighted)			69.5dB
Residual, unweighted (volume control	at min)		-77.5dB
DC output offset	lef	t 10mV, rig	ght 12mV
DC offset, pre-amp	left n	/a mV, righ	t n/a mV
Input overload	20Hz	1 kHz	20kHz
Disc (mm) input (IHF)	19.1dB	17.5dB	15.2dB
Disc (mc) input (IHF)*Phonod	.021mV	620hms	10pF
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	89.0dB	88.5JB	66.6dB
Aux input	75.0dB	69.3dB	43.6dB
Output impedance (damping) 0	1.090hm	0.090hm	0.10ohm
Channel balance, disc, at 1kHz			0.73dB
Volume/balance tracking	OdB	-20dB	-60dB
Aux input	0.04dB	0.68dB	8.05dB
Input data socket type ser	asitivity	loading	
Disc (mm) input Phono	0.49mV	47kohms	150pF
Disc (mc) input*Phono 0.	.021mV	620ohms	10nF
Aux inputPhono	60mV	14kohms	15pF
Power amp n/a	n∕a mV	n/a kohms	n/a pF
Output, pre-amp (tape)		_10.8 max,	8.90hms
Disc equalisation error, 30Hz-15kHz		_+0.02dB,	-0.85dB
Size (width, height, depth)		36>	<6×25cm
Typical price inc. VAT		£119 £	149 £199
#### Α M P L Ι F T E R S

### 'EL RA-820BX 11

ROTEL HI-FI, 25 HEATHFIELD, STACEY BUSHES, MILTON KEYNES MK126HR. -Tel: (0908) 317707-



roliferating suffixes indicate this model's steady evolution over the years, the popular and successful '820BX now achieving MkII status. However, it has changed only slightly, and only under the skin, to keep abreast of steadily improving standards of sound quality. It now has a larger mains transformer in order to improve the transient performance of the reservoirs and the subjective bass 'speed', plus extra quality components in selected places. For the 1987 edition we have re-auditioned the current model, but the measurements and general description have been left as before.

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 0.220hm 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

80hms. The reduction into 40hms was moderate, while the 20hm pulsed output exceeded rated level at 14.5dBW. This was equivalent to 100W into 20hms 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 separation 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

The BX II showed a worthwhile improvement over the earlier BX, particularly in terms of bass 'slam' and 'speed'. Maintaining, and indeed slightly improving on the 'BX's established virtues of good transparency and focus and generous stereo staging, the II offers 'weight' and an enhanced sense of 'scale' in an essentially neutral character, erring slightly towards the 'clinical'. Considered a touch 'bright' and 'coarse' at high frequencies, overall praise comfortably outweighed minor criticism of an amplifier which has easily maintained its highly competitive performance.

#### **CONCLUSIONS**

This latest Rotel again stormed through the For graph references see issue No. 50

listening tests, the latest modifications reflected in particularly fine bass performance. Load tolerant, it also offered a respectable output plus a clear sound with excellent stereo. A Best Buy rating is the only logical conclusion!

HESTHES.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 8ohms, maker's sp	nec	25W(	=14dBW)
Power output	20H:	1 kHz	20kHz
One channel. 80hm load	15 9dBW	16dBW	15.7dBW
Both channels, 40hm load	13 OdBW	13.7dBW	13.5dBW
One channel, 20hms, 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 po	ower, aux i	nput	
Intermodulation, 19/20kHz, at 0dBV	V, disc (m	m)	
Intermodulation, 19/20kHz, at 0dBV	W, disc (me	c)	n/a dB
Noise			
Disc (mm) input (IHF, CCIR weight	red)		
Disc (mc) input (IHF, CCIR weighte	ed)		n/a dB
Aux/CD input (IHF, CCIR weighted	d)		
Residual, unweighted (volume contr	ol at min).		n/a dB
DC output offset	lefi	t 36mV, rig	ght: 19mV
DC offset, pre-amp	left n	/a mV, righ	nt n/a mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	. 36dB	34dB	34dB
Dise (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)	0.240hm	0.24ohm	0.250hm
Channel balance, disc, at 1kHz			0.05dB
Volume/balance tracking	0dB	- 20dB	-6CdB
Aux input	0.1dB	0.8dB	0.1dB
Input data socket type s	sensitivity	loading	
Disc (mm) inputPhono	- m V	50kohms	220pF
Disc (mc) input*Phono	n/a mV	n/a ohms	n/a pF
Aux input Phono	mV	50kohms	180 <sub>P</sub> F
Output, pre-amp		>IV max,	3.8kohms
Disc equalisation error, 30Hz-15kHz		+ 0dE	8, -0.6dB
Size (width, height, depth)		43:	×6×25cm
Typical price inc VAT			£150
D			



### A M P L I F I E R S

### SANSUI AU-G11X



his compact budget integrated amplifier, claimed to be designed primarily for sound quality, is attractively finished with gold lettering on a well-ordered fascia, incorporating many of the usual facilities without producing operational confusion. It is priced a little over budget level at £139, and is rated at 25W/channel (14dBW). The disc input is moving magnet only, the tone controls are supplemented by a defeat switch, and further switches select loudness, mono/stereo and tape monitoring.

The headphone socket is accompanied by its own small volume control, and is in fact driven by its own little amplifier, independent of the loudspeaker connection and main signal path. The rear panel socketry is phono throughout, with a single pair of loudspeaker output binding posts, capable of taking quite heavy gauge cable. The overall external finish is to the expected high standards, and the unit feels reassuringly heavy considering its modest price and pretensions.

#### LAB REPORT

Using a medium sized transformer, the shared 5,800uF power supply incorporates extensive regulation and decoupling for different stages. The separate headphone amplifier avoids switching in the speaker path and gives optimum headphone drive. There is evidence that care has been taken in signal path component selection, with polystyrene capacitors etc, and direct wiring paths. The conventional bi-polar output uses generous high current transistors.

Power output is fairly generous, comfortably above the admittedly modest 25W specification

and quite load tolerant besides. Distortions were very low, and noise levels and overload margins were generally satisfactory. The DC offset was a little larger than average, and high frequency stereo separation is only just satisfactory. Inputs should be fine for compatibility with other components. The disc input RIAA curve shows good component tolerancing and an even midband, with sensible bandlimiting at the extremes (amounting to a possibly audible -1dB at 15kHz). Power supply modulation seemed very well under control.

### SOUND QUALITY

Rating a little above average, the '11X certainly delivered a cleaner clearer sound than what one might call the 'Far Eastern norm', but on balance it also fell a little short of the achievements of other audiophile-oriented integrated models at around the same price.

A degree of disc surface noise exaggeration was noted, and the most obvious characteristic was that the sound remained tightly controlled, at the expense perhaps of a little 'weight' and 'attack'. Focus was pretty good, but there was some loss of depth, with mild congestion, and a slightly 'dulled', 'thickened' effect. Coloration was generally low, but with some 'steeliness' noted when using CD as a source.

#### CONCLUSIONS

Producing a thoroughly respectable sound for a relatively modest price, the 'G11X also delivered a decent lab performance. Build quality and finish are both excellent with generous component quality and quite simple layout of signals paths. Taking commercial considerations into account, Sansui have chosen a sensible compromise between facilities and sound quality here, and a recommendation is appropriate.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ec	25W(=	=14dBW)
Power output	20Hz	1kHz	20kHz
One channel, 80hm load	16.0dBW	15.9dBW	15.8dBW
Both channels, 40hm load	13.3dBW	13.6dBW	13.5dBW
One channel, 20hms, pulsed	-dBW	13.6dBW	– dBW
Instantaneous peak current		+11A	-11A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	-82dB	-92dB	-70dB
Intermodulation, 19/20kHz, rated po	wer, aux i	nput	
Intermodulation, 19/20kHz, at 0dBW	V, disc (mi	n)	
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		70dB
Aux/CD input (IHF, CCIR weighted	l)		73dB
Residual, unweighted (volume control	ol at min)		92dB
DC output offset	lef	t 38mV, rig	ght 28mV
Input overload	20H:	1 kH:	20kHz
Disc (mm) input (IHF)	30.7dB	29.8dB	29.5dB
CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	61dB	52dB	29dB
CD input	61 d B	51dB	28dB
Output impedance (damping)	0.260hm	0.27ohm	0.25ohm
Channel balance, disc, at 1kHz			0.06dB
Volume/balance tracking			
Aux input0dB, 0.08dB;	-20dB, 0.	02dB; -60	dB, 1.6dB
Input data socket type	sensitivity	- loa	iding
Disc (mm) inputPhono	0.44mV	48kohms	100pF
CD inputPhono	30mV	63kohms	215pF
Output, pre-amp (tape)		10.1V may	, 1kohms
Disc equalisation error, 3CHz-15kHz		_+0.06dB,	-0,60dB
Size (width, height, depth)		43×7	i.5×28cm
Typical price inc VAT			£139

### A M P L I F I E R S



### SANSUI AU-G30X



utwardly, 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 20hms 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 loadtolerant 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 for a firm recommendation. 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 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ес	45W(=	(WBW)
Power output	20Ha	1kHz	20kHz
One channel, 80hm load	18.2JBW'	18.3dBW	18.1dBW
Both channels, 40hm load	15.9dBW	16.0dBW	16.5dBW
One channel, 20hms, pulsed	-dBW	17.5dBW	– dBW
Instantaneous peak current		+18.5.A	-20.0A
Distortion			
Total harmonic distortion,	20Hz	1 kHz	20kHz
at rated power, aux input	-77.4dB	-78.8JB	-68.8dB
Intermodulation, 19/20kHz, rated po	wer, aux	input	– 90.0dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (m	m)	87.4dB
Intermodulation, 19/20kHz, at 0dBW	V, disc (m	c)	n/a dB
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		68.2dB
Disc (mc) input (IHF, CCIR weighte	:d)		n/a dB
Aux/CD input (IHF, CCIR weighted	l)		73.0dB
Residual, unweighted (volume contro	ol at min)		-87.0dB
DC output offset	lef	t 47mV, rig	ght 36mV
DC offset, pre-amp	left n	/a mV, righ	it n/a mV
Input overload	20Hz	1 kHz	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)	>20JB	>20dB	>20dB
Stereo separation			
Disc input (mm)	68.4dB	53.5dB	30.6dB
Aux input	. 77.9dB	53.0dB	30.3dB
Output impedance (damping)	0.260hm	0.260hm	0.250hm
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 s	ensitivity	loading	
Disc (mm) inputPhono	1.75mV	47kohms	100pF
Disc (mc) input* n/a	n/a mV	n/a kohms	n/a pF
Aux inputPhono	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		+ 0.1 dE	8, -1.9dB
Size (width, height, depth)		43×	11×33cm
Typical price inc VAT			£199
First reviewed 1986			



### A M P L I F I E R S

### YAMAHA AX-300



his just-above-budget-price £120 integrated Japanese amplifier is typical of the new breed of simplified designs which are aimed particularly at the UK market. It is a compact model, though taller than most of its competitors, rated at 30-40W, and finished inevitably in black. A functional if stark front panel has five knobs, two pushbuttons and a headphone socket. Supplementing the main volume control are three subsidiary rotaries for tone and balance, plus an input selector, the centre position on the tone controls labelled defeat. Tape monitoring and power switching are provided by the individual pushbuttons. The rear panel has phono socketry throughout, the disc input restricted to moving magnet cartridges, plus a single set of binding posts for loudspeaker connection.

### LAB REPORT

Using a very clean single board layout, the '300 uses a high-gain discrete-component directcoupled bi-polar power amplifier section which also includes the tone control circuitry, and so avoids using a line stage altogether. Output relays provide effective protection, disc input circuitry is dual IC, and although mains connections were unshrouded the unit generally showed very competent Japanese build quality throughout, with clear evidence of sound quality priority.

Power output was respectably above the fairly modest specification, and was also respectably maintained into low impedances, with a generous current capability of 15/16A. Distortion and noise measurements were both very good, overload margins and stereo separation were fine, and calibration reasonable enough for the price. Inputs should show no matching problems provided auxiliaries have normal output levels. The power supply modulation spectrum shows an excellent result at any price, while the RIAA disc equalisation might have been a little closer toleranced, and will provide a touch of 'character'.

### SOUND QUALITY

The '300 was rated comfortably above average and close to a 'good' rating; it is clearly one of the more impressive models at its price level up with well regarded models costing considerably more. Not the most comfortable of sounds, the liveliness and dynamics provided the strongest impression, with good 'speed' and 'momentum' outweighing criticisms of some loss of transparency and a rather 'bright' overall balance. Not the subtlest or most controlled sounding performer, a natural sense of exuberance more than compensates.

#### **CONCLUSIONS**

Fine build quality plus sound quality oriented engineering bring Yamaha strongly into the market for 'stripped down' 'budget audiophile' integrated amplifiers with a very impressive contender. Livelier than most if a little less polite than many, the '300 clearly merits confident recommendation.

#### Test measurements

To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 40hms and 20hms is given in dBW (where OdB=1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

### **TEST RESULTS**

Power output		Integrated	amplifier
Rated power into 80hms, maker's sp	ec	30W	/(15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 80hm load	17.5dBW	17.5dBW	17.4dBW
Both channels, 40hm load	13.5dBW	14.5dBW	14dBW
One channel, 20hms, pulsed	– dBW	15.4dBW	-dBW
Instantaneous peak current		+15,	-16A
Distortion			
Total harmonic distortion,	20Hz	1 kHz	20kHz
at rated power, aux input	-92dB	-95dB	-88dB
Intermodulation, 19/20kHz, rated po	wer, aux i	nput	
Intermodulation, 19/20kHz, at 0dBW	V, disc (mi	n)	-71dB
Noise			
Disc (mm) input (IHF, CCIR weight	ed)		
Aux/CD input (IHF, CCIR weighted	ł) (ł		
Residual, unweighted (volume control	ol at min)		
DC output offset	lef	t 17mV, rij	ght 17mV
Input overload	20Hz	1 kHz	20kHz
Disc (mm) input (IHF)	32.5dB	32dB	31.8dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mm)	63dB	69dB	43dB
Aux input	83dB	68dB	44dB
Output impedance (damping)	0.090hms	0.090hms	0.130hms
Channel balance, disc, at 1kHz			0.65dB
Volume/balance tracking0dB, 0.08dB;	-20dB, 0.	79dB; -60a	dB, 1.22dB
Aux input			
Input data socket type	sensitivity	, loa	ading
Disc (mm) input Phono	0.49mV	47kohms	70pF
Aux inputPhone	29.5mV	62kohms	95pF
Output, pre-amp (tape)	1	1.5V max,	560ohms
Disc equalisation error, 30Hz-15kHz		+0dB,	-0.47dB
Size (width, height, depth)		44×9	9.5×31cm
Typical price inc. VAT			£120

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ot the most glamorous of the hifi 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.

And 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 a 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 installation engineer. 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 be that much more useful.

It is also worth pointing out that aerial 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 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.

Because specialist tuners have traditionally 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 better sounding tuners often have comparatively 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.





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### A&R ARCAM ALPHA

A&R CAMBRIDGE LTD, DENNY INDUSTRIAL ESTATE, WATERBEACH, CAMBRIDGE CB5 9PB.

atching the Arcam *Alpha* and *Delta*, this is an analogue tuner, covering FM and AM bands. The 'scale and pointer' presentation has distinct advantages over a digital readout as does a conventional watchface over the digital equivalent.

Tuning is facilitated by a neat LED indicator in the indicator pointer. This emulates the traffic light by changing from red *via* orange to green when a station is correctly tuned, and the frequency may then be held by selecting AFC (automatic frequency control). Radio specialists could argue that the resolution and accuracy of the pointer/scale is a little imprecise, but this will not worry the user who should in any case 'fine-tune' by ear. The tuning knob itself lacks any real flywheel action, but then one hardly has the right to expect this at a near 'budget' £150. The remaining buttons select FM and long and medium wave AM, plus mono/stereo.

### Sound Quality

FM sensitivity seemed fine, with decent stereo from around  $500\mu$ V aerial input, albeit with a slight whistle, and fine quality stereo from 1mV upwards. The sound quality itself was comfortably in the good class — less than the best but



a fine result for the price nonetheless. It was described as inherently pleasant and musically relaxing, if a trifle bland and lacking 'air' and 'drama'.

AM was rather insensitive with noticeable background noise which restricts dynamic range, but had the significant aural advantage of being able to 'fine-tune' the tuning envelope away from the station centre transmission frequency for the best trade off between balance and dynamics: as such results were amongst the most acceptable from a far from inspiring range of alternatives. At least this hi-fi tuner gives an AM performance to match a good transistor radio and plays it through the main hi-fi system.

### LAB REPORT

HESTHERE

Sensitive and with good signal-to-noise ratios, the *Alpha* measured pretty respectably throughout. Stereo separation and harmonic distortion were a little below par, and the pilot tone rejection figure dropped to -31dB with modulation. The frequency response showed a mild high frequency rolloff.

### CONCLUSIONS

This tuner has successfully established a distinctly 'British' identity, with attractively classic ergonomics. A modest price plus sound quality comfortably better than most are further reasons for a Best Buy recommendation.

### **TEST RESULTS**

Sensitivity for 50dB signal-to-noise Mono/stereo Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	3µV/30µV
Mono/stereo	68dB/ - 62dB
Muting threshold	2.5µV
Alternate channel selectivity	63dB
Pilot tone rejection, 19kHz/38kHz	66dB/55dB
AM rejection	60dB
Capture ratio	1.3dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	-43dBi-43dB
Stereo separation, 1kHz/5kHz/10kHz	_30dB/28dB/24.5dB
Output level, 100% mod	840mV
Dimensions (width, depth, height)	40×9.7×22.5cm
Typical price inc VAT	£150

atching the 4040 in presentation, the £150 FM-only 3140 has some nice touches in the black wooden sleeve made up into a quality case with rounded front edges. The tuned frequency is displayed on a large green digital frequency readout, alongside a decent sized flywheelassisted tuning knob.

A row of four pushbuttons provide useful functions, some rarely found on such a low cost model, including 'narrow/wide' and 'local/DX' to optimise reception for short or long range reception, plus mono/stereo and AFC on/off. The fact that the stereo beacon glows green over a switch labelled mono is a touch idiosyncratic, but a useful centre-tune indicator is also fitted.

### SOUND QUALITY

Sensitivity was very good, with very low noise stereo available from a modest  $500\mu$ V aerial input, and with added flexibility through the narrow/wide feature. The sound quality was very well received, rating very good and showing many of the favourable characteristics of state of the art models at far higher prices. There was



little to criticise apart from a slight 'thickening' of textures and slight rolloff detectable at high frequencies, but much praise was awarded for the clear, firm sound with good bass 'weight' and fine focus.

### LAB REPORT

Giving fine results for sensitivity, signal-to-noise, pilot tone and AM rejection, selectivity and capture ratio, the RF side of this fine tuner is beyond reproach. On the audio side the response was flat enough, with a gentle low frequency rolloff, but distortion was only average and stereo separation rather below par. The DX/local selector had only a marginal effect. The output level is lower than most, so a check on amplifier compatibility will be worthwhile.

### CONCLUSIONS

The Creek 3140 emerges as a true front rank performer with excellent ergonomics and audiophile sound quality, all at a near budget price — clearly a strong Best Buy amongst separate tuners, albeit with the minor handicap of covering FM only.

### **TEST RESULTS**

	iunci
Sensitivity for 50dB signal-to-noise Mono/stereo_	3µ√/35µV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	74dB/-65dB
Muting threshold	4µV
Alternate channel selectivity	100dB
Pilot tone rejection, 19kHz/38kHz	66dB/100dB
AM rejection	66.5dB
Capture ratio	1.3dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	52dB/-52dB
Stereo separation, 1kHz/5kHz/10kHz	24dB/26dB/27dB
Output level, 100% mod	233mV
Dimensions (width, depth, height)	42×17.5×6.2cm
Typical price inc VAT	£150

Turner

ELSTRUS

### **MISSION CYRUS**

his 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.

DECOMPOSITION OF

### 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 drive the *Cyrus* amplifier 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 50clB signal-to-noise ratio Mono/stereo\_ 7-7 uV/27 uV Ultimate signal-to-noise (CCIR/ARM/1kHz ref) -68dB/-59.0dB Monostereo Muting threshold, R.F. level \_\_\_\_5.5µV Alternate channel selectivity -43dB/-64dB Pilot tone rejection, 19kHz/38kHz AM rejection - 51dB Capture ratio\_ 4.8dB Total harmonic distortion At 100% mod, 1kHz, mono/stereo \_\_\_\_\_ Stereo separation, 1kHz/5kHz/10kHz \_\_\_\_ -57dB/-50dB \_\_\_\_\_998mV Output level, 100% modulation\_\_\_\_ Channel balance, stereo 0.04dB Dimension (width, height, depth) Typical price inc VAT\_\_\_\_\_ 21.5 x 8.5 x 39.5cm \_£180 First reviewed 1985. Reassessed 1987.

### NAD 4020B

HI-FI MARKETS, AXIS 4, RHODES WAY, WATFORD, HERTS WD2 4YW

raditionally 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.

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  $5\mu$ V 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  $800\mu$ V. 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
First region ed 1985	

BESTBUN



### QUAD FM4

Quad Electroacoustics Ltd, 30 St Peters Road, Huntingdon, Cambs, pei87db.

characteristically distinctive design from this famous British company, this mid-priced Quad tuner has been intelligently designed and works with a minimum of fuss. A large, well-weighted tuning knob gives manual station selection, the tuned frequency shown on the large digital display. A combined signal-strength/centre-tune bar graph is included in the display, and was found to work well. Seven pre-set stations may be automatically programmed, appropriately marked BBC1 through 4; BBC LR (local radio); and ILR1/ILR2 for the local commercial stations.

Rear panel facilities include a three-pin IEC mains input, a shrouded IEC three-pin mains outlet, plus a 750hm (female) coaxial aerial socket and DIN audio output. Both finish and constructional standards are high.

### SOUND QUALITY

Despite digital tuning, the FM4 had clean backgrounds free from any annoying whistles. By the time input reached 1mV, it showed decently quiet stereo backgrounds, and the sound quality was much favoured. Stereo images were well focused, and pleasing depth was reproduced. Tonally it sounded quite neutral, and the treble



was free of grain or harshness. Some mild loss of detail and bass attack was apparent when compared with the original sources, but this is a favourable result when the attainment of some of the other models is taken into account.

### LAB REPORTS

The *FM4* was quite sensitive, reaching 50dB stereo quieting (1kHz ref, CCIR/ARM) by 70 $\mu$ V and a 66dB ultimate stereo signal-to-noise ratio by 2mV, which is a satisfactory result, (slightly better than the broadcast chain). This tuner was not at its best separating a weak from a nearby strong station, with a rather below average

selectivity of around 50dB. Conversely AM rejection and capture ratio were quite good. Output level was lower than usual at 300mV but good pilot tone rejection was shown. Total harmonic distortion was about average with 0.25% mono and 0.5% stereo (full modulation, left or right channel only). It also responded well to overmodulation, and attained good stereo separation.

### **CONCLUSIONS**

This tuner appeals on the grounds of its fine sound, excellent ease of use, good build and finish, and a more than satisfactory technical performance. Clearly a quality design.

### TEST RESULTS

Sensitivity for 50dB signal-to-noise Monolstereo	luner 7uV/70uV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	ηνητεμν
Mono/stereo	70dB/66dB
Muting threshold	
Alternate channel selectivity	- 49dB
Pilot tone rejection, 19kHz/38kHz	63dB
AM rejection	
Capture ratio	1.8dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	0.25%/0.35%
Stereo separation, 1kHz/5kHz/10kHz	48dB/38dB/30dB
Output level, 100% mod	300mV
Dimensions (width, depth, height)	32×21×6cm
Typical price inc VAT	£289
First reviewed: 1983. Rating: Recommended	

### **ROTEL RT-850L** Rotel HI-FI, 25 Heathfield, Stacey Bushes, Milton Keynes MK12 6hr

· \_\_\_\_\_TEL: (0908) 317707\_\_\_\_\_ ·

otel'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	
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	575m\*
Channel balance, stereo	2.01JB
Dimension (width, height, depth)	43 x 6.5 x 31cm
Typical price inc VAT	<u> </u>
First reviewed 1986	

### SONY ST-S 700ES

his £300 upmarket 'ES' tuner is the top current Sony model available in the UK. Described as 'direct comparator', it is larger than most, solidly built and finely finished. This quartz digital synthesiser design covers FM and medium and long wave AM, with 10 preset switches plus 'manual' and computer controlled electronic tuning.

A feature is the wide/narrow IF option which helps get the best performance from local/distant stations respectively. Pushbuttons and knobs select auto muting/mode plus a variety of tuning and programming functions such as 'scan'. However, the signal strength meter is rather more decorative than functional, using 10 segments to display five levels, with full saturation at a low  $100\mu$ V.

### SOUND QUALITY

FM sensitivity seemed subjectively very good, adequate for good stereo by  $200\mu V$  and solid above  $500\mu V$  aerial signal, with noticeably quiet backgrounds compared with the norm. The sound quality too is very good indeed, with excellent stereo focus and width, fine resolution at low and high frequencies, and an even, smooth overall balance, perhaps a touch on the



bright side compared with other leading references. Coloration was negligible, but a slight softening of impact was queried by one listener.

The AM reception was competent and the tuning indicator worked well. Backgrounds were again unusually quiet, and the sound quality was pretty decent, particularly in the bass, though the 'corner' of the HF rolloff seemed audible as a slightly 'quacky' coloration.

### LAB REPORT

An outstanding set of performance measurements serve as a worthwhile benchmark against which lesser models may be compared, with signal-to-noise ratios particularly excellent. The normal/narrow tuning 'window' proved effective in operation, with appropriate advantages and disadvantages showing up in the figures.

### **CONCLUSIONS**

This is a first class tuner in every respect including FM sound quality, with above average AM reception. Though it is more expensive than average it shows what a basic Japanese IC package can achieve by intelligent engineering and a little relaxation of tight budgetry constraints, and fully merits recommendation.

### **TEST RESULTS**

	Iunci
Sensitivity for 50dB signal-to-noise Mono/stereo	2.6/36µV (3/39µV
narrow)	
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	82dB/75dB
Muting threshold	4µV
Alternate channel selectivity	71dB (83dB narrow)
Pilot tone rejection, 19kHz/38kHz	73dB/-93dB
AM rejection	71dB
Capture ratio1.	8dB (2.6dB narrow)
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	-70dB/-65dB

AM rejection	/ldl
Capture ratio	1.8dB (2.6dB narrow
Total harmonic distortion at 100% mod, 1kH;	2
Mono/stereo	-70dB/-65dB
Stereo separation, 1kHz/5kHz/10kHz	54dB/42dB/37dB
Output level, 100% mod	570m\
Channel balance, stereo	
Typical price inc VAT	£ 30

he natural partner to Technics' 'budget' SU500 integrated amplifier, this simple £100 tuner is comfortably the cheapest amongst those tested in 1987, yet is also well equipped. The construction is very slim and lightweight, but external finish in Technics' traditional 'camouflage' brown is to the usual high standard, and ergonomics are fine.

Using quartz digital synthesis to cover three wavebands (FM plus medium and long wave AM), 8 presets provide memory for 16 stations — the two groups distinguished by pushing briefly or holding down the requisite button. The main tuning control may be used manually or will scan automatically. The rear panel carries 750hm coaxial and AM aerial inputs, the usual loop AM aerial, plus a remote control socket for use when integrating in a Technics system.

### SOUND QUALITY

The FM reception (RF) capabilities of this tuner are very good, capable of decent quality stereo with aerial signals as low as  $300\mu$ V, delivering solid results from 1mV, and coping very capably with overmodulation. However, the sound quality itself rated a little below average. The



tuner was well behaved enough, generally uncoloured and neutral, but had a tendency to 'thicken' the sound somewhat. A loss of 'air' and 'speed' reduced insight into the music somewhat, while there was further criticism of a lack of 'weight' and 'grip' in the bass region.

The AM sound quality was dire: "sounds like music coming down a long furry tunnel", according to one panelist. Furthermore the 9kHz digital tuning intervals prevented any 'fine tuning' remedies.

### LAB REPORT

Fine sensitivity and very good general measured

performance gives no clue to the low cost of this model. The slight weaknesses are the limited pilot tone rejection, low stereo signal to noise, mild (-1dB) treble shelf cut in the frequency response, and a really silly muting threshold.

### CONCLUSIONS

The combination of a fine RF performance on FM and fair sound quality at something of a bargain price for tuners nudges us towards recommendation, though it must be admitted that we found it difficult to raise any great enthusiasm for what is, ultimately, very much a common denominator performer.

### Test Results

Sensitivity for 50dB signal-to-noise Mono/stereo	3.8µV/110µV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	73dB/50dB
Muting threshold	1.4µV
Alternate channel selectivity	
Pilot tone rejection, 19kHz/38kHz	33dB/47dB
AM rejection	-53dB
Capture ratio	1dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	54dB/ - 57dB
Stereo separation, 1kHz/5kHz/10kHz	_42dB/42dB/39dB
Output level, 100% mod	621mV
Channel balance, stereo	0.33dB
Dimensions (width, depth, height)	43 × 54 × 19.5 cm
Typical price inc VAT	£100

## A BREATH OF FRESH SOUND



666 HB1 LOUDSPEAKER OF THE YEAR 1984, 1985, 1986 - WHAT HI-FI BEST BUY 1983, 1984, 1985 - HI-FI CHOICE, HB2 RECOMMENDED 1979, 1980, 1981, 1982, 1983, 1984 - HI-FI CHOICE, "THEY POSSESS THAT EFFORTLESS SOUND QUALITY WHICH, WAS ALMOST IMPOSSIBLE TO BELIEVE", PRACTICAL HI-FI 1980, ". A CLEAR RECOMMENDATION", HI-FI NEWS 1983, HB3 "EXCITING AND VERY DRAMATIC. ...WITH AN EFFORTLESSNESS AND EASE, RHYTHMS ARE WELL DEFINED AND CRISP... A WARMTH AND RICHNESS OF TONAL COLOUR ...HIGHLY INFORMATIVE ... EXCELLENT LEVELS OF INSTRUMENTAL SEPARATION... AND DYNAMICS". PRACTICAL HI-FI 1983, "HIGH SOUND LEVELS WITHOUT ANY NOTICEABLE COMPRESSION. CONVINCING REALISM. ANALYTICAL SOUND REMINISCENT OF STUDIO MONITORS", HI-FI FOR PLEASURE 1984.
TT2 RECOMMENDED 1983, 1984, 1985 - HI-FI CHOICE "IN TERMS OF PERFORMANCE THE TT2 CAN BE WELCOMED TO THE SELECT BAND OF HIGH QUALITY UNITS". GRAMAPHONE 1984. "... EXCELLENT WELL MADE, ABOVE AVERAGE PERFORMANCE". HI-FI ANSWERS 1983. "THET IS IS SUPERIOR PRODUCT". HI-FI NEWS 1984.
HBS1 LOUDSPEAKER STAND OF THE YEAR, FEDERATION OF BRITISH AUDIO AWARDS 1984.
C21P2 "... ONE OF THE VERY BEST COMBINATIONS AVAILABLE UNDER £1000". NEW HI-FI SOUND 1986. "... BETTER THAN ANY 999



Heybrook Hi-Fi Ltd, Knighton Hill, Wembury, Plymouth, Devon. Telephone (0752) 863188.

f 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.

When setting the loudspeaker budget, it is vital to allow sufficient funds for a decent stand or support, and good quality connecting wire. From £150, for example, one should probably allocate £100 for the speaker itself, £40 or so for stands, and maybe a tenner for the cables. However good the loudspeaker, it will not achieve its potential unless the accessories are up to scratch.

### **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. Likewise, 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 multisource 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 standmounted 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.

### **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, manufacturers 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.

## **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.

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? 31

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.

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. 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.

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 highfrequency 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.

'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'.

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.



### **ACOUSTIC RESEARCH 18**



ast 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 £130 a pair.

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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 ferro-fluid-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 vinylclad 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 6.50hms. 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 competent 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)4	5.5×27.5×21cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(10) -60W
Recommended placementon 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 80hms at 1 metre)	90dB/W
Approximate maximum sound level (pair) at 2 met	res103dBA
Impediance characteristic (ease of drive)	good
Forward response uniformity	average
Typical price per pair, inc VAT	£130
For grath references see issue No 46	5

For graph references see issue No 46

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### KROYD A25

ROYD LOUDSPEAKER CO, UNIT A6, STAFFORD PARK 15, TELFORD, SHROPSHIRE TF3 3PB.



kroyd 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 fairsized compact system costs a competitive £100 a pair considering that the vinyl-covered sealedbox 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 listen-

ing, 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. 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 6.40hm baseline, this speaker proved easy to drive, with an average impedance value of 100hms. 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 $\pm 3 dB,$ at 2 metres	see graph
Low frequency rolloff (-6dB point) at 1 metre	52Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 80hms at 1 metre)	87dB/W
Approximate maximum sound level (pair) at 2 a	metres100dBA
Impedance characteristic (ease of drive)	good+
Forward response uniformity	below average
Typical price per pair, inc. VAT	£100

### **PERFORMANCE SUMMARY**





### BBC LS3/5a

Swisstone Ltd (rogers), Spendor Audio Systems Ltd. ——All manufacturing to fixed specifications under BBC licence——

hree 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  $5\frac{1}{2}$  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 7.50hms, so the design qualifies as an easy 100hm 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.

ALTRED TO TRANSPORT

### 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. Spendor, 1983 (retested 1984), reassessed 1985/86). Current typical price £265...

For graph references see issue No 41

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### **B&W DM100**

he '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  $\pm 2dB$  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 60hms and averaged 80hms. 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.

Note: The current version of the DM100 carries an 1 suffix, indicating minor production changes which we have not yet assessed.

For graph references see issue No. 41

### **B&W DM110**



vailable 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 per-

formance, engineering and fine value. A twoway 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 nonrebated 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  $\pm 0.5$ dB 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  $\pm 2$ dB, 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 80hm 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.

Note: The current version of the DMIIO carries an I suffix, indicating minor production changes which we have not yet assessed.

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#### PEAK S L **O U** D S E R

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ossessing 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 90hms. 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 <sup>1</sup>/3-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.

Reassessed. First reassessed 1981. Current typical price £129. 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."

HiFi Choice 1985

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### **CASTLE DURHAM**



he *Durham* is a fairly new design, selling for £179, 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. Hardwiring is used internally, external system connection is made *via* combined 4mm socket/bind-ing 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-midrange. 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 80hms, and constitutes an easy amplifier load since it did not fall below 6.40hms. 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 $\pm 3$ dB, 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 met	res102dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	very good
Typical price per pair, inc VAT	£179

### **PERFORMANCE SUMMARY**



### **CASTLE PEMBROKE**

lthough basically a compact design the *Pembroke* nonetheless encompasses a bass-reflex-loaded volume of some 32 litres.

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.

ACCOUNTS OF

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  $\pm$ 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  $\pm 1.5$ dB 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 £269.* 





### **CELESTION SL6S**

Celestion International Ltd, Ditton Works, Foxhall Road, Ipswich, Suffolk ip 38jp.

-TEL: (0473) 723131– David Prakel



'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 midband 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 60hm minimum confirming a true 80hm 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) -1 50W
Recommended placementfree	space, 40cm stand
Frequency response, within $\pm 3$ dB, at 2 metres	60Hz to 16kHz
Low frequency rolloff (-6dB point) at 1 metre	50Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 80hms at 1 metre)	84dB/W
Approximate maximum sound level (pair) at 2 me	etres101dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good+
Typical price per pair inc. VAT	£350



JBL 60T



Pact 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 reflexloaded 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 80hm standard tolerance; in fact the lowest value was a touch over the 40hm 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 placementfloor	or low stand (15cm)
Frequency response, within $\pm 3 dB$ , 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 m	netres104dBA
Impedance characteristic (ease of drive)	average (not 80hm)
Forward response uniformity	very good
Typical price per pair, inc VAT	£370

### **PERFORMANCE SUMMARY**



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### **JPW AP3**

JPW LOUDSPEAKERS LTD, PO BOX 31, PLYMOUTH, DEVON. -TEL: (0752) 784284-

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 90hms and a lowest of 60hms.

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.

FIEGO TALENTRY

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.

Reassessed. First reviewed 1985. Current typical price £210. For graph references see issue No. 41

### MISSION 70 II MISSION ELECTRONICS, STONEHILL, HUNTINGDON PE18 6ED.

-Tel: (0480) 57477-

speaker range.

ow 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

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  $\pm 0.5$ dB, and at 1 metre the speaker met fine  $\pm 2dB$  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, gener-

ally 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 50hms, and a fair rating would be 60hms, 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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MISSION ELECTRONICS, STONEHILL, HUNTINGON, CAMBS PE18 6ED. -Tel: (0480) 57477-



ission 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 vinylcoated 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 80hm 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 showed, 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  $\pm 3$ dB 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.

HECONDIENTED

#### 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 placementon	stand near wall
Frequency response, within $\pm 3$ dB, at 2 metres	_85Hz to 20kHz
Low frequency rolloff (-6dB point) at 1 metre	73Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 80hms at 1 metre)	89.5dB/W
Approximate maximum sound level (pair) at 2 metr	es104dBA
Impedance characteristic (ease of drive)	average
Forward response uniformity	good
Typical price per pair, inc. VAT	£130

### **PERFORMANCE SUMMARY**



For graph references see issue No 46



### **MONITOR AUDIO R252**

he *R252* is an inexpensive, two-way sealed box speaker of 17 litres internal volume, employing a 200mm steel-framed pulp cone bass/midrange driver plus a 19mm soft plastic dome tweeter. It is hard-wired internally including the high-power capacity, good-quality crossover network.

RECONTRATION

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  $\pm 3$ dB 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 5.50hms 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.

his 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;  $\pm 3$ dB 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 received 1983. Current typical prec £250.

### **MONITOR AUDIO R700MD**

Monitor Audio Ltd, 34 Clifton Road, Cambridge.



*i-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.

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### 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

### **PERFORMANCE SUMMARY**



For graph references see issue No 46

### **MORDAUNT SHORT MS100**

MORDAUNT SHORT LTD, DURFORD MILL, PETERSFIELD, HANTS GU31 5AZ.

\_\_\_\_\_Tel: (0730) 80721\_\_\_\_\_

he 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.

ANTON MANDON

This speaker is unusual in its use of a custommade 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  $1\frac{1}{2}$  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. It 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 £179s. For graph references see issue No 41



### **ROGERS LS2**

SWISSTONE ELECTRONICS LTD, 310 COMMONSIDE EAST, MITCHAM, SURREY.

his 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  $\pm$  3dB limits.

ATTRECONSTRATION

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 6.40hms 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 £170.

For graph references see issue No 41

### **ROGERS LS6** Swisstone Electronics Ltd, 310 Commonside East, Mitcham, Surrey.

he LS6 slots in below the LS7T, 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. 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 440 $\mu$ F 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*.

#### 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  $\pm 2$ dB 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 80hm 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 £240.

For graph references see issue No 41

HESTHUR



### SONY APM20ES MKII



ony 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 competitive £150.

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  $\pm 0.5$ dB. 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 50hms 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 possessing 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**
### SONY APM22ES

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.

he 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 fiveelement 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  $\pm 0.5$ dB, 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  $\pm 1$ dB 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.

THE CONTRACTOR

Dipping just below 60hms 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 £249. For graph references see issue No 41



#### LOUDSPEAKERS

#### SPENDOR PRELUDE

pendor'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 diecast 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  $\pm 3$ dB 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 £320.

For graph references see issue No 41



#### **SPENDOR SP2**



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,  $\pm 2.5$ dB 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  $\pm 3$ dB 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 £420. For graph references see issue No 41

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#### TANNOY MERCURY II



annoy 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, reflextuned 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 competent, 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 80hms. 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  $\pm 3$ dB 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 competent 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 placementc	open stands, 45cm
Frequency response, within $\pm 3$ dB, at 2 metres	55Hz to 20kHz
Low frequency rolloff (-6dB point) at 1 metre	55Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 80hms at 1 metre)	88dB/W
Approximate maximum sound level (pair) at 2 me	etres103dBA
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

#### LOUDS Ρ EAK E R S

**TANNOY VENUS II** 

TANNOY PRODUCTS LTD, THE BILTON CENTRE, CORONATION ROAD, CRESSEX IND ESTATE. — Нібн Wycombe, Bucks. Tel: (0494) 450606–

annoy'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.

III CONTRACTOR

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 6.40hms, allowing an 80hm 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.





## LOUDSPEAKERS

#### WHARFEDALE **5**04

WHARFEDALE LOUDSPEAKERS LTD, SANDLEAS WAY, CROSSGATES, LEEDS LS15 8AL.

—Tel: (0532) 601222—



he success of the diminutive Diamond first led Wharfedale to produce a Mkll 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 80hms, falling to nearer 50hms 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 offo rward 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)2	$1 \times 18.5 \times 20$ cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(15) - 50W
Recommended placement60cm s	tand, near wall
Frequency response, within $\pm 3$ dB, at 2 metres	0Hz to 12kHz*
Low frequency rolloff (-6dB point) at 1 metre	75Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 80hms at 1 metre)	85dB/W
Approximate maximum sound level (pair) at 2 metre	s98dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good
Typical price per pair, inc. VAT	±129
* see text	

#### **PERFORMANCE SUMMARY**



For graph references see issue No 46



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1.1

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⊵

# **CD PLAYERS**

ompact 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 five 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 cheap mechanisms are built into systems and portables. 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, alldigital 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 threat of a rival digital tape format (DAT) which will offer record as well as replay capabilities, but the hardware is likely to be significantly more expensive.

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 specialist LP record players are selling steadily, 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, and future CD applications under development include adding video (CD Video), interactive A/V (CD-I), and the CD-ROM computer software format. In-car, portable and personal players are 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 almost twice the price of an LP or musicassette (in the UK) but should resist 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.

An equivalent to the vinyl 45rpm 'single', containing a mixture of audio and video on a standard size disc, is about to be launched, as is a small (3in diam) audio only version.

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 coming on stream during 1987 should turn a shortage into a glut and bring prices down from early 1988.

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 five or six 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.





- Marantz, Meridian, Mission, Monitor Audio, Nakamichi, Pioneer, Quad, Rogers, Rotel, Sony ES, Wharfdale, Yamaha and more.
- All equipment on demonstration in our two private listening rooms fitted with surround sound (Yamaha DSP1).



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#### ACOUSTIC RESEARCH CD-04

ACOUSTIC RESEARCH LTD, HIGH STREET, HOUGHTON REGIS, BEDFORDSHIRE LU5 5QI. -Tel: (0582) 867777-



t makes a refreshing change to encounter a CD player which doesn't look like an identikit clone from the parts bins of Philips or Japan Inc. Alternatives are rare, and usually pricey besides, which makes this slant-front full-width model from loudspeaker and turntable specialist Acoustic Research almost unique at £289, even though the stylish bodywork clothes a basically Philips mechanism.

AR in fact have a small range of separate electronic components, and the infra-red remote control supplied with the CD-04 actually has the keys and functions to control such a complete system, in addition to the basic functions of the CD player. In a system, these visually compatible components may be stacked so that the slants overlap, giving a zig-zag profile, or with the slants faces aligned so the whole stack leans back for easy operation without stooping.

To preserve the visual effect, this CD player has a dummy volume/tuning control on the right hand side which acts as the switch for play and pause. The features and facilities are pretty basic, the corollary of which means that the machine is comparatively simple and straightforward to operate. A simple four-digit display indicates disc track or elapsed time, while other functions include skip and audible fast search, and programming of up to 20 tracks. The instruction manual is refreshingly accessible.

#### LAB REPORT

Based on the earlier Philips 14-bit 4× over-

sampling chip set but with dual DACs, the CD-04's frequency response shows the expected characteristic high frequency ripple, but zero interchannel phase difference. Channel separation was excellent, harmonic distortion very good, and intermodulation good, though the spectrogram does show some ultrasonic output.

Mechanical noise was low, but shock and vibration resistance was only average and track access time an unexceptional 4 seconds. The output met specification level, from a usefully low impedance that ensures good compatibility. The error correction and tracking tests were passed without drama, and signal to noise ratios were particularly good. Low level resolution was pretty good, at around 15.5 bits, and overall it is difficult to pinpoint any meaningful weaknesses despite the use of 'older' 14-bit CD technology.

#### SOUND QUALITY

The AR turned in an above average performance in the listening tests, as befits a product from a company making energetic efforts to appeal to the enthusiast/specialist sector. The sound was described as neutral and tidy, with midrange in particular sounding clear, 'open' and well focused. Voice reproduction was dynamic, while depth was well reproduced and the stereo image gave good perspectives with a fair measure of ambience. However, the treble was described as a touch 'odd', and the bass showed some mild 'lumpiness'.

#### **CONCLUSIONS**

This simple, elegant if unusually styled CD player may be based upon the older generation of Philips '14-bit' technology, but in no way seems to suffer as a result. The lab performance showed no technical weakspots while the listening tests confirmed that AR have done a good job in 'tweaking' the sound to suit enthusiast tastes. Furthermore, bearing in mind the supplied remote control, the price is pretty competitive, so Recommendation is clearly appropriate.

#### **TEST RESULTS**

	ZUHz	IKHZ	ZUKHZ
Channel balance	0.26dB	0.26dB	0.26dB
Stereo separation	1106dB	111dB	106dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, OdB	-87dB	- 85dB	-85dB
Total harmonic distortion, -10dB		-77dB	
Total harmonic distortion, -60dB		— 37dB	
Total harmonic distortion, -80dB		-20dB	
Intermodulation, 19kHz/20kHz, 0dB	_	-80dB	
Intermodulation, 19kHz/20kHz, -10dB	_	-76dB	_
Frequency response, left channel	-0	.86dB, 0, •	-0.49dB
Frequency response, right channel	-0	.86dB, 0, ·	-0.49dB
Signal-to-noise, 20Hz-20kHz unweighte	d	-110/	-111dB
Signal-to-noise, CCIR/ARM, 1kHz ref_		105/	-105dB
Output level, 0dB, left/right			2.09V
Output impedance			2000hms
De-emphasis1kHz, 0.4dB;	5kHz, 4.	7dB; 16kH	z, 9.5dB
Track access time			_4.0secs
Error correction capability	_>900µm	n gap, >80	0µm dot
Mechanical noise			low
Spuriae up to 100kHz			72dB
Resolution at -90dB			-86.5dB
Headphone socket			no
Dimensions (w×d×h)		43×33	×8.5cm
Estimated typical purchase price			£289



**DENON DCD 300** 

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



enon are one of the smaller Japanese operations, and one of the more recent to get proper distribution on the UK market. They specialise in hi-fi separates, and after attracting considerable attention with a range of good quality cassette decks are fast gaining a similar reputation in amplifiers and CD players too. For 1987 they are launching no fewer than six new models, covering every conceivable price point from this £210 '300 up to the exotic £1200 '3300.

This is the basic machine in the range. It is midi in size, light in weight, manual in operation, black in colour, and decently finished to Japanese build standards. A fairly elaborate though quite small display provides both track and timing information simultaneously, with various additional status indicators. The control layout is neat enough and was well liked, play, pause, and stop coming readily to hand, above the programming and repeat play buttons. The other operational controls, giving audible search, skip, display mode, open/close and the headphone socket are strung out willy nilly in a long line. The rear panel just has a pair of phono outputs.

#### LAB REPORT

Using standard 16-bit linear operation with a single time-shared DAC, the '300 gave a respectable rather than exceptional set of lab figures, appropriate enough to its budget price. The response showed a typical Denon characteristic, with a mild mid treble dip and following peak, but flat enough nonetheless. Channel balance was close, deteriorating slightly at high frequencies - like both the below average channel separation and good harmonic distortion. Intermodulation distortion was good, with ultrasonic components pretty well controlled.

Test track access time was a slowish 5 seconds, but the machine was mechanically very quiet and showed very good immunity from shock and vibration. Error correction and tracking tests gave no problems, but 0dB white noise was clipped top and bottom. Both signal-to-noise ratios were respectable enough, though somewhat asymmetric between channels, as were the rather below average readings for ultrasonic spuriae. Low level linearity was a little disappointing too, rating around 14.6 bits.

#### SOUND QUALITY

Just scraping into the above average ratings is a fine result for a budget price player with this standard of build quality. The sound was lively and open, with above average dynamics and clarity. Focus was good and the stage wide, with quite good depth besides. The treble was a trifle 'brittle' and forward, showing mild 'grain' and coarseness, but bass was above average. Overall this player gave a cheerful 'honest' sound.

#### **CONCLUSIONS**

Unspectacular all round competence is becoming a hallmark of Denon's budget models, and is precisely the situation with the DCD 300. Different competing players may sound better, measure better or be built a fraction better, but few offer better balance for the price, so despite the compromises imposed by price this Denon budget model well merits a Best Buy rating.

#### **TEST RESULTS**

	20Hz	1 kHz	20kHz
Channel balance	0.05dB	0.04dB	0.17dB
Stereo separation	80.7dB	81.9dB	67.3dB
Channel phase difference	0°	4°	85°
Total harmonic distortion, 0dB	-88.4dB	-89.1dB	-61.2dB
Total harmonic distortion, -10dB	-	-88.5dB	_
Total harmonic distortion, -60dB	-	- 35.9dB	
Total harmonic distortion, -80dB	-	-17.5dB	-
Intermodulation, 19kHz/20kHz, 0dB	-	-89.8dB	
Intermodulation, 19kHz/20kHz, -10dB	-	-88.6dB	
Frequency response, left channel	0.	09dB, 0,	-0.13dB
Frequency response, right channel	0.	09dB, 0,	-0.01dB
Signal-to-noise, 20Hz-20kHz unweighte	ed		_96/88dB
Signal-to-noise, CCIR/ARM, 1kHz ref			_91/87dB
Output level, 0dB, left/right			2V
Output impedance			.2kohms
De-emphasis1kHz, 0.21dB;	5kHz, 4.0	DdB; 16kH	łz, 8.9dB
Track access time			_5.0secs
Error correction capability	>900µm	gap, >80	0µm dot
Mechanical noise			very low
Spuriae up to 100kHz			-83/96dB
Resolution at -90dB		81.6/	-81.4dB
Headphone socket	_yes (fixe	d output)	100ohms
Dimensions (w×d×h)		_33.5×32	2×8.5cm
Estimated typical purchase price			£210

#### **DENON DC-500**

HAYDEN LABORATORIES, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST. PETER, BUCKS.

-Tel: (0753) 888447-



enon are one of the smaller Japanese operations, and one of the more recent to get proper distribution on the UK market. They specialise in hi-fi separates, and after attracting considerable attention with a range of good quality cassette decks, are fast gaining a similar reputation in amplifiers and CD players, launching no fewer than six of the latter for '87.

The £250 DCD 500 sits at the lower end of the range. It is a full size model similar to the '700 but without the remote control. It is a fairly basic machine, nicely built and finished with intelligent ergonomics and control layout, users commenting that it was particularly easy to

drive.

The display is fairly elaborate though quite small, providing both track and timing information simultaneously, with various additional status indicators. The main drive controls fall conveniently to hand, while the other operational controls, giving audible search, skip, display mode, repeat, programming and a fixed output headphone socket are strung out in a long line. The rear panel has only a conventional stereo pair of phono sockets.

#### SOUND QUALITY

Rated comfortably above average, this is a good result for such a reasonably priced player. The sound was pleasant and lively, with good stereo focus and perspectives, and notable clarity. The midband sounded a little lightweight, while the treble was quite good, with only mild coarseness and slight grain and 'edge'. Bass was presentable, presentation clean, and the overall impression was of good balance and competence.

#### CONCLUSIONS

Though it lacks the luxury of a remote control found with many £250 models, the DCD-500 performed sufficiently well in the listening tests to merit a strong recommendation, succeeding in providing a fine combination of sound and build quality at a very realistic price.





#### **DENON DCD 700**



ne of Japan's smaller consumer electronics operations, hi-fi specialist Denon are also one of the more recent to get proper distribution on the UK market. After attracting considerable attention with a range of good quality cassette deck separates, they are fast gaining a similar reputation in amplifiers and CD players too. Showing great confidence in the new medium, as well as a determination to compete with the marketing strategies of the giants, they are launching no fewer than six new 1987 models, covering every conceivable price point from £200 to £1200.

The £290 DCD 700 sits at the lower end of the middle of the range. It is a full size model similar to the '500, but includes a full feature remote control. That aside it is a fairly basic machine, nicely built and finished with intelligent ergonomics and control layout, users commenting that it was particularly easy to drive.

The display is fairly elaborate though quite small, providing both track and timing information simultaneously, with various additional status indicators. The main drive controls fall conveniently to hand, while the other operational controls, giving audible search, skip, display mode, repeat, programming and the variable output headphone socket are strung out in a long line. The various switches plus a ten-digit keypad are all on the remote handset. The rear panel has only a conventional stereo pair of phono sockets.

#### LAB REPORT

Using standard 16-bit linear operation with a

single time-shared DAC, the '700 shows significant detail improvements over the cheaper '300, indicating tighter tolerances throughout, while a special delay sampling technique avoids the interchannel high frequency phase difference normally associated with single DAC designs. The response showed a typical Denon characteristic, with a mild treble unevenness but flat enough nonetheless. Channel balance was close, and separation very good. Harmonic distortion was only average, worsening at high frequencies, but intermodulation was pretty good, with ultrasonic components well under control.

Mechanically quiet and with excellent shock and vibration rejection, track access time was a slowish 5.5 seconds. Error correction and tracking tests gave no problems. A couple of limitations shown in the 300 are carried on into the 700 model: 0dB white noise was again clipped top and bottom, and signal-to-noise ratios were still somewhat asymmetric between channels at high frequencies. The reading for ultrasonic spuriae was much improved, as was low level linearity at around 15.6 bits.

#### SOUND QUALITY

Rating firmly above average, the *DCD* 700 shows small but worthwhile improvements in sound quality over both the cheaper Denon models, so justifying its price point. The overall sound was pleasant, with good perspectives and a treble described as quite sweet, with little grain or subjective distortion. Bass was focused, firm and well defined, and the midband clear and neutral, though the treble could have been more

detailed and dynamic contrasts were a little muted. Overall this is a very competent middleranking deck.

#### CONCLUSIONS

Given the £290 price, the DCD 700 has clearly done enough to merit firm recommendation. The remote control assists already good ergonomics; the lab performance shows some attention to component tolerancing; the range of facilities is ample for most users; the build quality is sufficient to inspire some confidence; and the sound quality is comfortably up to the mark.

#### Test Results

	20112	1.6.112	ZUKF12
Channel balance	0.03dB	0.02dB	0.01dB
Stereo separation	98dB	98dB	96dB
Channel phase difference	0°	0°	7°
Total harmonic distortion, 0dB	-91.5dB	-86.8dB	-57dB
Total harmonic distortion, -10dB	-	-87dB	
Total harmonic distortion, -60dB _		— 29dB	
Total harmonic distortion, -80dB		- 19dB	
Intermodulation, 19kHz/20kHz, CdB		-82.6dB	
Intermodulation, 19kHz/20kHz, - 10dB		-90.2dB	
Frequency response, left channel	0	03dB, 0,	-0.45dB
Frequency response, right channel	0	03dB, 0. 🖻	=0.49dB
Signal-to-noise, 20Hz-20kHz unweighte	d		98/95dB
Signal-to-noise, CCIR/ARM, 1kHz ref			92/88dB
Output level, 0dB, left/right			2.1V
Output impedance			_1kohm
De-emphasis1kHz, 0.3dB;	5kHz, 4.0	5dB; 16kF	lz, 9.2dB
Track access time			_5.5secs
Error correction capability	>900µm	i gap. >80	0µm dot
Mechanical noise			very low
Spuriae up to 100kH:			105.2dB
Resolution at -90dB		87.9/	-85.4dB
Headphone sockety	es (variabl	e output)	100ohms
Dimensions (w×d×h)		43.5×31	l.5×9cm
Estimated typical purchase price			6200



enon are one of the smaller Japanese operations, and one of the more recent to get proper distribution on the UK market. They specialise in hi-fi separates, and after attracting considerable attention with a range of good quality cassette decks, are fast gaining a similar reputation in amplifiers and CD players, launching no fewer than six of the latter for '87.

The £330 DCD-900 is the top model in the 'affordable' price range, and is a full size fullremote model similar to the '700 but somewhat more heavily built and with a number of extra facilities. It is a fairly complex machine, nicely built and finished with intelligent ergonomics, if perhaps a little on the complicated side for some users we suspect. The display is very elaborate though quite small, providing track, index and timing information simultaneously on three digital indicators, with 20-digit music calendar and various additional status indicators. Next to the display, an 11-key pad provides the direct track access available on the remote control. The main drive controls fall conveniently to hand, while the other operational controls, giving audible search, skip, display mode, repeat, programming and a variable output headphone socket are strung out in a long line. The various switches plus a ten-digit keypad are all on the remote control handset. The rear panel has only a conventional stereo pair of phono sockets.

**SOUND QUALITY** Scoring above average overall, the '900 was rated fractionally above the cheaper Denon machines apart from the '700, yet this is still a good result for the price. Pleasantly lively, with good dynamics, it gives a fine stereo image with good frontal detail, focus, depth and width. Sounding slightly 'lean' in the midband, the treble is a touch forward with a hint of roughness. Bass is competent, but there was slight congestion on complex material. Overall this is a good but unexceptional performer.

#### CONCLUSIONS

Decent sound quality, fine build quality and plentiful facilities at a realistic price is quite sufficient to ensure this model's Recommendation, but it is not our favourite member of the Denon range.



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hough Ferguson do not make their own CD equipment, their reputation and market share on TV and video products ensure that the Thorn EMI brand is widely distributed, primarily through the less specialist dealers, so the marketing of bought-in audio products is a logical strategy to follow.

This 1987 £150 midi-size player differs from the 1986 *CD-02* model in being based on Yamaha rather than Sony technology. It must be one of the simplest players around — but that in itself is something of a strength. It also shows considerably more evidence of intelligent contemporary design than most — sparsely functional from a distance, easy to comprehend and use close up.

Part and parcel of the simplicity is a rather limited range of facilities on offer, though some users might regard a little self-discipline in this area as no bad thing. A small display gives basic machine condition information and details on one of three disc parameters, while facilities are limited to track skipping (not high speed search) and a nine track memory. And the excellent operating manual makes a welcome change from multi-lingual Far Easternspeak.

#### LAB REPORT

The *CD-04* uses standard Japanese technology, with a single, 16-bit DAC,  $2 \times$  oversampling and digital filtering. The frequency response is

smooth enough, but marred slightly by a 0.5dB peak centred on 15kHz, the phase response reflecting the channel-shared DAC. Channel balance was close, stereo separation respectable, and harmonic distortion good. Spot measurements for intermodulation distortion were also low, but the spectrogram shows a few more ultrasonic components than might be desirable.

Output impedance is a shade high for direct power amplifier connection, though such a scenario does seem a trifle unlikely. Track access speed and shock and vibration rejection were both about average and there was a mild degree of mechanical noise, but error correction tests were passed without fuss, and on our sample low level linearity was exceptionally good. Signalto-noise ratios were good too, but the level of ultrasonic spuriae was rather poor. Overall, these are well balanced and competent results nevertheless.

#### SOUND QUALITY

The CD-04 turned out to be one of the better sounding 'budget' machines, rating a very respectable 'average plus' overall which betters a number of more pretentious machines. Described as strong and forceful, tending to a little hardness in the midband at high levels, the bass sounded extended, 'punchy' and quite dynamic, while the treble was a trifle 'lazy' and somewhat projected. Midband focus was good, and the stereo image showed fairly good depth.

#### CONCLUSIONS

This new Ferguson could well provide an answer for those appalled by the complexities of many CD players and seeking a low cost, good quality, simple performer. Japanese build quality with a decent sound and respectable lab performance at a competitive price all indicate a Best Buy rating.

#### **TEST RESULTS**

	20Hz	1kHz	20kHz
Channel balance	0.08dB	0.08dB	0.06dB
Stereo separation	93dB	91dB	81dB
Channel phase difference	0°	2*	42°
Total harmonic distortion, CdB	-84JB	- SOJB	-78JB
Total harmonic distortion, -10dB		-83dB	
Total harmonic distortion, -60dB		-44JB	
Total harmonic distortion, - SCdB	-	-23.5dB	
Intermodulation, 19kHz/20kHz, 0dB	-	-83dB	_
Intermodulation, 19kHz/20kHz, -10dB		- 89dB	_
Frequency response, left channel	2.	eldb, e,	-1.42dB
Frequency response, right channel	_2.	01JB, 0,	-1.28dB
Signal-to-noise, 20Hz-20kHz unweighted	1	<u> </u>	98/101dB
Signal-to-noise, CCIR/ARM, 1kHz ref			93/97JB
Output level, 0dB, left/right			1.95V
Output impedance			_1kohms
De-emphasis1kHz, 0.31dB; 5k	H=, 4.13.	iB; 16kH=	, 9.23JB
Track access time			_4.0secs
Error correction capability	>900µm	gap. >80	Oum dor
Mechanical noise			noderate
Spuriae up to 100kHz			45dB
Resolution at -90dB		91.1/	-90.8dB
Headphone socket			no
Dimensions (w×d×h)	2200	_33.3×29	9×8.5cm
Estimated typical purchase price			£150

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DEMONSTRATION



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TRIO KENWOOD UK LTD, 17 BRISTOL ROAD, METROPOLITAN CENTRE, GREENFORD, MIDDX UB68UP.



nce known as Trio in the UK, the brand name change to Kenwood brings the UK product into line with the rest of the world. The smartly finished full-width DP-990D looks like a prestige model with its solidly cast front panel, offering full remote control with an extensive display, so it is a welcome surprise to find the price is a fairly modest £299. Both display details and legends are rather on the small side for easy reading, but the control grouping is logical enough and two large buttons provide useful 'manual override' out of the automatics and programming functions.

The operating manual is particularly arch, sprinkled with such headings as: "To play from the desired time of the desired tune", or "To play the previous or next tune". Writ very tiny upon the player itself are references to an (unspecified) 'over sampling system', plus a 'linear skate' disc loading mechanism whose advantages (or disadvantages) receive no reference whatsoever in the manual.

The unit as a whole is solidly built, but shows no apparent techniques specifically aimed at avoiding unwanted vibration effects. The front panel features a headphone jack with volume control, the rear a pair of phono audio outputs only.

#### LAB REPORT

Technology based on 16-bit chips with  $2\times$ 

oversampling and a shared DAC have resulted in an overall lab performance that was entirely competent, if unspectacular, rather reflecting the price level of the player. The response showed mild high frequency ripple, and a slight 'bump' in the filter characteristic centering on 15kHz — small enough in degree but just at the edge of the audible band nonetheless. Channel balance could have been closer at low and mid frequencies, but stereo separation, harmonic and intermodulation distortions were all good, the IM spectrogram showing just two obvious components at 68-70kHz.

While mechanical noise was very low and resistance to shock and vibration good, the track accessing time was a rather slow 6 seconds. Error correction and white noise tests were cleared without problems, noise was low, ultrasonic spuriae were well suppressed, and low level linearity was quite good, indicating a resolution of 15.5 bits.

#### SOUND QUALITY

The '990D rated a firm average, leaning towards the plus side, which is quite a good result for its price. Depth and stereo focus were both quite good, though there was some loss of resolution on low level ambient information. Dynamics were considered only average, with some limitation, and the subjective tonal balance included a subtle treble exaggeration. Some 'coarseness' was noted in the upper midrange, and the bass was a touch 'heavy' and 'slowed'.

#### **CONCLUSIONS**

Kenwood's *DP990D* clearly sits right on the borderline of recommendation. Both the listening tests and lab performance are par for the price, and the package is further enhanced by exceptional standards of finish and presentation, plus full feature and remote control provisions. On balance and bearing in mind the good all-round package it deserves recommendation, with the caution that comparable sound quality can be obtained more cheaply elsewhere.

#### **TEST RESULTS**

	20Hz	l kHz	20kHz
Channel balance	0.2dB	0.28dB	0.02dB
Stereo separation	105dB	105dB	80.5dB
Channel phase difference	0°	0°	40°
Total harmonic distortion, 0dB	-90dB	-91dB	-86dB
Total harmonic distortion, -10dB	_	-82.5dB	
Total harmonic distortion, -60dB 📥	_	-43dB	_
Total harmonic distortion, -80dB	_	-19dB	
Intermodulation, 19kHz/20kHz, 0dB		-91dB	_
Intermodulation, 19kHz/20kHz, -10dB	_	-80.8dB	
Frequency response, left channel	0.	02JB, 0,	-0.61dB
Frequency response, right channel	0.	03dB, 0,	-0.34dB
Signal-to-noise, 20Hz-20kHz unweighted	1		98/103dB
Signal-to-noise, CCIR/ARM, 1kHz ret			_93/98dB
Output level, 0dB, left/right			2.05V
Output impedance			2000hms
De-emphasis1kHz, 0.42dB; 5	kHz, 4.58	8dB; 16kF	Iz, 9.2dB
Track access time			6.0secs
Error correction capability	_>900µm	ı gap. >80	0µm dot
Mechanical noise			very low
Spuriae up to 100kHz			101dB
Resolution at -90dB			-88.2dB
Headphone sockety	es (variab	ele output	) 820hms
Dimensions (w×d×h)		44×3	0×9.5cm
Estimated typical purchase price			+799

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#### MARANTZ CD273



arantz are a subsidiary of Philips, but operate largely autonomously nonetheless as a specialist hi-fi brand, with entirely separate marketing and significant differences between product ranges. The CD players have most in common, and it is possible to establish equivalent models (this 273 being closely related to the Philips 160), but Marantz have stayed true to their hi-fi roots, specifying components selected for good sound quality and adding modifications of their own in some instances.

Received only just in time for the 1987 edition, this brand new manual control midisized Marantz is available in two versions. This review concentrates upon the 'standard' '273, priced at a competitive £199, but a *CD273SE* 'special edition' model is also available for an extra £40, identical in overall appearance and facilities but with added UK-sourced 'Eurotweaks' to enhance the sound quality.

The control layout is relatively clean and sensibly laid out, the large and clearly labelled main operating controls (including skip and audible scan) set apart from the less important programming (20 tracks), repeat and display functions. The display itself is quite small, but gives two separate numerical readouts for track number and elapsed or remaining time, and remains uncluttered by machine status LEDs. The presentation is smart with a good standard of finish, though the machine is very light in weight, a little flimsily constructed and plasticky in feel. However, much emphasis is placed on the under the skin engineering, features such as the separate analogue and digital power supplies and twin DACs being rare enough at twice the price.

#### LAB REPORT

Despite its budget price, this machine has advanced technical features, using twin 16-bit DACs with  $4 \times$  oversampling, and therefore shows no interchannel phase difference at high frequencies. Indeed the measurement set overall was no less impressive. Response is extremely flat, albeit with a trace of ripple at high frequencies. Channel balance measured very close, channel separation was outstanding, and harmonic distortion pretty good, albeit marred at low levels. Intermodulation distortion was exceptionally low, though the spectrogram does show a few clusters of ultrasonic spuriae.

Track access time was a reasonable 3.5 seconds, mechanical noise was reasonably low, shock and vibration resistance were very good, and error and tracking tests posed no problems. Signal-to-noise figures were exceptionally good, ultrasonic spuriae were quite well under control, and low level linearity was a reasonable 15 bits.

#### SOUND QUALITY

Not only did the '273 provide fine lab measurements for its price, it did very well in the listening tests too. The 'standard' model was rated firmly above average, close to the good category, and praised for its cheerful, lively, open and dynamic sound. There was a touch of treble brightness, but in this respect it was considered

slightly cleaner than its sister machine, the Philips 160. Stereo staging was impressive, with good focus, clarity and definition, and decent bass resolution.

#### CONCLUSIONS

The fine lab performance and listening test results, together with good presentation and ergonomics make a Best Buy rating mandatory for this budget price player. The only minor quibble might be that the build is a little less rugged and operation a little less smooth than some of the competition.

#### **TEST RESULTS**

	20Hz	1 kHz	20kHz
Channel balance	0.03dB	0.02dB	0.02dB
Stereo separation	121dB	108dB	98dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	-88dB	-84dB	-80dB
Total harmonic distortion, -10dB	_	-81dB	
Total harmonic distortion, -60dB		-42dB	_
Total harmonic distortion, -80dB		-14dB	_
Intermodulation, 19kHz/20kHz, 0dB	-	- 105dB	
Intermodulation, 19kHz/20kHz, -10dB		-99dB	
Frequency response, left channel	0.	03dB, 0,	-0.03dB
Frequency response, right channel	0.	03dB, 0,	-0.03dB
Signal-to-noise, 20Hz-20kHz unweighted	l	11	10/111dB
Signal-to-noise, CCIR/ARM, 1kHz ref		10	)5/106dB
Output level, 0dB, left/right		5	2.1V
Output impedance			2000hms
De-emphasis1kHz, 0.38dB;	5kHz, 4.6	6dB; 16kH	łz, 9.1dB
Track access time			3.5secs
Error correction capability	_>900µm	n gap, >80	0µm dot
Mechanical noise		f	airly low
Spuriae up to 100kHz			86dB
Resolution at -90dB			/-104dB
Headphone socket			no
Dimensions (w×d×h)		32×3	1×8.6cm
Estimated typical purchase price			£100

#### MARANTZ CD-273SE

MARANTZ AUDIO (UK) LTD, 15-16 SAXON WAY INDUSTRIAL ESTATE, MOOR LANE, -HARMONDSWORTH, MIDDX UB7 0LW, TEL: 01-897 6633-



eceived only just in time for the 1987 edition, this brand new manual control midi-sized Marantz is available in two versions. The 'standard' '273 is priced at a competitive £199, but this review concentrates upon the CD273SE 'special edition' model which costs an extra £40 and is identical in overall appearance and facilities (barring a pretentiously scripted Special Edition front panel logo), but with added UK-sourced 'Eurotweaks' to enhance the sound quality.

The control layout is relatively clean and sensibly laid out, the large and clearly labelled main operating controls (including skip and audible scan) set apart from the less important programming (20 tracks), repeat and display functions. The display itself is quite small, but gives two separate numerical readouts for track number and elapsed or remaining time, and remains uncluttered by machine status LEDs.

Presentation is smart with a good standard of finish, though the machine is very light in weight, a little flimsy in construction and plasticky in feel. However, much emphasis is placed on the under the skin engineering, features such as the separate analogue and digital power supplies and twin DACs being rare enough at twice the price.

#### SOUND QUALITY

Eclipsing the high standards set by the standard model, the '273SE scored a strong 'good' overall rating - edging towards audiophile territory at a near-budget price! Fine dynamics accompany a clean, coherent and stable stereo image, with good width and depth. The sound was easy and non-fatiguing, tidy and well ordered, with low distortion and pretty good low level resolution. Neutral in balance, the midrange showed less 'muddle' than the standard model.

#### CONCLUSIONS

One may assume a good lab performance comparable to the standard model. Build quality is quite adequate, finish and presentation good, but the 'SE is in any case an obvious Best Buy, simply on the basis of fine sound quality versus price.



n many ways this is a typical mid-priced CD player - black, standard size, standard search and programming facilities, manual control, selling for £380, but in point of fact it is claimed to be the leading seller via independent dealers during the pre-Christmas period 1987. There is much in common with the remote-control Marantz CD75, and its nearest Philips equivalent is the CD460

Manufactured in the Philips factory in Belgium, it shares much tried and tested common technology with most other Marantz and Philips models, not to mention a number of the players which are modified, branded and marketed by small specialist manufacturers. But Marantz see themselves as hi-fi specialists too though owned by Philips they operate autonomously to a great extent. They brand and sell only hi-fi equipment and are not in the business of flogging lightbulbs and toasters, so they like to distinguish their models from those of the parent company.

The CD65s now sold in the UK have been mildly 'tweaked' to enhance sound quality a little like the specialist-branded machines though not perhaps to quite the same degree. The technology includes the latest 16-bit  $4 \times$ oversampling technique, with dual D/A converters giving essentially linear phase, and digital filtering.

#### SOUND QUALITY

Originally rating above average and falling a little beneath the sonic shadow of the CD75, the '65 has now been upgraded to SE-type specifications. Still falling a little short of the current '75, the '65 has a similar overall rating as the midi-sized '273SE. The high quality Philips 16-bit sound has superior focus, dynamics and treble precision, giving a fine combination of liveliness and neutrality, with good stereo presentation.

#### CONCLUSIONS

The CD65 has been improved sufficiently so that this already best selling model still represents fair value for money, well deserving firm recommendation. It is, however, perhaps marginally the weakest in this respect compared with the '273 and '75 models.



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THE SPECIALISTS



#### MARANTZ CD75

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his is a typical mid-priced CD player — black, standard size, standard search and programming facilities, with remote control included at £450.

Manufactured in the Philips factory in Belgium, it shares much tried and tested common technology with most other Marantz and Philips models, not to mention a number of the players which are modified, branded and marketed by small specialist manufacturers. But Marantz see themselves as hi-fi specialists too - though owned by Philips they operate autonomously to a great extent. They brand and sell only audio equipment and are not in the business of flogging lightbulbs and toasters, so they like to distinguish their models from those of the parent company.

The CD75s that are sold in the UK market have therefore been mildly 'tweaked' at Marantz UK by changing certain output and power supply capacitor grades, in an attempt to enhance sound quality and give them an edge — a little like the specialist-branded machines though not to the same degree.

The technology includes the latest 16-bit 4X oversampling technique, with dual D/A converters giving essentially linear phase, and digital filtering. This latest chip set has more on board memory and therefore more powerful error correction than earlier models, and indeed those of many competitors.

#### LAB REPORT

Though there is still a trace of high frequency ripple under great magnification, the frequency response is essentially flat. Channel balance is indicative of normal commercial tolerances, with the twin converters providing zero phase error at high frequencies. Results for harmonic and intemodulation distortion were very good, albeit with some vibration between channels. White noise at 0dB showed slight clipping asymmetry, and resolution at -90dB does show room for improvement.

were quite rapid and output met the 2V spec. from a comfortably low source impedance.

#### Sound Quality

Despite its comparatively modest price, the CD75 turned in a very fine performance on the listening tests, comfortably beating its '65 sibling and coming close to several highly rated machines costing considerably more. Though falling a little short of the very best in terms of detail and dynamic resolution, the overall balance is particularly finely judged and the limitations very evenly spread. Lacking a little in bass 'speed' and 'weight', depth and space were also slightly curtailed, but the mid/treble balance is sweet, even and open.

#### **CONCLUSIONS**

The CD75 must surely be the best bargain around in CD players at the moment, and it is on this machine that Marantz UK's own special touches appear to have had the most telling effect. Delivering a sound quality that can rival machines twice the price even though it may lack some of their luxury touches, the CD75 is an obvious Best Buy.

#### **TEST RESULTS**

	20Hz	IkHz	ZÜkHz
Channel balance	0.14dB	0.15dB	0.13dB
Stereo separation	117dB	106dB	103dB
Channel phase difference	. 0°	0°	0°
Total harmonic distortion, 0dB	-92.7dB	-89dB	- 86dB
Total harmonic distortion, -10dB		-83dB	
Total harmonic distortion, -60dB		- 45dB	_
Total harmonic distortion, -80dB		- 18dB	_
Intermodulation, 19kHz/20kHz, 0dB			90dB
Intermodulation, 19kHz/20kHz, -10	dB		92dB
Frequency response, left channel	. 0	0	-0.09dB
Frequency response, right channel_	. 0	0	-0.08dB
Signal-to-noise, 20Hz-20kHz unweigh	nted		110dB
Signal-to-noise, CCIR/ARM, 1kHz r	ef		104dB
Output level, 0dB, left/right			2.03V
Output impedance			200 ohms
De-emphasis 0.38dB(1kHz), -	4.63dB(5kF	lz), (-9.1d	B(16kHz)
Track access time			3.5secs
Error correction capability	gap>	900µm, do	t>800µm
Mechanical noise			_very low
Spuriae up to 100kHz			-87.3dB
Resolution at -90dB	L -	-97.9db, R	- 108dB
Headphone socket		_variable,	150 ohms
Dimensions (w×d×h)		42 × 32	×8.5cms
Estimated typical purchase price			£450
First reviewed The Collection 1987			

## PHILIPS CD 160

PHILIPS ELECTRICAL LTD, CITY HOUSE, 420-430 LONDON ROAD, CROYDON, SURREY, CR9 3QR.

-TEL: 01-689 2166-



hilips have capitalised on their position as co-inventors of the CD medium to re-establish themselves in the hi-fi marketplace, by means of a succession of standalone players whose main distinguishing feature has been a high quality sound at a competitive price. Whereas most other consumer electronic brands update complete ranges on a more-or-less annual cycle basis, Philips introduce items piecemeal, often adjusting relative prices at the same time, so that the range gradually evolves from month to month. It therefore becomes a little confusing to keep track.

The CD 160 (and the identical remote control '260) are the middle models of the midi-size players, and belong to the same technology generation as the full size '460, with 16-bit dual DACs and 4X oversampling. There is no longer any price saving in going midi, but the '160 nevertheless sells at a 'budget' £200, and offers most of the usual basic features with an optional add-on remote if desired.

The control layout is relatively clean and sensibly laid out, the large and clearly labelled main operating controls (including skip) set apart from the rather scattered scanning, programming (20 tracks), repeat and display function controls. The display itself is quite small, and is rather cluttered by machine status LEDs. The presentation is smart with good finish, but the machine is a little flimsy in construction and plasticky in feel.

#### SOUND QUALITY

Rating firmly above average despite its budget

price, the CD160 represents a worthwhile sonic improvement on the earlier but nonetheless respected CD150B. The '160 sounds clearer, with better focus, higher definition and more convincing bass. The treble has a touch of brightness – a slight defocusing with a wispiness and zing in the high treble - but it is dynamic, cheerful and lively, with an attractive, open sound that was generally well received.

#### CONCLUSIONS

Though mildly overshadowed by the now similarly priced '460, and the slightly more expensive '360, the CD-160 is still a Best Buy model, particularly for those who place sound quality ahead of a slightly plasticky build quality in their order of priorities.



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#### PHILIPS CD360

Philips Electrical Ltd. City House, 420-430 London Road, Croydon, Surrey cr9 30r. -Tel: 01-689 2166-



hilips have capitalised on their position as co-inventors of the CD medium to re-establish themselves in the hi-fi marketplace, by means of a succession of stand-alone players whose main distinguishing feature has been a high quality sound at a competitive price. Whereas most other consumer electronic brands update complete ranges on a more-or-less annual cycle basis, Philips introduce items piecemeal, often adjusting relative prices at the same time, so that the range gradually evolves from month to month. It therefore becomes a little confusing to keep track. Writing in Spring 1987 the CD360 is the top model of three midi-size players; is one of the most recent introductions to the range, using the latest simplified board construction techniques; and is modestly priced at £250 for a full-feature remote-control player.

Sharing the same basic chassis as the CD160, the 360 adds two thoroughly desirable extra features: a limited function remote control (an outboard item available as an optional extra on other midi players), and the rather clever FTS (favourite track selection) facility. FTS allows the user to store permanently an order of play programme for any or all of the discs in his collection (up to a couple of hundred), the machine automatically identifying the disc and executing the stored programme when FTS is selected.

The control layout is relatively clean and sensibly laid out, the large and clearly labelled main operating controls (including skip) set apart from the rather scattered scanning, programming (20 tracks), repeat and display function controls. The display itself is quite small, and is rather cluttered by machine status LEDs. The presentation is smart with good finish, but contruction is a little flimsy and plasticky in feel. The rear panel had a digital output as well as conventional stereo audio.

#### LAB REPORT

Despite the budget price and construction, this machine has advanced technical features. It uses the latest twin 16-bit DACs with  $4 \times$  oversampling, and so has no interchannel phase difference at high frequencies. Indeed, overall the measurements were very impressive. Response is extremely flat, albeit with a trace of ripple at high frequencies. Channel balance measured very close, channel separation was outstanding, and harmonic distortion very good, albeit marred by a channel imbalance at low levels. Intermodulation distortion was exceptionally low, though the spectrogram does show a few clusters of ultrasonic spuriae.

Track access time was a reasonable 4 seconds, mechanical noise was very low, shock and vibration rejection were excellent, and error and tracking tests posed no problems. The 0dB white noise test did reveal some rounding at the top, and very slight rounding at the bottom of the waveform. Signal-to-noise figures were exceptionally good, and ultrasonic spuriae were quite well under control. However, low level resolution on our sample was a disappointing 14 bits.

#### SOUND QUALITY

Despite their apparent physical similarities, the 360 sounded significantly better than the still highly rated 160, turning in a 'good' rating overall which is quite remarkable for the price. This is probably due to the simplified construction of this more recent model. To a basically attractive, lively and open sound, the 360 adds better dynamics, a firmer clearer bass, a more sharply defined and located treble with less untidiness besides, plus general improvements in stereo imagery and ambience resolution, and less muddle.

#### CONCLUSIONS

The fine lab performance and exceptional listening test results, together with good presentation and the attractive FTS feature make a Best Buy rating mandatory for this modestly priced midi machine. This is a lot of plastic player for the money.

#### TEST RESULTS 2∩⊔.

	20112	1 K1 12	LUKIIL
Channel balance	0.05dB	0.05dB	0.05dB
Stereo separation	119dB	106dB	99dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	-93.2dB	-86.4dB	-86.8dB
Total harmonic distortion, -10dB	_	-83.4dB	-
Total harmonic distortion, -60dB	_	-47.6dB	
Total harmonic distortion, -80dB	_	-21.2dB	
Intermodulation, 19kHz/20kHz, 0dB	-	-94.3dB	
Intermodulation, 19kHz/20kHz, -10dB	_	-94.9dB	
Frequency response, left channel		_0dB, 0,	-0.03dB
Frequency response, right channel	-	_0dB, 0,	-0.03dB
Signal-to-noise, 20Hz-20kHz unweighte	ed	1	11/110dB
Signal-to-noise, CCIR/ARM, 1kHz ref		1	08/105dB
Output level, 0dB, left/right			2.15V
Output impedance			2000hms
De-emphasis1kHz, 0.38dB; 5	kHz, 4.6d	B; 16kHz	, -9.1dB
Track access time			4.0secs
Error correction capability	>900µm	1 gap, >80	00µm dot
Mechanical noise			_very low
Spuriae up to 100kHz			-87.1dB
Resolution at -90dB		94.9/-	-107.2dB
Headphone socket			no
Dimensions (w×d×h)		32×3	0.5×9cm
Estimated typical purchase price			£249

For graph references see issue No. 51

11.11. 201.11.

ROTEL HIFI, 25 HEATHFIELD, STACEY BUSHES, MILTON KEYNES MK12 6HR. Tel:(0908) 317707

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otel have pioneered the technique of combining low cost Far Eastern manufacture with UK design expertise to create components specifically and successfully tailored to UK tastes. The amplifiers have taken the lead here, but other electronics components are also produced along similar lines, including two CD players, though in fact these are based on the popular Philips chassis, manufactured in Hasselt, Belgium. The basic '820 sells for around £249, £100 less than the 'tweaked' *BX*.

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It is a full width unit finished in black, and is currently a simple manual machine with addon remote control option, and has a fairly standard package of operating features. However, fully integrated remote control is now included, with no price increase. External finish is good, and build quality sound enough, if a little plasticky compared with some rivals. The display is a simple, switchable 4-digit section for timing or track presentation, backed by five status LEDs. Ergonomically the main operating panel is logically ordered, but the subsidiary functions of display switching, repeat, step, and 20-track programming seem randomly placed. The rear panel has a digital co-ax output and provision for an add-on remote control in addition to the phono stereo audio pair.

#### SOUND QUALITY

Showing the expected family resemblance to other Philips-based machines, of the '460/'160 genre, the '820 scored near the top of the 'above

average' grouping, a decent result at the price but a full subjective grade behind the 'BX's achievement. The sound is direct and lively, well focused with a good scale of image, and seemed marginally sweeter, more precise and transparent in the treble than the standard brew, though such aspects were further improved in the 'BX.

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#### CONCLUSIONS

Though essentially a Philips clone at a somewhat higher price, the Rotel 820 does offer a very respectable sound quality for the price, and a reasonable build quality besides. It clearly deserves recommendation, particularly with the incorporation of remote control without an increase in price.



Frequency response range 15:50,000 Hz Outout voltage: 0.35 mV (Hz J, Scm sec). Channel separation 27 2011 Hz Hz Channel baiance: 15:05 (Ht Hz J) Channel baiance: 15:05 (Ht Hz J) Coll inductance: 50:05 (Ht Hz J) Load resistance: 20 dnns or more Load capacitance: 00:0200 fr Oynamic compliance: 30:10 ° cm/dyne. Static compliance: 30:10 ° cm/dyne. Struis shape: 0:2 x 0.7 mileliopical tip Wercal tracking angle: 23° Weight: 50.g The only complete transducer family CARTRIDGE • HEADPHONE • MICROPHONE • VITAL LINKS



#### **ROTEL RCD 820BX**

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



otel have pioneered the technique of combining low cost Far Eastern manufacture with UK design expertise to create components specifically and successfully tailored to UK tastes. The amplifiers have taken the lead here, but other electronics components are also produced along similar lines, including two CD players. Paralleling nomenclature used in the amplifiers, the model fully reviewed here is the 820BX variant which is modified in the UK for improved sound quality. It sells for around £350, a £100 premium on the standard '820.

The 820BX is a full-width unit finished in black and based on a Philips chassis (some derivation on the 460, one presumes). As tested this was a simple manual machine with optional add-on remote control, but this feature is now built in at no extra cost. External finish is good, and build quality sound enough, if a little plasticky compared with some rivals. The display is a simple, switchable 4-digit section for timing or track presentation, backed by five status LEDs. Ergonomically the main operating panel is logically ordered, but the subsidiary functions of display switching, repeat, step, and 20-track programming seem randomly placed. The rear panel has a digital co-ax output and provision for the add-on remote control in addition to the phono stereo audio pair.

#### LAB REPORT

The range of test measurements indicate a fine overall lab performance, compromised slightly by some mild channel imbalances, presumably reflecting limited component tolerancing. The

response is smooth and flat through most of the frequency band, showing gentle and probably sensible filtering towards the bandwidth extremes (11kohm loading). Close channel phase coherence confirms the twin 16-bit DACs, used with  $4 \times$  oversampling. Channel separation was very good, though with significant difference between L on R and R on L. Both harmonic and intermodulation distortions were very good, the spectrogram showing a basically clean ultrasonic region with a single 25kHz component.

Output level was accurate, and source impedance low enough for direct power amplifier working. Mechanical noise was low, track accessing a fairly rapid 3.5 seconds, and error/tracking tests were handled without problems. Feedback rejection was very good, though shock rejection rated only average. Electrical noise was very low indeed, and ultrasonic spuriae well suppressed, but low level linearity was a rather average 15-bits, and the white noise test (0dB) showed very slight rounding at the top.

#### SOUND OUALITY

Rating a solid good overall, the 802BX certainly provided a significant improvement over the standard 820, though at the same time it did not particularly stand out amongst similar modified-Philips machines. Dynamics and depth were both good, but there was also a slight 'clouding' effect which reduced transparency through the well focused but slightly narrowed soundstage. The bass was firm, strong and well above average, while the treble was a mite recessed, lacking a little 'sparkle'. Overall, the sound was aptly described as both entertaining and involving.

#### CONCLUSIONS

While the 820BX CD player does not quite attain the competitive position of the 820BXII amplifier, it is a respectable performer nonetheless. The lab performance was generally good, though not without a few L/R channel anomalies; the build quality and features were adequate, if ungenerous. But it has still done more than enough to merit recommendation on the basis of a fundamentally good standard of sound quality for the price, maintaining Rotel's reputation and philosophy in this new product area.

#### **TEST RESULTS** 20H7

	20Hz	1kHz	20kHz
Channel balance	0.01dB	0.02dB	0.43dB
Stereo separation	113dB	93dB	81.5dB
Channel phase difference	0°	0°	2°
Total harmonic distortion, 0dB	-93.4dB	-88.8dB	-84.8dB
Total harmonic distortion, -10dB		-83dB	
Total harmonic distortion, -60dB	_	-46dB	
Total harmonic distortion, -80dB		-21dB	_
Intermodulation, 19kHz/20kHz, 0dB	-	-94dB	
Intermodulation, 19kHz/20kHz, -10dB		- 90dB	_
Frequency response, left channel	-0	54dB, 0,	-0.86dB
Frequency response, right channel	-0	53dB, 0,	-1.27dB
Signal-to-noise, 20Hz-20kHz unweighted	1	1(	07/107dB
Signal-to-noise, CCIR/ARM, 1kHz ref		1(	03/103dB
Output level, 0dB, left/right			2.1V
Output impedance			2000hms
De-emphasis1 kHz, -0.4dB; 5kHz	, -4.7dE	5; 16kHz,	-9.37dB
Track access time			3.5secs
Error correction capability	_>900µm	n gap, >80	00µm dot
Mechanical noise			low
Spuriae up to 100kHz			100dB
Resolution at -90dB		-104.7/-	-100.1dB
Headphone socket			no
Dimensions (w×d×h)		42 × 3	1×8.5cm
Environment and an and an analysis of the			0250





ony see this new 1987 midi-sized model as the successor to the highly successful *CDP 35*. (This *Choice* Recommended model was 1986's biggest selling machine.)

The M20 is the cheapest in a range of four midi machines. All share the high standards of quality and presentation that play no small part in Sony's success, but the manually operated '20 has the most basic facilities at the same £199 price point as last year. An extra £30 adds the full-feature remote control of the M30. We had planned to review the M50, but our sample withdrew its labour: this £270 model has a more comprehensive display plus extra technical features. The £350 C5M is a 5-disc autochanger, with the most convenient and ingenious loading mechanism yet.

The M20 is quite well equipped for a baseline model, yet it is also neatly laid out for simple operation. The features include a 20-track programmable memory, skip and audible high speed scan, repeat and shuffle (random) play, plus displayed track, index and disc timing.

#### LAB REPORT

The basic circuitry is developed from last year's more upmarket machines, using  $2 \times$  oversampling and digital filtering with a single time-shared 16-bit DAC. The technical performance is generally well balanced, while showing the mild compromises appropriate to a player in the 'budget' category. Frequency response was flat

below 1kHz, showing slight ripple and uneveness at higher frequencies but within close limits nonetheless. Channel balance was close, deteriorating slightly at high frequencies, while the interchannel phase difference confirms the shared DAC.

Harmonic distortion was generally good, but weak at low levels. Intermodulation gave good figures but the spectrogram does reveal a number of lurking ultrasonic components. The output impedance was rather high, so this player may not be suitable for direct or *via* potentiometer connection to a power amplifer. Shock and vibration resistance was good, mechanical noise quite low, and track access time a reasonable 5 seconds. Error correction tests posed no problems, resolution was a decent 15.4-bits at low levels, and signal-to-noise ratios were quite good, but the suppression of ultrasonic spuriae could have been better.

#### SOUND QUALITY

The M20 scored a straight average on the listening tests, which is a good result for a budget player. The sound was considered a little lightweight but dry and quick in the bass. Mid and treble both sounded reasonably clean with quite good focus and dynamics. The soundstage could have been wider with better depth resolution, but there were no upsetting colorations and imbalances, merely the expected limitations of an essentially competent budget deck.

**CONCLUSIONS** 

The CDP-M20 makes a worthy heir to its successful predecessor, fully keeping pace with the improving standards of the marketplace as a whole. It combines decent subjective and laboratory performance in a competitive £200 package, with the bonus of fine Japanese build and presentation quality, and so clearly merits firm recommendation.

#### **TEST RESULTS**

1111 20111

	20112	IKHZ	ZUKHZ
Channel balance	0.02dB	0.02dB	0.17dB
Stereo separation	92dB	91dB	71dB
Channel phase difference	0°	2 °	40°
Total harmonic distortion, OdB	-82dB	-83dB	-8 <u>6</u> dB
Total harmonic distortion, -10dB		-82dB	
Total harmonic distortion, -60dB	-	– 40dB	
Total harmonic distortion, -80dB	_	-14.5dB	_
Intermodulation, 19kHz/20kHz, 0dB	-	- 86dB	_
Intermodulation, 19kHz/20kHz, -10dB	-	-88.5dB	_
Frequency response, left channel	0	.04JB, 0,	-0.64dB
Frequency response, right channel	0	.05dB, 0,	-0.49dB
Signal-to-noise, 20Hz-20kHz unweighter	d b		_89/93dB
Signal-to-noise, CCIR/ARM, 1kHz ref			_84/88dB
Output level, 0dB, left/right			2.12V
Output impedance		2	2.4kohms
De-emphasis1kHz, 0.4dB;	5kHz, 4.	6dB; 16kF	łz, 9.3dB
Track access time			5.0secs
Error correction capability	_>900µm	n gap, >80	00µm dot
Mechanical noise			quite low
Spuriae up to 100kHz			76dB
Resolution at -90dB			-86.7dB
Headphone socket		es (fixed)	100ohms
Dimensions (w×d×h)		35.4×	27×8cm
Estimated typical purchase price			£199

#### SONY CDP-310

Sony UK LTD, Sony House, South Street, Staines, Middlesex TW184PF.





o-inventors of the CD format, Sony are also amongst the market leaders, and have introduced for 1987 some ten mains machines plus several portables to maintain their market position. Disregarding the prestige 'ES models, alongside no less than five midis, there are two full width models, both with full remote control. The simpler £250 CDP 310 costs £50 less than the more complex and technically more advanced '710 reviewed in the following pages.

The finish and build quality are both exemplary, even if Sony are able to surpass it with their ES series, which are clearly more solidly built overall. Still the '310 more than passes muster,

even if it does represent a more cost effective package. All the usual features are available, and intelligently laid out. Lacking the complexity of the '710's front panel direct entry keypad and displayed music calendar, the '310 at least offers the convenience of the former on the comprehensive handset.

#### SOUND QUALITY

Scoring a healthy enough average rating, the '310 showed a small but worthwhile improvement over the 'M20, with enhanced dynamic qualities and a more solid extended bass, though it fell substantially behind the '710 with its more advanced digital circuitry. Focus was quite good, but with some loss in stereo depth and transparency. The treble was quite tidy, but with a mild 'lispiness' or 'edge'. Overall, this is decent commercial sound quality, but nothing special.

#### CONCLUSIONS

Fine build quality, facilities and presentation, plus a very acceptable standard of sound quality for £250 make recommendation of the CDP-310 mandatory. But those who want a full size machine should consider carefully the slightly more expensive '710. And if size is immaterial, the M50 ought to be investigated — though we were unable to test this model, it appears to incorporate '710 technology in a £270 midi package, which could be a winning combination.





SONY CDP 710



o-inventors of the CD format, Sony are also amongst the market leaders, and have introduced for 1987 some ten mains machines plus a couple of portables to maintain their market position. This is the top model in Sony's extensive seven-model standard lineup, disregarding the more exotic ES models described elsewhere: alongside no less than five midis, there are two full-width models, both with full remote control, this £300 CDP 710 costing £50 more than its simpler '310 brother.

For the extra, one gets additional features like the front panel 20-digit direct entry keypad, plus internal engineering changes to the digital conversion circuitry. The finish and build quality are both exemplary, even if Sony are able to surpass it with their ES series which are clearly more solidly built overall. Still the 710 more than passes muster, even if it does represent a more cost effective package. All the usual features are available in full measure, and intelligently laid out, though the degree of complexity might not be to every taste.

#### LAB REPORT

This particular model has 'high tech' digital circuitry, with dual 16-bit DACs (from Philips sources) used with  $4 \times$  oversampling, and Sony's own advanced digital filtering, giving a ruler-

flat frequency response with no interchannel phase discrepancy. Stereo separation was very good, deteriorating marginally at high frequencies, while both harmonic and intermodulation distortion measurements gave excellent results.

The output level was near enough correct, but the output impedance was on the high side, which might create the odd problem for dedicated enthusiasts attempting to drive some power amplifiers directly or *via* a passive volume control. Mechanical noise was low, track access speed very fast, shock and vibration rejection excellent, and error correction and tracking tests handled without difficulty. Electrical noise levels were excellent, ultrasonic spuriae were well suppressed, and low level linearity was a very good 15.7 bits.

#### SOUND QUALITY

Despite its comparatively modest price, this player scored a very impressive and strong overall 'good' rating. Showing excellent vocal focus and stereo staging, with good depth and width, the soundstage was slightly 'forward', and tonally mildly 'lean'. Bass was qualitatively good, if a trifle lightweight, and the treble showed fine explicit detail. Though lacking a little 'slam', the 710 provided a fine combination of good dynamics and subtle detail.

#### CONCLUSIONS

This player proved to be one of the more outstanding new entries for the 1987 edition, Sony's additional 'high tech' fix on this premium model appearing to give a significant boost to sound quality. The build quality may not quite achieve *ES* standards, but it is more than sufficient nevertheless, while the range of facilities and lab performance are both generous at the price, irrespective of the sound quality. The *CDP 710* is therefore an obvious Best Buy.

#### **TEST RESULTS**

	ZUHz	IKHZ	ZUKHZ
Channel balance	0.22dB	0.22dB	0.3dB
Stereo separation	128dB	110dB	84dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	-87dB	-83dB	-87dB
Total harmonic distortion, -10dB		-81dB	_
Total harmonic distortion, -60dB	_	-41dB	-
Total harmonic distortion, -80dB		-23.5dB	
Intermodulation, 19kHz/20kHz, 0dB	_	-91dB	
Intermodulation, 19kHz/20kHz, -10dB	_	-85dB	
Frequency response, left channel	0	.01dB, 0,	-0.03dB
Frequency response, right channel	0	.01dB, 0,	-0.11dB
Signal-to-noise, 20Hz-20kHz unweighted		1(	09/110dB
Signal-to-noise, CCIR/ARM, 1kHz ref _			104dB
Output level, 0dB, left/right			2.21V
Output impedance			l.6kohms
De-emphasis1kHz, 0.33dB; 5	kHz, 4.3	5dB; 16kF	Iz, 9.1dB
Track access time			2.0secs
Error correction capability	.>900µn	n gap, >80	0µm dot
Mechanical noise			low
Spuriae up to 100kHz			99dB
Resolution at -90dB			-89.3dB
Headphone socketyes	s (variabl	e output)	100ohms
Dimensions (w×d×h)		43×3	3×9.5cm
Estimated tunical numbers price			£300

SONY CDP-222ESD Sony uk Ltd, Sony House, South Street, Staines, Middlesex twi8 4PF. -TEL: Staines 61688-



he CDP-222ES is the least expensive model in the costly but beautifully presented Sony ES range of three CD players. Features and facilities are too comprehensive to detail without the review taking on the appearance of a shopping list, but this is very much a luxury machine with everything one would expect plus a few more besides - inevitably resulting in a somewhat complex layout, no doubt to the delight of many, but the possible intimidation of some.

Full comprehensive remote control is provided, but this does not have the remote volume of the more expensive models. Other economies have been found in avoiding the elaborate power

supply provisions and anti-vibration G-chassis, though the '222 still makes a serious attempt to combat shock and vibration. A 20-digit keypad gives direct track access and programming on both handset and machine, the latter's music calendar display providing attractive visual confirmation. Under the skin, the '222 has Sony's 4× oversampling system, based on Philips twin DACs but with Sony's digital filtering technology.

#### SOUND QUALITY

Despite the luxurious build quality, the '222 was a mild disappointment in the listening tests, scoring a healthy enough 'above average' rating

 better than the '310 but falling a little short of the non-ES '710 model. The stereo image had good scale and focus, with fair depth and good low level detail. The sound was inviting and interesting, quite dynamic and authoritative with good bass; overall this is a tidy, clean all rounder.

#### **CONCLUSIONS**

The combination of exceptional build and presentation plus respectably good sound quality at a realistic price is sufficient to merit recommendation, but our preference for alternative Sony models either side in the price hierarchy keeps our enthusiasm for the '222 just a shade lukewarm.





**TECHNICS SL-P 111** 



he hi-fi brand of the mighty Matsushita organisation, Technics have been market leaders for many years, showing a particularly effective knack for choosing the right compromises when engineering components for the budget sector of the marketplace. This brand

budget sector of the marketplace. This brand new full-width £179 Technics player is a little different from most others of its type in the way in which the controls function, though in other respects it is a conventional enough budget player. Lightweight in construction, it is nonetheless well finished and presented, and is technically based on well established methods seen previously on more upmarket players. In most respects the *SL-PJ22* midi size player is an identical smaller version.

Stark and simple enough to warm the hearts of many an audiophile, the '111's total complement of six large and three small pushbuttons makes a dramatic contrast with the Technics' upmarket players like the '520, '720 and '1200. Surely Technics have not abandoned the feature race? Of course not! Many of these buttons serve more than one function, providing different facilities according to how they are pressed.

The result is a simple and easily understood configuration for the major tasks, plus the capability to do more for those prepared to crack the detailed code, set out in the even more detailed manual. Though distinctly economysized, the display panel has separate track and timing readouts, plus four machine status indicators. Most of the usual functions such as skip, audible scan, program play and repeat are available, plus something faintly bizarre requiring four separate control commands called 'preset edit play'.

#### LAB REPORT

The practice of applying older technology in budget players can be seen in the use of a single 16-bit linear time-shared DAC, with its attendant high frequency interchannel phase error, but the measurement set overall was pretty well balanced nonetheless, with no particular weakness and some good points. The frequency response was pretty flat, with just some unevenness and channel imbalance at high frequencies. Distortion measurements were good, particularly for intermodulation, while the latter's spectrogram showed just one spurious ultrasonic reflection.

The output level was a little higher than spec. — those who attempt to carry out A/B comparison should be warned that this player may be flattered by additional loudness if levels are not adjusted carefully. Track access was very fast, mechanical noise low, and shock and vibration immunity pretty good. Error correction and tracking tests were handled without problems, electrical noise and ultrasonic spuriae were both fairly low, while the practical low level linearity of our sample was a very good 15.7-bits.

#### SOUND QUALITY

While not setting any new benchmarks for performance against price, the *SL-P111* acquitted itself very respectably in the listening tests, rating above average overall, a very acceptable result for the price. Typically Technics, the tidy sound was coherent and well focused, with an even tonal balance but slightly 'hardened' and a touch forward in the midband. The bass was good, and depth was quite well portrayed, but there was a slight loss of transparency and softening of dynamics.

#### CONCLUSIONS

An above average sound quality at a well below average price, coupled with decent lab performance and good presentation and build quality is clearly the recipe for a Best Buy. The ergonomics of this player differ to a degree that may be appealing or infuriating, and the discerning may find the sound of some competitors more attractive, but the Technics scores above all on its good balance — its relative success in being most things to most men.

#### **TEST RESULTS**

	20Hz	1 kHz	20kHz
Channel balance	0.08dB	0.09dB	0.27dB
Stereo separation	93dB	93dB	83dB
Channel phase difference	0°	2°	45°
Total harmonic distortion, 0dB	-80dB	- 80dB	-83dB
Total harmonic distortion, -10dB	_	-81dB	
Total harmonic distortion, -60dB	_	- 43dB	_
Total harmonic distortion, -80dB	_	-17dB	
Intermodulation, 19kHz/20kHz, 0dB	-	-88dB	_
Intermodulation, 19kHz/20kHz, -10dB	_	- 100dB	_
Frequency response, left channel		0.03dB, 0	, 0.03dB
Frequency response, right channel	0	.01dB, 0, -	-0.16dB
Signal-to-noise, 20Hz-20kHz unweighted	l		96/99dB
Signal-to-noise, CCIR/ARM, 1kHz ref	-		91/94dB
Output level, 0dB, left/right			2.5V
Output impedance			550ohms
De-emphasis1kHz, 0.3dB	; 5kHz, 4	4dB; 16kH	z, 8.9dB
Track access time			_2.5secs
Error correction capability	_>900µn	n gap., >80	0µm dot
Mechanical noise			very low
Spuriae up to 100kH:			92dB
Resolution at -90dB			-90.6dB
Headphone socket			no
Dimensions (w×d×h)		43×23.5	×7.1cm
Estimated typical purchase price			£179



#### TECHNICS SL-P520

PANASONIC (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS SLI 61B. -TEL: (0753) 34522-



heaper of a pair of similar midpriced machines, the full width £350 '520 has luxury features and facilities to satisfy the most eager button pusher, plus full function infra-red remote control (including coarse volume). It also incorporates a number of Technics' proprietary advanced engineering features such as search/dial cueing, high access speed optics, class AA analogue preamplification, and anti-vibration construction (comprising insulating feet and internal floating deck insulation). The elaborate display covers machine status, separate time and track/index, plus a disc menu to assist programming.

External 'camouflage' finish and build quality are to very high standards, and the exceptionally fast, quiet transport gives an expensive operating 'feel', but the complexity of controls and display suggest this is not a machine for sufferers of 'technofear'. Furthermore, the ergonomics are perhaps not totally logical, the dominant dial on the front panel merely controlling the fast cueing, a function of limited importance.

The main operating functions are on large buttons situated below the display, interspersed with 1-10 programming keys plus memory, clear and index buttons. Three other separate button clusters provide repeat play functions, volume control on a headphone output, and switch the cueing to high or low scan ratios, and auto space between tracks, and switch the time display mode.

#### LAB REPORT

Using 16-bit chips with 2× oversampling and

digital filtering, it is perhaps a little surprising at this price level to find a single, time-shared DAC, with its inevitable interchannel phase shift at high frequencies. The frequency response was very flat indeed, showing just the suggestion of ripple at high frequencies. Stereo separation was very good, and harmonic distortion was fine at high levels, deteriorating somewhat at low levels. Intermodulation distortion measured pretty low, the ultrasonic spectrogram showing just one area of perturbation at 68kHz.

The quality of the transport mechanism is shown in the low mechanical noise, high track access speed, and very good resistance to external shock and vibration. Error correction tests were passed without fuss, electrical noise was low, ultrasonic spuriae were well suppressed, while low level linearity was a pretty good 15.5 bits. Overall, the 520 is the usual well balanced high quality lab performer we have come to expect from this manufacturer.

#### Sound Quality

Comfortably rating above average, the 520 was difficult to fault soundwise, but at the same time failed to cause any great excitement or raise particular enthusiasm amongst the listeners. The balance was smooth, even and uncoloured, with a well-ordered, precise soundstage conveying subtle and delicate fine detail. But dynamics and transients seemed a touch muted and softened, giving a slightly bland effect throughout. Nice, polite and essentially very

listenable, a slight lack of 'sparkle' held the score back a little.

#### CONCLUSIONS

With a particularly fine transport mechanism and generally fine standards of build, engineering and lab performance, the Technics '520 also offers an extravagant range of features and facilities at a quite competitive price. The sounds produced were also of decent quality, so recommendation is appropriate, while noting that this is a rather complicated machine to use.

#### Test Results

	20Hz	1 kHz	20kHz
Channel balance	0.04dB	0.03dB	0.07dB
Stereo separation	103dB	105dB	82dB
Channel phase difference	0°	2°	40°
Total harmonic distortion, 0dB	- 82dB	-84dB	-87dB
Total harmonic distortion, -10dB		-81dB	
Total harmonic distortion, -60dB	-	- 44dB	_
Total harmonic distortion, -80dB	-	-18dB	-
Intermodulation, 19kHz/20kHz, 0dB		-78dB	
Intermodulation, 19kHz/20kHz, -10dB	_	- 82dB	
Frequency response, left channel	0.	02dB, 0, -	-0.15dB
Frequency response, right channel _	0.	01dB, 0, -	-0.19dB
Signal-to-noise, 20Hz-20kHz unweighted	d b	9	8/103dB
Signal-to-noise, CCIR/ARM, 1kHz ref	3		94/98dB
Output level, 0dB, left/right			2.05V
Output impedance		(	6000hms
De-emphasis1kHz, 0.31dB;	5kHz, 4.5	idB; 16kH	z, 8.9dB
Track access time			_2.0secs
Error correction capability	_>900µm	gap, >80	0µm dot
Mechanical noise			low
Spuriae up to 100kHz			-101dB
Resolution at -90dB			-86.9dB
Headphone sockety	es (variab	le output)	830hms
Dimensions (w×d×h)		43×27	$\times 8.8$ cm
Estimated typical purchase price			£350

## **TECHNICS SLP 720**

PANASONIC UKLTD, 300-318 BATH ROAD, SLOUGH, BERKS SLI 6JB. -TEL: (0753) 34522-



ore expensive of a pair of similar mid-priced machines, the full width £400 720 has luxury features and facilities to satisfy the most eager button pusher, including full function infra-red remote control (including coarse volume). It also has a number of Technics' proprietary advanced engineering features such as search/dial cueing, high access speed optics, and class AA analogue pre-amplification. The elaborate display covers machine status, separate time and track/index, plus a disc menu to assist programming.

ALCOMMENTS OF

There are two key features over and above those provided on the '520: separate analogue and digital power supplies, with special quality circuit components; and even greater attention paid to reducing vibration, via an additional, heavy and inert TNRC/metal base. These factors add nearly a kilo to the net weight.

External 'camouflage' finish and build quality are to very high standards, and the exceptionally fast, quiet transport gives an expensive operating 'feel', but the complexity of controls and display suggest this is not a machine for the easily intimidated. Furthermore, the ergonomics are perhaps not totally logical, the dominant dial on the front panel merely controlling the dial cueing, a function of limited importance.

#### Sound Quality

Though nominally similar in most respects to the '520, the '720 established a clear preference on the listening tests, comfortably rating 'good' overall and clearly justifying its price - indeed the '720 sounded effectively identical to the substantially more expensive and elaborate semipro '1200. Distinguished by supreme competence, the sound was remarkably neutral and well balanced, with good definition and control throughout the frequency range, but marginally losing fine focus in the treble. However, ultimately it was considered a trifle bland and uninvolving, with a mild loss of speed and dynamics.

#### **CONCLUSIONS**

The '720 is clearly the best value amongst the top Technics models, and may be confidently recommended for its fine neutrality and self-effacement, plus excellent finish, facilities and build quality, for those who don't mind a little



YAMAHA CD-X5

YAMAHA ELECTRONICS UKLTD, YAMAHA HOUSE, 200 RICKMANSWORTH ROAD, WATFORD, -HERTS WD1 715. TEL: (0923) 33166-



his large and diverse Japanese company has a broad range of activities with a number of totally autonomous divisions, mostly reflecting a general interest in different aspects of music (disregarding the motorcycles of course). The hi-fi division has shown increasing strength on the UK market in recent years, with amplifiers and CD players making prominent contributions.

The CD-X5 is their latest 1987 midi-sized budget player. It is a manual only machine costing around £200 with the usual basic quota of facilities, nicely finished and with good build quality, if rather light in weight and lacking any real anti-vibration measures.

The front panel is simple and straightforwardly laid out, with large buttons for main transport functions like play, skip and scan, and a smaller threesome for programming, repeat and display mode. The display itself is fairly elaborate, with two separate digital readouts for disc information, plus half a dozen status indicators. The rear panel carries just a stereo pair of phono sockets.

#### LAB REPORT

This Yamaha model uses a single time-shared 16-bit DAC, with  $2 \times$  oversampling and digital filtering, so there is some high frequency interchannel phase shift. The response was pretty flat through bass and midband, but rose fractionally to a broad treble plateau, +0.4dB across the final octave. Channel balance was very close, and separation about average, deteriorating somewhat at high frequencies. Harmonic distortion was good, and intermodulation acceptable if below average, the spectrogram revealing significant ultrasonic spuriae.

The output impedance is sufficiently high to suggest exercising extra compatibility care if proposing to drive a power amplifier directly or via a passive volume control. Mechanical noise was quite low, track access a reasonable 4 seconds, but shock and vibration resistance was poor. Error correction tests were passed without fuss, electrical noise levels were quite low, but ultrasonics showed limited filtering. Low level linearity was a respectable 15.3-bits.

#### Sound Quality

Rating a strong 'average' overall, this is a good result for a low cost player. The CD-X5 is cheerful and lively, with good dynamics, but the sound was also a touch 'coarse' with hints of 'hardness' on loud sections. The upper treble was oddly projected and defocused from an otherwise good stereo image with fair depth and clarity. The bass showed good drive, but an impression of treble 'grain' and mild sibilant exaggeration remains.

#### **CONCLUSIONS**

Good build quality, respectable lab performance and decent sound quality at a realistic price ensure that Yamaha's leading budget model continues to merit Recommendation in its latest guise. It is not in our view the best sounding in its class, but offers a fine overall balance taking the construction and finish into account.

#### Test Results

	ZUHz	IkHz	ZUKHz
Channel balance	0.03dB	0.03dB	0.04dB
Stereo separation	86dB	85dB	66dB
Channel phase difference	0°	2°	40°
Total harmonic distortion, 0dB	-83dB	-84dB	-84dB
Total harmonic distortion, -10dB		-82dB	
Total harmonic distortion, -60dB	_	-42.5dB	
Total harmonic distortion, -80dB	-	-21dB	
Intermodulation, 19kHz/20kHz, 0dB	_	-77dB	
Intermodulation, 19kHz/20kHz, -10dB		-83dB	
Frequency response, left channel	(	0.01dB, 0,	-1.3dB
Frequency response, right channel	0.	01dB, 0, •	-1.34dB
Signal-to-noise, 20Hz-20kHz unweighte	d b	9	9/103dB
Signal-to-noise, CCIR/ARM, 1kHz ref			94/98dB
Output level, 0dB, left/rigl:t			2 V
Output impedance		2	.2kohms
De-emphasis1kHz, 0.26dB; 5	6kHz, 3.81	ldB; 16kH	Iz, 9.1dB
Track access time			_4.0secs
Error correction capability	_>900µm	agap, >80	0µm dot
Mechanical noise	1		uite low
Spuriae up to 100kHz			74dB
Resolution at -90dB			-85.4dB
Headphone socket	_yes (fixed	d output)	100ohms
Dimensions (w×d×h)		_34×7.7:	× 28.5cm
Estimated typical purchase price			£200

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) 264975. A&R, Denon, Dual, Linn, Mission, NAD, Quad, Roksan, Rotel, Yamaha, etc. (closed Weds) BADA MEMBER

PAUL GREEN HI-FI LTD, Kensington Showrooms, London Rd, Bath. (0225) 316197. A&R, Creek, Dual, Heybrook, Linn, Musical Fidelity, Rotel, Systemdek, Whatfedale. Dem facilities available, ring for appointment, car park. Open Tues-Sat, 9-5.30. Home trial facilities, free installation, instant credit  $\underline{up}$  to £1,000. Credit cards: Access, Visa. BADA MEMBER.

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TRURO HI-FI & E.T.S. Ltd, 25 King St, Truro. (0872) 79809. A& R, Denon, Dual, Heybrook, Linn, Mission Cyrus, Nad, Quad, Rotel, Thorens. Dem facilities: Single speaker studio. Open Mon-Sat 8.45-5.30. Home trial facilities, credit up to £1.000. Credit cards: Access, ETS Visa. Service dept.

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# **CASSETTE DECKS**

hough the Compact Cassette is very much hi-fi's 'bastard' medium, at least on ethical grounds, there is no disputing its success, its convenience, or the high standards of sound quality that can be achieved nowdays - at its best, fully comparable with CD or LP disc. The unique feature of the medium is, of course, the ability to record. But it should also be stressed that musicassettes are a major source of pre-recorded music, now outselling LPs and growing (in numbers terms) faster than CDs! 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.

The most obvious recent trend in domestic mains machines has been towards the double 'dubbing' deck, fitted with two transport mechanisms. Choice has tended to stear clear of these, less for moral reasons, discussed shortly, than because there is no way such a machine can out-perform a single transport machine at a similar price. However, the market share of dubbers continues to increase, particularly in budget and system/stack sector, so we have included a number of new examples this time around. By and large, they have done little to change our opinions significantly. However, those who do want this extra facility can now decide for themselves whether the price penalty is worthwhile.

#### MORALITY & HYPOCRISY

Happy enough to sell ever increasing quantities of pre-recorded tapes for all applications, particularly back-catalogue re-issue compilation material, 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 paranoia surrounding DAT in particular, with threats to damage all recorded music with a Copycode spoiler system, sits inconsistently alongside imminent Government intentions to legislate a 10% copyright surcharge on blank cassettes.

#### REPLAY

Nowdays the best musicassettes can give very respectable quality, so pre-recorded material certainly deserves to be taken seriously, and the replay-only performance of a cassette deck must be considered important too. Theoretically, prerecorded cassettes could be as good as 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 electronically. However, in practice quality and quantity often conflict, and the profits are created by the latter. Nevertheless the end result can be 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 requires a good quality tape transport mechanism and replay head, plus 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 attention to this.

#### **RECORD/REPLAY**

In some ways record/replay is easier than replay only, insofar as head alignment, Dolby tracking and equalisation errors can cancel out and compensate for each other. However, any inherent transport problems are likely to be exaggerated, and there is now a still greater 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 — a useful facility for those prepared to take the trouble.

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' meter level for getting most signal without compression onto a specific type of tape.

It is worth carrying out a few practice runs to explore the limits of the deck with a particular tape. Try increasing the record level by a specific amount at specific counter intervals during recording, then back off the volume setting at the same time intervals during replay so that the overall sound level remains reasonably constant. You should then be able to hear the sound balance and/or distortion start to change as either machine or tape reaches overload, and so deduce the right peak meter levels to use for the best balance between background noise and recording quality. It may also be worth trying a similar subjective run through with and without noise reduction circuitry, as some listeners prefer an unprocessed if noisier sound, and noise reduction circuits are not always properly adjusted for different tape sensitivities.

#### TAPE TAPES

A full comparative analysis of different brands and types of tape will be found in the *Cassette Tapes* section of issue 52. Though there are three formal groups of tapes, Types I, II and IV, there are variations 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. (But note that the tape manufacturers have an annoying habit of re-mixing formulations regularly without chang-

Reviews reprinted from issue No 52 by Alvin Gold

ing the brand identity.)

The very cheap ferric tapes are not hi-fi quality, so it is better to go for premium Type I ferric from a reputable brand for general purpose 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 whiskers on some decks — but may not work too convincingly on others. Perversely, the very best decks can produce stunning results on the better quality Type I ferrics.

#### FEATURES

No other component fulfills a button pusher's dream like a cassette deck. The bare essentials boil down to tape 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 enchance the enjoyment or baffle the user, depending upon temperament. Microphone inputs are fast disappearing, with better quality microphones commonly containing battery pre-amps to provide a line-level signal for normal deck or amplifier connection, but headphone sockets remain. Extra noise reduction may be Dolby C and dbx, with headroom extension from Dolby HX Pro.

Electronic logic control may supervise an almost silent transport system, giving the potential for microprocessor-controlled track search and programming systems; for auto-reverse to extend play or record times; and for automatic tape tuning in the more expensive machinery. Bias 'tweaking' enhances tape matching, while replay EQ may be trimmed for optimum replay response on some machines.

The manufacturer can choose to spend money on a better quality single transport, with a closed-loop double-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 of your own priorites and requirements, and having studied our reviews, it's not a bad idea to audition one or two likely contenders. A comparison with something really good is almost essential to establish a quality yardstick when trying to assess how much you will need to spend to achieve the desired level of performance. The enthusiast may not take the purchase of a cassette deck as seriously as he would the selection, of turntable, arm and cartridge, but audible differences between cassette machines are no less obvious.



### AKAIGX-6

AKAI (UK) LTD, 12 HASLEMERE HEATHROW ESTATE, SILVER JUBILEE WAY, HOUNSLOW, MIDDLESEX.



he Akai GX-6 is a very cleanly styled and quite ambitiously designed deck, costing £329. The fundamentals include Dolby B and C noise reduction (with independent MPX filtering) and three heads, the record and playback heads being mounted in the same housing, and built according to Akai's proprietary GX glass crystal ferrite design. With off-tape monitoring available whilst recording, tape/source mode switching is handled automatically, but with a manual override facility on tap for instant comparisons. (Incidentally, all such comparisons should be made at the partnering amplifier to get a realistic idea of all the qualitative losses imposed by the recorder.)

RECOMMENDED

The usual three tape types are accepted. Not only does the deck automatically set record bias and equalisation to suit - there's a fine bias adjust knob as well - the record level meters then proceed to show what they consider a suitable working maximum level. The meters have an operating window of no less than 52dB. with red LEDs above 0VU, peak hold - the biz in fact. Sharing the same display area, an electronic tape counter shows number or time, and is (almost) intelligent enough to work out for itself the length of the tape you've inserted. (Insert a C120, however, and it repeatedly flashes a warning sign thus: C45-C60-C90-C45 and so on, finally reverting to an incorrect reading based on the C90 algorithm.)

The transport section is very quiet in operation and fully logic controlled, with music search, automatically timed mutes, intro scan and 'record cancel', which reinstates the position just before the last recording began. Finally the eject feature is tied into the machine logic. It closes automatically when play is invoked, and opens when the stop is touched twice. Neat. Double neat.

The display area is particularly attractive, and Akai have clearly gone to some trouble to give the GX-6 a clean 'user interface'. It really is very well designed, made — and, incidentally, finished.

#### LAB REPORT

As it happens, the only tape type used on test

that was not as recommended was the Type I tape, and this was the only one that gave a dead accurate response shape with the bias knob centred. Well, one of the beauties of a bias knob is that it transfers the manufacturer's responsibility for getting things right to you — but at least then you do get results. In this case a bit of extra bias will pull the Type II and IV responses back a bit. The other frequency plots suggest that Dolby mistracking should not be a problem, and that the replay response is broadly satisfactory, albeit with a degree of premature rolloff due to a 50° azimuth error.

The IM distortion level is low, and as 0VU corresponds to IEC 0dB, the record levels can be allowed to peak a little higher than normal. The transport is a cracker (another of those technical terms, I'm afraid). Absolute (numerical) wow & flutter is very low. The noise modulation plot show a stable, fine centre frequency, with the first sidebands at +/-15Hz, -27dB, then +/-52Hz, -36dB, the overall noise level being low. The fluttergram shows that there are some wow components, but at decently low levels, and that the upper part of this frequency spectrum is very well controlled with low noise.

#### SOUND QUALITY

The Akai produced a surprising amount of LF rubbish, *ie* music-unrelated spurii — basically just rumbling noises, which stayed regardless of bias setting, tape type, record level or whether Eastenders was on at the time. There was no really obvious reason why this should have been the case, but it was noticeable that head contour effects reached a long way up into the midband, and peaked around 100Hz. These effects, arising from geometric considerations, have the practical appearance of filter ripples, and what was audible sounded just like filter ringing: a resonant effect, concentrated around one frequency area, but essentially devoid of pitch.

When music of any volume was being recorded, the bass noises were inaudible, but the problem continued as a bloated quality in the region, with a lack of precision and transient attack. This was a pity since the Akai sounded positively wonderful in all other aspects. The midband and top were not unduly upset by the slightly odd LF behaviour, and in fact lent music a sense of luminosity and transparency, of clarity and separation that was well ahead of the normal standard for this price level.

Best results were had with metal Type IV tapes. Dolby B noise reduction offered better midband transparency but a more metallic sounding top than Dolby C, but the difference was not huge. The Dolby-less sound quality was simply too hiss-bound for proper appraisal with most types of music, though where possible it won by sounding much 'faster' with more consistent stereo.

The lower bias tapes had more 'body' than metal, but an imprecise top end by comparison — Type I ferrics especially. Again though the difference wasn't huge, and the deck did well. Pre-recorded cassettes reproduced almost as well, with plenty of floor-to-ceiling detail and a reasonable degree of refinement (as much as you usually get out of commercially duplicated recordings) — incidentally with a slightly reduced level of the bass problem described above.

#### CONCLUSIONS

When using the GX-6, there is a strong sense that it is no mere range filler, that someone had really thought this one through, and cared about how it came out. The reality is that it lives up to that indefinable specialness. Had the LF end been properly sorted out, the GX-6 would probably have merited Best Buy status, despite its highish price.

#### TEST RESULTS

Rec/replay response - 3db ref 1kHz IEC Type I\_ <20H:-14.5kH: IEC Type II <20Hz-16kHz <20H:-22kH: IEC Type IV Wow & Flutter - Peak DIN wtd/unweighted 0.065%/0.11% Speed error \_\_\_\_\_\_ Type I signal/noise CCIR/ARM 315Hz\_ 0.69 \_49dB distortion 0dB \_0.65% Type II signal/noise CCIR/ARM 315H:\_ \_51.5dB distortion 0db \_\_\_\_\_ Type IV signal/noise CCIR/ARM 315HZ 0.95% \_54.IB distortion 0db \_ 1.3% Channel separation 0VU/1kHz 44.5dB 107mV/>7V Line input sensitivity/overload Mic input sensitivity/overload \_n/a Line output for QdB/maximum \_\_\_\_\_6 IM distortion 10kHz/11kHz QdB peak, 1kHz product \_\_\_\_6 606m\74 22\ 0.41% \_50 degrees Azimuth check R-L phase at 8kHz \_ VU indication at IEC 0db \_\_\_\_\_ \_0dB 44×11.1×35.3cm Dimensions (w×h×d) Typical Retail Price £329





erhaps wisely, the *DR-M07* is as close as Denon come to selling a beer budget cassette deck. It is just the kind of product that will appeal to an audiophile of limited means; it's cheap, has the bare minimum of frills, and decent under-the-skin engineering.

In fact using the Denon is by no means a hair shirt experience, since it does at least have fine bias adjustment, which works on all bar metal (type IV) tapes in the time honoured way. The other facilities consist of input level and balance pots, a headphone socket (fixed level), 3-position rotary tape type and Dolby selectors (B/off/C), and a simple mechanical tape counter.

The only feedback provided the user are power on indicators (the bottom 'minus infinity' LED on the record level meters (!)), and a record mode telltale. The logic controlled transport keys work smoothly and the *DR-M07* conveys an unmistakeable impression of quality. The only slightly tacky touch is the record level meter, which is both plain ugly and has a very limited range (16dB) and coarse resolution (3dB at best).

#### LAB REPORT

A substantial measured azimuth misalignment led to an early rolloff at high frequencies on prerecorded tapes — the -3dB point occurs around 6.5kHz. The record/replay responses on the other hand look a good deal healthier. The fine bias control can take care of the ferric response rolloff, but you are left with what you see in the case of metal, and the only course of action is to choose a metal tape with a duller sound than the IEC type used for these tests — see tape section. The wow and flutter numbers are impressively low for what after all is a budget price deck, but this is one instance where the real situation isn't revealed by the one figure alone. The flutter spectrum analysis (not shown) is unimpressive due to the quantity and number of wow components and higher frequency noise, at around -42dB between 40Hz - 50Hz. The noise spectrogram is also unimpressive.

Unusually, OVU on the meters also corresponds to IEC 0dB, and harmonic distortion levels are off the scale of the measuring equipment (>3.3%) at this point, so casting the good signal/noise figures in a less favourable light of course. The practical advice is never to let peaks stray into the red. Note also the high level of intermodulation distortion, which means that metal tapes may not be fully exploited.

#### SOUND QUALITY

Quite frequently, a high fidelity component manages to transcend its measured performance. This is just such a case. Pre-recorded material works really well, with fine subtlety and an accurately reproduced soundstage — the space and the limits around that space being explicitly reproduced from suitable recordings. Replay speed stability was a strong point too, again despite the numbers. The only real criticism in relation to price was an occasional 'edgy', 'wispy' treble quality.

Special attention was paid to source material likely to show up any transport problems, but the Denon consistently scored better than expected here. The only really obvious shortcomings occured elsewhere — for example, in the loss of transparency the two noise reduction systems brought in their wake, and in significant noise 'pumping' when using Dolby C (which can often be heard clearly with headphones, but much less easily with loudspeakers). Overall, the Denon lacked a degree of incisiveness and 'hearthrough' clarity, and on these grounds was best suited by metal Tape IV, followed closely by chrome bias Type II tapes.

#### CONCLUSIONS

It's not always easy to find out why things work well or badly, but in this case the audio electronics themselves sound decidedly better than usual. There were a number of objective shortcomings ranging from cheapskate metering to a certain amount of transport 'wobblies' — on paper at least. In practice the 'M07 simply sounded marvellous, with good stereo, abundant detail and a welcome lack of artificiality. Obvious Best Buy material.

#### **TEST RESULTS**

Rec/replay response – 3db ref lkHz	
IEC Type I	25Hz-14kHz
IEC Type II	25Hz-13.5kHz
IEC Type IV	25Hz - 16.5kHz
Wow & Flutter - Peak DIN wtd/unweighted	0.09%/0.25%
Speed error	+0.2%
Type I signal/noise CCIR/ARM 315Hz	54dB
distortion OdB	>3.3%
Type II signal/noise CCIR/ARM 315Hz	55.5dB
distortion Odb	>3.3%
Type IV signal/noise CCIR/ARM 315HZ	57dB
distortion Odb	>3.3%
Channel separation OVU/1kHz	43.5dB
Line input sensitivity/overload	110mV/>7V
Mic input sensitivity/overload	n/a
Line output for OdB/maximum	575mV/4.27V
IM distortion 10kHz/11kHz 0dB peak, 1kHz prode	uct5.43%
Azimuth check R-L phase at 8kHz	28 degrees
VU indication at IEC 0db	0dB
Dimensions (w×h×d)	43.4×11×23.6cms
Typical Retail Price	£140

For graph references see issue No. 52

HESPHERE.

# CASSETTE DECKS

**DENON DR-M10** 



he Denon *DR-M10* is a comparative rarity amongst decks around £200. It incorporates only a level of facilities typical of much cheaper machines, the idea being that most of the resources are devoted to ensuring good sound quality instead.

Centrepiece of the deck is a logic controlled, Denon-made transport operating *via* cams instead of the usual solenoids. The obvious advantage is that different drive modes engage with quietness and decorum.

The only vaguely unusual transport modes are track search and automatic record mute which also acts as a record/pause. According to the manufacturer's propaganda it acts as a normal pause control during playback too: it doesn't. The usual three tape types are accepted with automatic switching of bias and equalisation, confirmed by telltales on the front panel. There is a fine bias adjustment pot which works with Type I and II tapes only, and noise reduction is as usual performed by Dolby B and C. Headphones can be connected but not microphones, and the front panel is completed by a simple mechanical tape position counter.

Oh — nearly forgot. There's an output level control wired not only into the headphone feed, but also into the main output. The main output should have been left clean, a minor act of audio vandalism that loses Denon one brownie point. The clever bits that *earn* brownie points include three motors (capstan, reel and servos, the reel motor being a low cogging type intended to smooth tape tension over the heads), an elaborate power supply section, and DC coupled amplifier stages throughout.

#### LAB REPORT

There's nothing wrong with the frequency responses, which look like exemplary text-book stuff. There is a slight tilt towards the treble with Type IV tape, but it doesn't amount to much, and the Dolby circuits are well aligned. With pre-recorded tapes there's just a suggestion of an upwards tilt too, but it's a good response shape on the whole, and azimuth error was quite modest.

The wow and flutter figures are less inspiring, but once again it takes spectral analysis to bring the whole picture into perspective, in this case showing more random noise than discrete periodic frequency wow or flutter. There is a component at 6Hz, -33dB, but for much of the range covered the noise floor remains below -40dB.

The noise spectrogram speaks of good pitch stability but some noise modulation at around -27dB from 20Hz out. The 0VU signal/noise figures are quite good, but Type IV metal distortion levels are quite high.

#### SOUND QUALITY

The *DR-M10* upholds the growing reputation of the breed and largely fulfils the promise held out by the sober and well aimed physical design. Even so, the listening notes catalogue a degree of 'heaviness' when reproducing subtle instrumental passages, an inability to 'hear through' the tape, and a slightly 'wavery' quality, more a loss of ultimate pitch precision than any really definable variation in pitch.

For the most part, the *DR-M10* is an enjoyable and capable recorder with a wide working dynamic range, a real sense of consistency with level, and good stereo imagery. However, the deck tends to sit hard on the dynamics and cutting qualities of really hard hitting transient material recorded at high levels. The brightness at the top when using Type IV metal tape was innocuous in practice, largely due to satisfactory HF sound quality. Pre-recorded tapes sounded neutral but slightly 'dirty', despite the slightly tilted response.

#### CONCLUSIONS

With one of the simplest and most purposeful sets of controls on the market, the *DR-M10* is one of the best decks in its area of the market, representing a very worthwhile step up from budget recorders. Had the electronics been slightly more transparent it would have rated Best Buy, and is nevertheless a near miss.

#### TEST RESULTS

Rec/replay response – 3db ref 1kHz	
IEC Type I	29Hz-14kHz
IEC Type II	29Hz-14kHz
IEC Type IV	29Hz-17kHz
Wow & Flutter - Peak DIN wtd/unweighted .	0.18%/0.46%
Speed error	
Type I signal/noise CCIR/ARM 315Hz	51dB
distortion 0dB	0.75%
Type II signal/noise CCIR/ARM 315Hz	52dB
distortion 0db	0.85%
Type IV signal/noise CCIR/ARM 315HZ	52.5dB
distortion 0db	1.6%
Channel separation 0VU/1kHz	
Line input sensitivity/overload	130mV/>7V
Mic input sensitivity/overload	n/a
Line output for 0dB/maximum	848V/3V
IM distortion 10kHz/11kHz 0dB peak, 1kHz pro	duct9.3%
Azimuth check R-L phase at 8kHz	12 degrees
VU indication at IEC Odb	+ 3dB
Dimensions (w×h×d)	43.4×11.5×28.6cms
.Typical Retail Price	£180

For graph references see issue No. 52

HICOMON DUD





he DR-M12HX is in many ways a de luxe version of the DR-M10. Though slightly more sophisticated in hardware terms, it follows the same general pattern in emphasising under-the-skin engineering rather than features. There's an alternative DR-M14HX version too, which includes a full infra-red remote control and costs £230.

Facilities are straightforward. Noise reduction is the usual Dolby B and C mix, with separate MPX switching. The transport includes track search and automatic record mute using a control button that obligingly doubles as a record/pause key. Tape type selection is automatic, and record levels are set using impressive fluorescent meters with good range and resolution. The tape counter is electronic and has a imemory stop button. Finally, an output level control is wired into both the headphone socket, and also the main amplifier output.

The transport is quite elaborate in design. Power is supplied by no less than three motors, one for the capstan, another for the reel hubs, and the third to operate the cams which replace solenoids in actuating the various transport modes.

Internal features include Dolby HX Pro, which reduces the HF compression that afflicts recordings made on low bias tapes in particular, a new head profile that extends and smooths bass response, and some quite sophisticated amplifier technology.

#### LAB REPORT

The broad picture is that the Denon does offer low absolute levels of wow and flutter, as you can see from the numbers. But the noise shoulders are fairly prominent on the spectrum analysis, and some wow components are apparent. The fluttergram shows broad flutter noise at 25-30Hz, and several wow components around the -30dB level in the region 4-10Hz. All distortion products are low too, including intermodulation distortion which other Denons didn't cope with as well. The reason for this last observation, it transpires, is that this deck has a new record/replay amp.

Azimuth is quite accurately set, and the playback only frequency response is fairly accurate, allowing for a small amount of engineered-in brightness. The Type I and II record/replay results shelve up by about a dB above 500Hz-1kHz, but this in itself is not disastrous and Dolby processing does nothing to make matters worse. All bets are off with metal tape, however, whose output rises slowly but considerably with increasing frequency. Naughty, especially as this is the one tape type whose record bias is fixed.

#### SOUND QUALITY

The combination of Dolby *HX Pro* circuitry with the new record amps that have extra head-room conspire to give this deck a wide working dynamic range, and a more transparent, less obvious kind of sound than usual, especially when the mid to high frequency extremes are stressed.

The net result is that the *DR-M12HX* sounds less like a cassette deck than usual. There is an appealing incisiveness about the sound which can successfully suggest real power combined with a genuine cutting edge, though it can sound rather thin and dry and lacking in

ambience. Commercial tapes played on the Denon reproduced broadly along these lines, though even with the best tapes available, the quality of sound was clearly inferior to a good home recording.

TIECONNIENDED

Good as it is, it's only fair to note that the review deck suffered from a lack of true pitch constancy, which robbed the music of some of its believeability. Sometimes the music could be heard to flutter audibly, and at others it sounded slightly edgy. There was a curious fault too: the channels had been switched internally. It's nice to know that even robots are human!

#### **CONCLUSIONS**

The *DR-M12HX* is well constructed and unusually pleasant to use. It very nearly sounds superb too; a bit of work on the transport might make that promise a reality.

#### **TEST RESULTS**

on \_ 3db and 1bHa

Rechepiay response Sub rer ikinz	
IEC Type I	33Hz-17kHz
IEC Type II	34Hz-16kHz
IEC Type IV	34Hz-20kHz
Wow & Flutter - Peak DIN wtd/unweighted	0,10%/0.23%
Speed error	0.4%
Type I signal/noise CCIR/ARM 315Hz	50dB
distortion OdB	0.9%
Type II signal/noise CCIR/ARM 315Hz	51.5dB
distortion Odb	0.9%
Type IV signal/noise CCIR/ARM 315HZ	53dB
distortion Odb	1.3%
Channel separation 0VU/1kHz	
Line input sensitivity/overload	80mV/>7V
Mic input sensitivity/overload	n/a
Line output for 0dB/maximum	632mV/3.8V
IM distortion 10kHz/11kHz 0dB peak, 1kHz prod	uct0.58%
Azimuth check R-L phase at 8kHz	8 degrees
VU indication at IEC 0db	OdB
Dimensions (w×h×d)4	3.4×11.5×28.6cms
Typical Retail Price	£220



**DENON DR-M30HX** 



he £300 DR-M30HX is quite an ambitious product, and the most important selling features are that popular double act — three heads with off-tape monitoring, and a closed-loop, twin-capstan transport. It also joins the very select handful of recorders with infrared remote control and a further important inclusion is Dolby HX Pro.

In practice the Denon's modus operandi is almost intuitively obvious. About the only criticism is the awkward switching for Dolby B and C. Like some of the other Denon models, the *DR-M30* uses near-silent cams to engage transport functions instead of solenoids. The controls themselves stretch out in a long line instructing a logic chip which addresses the transport in a way that avoids strain on the tape.

The other controls are kept to a minimum. Apart from Dolby switching, with an independent MPX filter option, record bias can be adjusted within fine limits, while tape type selection is otherwise automatic. Then you're down to minor points like the headphone socket, the output volume control, a record mute facility and an electronic memory counter. The meters have a 28dB operating range.

The DR-M30HX also comes with a simple infra-red remote control, which addresses all the normal transport modes, plus 'record'.

#### LAB REPORT

The basic 0.08% wow & flutter figure is more than presentable, but careful analysis uncovered a prominent shoulder in the noise modulation plot at -35dB which stretches from +/-30Hz to +/-60Hz. Similarly, rising high frequency

With the bias control centred, the Type I ferric IEC tape response looked slightly overcooked, though it can be corrected easily by slightly reducing the level of bias. The Type II response was spot on, but Type IV metal was underbiased, leading to a broadband rise peaking at +2.2dB around 16kHz. This is a pity since the electronics are abundantly capable of

'scrape' noise is evident in the fluttergram.

response rise is going to make them sound incorrectly set up. The replay response is curtailed in bandwidth, but flat though the midband. The noise figures turned out to be satisfactory.

driving metal tape very hard indeed, yet the

#### SOUND QUALITY

Apart from a suggestion of upper midband congestion — a combination loss of detail and smoothness at the high frequency end of the spectrum — the Denon replays commercially recorded tape with real finesse. This favourable impression was reinforced when making its own recordings, where the prerecorded standard was easily exceeded.

When used in a system that was really 'on song', the '30HX retained an unmistakable sense of the life and vitality of the original — the subtle qualities that tape normally struggles to capture before ignominiously failing. The Denon didn't take altogether too kindly to very dense, loudly recorded passages: these sounded distinctly congested notwithstanding the good test bench behaviour. This even applied with metal tape, but the fact that the Denon covered a slightly narrower dynamic window really well will be adequate recompense to those who use

tape for recording music and not test tones.

In summary then, the deck was highly successful. But it never really sounded right with metal Type IV tape, which had a 'blarey' quality, an almost 'metallic' upper midband and lower treble.

#### CONCLUSIONS

Though lacking the last ounce of top end life that can come with metal tape on a sympathetically designed deck, the Denon *DR-M30* has a range of features that will suit most enthusiasts well, and the way they have been dispersed around the front panel will please their grannies almost as much. Sound quality with Type II tape in particular was surprisingly honest to the source. Recommended.

#### **TEST RESULTS**

Rec/replay response – 3db ref IkHz	
IEC Type I	<20Hz-14kHz
IEC Type II	<20Hz-15kHz
IEC Type IV	<20Hz-21kHz
Wow & Flutter - Peak DIN wtd/unweighted	0.08%/0.10%
Speed error	-0.2%
Type I signal/noise CCIR/ARM 315Hz	51dB
distortion OdB	0.85%
Type II signal/noise CCIR/ARM 315Hz	52dB
distortion Odb	0.85%
Type IV signal/noise CCIR/ARM 315HZ	53.5dB
distortion 0db	1.3%
Channel separation 0VU/1kHz	
Line input sensitivity/overload	120mV/-V
Mic input sensitivity/overload	_n/a
Line output for OdB/maximum	830mV/2.8V
IM distortion 10kHz/11kHz 0dB peak, 1kHz pro	oduct0.09%
Azimuth check R-L phase at 8kHz	3 degrees
VU indication at IEC 0db	+1dB
Dimensions (w×h×d)	43.4×11.5×28.6cms
Typical Retail Price	£319



Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks.



enon's flagship *DR-M44HX* is a three-head (which means off-tape monitoring whilst recording), dual capstan cassette deck with an extremely effective automatic tape set-up system (as distinct from auto tape type recognition, which is also fitted). In addition, Dolby *HX Pro* reduces HF compression and makes the recording process more linear at high levels, especially with low bias tapes.

In common with other recent Denon models, the DR-M44HX uses a new cam-operated transport, so tape handling is unusually gentle from the moment a cassette is placed in the back-lit well. Thisdeck is never impolite enough to click and jerk in the way solenoid controlled decks are wont to do as they shift from mode to mode. The transport is made by Denon themselves, who are one of very few who don't buy their transports from an OEM supplier.

The 44 is also blessed with a very full and complex status display. This includes an excellent set of record level meters (28dB range, good resolution, two colours, peak hold LEDs), and an electronic tape counter reading in minutes and seconds, complete with matching memory stop feature. The display area also serves to show the current transport status, tape/source monitoring status, the information concerned with the auto tape tuning system and much more.

Noise reduction is courtesy of the ubiquitous Dolby B and C, with separate MPX filtering. The output level of both headphones and main preamp level output can be adjusted with an output pot: the same criticism applies here as elsewhere; for sonic reasons the level control should not be wired into the critical amplifier feed (sound effect of slapping wrist). A remote control can be added, using an outboard receiver. Even as it stands though, control layout is immaculate, and the deck is a pleasure to use.

#### LAB REPORT

The DR-M44HX has an excellent transport, arguably the single greatest attribute of any cassette deck. The 0.04% weighted wow and flutter figure is low enough in its own right of course, but it's backed up by a flutter spectrogram which shows negligible wow, and other effects

well distributed.

The feature that most clearly approximates to a flutter component is at 23Hz, but even this peaks at only -40dB. The pitch centre in the noise modulation graph is also extremely sharp and narrow, which suggests that pitch resolution will be excellent. Modulation noise is low throughout.

The amplitude responses are equally well optimised. The bass end is very well engineered, and deviations from the straight and narrow amount to no more than can be contained in a 1.5dB envelope (at least when the auto tuning system has been used first, and regardless of the brand and type of tape used). There was no discernible Dolby mistracking.

By rights, however, prerecorded tapes should sound a little dull. There's a fairly substantial azimuth error (67 degrees at 8kHz) which should not be present on a deck of the Denon's pretensions. The only other small fly in the ointment is the high level of intermodulation products, which suggests that the record circuit may be running out of headroom at this point, even though the less sensitive harmonic distortion numbers give no confirmation.

#### SOUND QUALITY

From the first bar of the first recording, it was obvious that here was a deck with real class and an uncommon repertoire of skills. The *DR*-*M44HX* has a number of priceless (all right, expensive) facilities. One of these is Dolby HX Professional, which beefs up ferric (Type I) performance standards by reducing compression and improving consistency, especially at high levels. The upshot of this is that a good ferric tape can show most of the capabilities of a good Type II tape, especially in the realm of mid and HF dynamics.

The other is much more important: guaranteed rock steady pitch plus considerable resolution (I believe there is a causal relationship between the two), and without any sense of grain. Best of all, the sound is simply but unmistakably of very high musical quality. This Denon may be used in a truly capable, high resolution 'audiophile' system without betraying itself too obviously as a mere cassette deck, which is no mean accolade given current cassette deck standards!

TIREONNIENTED

The intermodulation result is reflected in the headroom: high energy HF-rich material tended to splatter and image vaguely around the sound-stage with metal tapes in use. Nevertheless, and despite Dolby *HX Pro*, this deck is a natural for exploiting metal tape. Not because of any half-baked notions of extra HF headroom, but because metal is particularly effective at capturing the subtleties and expressive range of midband information when using a good quality source.

Only pre-recorded material disappointed slightly. The quality of music making here was more abrupt, less articulate, and less convincing dynamically. There was also more extreme HF hiss than normal with Dolby B engaged. Dolby B performed quite satisfactorily when recording and playing back, but as usual Dolby C processing messed things up and defocused the sound to a degree.

#### CONCLUSIONS

The *DR*-M44HX has certain objective limitations, mostly minor, but is true to the spirit of the music it reproduces, especially with Type IV (metal) tape. A first class transport is the key, but the good range of features, notably auto-tape tuning, does nothing to hinder. Highly recommended.

#### TEST RESULTS

Rec/replay response – 3db ret 1kHz	
IEC Type I	23Hz-14kHz
IEC Type II	24Hz-15kHz
IEC Type IV	23Hz-21kHz
Wow & Flutter - Peak DIN wtd/unweighted	0.04%/0.11%
Speed error	0.4%
Type I signal/noise CCIR/ARM 315Hz	48dB
distortion 0dB	0.65%
Type II signal/noise CCIR/ARM 315Hz	50dB
distortion 0db	0.75%
Type IV signal/noise CCIR/ARM 315HZ	51.5dB
distortion 0db	0.85%
Channel separation 0VU/1kHz	45dB
Line input sensitivity/overload	89mV/>7V
Mic input sensitivity/overload	n/a
Line output for 0dB/maximum	826mV/3.4V
IM distortion 10kHz/11kHz 0dB peak, 1kHz prod	duct10%
Azimuth check R-L phase at 8kHz	67 degrees
VU indication at IEC 0db	+1dB
Dimensions (w×h×d)	43.4×11.5×28.6cms
Typical Retail Price	£399
*after auto-tuning	

MARANTZ SD-35



arantz have made quite a splash (for want of a better term) in the budget esoteric market, largely through the efforts of designer Ken Ishiwata and product manager Steve Harris, both of whom are keen audiophiles.

Applying audiophile criteria to cassette decks, especially low cost cassette decks, might be regarded as novel, if not in danger of being revolutionary. This one is actually subtitled as an 'audiophile deck', a label it earns by, for example, incorporating a number of audio grade components in sensitive circuit areas. The quality theme is continued externally with a smooth and attractive three dimensional gold on satin black fascia, and a reassuringly solid and expensive feel.

Annoyingly, single finger record/pause starts are not allowed, and as a matter of personal preference I missed a memory stop feature, which is about the most rudimentary way there is of finding your way around a tape. However, the SD-35 will find the start point of a recording that has just been made if rewind is selected direct from record mode.

The other facilities are straightforward, and neatly executed, and the deck is blessed with a transport that fairly glides about its business, with little of the clankiness or lack of feel of many rivals. Tape selection is automatic, and noise reduction is by Dolby B and C, with an independent MPX filter.

The usual transport modes include a one touch four second mute feature. Record bias is adjustable for all but metal tapes (the usual exclusion), and record levels are set on a pleasingly designed rotary input level control, using an even more pleasingly designed but perhaps rather brightly lit pair of record levels meters with reasonably wide range and resolution.

#### LAB REPORT

The numbers suggest that the *SD-35* should reproduce timbre and pitch accurately, and the noise spectrogram is extremely clean, with all residuals -40dB or better. The spectrogram does show some complex noise modulation, with a number of small but clearly defined sidebands. However, the pitch centre is sharply defined, and sidebands are adequately controlled.

The record/playback responses are quite satisfactory, allowing for a mild tendency to brightness especially with metal and Dolby C. The effect is smooth and far from severe though, and curable (if it seems like a problem) by choosing tapes with a falling top end response. Other test results are at worst unremarkable — so no remarks.

#### SOUND QUALITY

Headphone listening was spoiled a little by random variations in output caused by slightly 'iffy' tape-to-head contact. This, and a rather bright replay only response (applicable to prerecorded material) were perhaps the only obvious snags with this machine.

The SD-35 is a remarkably successful recorder, with much of the credit due to the rock steady transport. The consistent measured performance between tapes was reflected in relatively consistent sound, though predictably Type I ferric tapes often sounded rather flattened when pushed hard.

Sound quality was best without noise reduction, where it was characterised by excellent resolution, a tidy and tuneful bass, and well resolved stereo imagery. With Dolby the sound stayed very good on the whole. But there was some mild Dolby mistracking, along with quite severe noise pumping with transient material (piano etc) which was more distracting than the steadier hiss that results when Dolby isn't being used.

Commercial pre-recorded material sounded fine, the added brightness being perfectly tolerable due to the precision and cleanliness of high frequency reproduction.

#### CONCLUSIONS

Good quality, properly aligned electronics combine with an excellent tape transport and good ergonomics to make the *SD-35* an obvious Best Buy.

#### TEST RESULTS

Rec/replay response - 3db ref 1kHz

. , .	
IEC Type I	32Hz-13kHz
IEC Type II	30Hz-14kHz
IEC Type IV	29Hz-19kHz
Wow & Flutter - Peak DIN wtd/unweighted	0.07%/0.19%
Speed error	+0.25%
Type I signal/noise CCIR/ARM 315Hz	50dB
distortion 0dB	0.6%
Type II signal/noise CCIR/ARM 315Hz	52dB
distortion Odb	0.95%
Type IV signal/noise CCIR/ARM 315HZ	53dB
distortion Odb	1.5%
Channel separation 0VU/1kHz	
Line input sensitivity/overload	98mV/>7V
Mic input sensitivity/overload	n/a
Line output for OdB/maximum	507mV/2.9V
IM distortion 10kHz/11kHz 0dB peak, 1kHz product	1.26%
Azimuth check R-L phase at 8kHz	16 degrees
VU indication at IEC 0db	OdB
Dimensions (w×h×d)	_42×10×26cms
Typical Retail Price	£160

#### C S S D E Κ S Α E Т Т E С



# MARANTZ SD-45II

MARANTZ AUDIO (UK) LTD, 15-16 SAXON WAY INDUSTRIAL ESTATE, MOOR LANE, -Harmondsworth, Middx ub7 olw. Tel: 01-897 6633-



his two head, two motor, £200 Mk II model fits slap bang in the middle of the UK market. Best described as of simple functional design, it has circuitry specifically developed to meet the expectations of the less wealthy audiophile. To this end, it uses ceramic damped Cerafin capacitors around the Dolby block and power supply section, and has what Marantz describe as a separate high slew rate opamp playback amplifier rather than the rather nasty single IC chips often used.

Build is solid and heavy, whilst fit and finish are in the 7 out of 10 category. Ergonomics are good on the whole, except that the transport uses feel-less keys, artlessly jumbled together.

Small but very well calibrated record level meters have a more than handsome 37dB operating span, with peak hold LEDs. The deck also includes such handy gadgetry as an autotape type selector, variable bias (Type I and II only, as usual), Dolby B and C and a separate MPX filter.

Naturally, the SD-45II has an automatic record mute function, but illogically there's no direct way of taking advantage of this as there is no track search feature (propaganda sheet notwithstanding). However, the deck will seek out the beginning of recordings if 'rewind' is selected direct from 'record' without passing through 'stop', the pause key flashing when it has done so.

The SD-45II has an electronic tape counter and memory stop feature. There is one itsy-bitsy oversight, however: the memory has no status indicator, so you'll have to remember whether it's been selected for yourself.

#### LAB REPORT

The lab test programme was passed with ease and style - with just the odd caveat for the bright pre-recorded replay response (this isn't the only Marantz so affected). The ferric (Type I) graph had a similar characteristic, which tends to make recordings sound very incisive but rather thin and hissy. The other responses were almost perfectly flat with or without Dolby (and still hissy by normal standards!). The record chain has plenty of headroom, and signal/noise ratios are good verging on excellent, whilst distortion levels are unusually low.

And the good news continues . . . the raw wow & flutter figures are good. The noise spectrogram indicates good pitch resolution and sidebands at +/-60Hz with a peak amplitude at -36dB. In English, that means good. The energy content of the flutter analysis is also low (that means good too). The worst flutter component is at 30Hz, -35dB, and wow is low, with few discrete components. However, the SD-45 is rather adept at picking up and amplifying stray magnetic fields, so siting should be done with special care.

#### Sound Quality

Pre-recorded material often sounded hissy, particularly at high frequencies, but as a recorder the SD-45II proved remarkably successful in comparison to its peers, though here too high frequency tape hiss was a little more obvious than usual. However, Dolby mistracking was not too apparent and sound quality with Dolby in was not prejudiced.

Recognisably of the same parentage as the For graph references see issue No. 52

SD-35, the 45 has much the same very high level of detail and absence of 'fluff'. Bar an occasional touch of 'acidity', this is a deck that really sings, with a more articulate, more pitch specific and generally classier sound than most of the direct competition. The sound has a good working dynamic range, and the result was very firm and stable in character. Speed stability was also subjectively good, if not totally secure pitchwise. The sound had real projection and power in the midband and above, but the bass seemed mildly flattened in character.

#### CONCLUSIONS

On balance, this is an excellent sounding deck, which extracts more information off tape with less dynamic squash than experience with its competitors will lead you to expect. Only a marginal lack of absolute pitch security counts against it at the price.

#### TEST RESULTS

Rec/replay response – Jub rer Ikriz	
IEC Type I	32Hz-13kHz
IEC Type II	28Hz-13kHz
IEC Type IV	_<20Hz-18kHz
Wow & Flutter - Peak DIN wtd/unweighted	0.10%/0.24%
Speed error	+0.1%
Type I signal/noise CCIR/ARM 315Hz	50JB
distortion OdB	0.65%
Type II signal/noise CCIR/ARM 315Hz	52.5dB
distortion 0db	0.9%
Type IV signal/noise CCIR/ARM 315HZ	53JB
distortion 0db	1.3%
Channel separation 0VU/1kH:	
Line input sensitivity/overload	98mV/>7V
Mic input sensitivity/overload	n/a
Line output for OdB/maximum	520mV/3V
IM distortion 10kHz/11kHz 0dB peak, 1kHz product	0.44%
Azimuth check R-L phase at 8kHz	5 degrees
VU indication at IEC 0db	OdB
Dimensions (w×h×d)	_42×10×26cms
Typical Retail Price	= £200



# MARANTZ CP230



ere is a welcome and extremely practical oddity: a true portable cassette deck, extremely well thought through and comprehensively equipped, for just £250. But if after you've read what follows you decide you want even more, there is a similarly packaged companion model with three heads, off-tape monitoring, *dbx* noise reduction and slightly higher rated specs (before dbx), the £300 CP430.

The deck itself is scarcely larger than a chunky paperback — the vital statistics are just  $226 \times 50 \times 167$ mm, and less than 1.3kg for the raw unit. The deck is either powered by three *MN1300* batteries (always use alkalines — the Marantz is a heavy drinker), an outboard mains power unit (supplied), or a rechargeable power pack unit (extra). Also supplied is a working case that allows access to everything that counts on the move, a shoulder strap, and a small case that fastens to the strap to hold microphones and a tape or two — and perhaps a very thin sandwich.

Every kind of portable recording need is catered for, and the deck will attract some domestic users too. The mechanical transport controls are well laid out and allow audible cueing. Tape movement can be logged on the tape counter and stopped at the counter zero reading using a memory switch, though the review deck was a bit erratic here. Record levels are set manually using a small dual-concentric control, recessed to avoid accidental changes. In addition, a limiter is fitted which can act as an auto level control if required, and is useful for live 'actuality' recording. Levels are monitored on good quality (optionally illuminated) moving coil meters (which also monitor battery condition), backed up by a peak reading LED.

The CP230 plugs into a hi-fi system using standard DIN and phono socketry, and accepts headphones and microphones (mono or stereo), the latter supplemented by -15dB and -30dB attenuators for some of the higher output electrets or to handle high input volumes. The deck also has a single built-in loudspeaker for monitoring purposes, switchable to reproduce either left or right hand channel or a mono sum. Other features include variable bias for all three tape types, variable pitch (playback only), and Dolby B switching with or without MPX filtering.

The Marantz may sound over the top on paper, and it's difficult to credit the sheer profusion of controls, sockets and other paraphernalia. They confront you every time you look round another edge or peer into another cranny. Yet miraculously, so well is the grouping and organisation of controls contrived, the deck is anything but confusing to use, and a little practice makes the machine almost intuitively obvious. It is robustly constructed from metal and plastic structural parts, and in every sense is eminently practical. The only thing missed out on my wish list was a built-in mono microphone for emergency convenient low-fi use.

#### LAB REPORT

The *CP230* cannot claim to be of domestic hifi standard all round, though in certain respects the sound belies the measurements. The wow and flutter is a relatively poor 0.20% weighted, but the unweighted figure is a more acceptable 0.29% and the flutter spectrogram shows why. The wow end of the spectrum is quite good, but there's a strong energy bias around 50Hz, perhaps because the capstan flywheel is too small. This is certain to add some roughness to the sound and result in a loss of resolution. The noise spectrogram also shows severe noise modulation outside the DIN weighting curve.

The Marantz runs perilously close to clipping at 0VU, as the intermodulation test shows. Simple harmonic distortion levels and signal/noise figures are perfectly satisfactory at this level on all three tape types, but complex high level, high frequency material will not be recorded cleanly.

The response shape is good in each case too, the ferric Type I plot promising the snappiest performance. Dolby noise reduction only mistracks to a marginal extent. However, the replay only response is very poor, and declines at a rate of knots from well below 1kHz, resulting in an effective (perceived) bandwidth worse than AM radio.

Note that IEC 0dB corresponds to +5dB on the meters, and that although they read transients quite well, they do tend to under-read peaks a little compared to LED meters. The peak reading LED responds faster and therefore acts as a useful safety net.

#### SOUND QUALITY

You'll not be surprised to hear that prerecorded material replayed with a very dull and rather stodgy, monochromatic sound, with the harmonic overtone structure severely curtained. It was, to use the correct technical phrase, a washout.

When recording, the *CP230* caused a loss of body and richness, which was also apparent when the electronics were assessed on their own. In addition to this, it sounded a little cluttered and coarse, and some HF unevenness and 'splash' was intermittently apparent. These shortcomings were reduced with the higher energy formulations, however.

On the whole the Marantz coped quite well with complex, wide ranging material, and almost as well with very simple recordings of chamber and recital material for instance, where the problems are always most clearly exposed.

Top end squash was quite easy to avoid without running into noise problems caused by excessively low record levels, because the deck has quite a wide inherent dynamic range. Even so, the ability of this deck to produce listenable tapes when not using noise reduction is questionable in most situations. Happily, the degradation caused by the additional signal processing circuits wasn't serious in context, though it *was* audible.

Logically, Type II chrome-bias tapes should suit the *CP230* best, and certainly the Marantz proved incapable of extracting the best that metal can offer. Nevertheless, metal on the Marantz offered a particularly attractive blend of shape and stability in the midband that was well worth having.

#### CONCLUSIONS

As a pro or semi-pro recorder which can be taken on an assignment, the Marantz has several

virtues, including versatility, practicality and toughness.

As a domestic hi-fi recorder, the case is nothing like as clearly in the Marantz's favour, and the review sample wouldn't adequately serve for commercially recorded software at all. When used to play back its own tapes, however, the situation was much better, and this is clearly a recommendable package. By any standards, it's also extremely well priced.

#### TEST RESULTS

Rec/replay	response	- 3db	ref	1kF
receireping,	response	240		****

recoreplay response 540 ret iki12	
IEC Type I	40Hz-14kHz
IEC Type II	40Hz-16kHz
IEC Type IV	40Hz-18kHz
Wow & Flutter Peak DIN wtd/unweighted	0.20%/0.29%
Speed error	+0.15%
Type I signal/noise CCIR/ARM 315Hz	-49dB
distortion OdB	0.7%
Type II signal/noise CCIR/ARM 315Hz	50dB
distortion Odb	
Type IV signal/noise CCIR/ARM 315HZ	51dB
distortion Odb	0.85%
Channel separation OVU/1kHz	47dB
Line input sensitivity/overload	88mV/>7V
Mic input sensitivity/overload	_0.48mV/110mV*
Line output for 0dB/maximum	645mV/1.29V
IM distortion 10kHz/11kHz 0dB peak, 1kHz product	6.6%
Azimuth check R-L phase at 8kHz	30 degrees
VU indication at IEC 0db	+ 5dB
Dimensions (w×h×d)2	2.6×5×16.7cms
Typical Retail Price	£250
*mic attenuator at QdB	

For graph references see issue No. 52



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#### С A S S E E С Κ S E 1 Ί I)

# NAKAMICHI BX-125E

NAKAMICHI B&W (UK) LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING, -West Sussex. Tel: (0903) 750750-



he BX-125E is a 'budget' Nakamichi deck (the word budget used in a relative rather than absolute sense), with two heads plus Dolby B and C noise reduction. What sets the BX-125E apart is what sets most Nakamichis apart: engineering integrity. The impression of a solid and stable build quality is unmistakable, reinforced by a cam-operated transport which has a well-oiled slickness that would credit a deck several times the price.

Operating logic is just about perfect too. The touch of a single finger invokes record/pause, another starts record mode proper. The record level meters have adequate resolution and a near 40dB operating dynamic range. Twin record level sliders make ganged fading easy and facilitate balance adjustment. The tape counter is mechanical, but does have memory stop and repeat, the latter cycling between counter zero and the end of the tape, or simply between the two tape extremities. Microphones are not accommodated, but a headphone socket is adjustable via a front panel pot which also feeds the main output. (Naughty!)

The usual Nakamichi quirks are here too, notably the separate bias and equalisation switching for the various tape types, confusingly labelled with IEC type numbers and Nakamichi's own tape designations. Dolby switching is confusing too.

Automatically controlled fades can be accomplished with the Master Fader rocker control, and the deck can be coupled to a timer. As with all Nakamichi models, the cassette well cover is readily removable if access is required to the heads and guides for cleaning and demagnetisation. The transport as always is a peach, with

no less than three motors, one each for the tape hubs and the single capstain.

#### LAB REPORT

The noise spectrogram has an excellent pitch centre, with virtually no noise or sidebands out to  $\pm 40$ Hz, and a low overall level of noise. Wow and flutter is well controlled in absolute terms (0.065% wtd, 0.14% unwtd), but analysis shows a cluster of wow components below 10Hz, measuring -33dB at 5Hz. At 40Hz there is a strong -30dB flutter component, indicative perhaps of a resonant mode of some description.

Peak level intermodulation is low enough to suggest adequate headroom for metal tape, but without overgenerous margins. Head azimuth is only modestly in error, but the replay response is flat only up to about 2kHz, after which it rolls off rapidly, with -3dB coming up around 7.5kHz. The record/replay response shapes are mostly pretty good barring some HF effects, the most disturbing of which is quite significant Dolby mistracking, especially with Dolby C. The noise vs harmonic distortion tests threw up quite good results.

Note that this deck must be positioned carefully to avoid hum pickup.

#### Sound Quality

Allowing for some rough edges, the BX-125 lived up to its reputation, except when using prerecorded material. Although the Nakamichi sounded only mildly dulled with such tapes, it did sound messy and the various instruments and voices in representative recordings sounded poorly separated, with a curiously muddy bass and slightly higher than expected hiss levels.

Recordings made on the machine itself could

not have presented a stronger contrast. The BX-125 does have an upper midband colouration of the kind associated with (for example) certain capacitor types when fitted to suitably transparent sounding amplifiers. Underpinning this, however, is truly excellent resolution, a taut, tuneful but again rather coloured bass, and a sweet treble which speaks volumes for transport stability and circuit design generally. This Nakamichi doesn't swamp inherent differences in tapes, and whilst the three tape groups all worked well, Type IV metals offered more lucid and articulate midrange, and firmer bass.

#### CONCLUSIONS

There is a certain messiness to the sound of this deck, but the fundamentals are very, very right. Dynamics, pitch integrity and clarity come together in a very convincing form. But prerecorded cassettes remain the poor relation.

#### Test Results

20Hz-19kHz
21Hz-19kHz
20Hz-22kHz
_0.065%/0.14%
+0.4%
48.5dB
0.95%
51dB
1.0%
50.5dB
1.5%
47dB
75 mV/>7V
n/a
666mV/3.19V
1.58%
13 degrees
+ 4dB
_43×10×25cms
£395





onventional in external design and layout, the TA-2130 is solidly built and quite slick in a low-key way if you turn a blind ear to the usual deafening solenoid clicks. It's a two-motor, two-head deck, with Dolby B and C, auto tape recognition, and variable bias ('Accubias') (for Types I and II tapes only). The record level meters have a best case 3dB resolution and a 26dB dynamic range, which is adequate. Strangely, the almost inevitable track search facility is only available as an intro-scan feature, to play a few seconds from each track, though of course play can be continued manually at any time. The machine will also repeat individual tracks or tape sides up to five times. a best case 3dB resolution and a 26dB dynamic range, which is adequate. Strangely, the almost inevitable track search facility is only available as an intro-scan feature, to play a few seconds from each track, though of course play can be continued manually at any time. The machine will also repeat individual tracks or tape sides up to five times.

This is one of the few moderate price cassette decks left fitted with microphone inputs (come to think of it, I keep writing the same thing . . .). Unusually, the mike inputs have their own input level controls separate from the line level controls, which provides a simple built-in mixing facility, perhaps for making compilations with voice overs, or adding music to whatever is being recorded.

The cassette loading drawer is obstructively designed: unless the tape is inserted at precisely the right angle, the thing jams up and refuses to take it at all. A trivial redesign would cure this. And whilst they are about it, how about a little friction coupling between the split halves of the input level controls? Ta very much.

#### LAB REPORT

On the whole, the Onkyo emerges from the bench tests without too many blots on its copybook. The spectrogram shows good centre frequency definition, clean (uncorrelated) noise out to +/-20Hz at -25dB, and quite good broadband noise modulation. The major flutter component is at 5Hz, -23dB which is a little high for comfort, but the spectrum at higher frequencies is quite clean — low noise and low flutter.

IM distortion is disappointingly high at 10.9% (measured in the usual way), and the record electronics don't have much headroom to spare. (Metal tape Barbara Striesand freaks or percussion enthusiasts might be better off looking elsewhere.) However, all response runs were clean and accurate with especially neutral midbands, and Dolby processing caused little change. The replay only response, of particular interest to those who listen to pre-recorded material, is very wonderful: the midband area is essentially flat, and the -3dB points falls at 13kHz.

#### SOUND QUALITY

Commercially recorded tapes sounded pretty fair, apart from an occasional attack of the 'wobblies' and a smidgen of HF grain and noise. Tonally the deck sounded neutral, and musically the sound had a nice, cohesive quality with adequate detail — nothing too ambitious mind.

And it makes good recordings too, though the tiny non-coupled twin input pots are a right royal pain in the butt. The Onkyo offers a degree of consistency amongst the various tape species, and on balance Type II tapes like TDK SA offer about the optimum compromise between performance and price. Metal tape is hardly worth the premium here. The overall characteristics were a handy mixture of clarity, stability and — best of all — a consistency with changing levels and frequencies that helped make the deck satisfactorily unobtrusive in practice.

#### CONCLUSIONS

Not a complicated deck this, the particular blend of gadgetry appears to have been arrived at without the benefit of a hands-on by someone who uses cassette decks on a day to day basis. Sound quality and engineering, however, are a little better than average and the price is reasonable. Recommended.

#### **TEST RESULTS**

Recreptay response – Sub ref IRT12	
IEC Type I	24Hz-12kHz*
IEC Type II	_24Hz-14.5kHz*
IEC Type IV	24Hz-16kHz*
Wow & Flutter - Peak DIN wtd/unweighted	_0.13%/0.30%
Speed error	0.5%
Type I signal/noise CCIR/ARM 315Hz	52dB
distortion 0dB	0.6%
Type II signal/noise CCIR/ARM 315Hz	54.5dB
distortion 0db	2.6%
Type IV signal/noise CCIR/ARM 315HZ	55dB
distortion Odb	2.0%
Channel separation 0VU/1kHz	
Line input sensitivity/overload	72mV/>7V
Mic input sensitivity/overload	).57mV/23.8mV
Line output for OdB/maximum	536mV/2.7V
IM distortion 10kHz/11kHz 0dB peak, 1kHz product	10.9%
Azimuth check R-L phase at 8kHz	8 degrees
VU indication at IEC 0db	OdB
Dimensions (w×h×d)43.5:	×11.2×26.2cms
Typical Retail Price	£220

\* bias set per manufacturers recommendations for TDK tapes

For graph references see issue No. 52



#### A S S С E Т E D E C K S

### SONY TC-FX 150

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF. -Tel: Staines 61688-



t the time of writing, the TC-FX150 was so absolutely brand new, there was no published information to be had beyond the £90 price.

As the guy from Sony said, the TC-FX150 'looks the biz'. Although hardly a substantial piece of engineering, it is very smooth and glossy. The transport controls are entirely unassisted mechanical press buttons. But they are well anchored and positive in feel, and also allow free interchange between fast wind and play (and vice versa) apparently without damage. However, normal use tends to slide the player around; this is a two-handed cassette deck.

Ultra simple 5-step meters with a bare 11dB range are the most obvious sign of cost paring. The bottom LED (set at around -10dB) is actually labelled minus infinity! Dolby C (in addition to the ubiquitous Dolby B) is the most impressive inclusion. There's a mechanical tape counter and manual tape type setting using (thankfully) a row of three appropriately labelled press buttons. On the test sample, the input level pot (not the knob) was about 60 degrees off true. which-unfortunately cannot be corrected by resiting the control knob.

#### LAB REPORT

Technical performance is above average which is more than you've any right to demand in a cassette deck that costs a paltry £90. A couple of things are open to criticism however. One of which is the suspect bass behaviour seen in the response curves: note the sharp suckout centred on 50Hz. Head contour effects are unusually extended up into the midband too, and these factors can be expected to affect auditioning.

The top end of the frequency range seems to have been set up rather erratically - the responses were run with the recommended Sony tapes as well as the normal IEC standard tapes (which actually proved marginally better suited than Sony's own). Type I tapes are rolled off a little early at HF, whilst metal tapes gave the odd camel like hump you can see in the accompanying data panel. Performance with prerecorded cassettes was a complete joke. There was a net loss of treble when replaying Dolbyed cassettes with the Dolby de-processing switched off!

Wow and flutter levels are moderate, the spectrograms identifying several discrete components sprinkled around, with dominant wow at 5Hz, -28dB. Speed drift, however, was very low. There are noise 'shoulder' like effects on the noise spectrogram at a just respectable -32dB between  $\pm 20-40$ Hz.

Intermodulation distortion exceeding 20% is very high indeed, which means compromised performance with complex, high level signals, especially with Type IV metal tapes. Harmonic distortion with metal tape is also very high at above 3%, but this is tied to quite good noise levels, which evens the odds to an extent.

### SOUND QUALITY

The TC-FX150 auditioned better than expected except with pre-recorded stuff, where sound quality doesn't even come into the equation. This is odd considering Sony have aligned the machine with absolutely zero azimuth error.

However, recording and playing back on the

deck itself, led to some quite acceptable results. There wasn't enough dynamic range between the noise floor and maximum level to allow serious use of the deck without noise reduction, but with Dolby B the sound was tolerably clear and lifelike, and superior to similar recordings made with Dolby C, which sounded oddly heavy. Ferric Type I recordings tended towards 'wooliness', and metal Type IV tape failed to offer any real advantage over Type II. Overall the best bet is to use Type II tapes like TDK SA or Sony UX-S, and Dolby B.

#### **CONCLUSIONS**

There's a lot of hedging about and many specific caveats, but the TC-FX150 is obviously a good £90's worth, capable of results that generally deserve the high fidelity tag. Replay only performance, however, was unsatisfactory.

#### Test Results

Rec/replay response - 3db ref 1kHz	
IEC Type I	22Hz-11kHz*
IEC Type II	56Hz-14kHz*
IEC Type IV	56Hz-15kHz*
Wow & Flutter - Peak DIN wtd/unweighted	0.13%/0.24%
Speed error	+1.2%
Type I signal/noise CCIR/ARM 315Hz	55JB
distortion 0dB	1.7%
Type II signal/noise CCIR/ARM 315Hz	53.5dB
distortion Odb	53.5%
Type IV signal/noise CCIR/ARM 315HZ	54.5dB
distortion 0db	3.2%
Channel separation OVU/1kHz	46dB
Line input sensitivity/overload	86mV/>7V
Mic input sensitivity/overload	n/a
Line output for 0dB/maximum	646mV/3.36V
IM distortion 10kHz/11kHz 0dB peak, 1kHz produc	t20.7%
Azimuth check R-L phase at 8kHz	0 degrees
VU indication at IEC Odb	OdB
Dimensions (w×h×d)43	×11.3×24.5cms
Typical Retail Price	£90
*Sony tabe	



# SONY TC-R502ES



he *TC-R502ES* is the least expensive model in Sony's elite *ES* range, and paradoxically one of the best equipped. It is a full Dolby B/C auto-reverse deck, the rapid acting reverse mechanism triggered by an infra-red detector that looks for the tape/leader join.

In addition to the commonplace track search which finds the start point of the current or next track, a switch can be set to skip blank passages on playback. There are other 'trick' facilities too, including intro-scan, automatic rewind followed by play, record mute, 'punch in' recording (to enter record mode from play without stopping), one-finger record starts, and both sides sequential recording. The peak hold record level meter used also on more expensive ES decks, has excellent range, resolution and legibility. An electronic memory counter calibrated in minutes and seconds blinks like an old friend near end of side in the record mode.

There are two other important features. One is an easily set sensitivity adjustment to allow accurate Dolby B&C tracking. The other is Dolby *HX Pro*, which linearises recordings by holding the overall level of bias constant.

Without transcending the styling mores of the high fidelity cassette deck, the *TC-R502ES* achieves a level of perceived engineering integrity and finish that must be the envy and despair of Sony's competitors.

#### LAB REPORT

This 502 had been well set up by the manufacturer, and was tested with appropriate Sony brand tapes. Upper frequency response is par-

ticularly well maintained with Type IV metal, but overall record/replay responses were all contained approximately within a +/-0.5dB envelope which can't be bad. Prerecorded tapes will also play back with a flat response, truncated slightly at the HF end because of azimuth misalignment. Metal (Type IV) tapes on the other hand consistently gave a slightly elevated top in this recorder. Response runs with Dolby B and C showed consistently with each other and the Dolby-less response.

Sony metal gave significantly lower OVU distortion (1.7% instead of 2.8%) than TDK, at the cost of 3dB extra noise. The other tape types showed less significant differences. The noise modulation spectrum was satisfactory in the sharp definition of the centre frequency, and noise energy away from this frequency was low. The high level intermodulation test gave an extraordinarily low figure.

Wow and flutter measured well, but the 50Hz fluttergram does show numerous flutter and wow components, well distributed but of sufficient energy to suggest that some blurring of fine detail may result. In context, these are good results for an auto reverse deck (and consistent between sides by the way), but only reasonable by premium unidirectional deck standards.

#### SOUND QUALITY

The *TC-R502ES* just about qualifies as an autoreverse deck that hasn't sold out for the sake of auto reverse operation. The deck sounded crisp, alive and gave quite good stereo and tonal quality on all recommended tape types.

There was just detectable degradation with

Dolby B and C processing, in the form of a loss of impact and instrumental separation, and a slight falling apart of the sound when dealing with complex but not necessarily high level signals — full orchestral strings for example.

Metal tape recordings tended to sound a little thin and 'edgy' with some source material, but again were consistent with level. Wide dynamic range material can be handled with ease, and without noticeable compression. Prerecorded tapes sounded spacious and alive.

#### CONCLUSIONS

The 502ES is a pleasure to use and is superbly equipped with Dolby *HX Pro* and a fast acting auto-reverse that doesn't compromise performance unduly, though it doesn't have the on-rails type stability of some *ES* models.

#### **TEST RESULTS**

Recireptay response – Jub ret 1k112	
IEC Type I	<20Hz-14.5kHz
IEC Type II	<20Hz-15kHz
IEC Type IV	<20Hz-21kHz
Wow & Flutter - Peak DIN wtd/unweighted _	0.06%/0.14%
Speed error	+0.6%
Type I signal/noise CCIR/ARM 315Hz	53dB
distortion OdB	0.9%
Type II signal/noise CCIR/ARM 315Hz	55dB
distortion 0db	1.6%
Type IV signal/noise CCIR/ARM 315HZ	52.5dB
distortion Odb	1.7%
Channel separation 0VU/1kHz	48.5dB
Line input sensitivity/overload	100mV/>7V
Mic input sensitivity/overload	n/a
Line output for OdB/maximum	685mV/3.9V
IM distortion 10kHz/11kHz 0dB peak, 1kHz prod	uct0.26%
Azimuth check R-L phase at 8kHz	16 degrees
VU indication at IEC 0db	+ 2dB
Dimensions (w×h×d)	43×10.5×28.5cms
Typical Retail Price	£279

For graph references see issue No. 52

THE CONTRACTOR

# SONY (WMD6C) WALKMAN PRO

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF

he editor was insistent about this one. 'It has the best midrange in the business', he said, 'make sure it's in'. But I had already requested a sample of the memorably named WM-D6C Walkman Professional. Measuring  $181 \times 40 \times 95$ mm, it is a little larger than normal Walkpeople, but smaller than anything else, and weighs 640 gms with batteries. It feels chunky and solid, but will disappear into a good size coat pocket, no trouble. Of course, that's the idea . . .

The '*Professional*' in the same name isn't boastful imagery or wishful thinking: it's literally true. The WM-D6C is the ideal reporter's electronic notepad where quality counts, say for broadcasting purposes. It's also perfect for bootlegging . . .

Of course it's also an excellent Walkman like any other Walkman except that in this case you get something that really sings. And it's a cassette deck, or can be used as one, with all the normal facilities of a cassette deck, including switching for the usual three tape types, here labelled Normal I, CrO2 II and Metal IV (are you reading this Nakamichi?), and Dolby B and C noise reduction. There's even a third position here called 'off' which sounds even better.

One thought that occurred to me was that in many ways the WM-D6C achieves what portable CD players set out to achieve — and more. Portable CDs attempt to offer portability combined with excellent sound quality. What they actually offer in practice is clumsy, bulky software packaging (which is also extremely vulnerable by the way), much higher battery consumption; and mechanical performance that is fine, as long as the player is kept still and preferably level.

And just in case you're thinking, a DAT player with the practicality of this cassette player is still science fiction, and would be many times as expensive, even if there was any software available for it (there isn't). (Sony's new £5,000 pro portable DAT machine is substantially larger and heavier than the editor's lap portable computer, never mind his Pro Walkman). A thought, as I say.

The transport controls are cleverly packaged and allow the usual modes plus punch-in recording and cue and review — audible if you fiddle with the controls just so, but unmuted so you should watch the volume control if you value your tweeters. Or even your ears. Be warned also that auto-stop doesn't function from fast wind.

A simple mechanical tape counter is mounted at 90 degrees to the usual viewing angle and a 5-LED peak level meter (calibrated at -10, -5,0, +3, +6dB) displays the levels of the highest of the two channels, and also monitors battery condition. To save battery power, make the unit less obtrusive in clandestine situations or to improve sound quality (or all of the above) the LED can be switched off.

Other hardware includes microphone and headphone socketry, the former with a -20dB attenuator switch, and a variable playback speed pot which is active only if the quartz servo is switched out of circuit first. Naturally there are in- and outputs at line level. All socketry is based on the Walkman standard 3.5mm stereo

connectors which are dictated by the size of the player. (Phono adaptor leads are readily available.)

The Sony comes with a simple but adequate case and strap and a pair of simple micro headphones (you can buy better from Sony themselves and elsewhere). As standard, power comes from 4 MN1500/HP7AA size cells (use alkalines or rechargeables), but there are several other possibilities including various AC and car units. Sony make a wide range of suitable electret microphones too, and in the case of the *ECM-102* the deck even supplies the necessary polarising voltage.

On first acquaintance, some of the controls seem unnecessarily fiddly and/or stiff. Certainly the tape selector could have been abandoned in favour of a feeler system like other modern decks, but the main point is that Sony have simply done their best to proof the deck against accidental operator errors.

#### LAB REPORT

Overall the *Pro* produced a set of measurements that was altogether the equal of anything at twice the price designed purely for mains use. No excuses whatsoever need be made for its size or portability.

The noise modulation plot is a little noisy, but there are few discrete effects, and the centre frequency was very sharply reproduced indeed, with absolutely negligible spread which is the visible indication of drift. The fluttergram indicates moderate levels of wideband noise, plus some sub-5Hz wow. Wow and flutter was moderate to low elsewhere. Note the figures (0.12% peak DIN wtd, 0.30% u/w) which are astonishing for a portable machine, and satisfactory by mains domestic standards.

The IM distortion check gave a very low figure, 0.5% total, which means there is plenty of headroom to exploit metal tapes fully. Azimuth was satisfactory.

Integrity of the various response curves was also of the highest order, with the solitary exception of the playback only one, which dies a bit early (-3dB, 9kHz). The record/playback responses are all flat within a 1dB envelope up to around 15kHz using IEC tapes — which indicates a standard of setting up that beats most of Sony's own home recorders flat. The LF end is also well controlled. Although the 0VU distortion levels look high, the meters themselves are set high (0VU=IEC 0dB), and the signal/noise ratios are also very good. Easing the record levels slightly will restore normality.

The only point that might cause some concern is that the line output voltage is a little low, and may not drive some amplifiers fully, though hands on experience would tend to dismiss this worry. (The headphone output can of course be used instead, but sound quality is definitely inferior in this mode.) The microphone sensitivities are low too, but adequate for the electronics Sony envisage the deck being used with.

#### Sound Quality

In a nutshell, sound quality is excellent, though it isn't strictly neutral. As PM suggested, the Sony does have an extraordinarily lucid and 'hear through' midband, and this is certainly the deck's best feature. But it works also because the HF end is unusually clean and clear, and because the bass end is distinctly lightweight, and therefore avoids overwhelming the midband in the manner of much cassette equipment (and also cheap turntables). The secret of the clarity is probably the necessary simplicity of the Sony's circuitry — necessary both to fit in the box and to avoid consuming too much power. It's ironic that these measures, not directed at sound quality in any way, should end up helping to improve just that area of performance.

Noise levels are quite low and appear mostly as a thin, HF hiss. Certainly noise is low enough to allow Dolby-less recording with head-banging material. With more dynamic music, the Dolby B at least doesn't have too strong a negative influence (Dolby C clamps down on the range of the sound a little more noticeably). One intermittent snag is that tape tension over the head appears to be low, and dropout is a little more in evidence than usual.

All three tape groups were capable of making extremely fine recordings with the WM-D6C, but the ability to lay very high currents on tape, combined with excellent signal/noise and first class frequency domain uniformity meant that metal Type IV tape was able to demonstrate it's inherent superiority giving greater clarity and less HF 'squash' and modulation noise. Ironically, and entirely coincidentally of course, metal tape recordings were inclined to sound slightly 'metallic' and grainy, but this was a mild side-effect of the superb clarity. Subjective speed uniformity was even better than the numbers suggested, and held up remarkably well when the unit was shifted around.

#### CONCLUSIONS

One of the finest sounding cassette decks on the market today *regardless* of price. The fact that it fits in your pocket and works off batteries are just bonuses. An extraordinary recorder, and mandatory Best Buy material. But one minor caveat: the rumour mill suggests it is not as reliable as conventional machines — and we would hesitate to take one into the local radio shop for service.

#### **TEST RESULTS**

Rec/replay response - 3db ref 1kHz	
IEC Type I	32Hz-14kHz
IEC Type II	32Hz-16kHz
IEC Type IV	32Hz-16kHz
Wow & Flutter Peak DIN wtd/unweighted	0.12%/0.30%
Speed error	
Type I signal/noise CCIR/ARM 315Hz	55dB
distortion 0dB	3.0%
Type II signal/noise CCIR/.ARM 315H:	55dB
distortion 0db	3.1%
Type IV signal/noise CCIR/ARM 315HZ	56.5dB
distortion 0db	3.1%
Channel separation 0VU/1kHz	45dB
Line input sensitivity/overload	89mV/>7V
Mic input sensitivity/overload	_0.34mV/10.6mV
Line output for OdB/maximum	390mV/2.9V
IM distortion 10kHz/11kHz 0dB peak, 1kHz product	0.5%
Azimuth check R-L phase at 8kHz	19 degrees
VU indication at IEC 0db	OdB
Dimensions (w×h×d)	18.1×4×9.5cms
Typical Retail Price	£249

**TEAC V-200** 



eac have always concentrated on the budget end of the market, and this deck costs a mere £79.95, making it amongst the least expensive you can lay hands on, and a full £10 below the first popular price point.

INCOMMONDIA

At £80 you don't get fireworks. The transport controls are an old fashioned if practical set of power assisted piano keys. They wobble alarmingly, but they work, even allowing free movement from mode to mode without passing through stop. So the style of the deck is a bit agricultural, but is there anything so wrong with farming?

Facilities? Not really. You do get Dolby B, and tape type switching of the type that uses inscrutable permutations of two push buttons to cater for the three tape groups. Included is a mechanical tape counter, and around the rear DIN socketry parallels the phono sockets. The record level meters are very simple, with five active steps over a narrow 16dB range, plus a power status indicator misleadingly labelled 'infinity'.

The list of omissions includes a balance control, headphone and microphone socketry. There isn't even autostop on rewind or fast forward, which is practically prehistoric.

#### LAB REPORT

The story is much as it is with the other Teac decks in this issue. Distortion is high and speed stability is suspect, whilst the frequency responses are all over the shop. But there are two important differences between this machine and others in the range. One we've already discussed: it's cheaper. The other is that the measurements aren't too appalling. Noise modulation just scrapes an acceptable rating, though there is some highish mod noise around -23dB down between 20Hz-40Hz. Wow and flutter is poor, with prominent flutter components at -25dB, and a fair amount of audible wow below 7Hz.

IM distortion using the usual test is 10%, and harmonic distortion at 0VU is below 2% with a sufficiently good signal/noise ratio to make it practical to keep record levels well down. Still, this deck has a comparatively narrow working dynamic range, and as such is not well enough equipped to make much of metal tapes. The record/replay responses are almost a repeat run of some other Teac models, with Type II and IV tape being balanced to sound bright, and ferric Type I tape handled most neutrally of the lot. As you might have noticed though, nothing stirs below 80Hz. However, the playback only response is good, being essentially accurate through the midband with the -3dB point at 15kHz.

#### SOUND QUALITY

Forget the measurements, this deck works. Perhaps because it's so simple inside, the sound isn't as thoroughly processed as usual. Maybe there's another reason. Who knows?

It isn't a perfect recording machine. With ferric tapes it's inclined to sound 'woolly', and there are occasional traces of flutter and dropout. With higher bias tapes the sound comes to life, albeit with a tendency to compress and fall apart rather early at higher record levels. At other times the sound is a little jangly — incipient mistracking (I jest)? — but is otherwise surprisingly good. There is less midband, midlevel compression than usual and the soundstage remained surprisingly stable.

Transient edges are reproduced well, and the overall impression is that although this deck may not sound very expensive, it does sound fundamentally articulate, which is more than a lot of much more sophisticated decks can manage. The measurements indicate bass shortcomings, but in practice the main limitation was the waffly, blurred character that is frequently part of competing packages. Prerecorded material was handled every bit as impressively.

#### CONCLUSIONS

The V-200, as represented by our sample, offers real value for money. The only problems are that it looks cheap and nasty, and build quality really isn't up to much. The tape switching is obstructive and the metering scarcely less so. But the deck as a whole is open and honest, with less blurring of transients than usual.

#### TEST RESULTS

Rec/replay response - 3db ref lkHz	
IEC Type 1	56Hz-13kHz
IEC Type II	56Hz-16kHz
IEC Type IV	54Hz-16kHz
Wow & Flutter - Peak DIN wtd/unweighted	0.20%/0.40%
Speed error	+0.8%
Type I signal/noise CCIR/ARM 315Hz	53dB
distortion OdB	0.9%
Type II signal/noise CCIR/ARM 315Hz	53dB
distortion 0db	1.9%
Type IV signal/noise CCIR/ARM 315HZ	55dB
distortion 0db	1.9%
Channel separation 0VU/1kHz	-45dB
Line input sensitivity/overload	91.5mV/>7V
Mic input sensitivity/overload	n/a
Line output for 0dB/maximum	620mV/3.5V
IM distortion 10kHz/11kHz 0dB peak, 1kHz produ	uct10%
Azimuth check R-L phase at 8kHz	15 degrees
VU indication at IEC 0db	+ 6JB
Dimensions (w×h×d)	43.5×12×21.5cms
Typical Retail Price	1:80

**TECHNICS RS-B305** 



hilst truly mark taste gine deck can be like.

hilst standing clear of the truly low cost end of the market, the *RS-B305* gives a taste of what a sensibly engineered few-frills cassette e.

Light-touch powered transport keys include one that mutes the record circuitry for four seconds before switching to record standby. The input level arrangements consist of separate rotary level and balance controls; stereo stability during fades therefore depends entirely on the channel tracking integrity of the pot, which was OK. Crude 5-stage record level meters have coarse 5dB steps below OVU, and 3dB steps above indicated in a different colour.

A vertical row of press buttons adjusts the recorder for the three tape types, but it would have been better had this been automatic; cheaper too, probably. Dolby B and C noise reduction are selected using an awkward twin switch configuration.

Other features include a simple mechanical tape counter, a timer switcher (record or play) and socketry for headphones and two microphones. The headphone outlet is at a fixed level and is best suited to moderate or low impedance cans. The transport logic control is extremely effective in all modes, and the transport itself is a relatively sophisticated two motor type with separate drive to the reels and the capstan/pinch roller. The mechanism is smooth and quiet once it's spinning, but there is a sharp click as functions engage (or disengage).

#### LAB REPORT

There was some HF loss replaying prerecorded

tapes (– 3dB at 11kHz), much of which is due to an azimuth error calculated at around 19 degrees. The measured record/replay responses, however, were excellent on IEC Type I and II tapes, with virtually no Dolby tracking errors evident; the slightly truncated HF responses are due to the non-defeatable MPX filtering. The IEC Type IV (metal) response shape indicates very mild underbiasing.

This deck is on strong ground mechanically. Wow and flutter measures well, and spectrum analysis shows that frequency components are particularly low in level, a sure sign of a basically sound tape path design. Distortion levels are also satisfactory, and electrically the Technics seems quite clean. With better azimuth alignment back at the factory, this deck could be above easy criticism.

Recording levels can be allowed to stray several dB over 0VU (by about 3dB-5dB for each tape type) without fear of severe compression or distortion.

#### SOUND QUALITY

In a word, and taking cost into the equation, the 305 sounded excellent. Even the audio amplifiers fitted are of good basic sound quality.

Notwithstanding the slightly poorer measured Type IV performance, it was with metal tapes that the Technics sounded at its most convincing. The strongest points were fortuitously in just those areas where inexpensive cassette decks most often come adrift. The 305 had a quality of solidity and stability in its music making, a sureness of pitch in the bass and an absence of flutter-related problems that was most welcome. However, recordings made on Type I and II tapes sounded mildly flattened both dynamically and spatially: Type IV sound quality was simply livelier and more realistic. The marginally bright sound didn't seriously detract from this, but it wasn't the reason for the good results either.

There was relatively little loss of resolution with Dolby C switched in, though where noise was well masked by the music, non Dolby recordings sounded better still, followed in the rankings by those made with Dolby B.

#### CONCLUSIONS

This is an excellent deck, well worth the price premium over the true budget price models for its stable build and sound quality. Though prerecorded material sounded less good than the home-brewed variety, this is but a mild blot on an otherwise clean copybook.

# TEST RESULTS

Recircpiay response Sub rel IRI12	
IEC Type I	40Hz-15kHz
IEC Type II	40kHz-14kHz
IEC Type IV	40kHz - 16kHz
Wow & Flutter - Peak DIN wtd/unweighted _	0.075%/0.27%
Speed error	-0.3%
Type I signal/noise CCIR/ARM 315H=	48dB
distortion 0dB	0.6%
Type II signal/noise CCIR/ARM 315Hz	50.5dB
distortion 0db	0.6dB
Type IV signal/noise CCIR/ARM 315HZ	51.0dB
distortion Odb	0.8%
Channel separation OVU/1kHz	
Line input sensitivity/overload	650mV/>7V
Mic input sensitivity/overload	0.66mV/225mV
Line output for OdB/maximum	650mV/2.25V
IM distortion 10kHz/11kHa OdB peak, 1kHz pr	oduct0.18%
Azimuth check R-L phase at 8kHz	+ 31 degrees
VU indication at IEC 0db	+ 3dB
Dimensions (w×h×d)	43×10.2×23.7cms
Typical Retail Price	£139.95





Ithough the *KX-200* is constructed to an adequate commercial standard, and although the transport works with acceptable levels of smoothness and finesse, there is no excess of build quality over what is basically necessary. The controls and displays are grouped according to function, and the deck is undoubtedly workmanlike. However, control graphics are mostly a little too faint to be readily distinguishable under some lighting, whilst the record level meters simply look cheap and flashy.

The *KX-200* is a unidirectional deck with two heads and two motors — one for the reels, the other the capstan. Noise reduction is courtesy of the ubiquitous Dolby *B* and *C*. Headphones are fed at fixed level, but microphones are not accepted. The record level meters have five active steps, plus one which is permanently lit and behaves as a power on indicator.

Although basically straightforward, the *KX*-200 is well equipped, and includes track search, intro scan, automatic 4 second mutes at the press of a button, a repeat mode that will either repeat complete sides or between two previously set markers, and automatic tape type recognition. One unusual provision is a socket for an optional infra-red remote control.

Recordings may be started with one finger though you might have more trouble doing a fade with the twin rotary input pots, and pause only operates in the record mode. One nice touch: if you stop a recording by using the rewind button, the deck rewinds only the start of that recording, and is therefore either ready to start over again or replay what has just been recorded. The deck also handles 'punch in' recording by holding the play button in and pressing record/pause. (This facility is completely uncatalogued.)

#### LAB REPORT

Both metal and chrome tapes (Types IV and II) are a little underbiased on this machine, which in the case of the IEC Type II leads to a substantial response lift centred on 5kHz, but starting below 2kHz. The bass lift around 50Hz is also unusual, and is of course substantially independent of tape type. The replay only trace shows a typical Yamaha characteristic: slightly, bright in the mid treble.

The KX-200 is a little noisy, but well behaved. The noise spectrogram shows that it has a good stab at the pitch centre, with the main sideband shoulders a satisfactorily low -40dB. Wow and flutter measures rather high at 0.12% weighted; this is explained by the 50Hz fluttergram which shows -30dB harmonic flutter components at 30Hz and 40Hz. However, the overall base level of this speed instability analysis is quite low.

#### SOUND QUALITY

At its price, the Yamaha proved excellent bordering on exceptional. The basic electronics monitored *via* the system amplifiers (for example whilst making a recording) sound surprisingly un-electronic and un-processed in character. Sound quality from pre-recorded tapes was most satisfactory — indeed surprisingly good.

Much the same holds for recordings made on this deck. On the negative side there is a tendency to flatten imagery, the sound is a little soft and wayward at times, and is also surprisingly lacking in bass weight and impact, though the quality of the bass that remains is quite good. What impresses however, is the clean, open mid and top end. The softness is not terminal, and is often only heard at all on a direct A-B comparison, while the lasting impression is of a fluent likeable performer that does real justice to the music it serves.

In this instance, somewhat unusually, Type I and IV tapes provide the best match overall — the latter preferable for the utmost clarity and precision (at the cost of a little steeliness). Most good chrome bias tapes simply sound harsh.

#### **CONCLUSIONS**

Cheap, well equipped and workmanlike, sound quality is less obviously processed than usual, and altogether this is one of those decks where the whole is more than the sum of the parts.

#### TEST RESULTS

Rec/replay response – 3db ref 1kHz	
IEC Type I	<20Hz-17kHz
IEC Type II	<20Hz-17kHz
IEC Type IV	<20Hz-17kHz
Wow & Flutter - Peak DIN wtd/unweighted_	0.12%/0.31%
Speed error	+0.4%
Type I signal/noise CCIR/ARM 315Hz	48dB
distortion OdB	0.85%
Type II signal/noise CCIR/ARM 315Hz	49.5dB
distortion 0db	1.4%
Type IV signal/noise CCIR/ARM 315HZ	51dB
distortion Odb	1.5%
Channel separation 0VU/1kHz	48dB
Line input sensitivity/overload	80mV/>7V
Mic input sensitivity/overload	n/a
Line output for 0dB/maximum	538mV/2.83V
IM distortion 10kHz/11kHz OdB peak, 1kHz pro	oduct3.2%
Azimuth check R-L phase at 8kHz	+ 10 degrees
VU indication at IEC 0db	+6dB
Dimensions (w×h×d)	43.5×11.2×27.2cms
Typical Retail Price	£140

For graph references see issue No. 52

BESTELS



YAMAHA KX-400

YAMAHA ELECTRONICS LTD, YAMAHA HOUSE, 200 RICKMANSWORTH ROAD, WATFORD, -Herts wd1 715. Tel: (0923) 33166-



one of Yamaha's cassette decks could be called poorly equipped, though the 'rob Peter to pay Paul' principle can mean tradeoffs elsewhere. The trick Yamaha have pulled is to steer these tradeoffs into areas of secondary importance like finish and the extensive use of plastic body panels.

The KX-400 is an auto-reverse deck, capable of bi-directional recording and continuous autoreversing in the play mode. Dolby B and C noise reduction are fitted along with separate MPX switching. Dolby HX Pro is also included. There are many other handy features, including some negative ones like the ugly and badly scaled record level meters. A plethora of tape search features are fitted including track search, intro search, blank skip, plus phrase (aka brickwall or A-B) and track repeat. When aborting recordings by means of the rewind key, the deck returns with great precision to the start of the recording. Recordings can be faded in and out using a push button. But there's no pause mode when playing tapes (there is when recording), and no counter memory.

The Yamaha will accept an infra-red remote control handset, using an optional outboard receiver. Headphones can be connected; microphones can't.

#### LAB REPORT

Bench test performance is good. Absolute levels of wow and flutter are not up to the standards of a similarly priced unidirectional deck, but the shortfall is quite small, and the 50Hz fluttergram indicates that the misspent energy is almost randomly distributed, which is a good sign. The noise modulation spectrogram is similarly satisfactory. The major sidebands are around the - 30dB level at 44Hz, and the centre frequency is sharply defined, implying good pitch resolution.

The rather dropout-prone nature of the response traces suggests that tape to head contact could be improved. The deck is otherwise well set up except that all three main IEC tape types were mildly underbiased. The Dolby response run shows how these circuits modify the amplitude/frequency behaviour of the deck, Dolby C especially. Nevertheless, the Yamaha has clean, flat midrange responses, and head contour effects in the bass are reasonably restrained. The playback-only response rises slowly to peak between 3-4kHz, and then rolls slowly away.

Absolute noise levels are about average in relation to the distortion figures at 0VU, except that ferric Type I tapes came over as slightly noisy. Intermodulation levels were fair.

#### Sound Quality

On the whole, this is a very clean sounding deck. In all modes of use except when playing prerecorded cassettes, the KX-400 manages to sound 'airy' and 'spacious' without loss of image precision or resolution. It's not unusual for cassettes to sound cramped and monophonic, but the KX-400 offered a surprisingly tangible sound, with a soundstage that breathed, and where depth information was preserved.

It's difficult to pin down the reason for this unexpected strength on audition, but the Dolby HX Pro circuitry may have something to do with it. Several factors point towards this, for example the convincing way the deck maintains top end dynamics with lower energy ferric Type I cassettes without the usual compression.

Prerecorded tapes tended to sound a little 'plodding', apparently due to the uneven way harmonics were handled. Tapes often sounded slightly thin and bright, but the lack of real topend robbed the sound of the more subtle qualities needed to separate individual instruments and singers in complex recordings a common cassette medium shortcoming. Even here though the deck sounded OK.

#### **CONCLUSIONS**

In summary, the KX-400 is a highly commercial package featuring every widget under the sun, many of which (eg Dolby HX Pro) are of real value. Happily, it also sounds surprisingly good most of the time, and can be confidently recommended.

#### TEST RESULTS

recoreplay response Sub rel ikitz	
IEC Type I	<20Hz-17kHz
IEC Type II	<20Hz-18kHz
IEC Type IV	<20Hz-21kHz
Wow & Flutter - Peak DIN wtd/unweighted	0.12%/0.20%
Speed error	+0.5%
Type I signal/noise CCIR/ARM 315H:	47.5dB
distortion OdB	1.0%
Type II signal/noise CCIR/ARM 315H:	49.0dB
distortion Odb	0.9%
Type IV signal/noise CCIR/ARM 315HZ	51.0dB
distortion Odb	1.1%
Channel separation 0VU/1kHz	
Line input sensitivity/overload	73.5mV/>7V
Mic input sensitivity/overload	n/a
Line output for 0dB/maximum	536mV/3.3V
IM distortion 10kHz/11kHz 0dB peak, 1kHz pro-	duct1.6%
Azimuth check R-L phase at 8kHz	+31 degrees
VU indication at IEC 0db	+ 3dB
Dimensions (w×h×d)	43.5×11.2×27.2cms
Typical Retail Price	5200

# CHOOSING AND USING. CDBASED MIDISYSTEMS

usic is easily recorded and reproduced using our century's technology, yet is also easily corrupted in the reproduction. Our memories for sounds are good in many ways, yet extremely feeble in others, and in the absence of the 'real thing' we may be quite able to accept a poorlycontrived fake.

By itself this hardly seems important. If we're that easily fooled by the faking process — if we can 'hear through' failings in the reproduction process to the music beneath — why do we need to worry about the quality of the reproduction?

First although we may not find it easy to pick out the specific faults with reproduced sound, the fact remains that poor sound soon becomes tiring and unrewarding to listen to. Secondly, poor sound usually means *incomplete* sound. If musical information is missing, we're simply not hearing all the music, and again the act of listening becomes tiring and unrewarding.

It is for these reasons and these reasons alone, that pursuing audio excellence is a worthwhile exercise. For countless thousands of people, a 'hi-fi' midi or rack system has become merely an ornamental centrepiece of the house rather than a tool for playing music, because after the initial excitement had passed, there was little joy left in listening to music. This is the effect of poor sound-reproducing equipment. But there are hi-fi systems which *will* give you musical enjoyment and enduring pleasure.

#### THE CONVENIENCE

For many people interested in listening to music in the home, a packaged audio system of the type usually referred to as a midi system is the obvious choice. There is no doubt that choosing your own separates to make a working system has its satisfactions, and under ideal conditions will provide the most worthwhile and musical results. But it is also liable to end up with a rather Meccano-like appearance and wired up with 'a plateful of spaghetti,' to use Sony's memorable description.

The integrated system avoids these problems, with components of matching appearance, sometimes with a piece of furniture to subdue the 'hi-tech' look of bright chrome, control knobs and displays. Choosing a one-make system might appear to guarantee optimum electrical and mechanical matching. But appearances can be deceptive and many apparently well-matched systems (in the technical sense) are anything but.

To warrant inclusion in our test programme, all systems had to include a compact disc player, a cassette deck, a tuner and an amplifier, and many of them came with a turntable and loudspeakers too. However the choice of these components may be left to the buyer, and in other cases the manufacturer provides a range of options.

Increasingly, integrated systems are being made physically smaller than in the past. Typical component widths have reduced from 43-44cms to 33-35cm now, and this publication concentrates on the latter — hence the midi in the title. The only disadvantage the midi has against the full width system can be when using more powerful amplifiers at continuous high levels, during a party perhaps, and here the cooling capabilities can come under strain.

Not only does the packaged system approach take some of the decision making angst out of buying hi-fi, it also allows manufacturers to offer very worthwhile features such as remote control and automatic switching which are rare amongst specialist separates. The result is usually domestically both convenient and acceptable — if sometimes a little garish — and is nearly always available at a very competitive price.

#### THE COMPROMISES

When is a hi-fi not a hi-fi? The answer is surely when it makes such a mess of the music that one switches off out of boredom or irritation. Regrettably, this is all too often the case with CD midi-systems. Those included in this Best Buy Guide are a pitifully small handful of survivors from 35 we tested only twelve months ago. Many were, frankly, unacceptably compromised in our opinion — we ended up with only seven Best Buys and eight Recommended systems amongst the 35, which is a pretty poor hit rate. And many of the acceptable ones have already been rendered obsolete by this year's models. So these particular survivors have plenty going for them.

It's more or less accepted that a pre-packaged system is bound to introduce some element of sound quality compromise compared to specialist separates hi-fi — it is the price the user pays for convenience. Hi-fi at every level is a matter of compromise — it is an area where British loudspeaker engineers have been particularly adept — and nowhere is the art of compromise more important than when attempting to package a complete system at a competitive price.

But the fact remains that some midi systems are decidely more equal than others. All too often it is painfully obvious that the engineers responsible are either entirely ignorant of the consequences their decisions have on sound quality, or simply don't care. The system ends up simply as a cynical exercise in packaging and price.

Elsewhere in this Guide are a number of intro-

Reviews reprinted from CD Based Midi Systems by Alvin Gold.

ductions dealing with specific hi-fi components, in much greater detail than the space available here allows. The rest of this page will therefore concern itself with some warnings about some of the more iniquitous features and factors frequently found in midi systems — not in order to criticise those systems reviewed in the next few pages, but more as a warning to readers who might be contemplating an alternative that we haven't yet tested.

CD players are proving to be the most reliable and consistent system source. However, we did encounter a number of examples where the mechanism proved reluctant to track imperfect or even apparently perfect discs. Checking this out can be difficult, as it seems to depend on the adjustment/alignment of a particular sample rather than any general limitation applied to a specific model. However, a dealer worth his salt may well have one or two 'difficult' discs around the place to check out the CD mechanism of the system you are planning to purchase.

System cassette decks are plagued by the double deck syndrome — for a given price, two tape transports are bound to be only half as good as a single one. And how often will dubbing be required, given that the results are usually poor? The other feature to avoid is automatic level control, most of which damage the music to a greater or lesser extent. Setting record levels on a manual knob is not that difficult.

It is difficult to give general advice about tuners, as results will vary according to local signal reception conditions and the quality of the aerial. Amplifiers are usually best kept as simple as possible, so graphic equaliser tone controls are much less useful than their dramatic appearance might suggest.

Practical, useable power outputs may well be much less than those claimed, so make sure the system goes as loud as you want without undue strain.

Turntables have become the dogs of the system world. Clever automatics are no substitute for the mechanical engineering quality necessary to get decent reproduction from vinyl, and few systems stretch budgets sufficiently to incorporate any real engineering. Some systems can accommodate an external turntable source, and this is certainly worth considering for anyone with a reasonably sized record collection.

Loudspeakers vary dramatically. At best they can rival (and be sold as) budget hi-fi separates. At worst the Proms sound worse than they do on TV (well, nearly anyway). Try comparing the ones that come with your intended midi system against a pair of \$80-\$90 hi-fi speakers from a reputable manufacturer — they won't sound as good, but the result shouldn't be too derisory.

# C D M I D I S Y S T E M S

# FERGUSON HF03

THORN EMI FERGUSON, CAMBRIDGE HOUSE, CAMBRIDGE ROAD, ENFIELD, MIDDLESEX EN1 1UL.

—TEL: 01-363 5353—



espite its rather stark appearance and sombre finish alternating grey with black perspex, the good side of what passes for conservatism characterises this system best. It is low in price, but has been built to quite a high standard. Best of all, it exercises restraint where that quality is needed most — and is most rarely found. That is, for example, no graphic equaliser, an almost universal fitting elsewhere despite the fact that such circuits almost never do what is often claimed for them, and in fact invariably screw up the sound simply by their presence in circuit.

One or two minor operational difficulties aside, this is also easy enough to use to justify the 'granny proof' euphemism. The system is also well made and well finished. Note that despite the English manufacturer's name it is imported from Japan, and in fact it appears to come from the Mitsubishi stable. (The loudspeakers are exceptions, being made in this country.)

#### HF0A/6 TURNTABLE

A very ordinary belt driven auto-return player with pivoted arm and magnetic cartridge, the sole distinguishing feature of this deck is that it is found on a system this low in price. Poor as it may be compared to serious high fidelity equipment, it is the kind of deck that is more commonly found in more expensive £500 — £600 systems, perhaps with the addition of fully automatic working.

The deck ran slow and the cartridge behaved rather differently on the two channels. As it was correctly mounted from the geometry angle, this suggests a simple sample fault.

#### HF03/0 MAIN UNIT

CD players don't come simpler than the one fitted to the Ferguson. It has control buttons to open and close the loading drawer, to start and stop play mode, and to skip the beginning of the tracks. There are no track or index search facilities, no memory facility and — taking the cost of the system into account — no cause for complaint.

This operational simplicity is echoed elsewhere, the sole concessions to luxury being the twin Dolby B equipped cassette mechanisms (only one of which records), and the digital tuner with its provision for seven preset stations each on FM, MW and LW. The display shows the preset number and frequency, but the band is assumed, or must be inferred.

The display switches over a numeric scale for a slow acting electronic volume control. A little bit of cheating was noted here: the scale runs between 0 and 99, but volume levels only change at every other count, and then only until it has reached 78. On test the amplifier gave 35 watts/channel exactly as claimed.

The CD player was rather too ready to skip tracks for comfort, even on discs that appeared to be totally pristine and which gave no problems with other players. Paradoxically though, marked discs were handled rather better than had been anticipated given the problems with unmarked ones. The deck obviously suffers from selective problems with disc errors, but this is not uncommon.

One deceptively innocuous characteristic of

the tuner is that it is possible to tune transmissions in over a much wider than normal bandwidth — typically up to +/-100kHz providing perfectly adequate reception. This generally means that when correctly tuned, low distortion levels on peak can be expected. But the characteristic will not stand the tuner in such good stead in areas where a lot of transmissions are crowded close together — the overlap zone between the coverage areas of two major transmitter sites for example — where there may be mutual interference.

Other bench tests have good results. In the case of the cassette section, the record playback responses were remarkably well optimised. Had speed stability been to the same standard, the deck would have been exceptional.

#### HF03/7 LOUDSPEAKERS

The comment that was made of the turntable applies here too: this is a product which only surprises because it is found in a system so inexpensive. Based on a reasonably solid sealed enclosure, the active elements are a long-throw flat square drive unit coupled to what appears to be a metallised version of the Audax small dome tweeter - which I would judge sounds no better than the standard article. Nevertheless the HF03/7 is about an order of magnitude better than other cheap system loudspeakers. Efficiency is not high, but the amplifier has power in abundance. The speakers sound better near a wall, but satisfactory in free space - on stands of course, and preferably with the baffle covers pulled off.

#### How IT Sounds

One of the more impressive features of the Ferguson was the loudspeakers. On material that lacked treble energy they sounded smooth, full and detailed, with very good projection of the stereo soundstage and a believable musical character. The sound deteriorated noticeably on music with a lot of treble energy, at which point everything tended to become rather frenzied and 'metallic hued'. Some compression was also apparent under some circumstances, and it was always possible to find records and discs that made the speakers sound as though they were lacking in low frequency extension — which in absolute terms was the case.

But I was impressed that a relatively modest, low cost system loudspeaker could so successfully impersonate proper high fidelity standards so much of the time. Furthermore, the amplifier helped by fighting its own corner so well too: it sounded lean, clean and in control, was capable of going quite loud, and remained consistent in character whilst doing so. There was just a hint of temperament in the form of an abrasive edginess at times, and it is interesting (if fruitless) to speculate whether having a mechanical volume control in place of the electronic one would have helped. (Previous experience with other designs suggest it certainly would).

Cassette recordings were hampered by a record level meter that under-read peaks wildly, so anything in the least vigorous or dynamic and allowed to peak at the 0VU point on the meters is likely to sound grossly distorted. Happily a few practice trials will soon get over this difficulty.

What's left is very nearly a good cassette deck. It sounds unusually detailed and clear, with an

impressive sense of precision in the treble (again with a little of that rawness that so characterises the system as a whole), and well repressed noise levels. There is one snag, however, in the amount of audible 'fluttery' effects, leading to some very odd sounding cymbals and other treble rich notes. Slightly higher mechanical transport standards would cement an otherwise solid performance.

The turntable was pretty fair too. Not surprisingly it was far too microphonic for its own comfort, and if it could be made to sound a little less fierce when reproducing scratches and other surface marks, that would be icing on an otherwise quite appetising cake.

The tuner also worked well. Background hiss levels on FM were well suppressed and sensitivity was good too, though the Ferguson fell into the common trap of being unwilling to switch to mono, however weak the signal being received at the aerial socket. Fortunately the mono transition can be forced using a switch provided. The tuner sounded pretty good. A little bright and lean certainly, but no more than a little. However, AM technical performance and sound quality were disappointingly dull (in both senses) and interference prone, even making due allowances for the limitations of AM as a medium.

Which leaves the CD player. I thought this was a relatively weak performer, but paradoxically I believe this is an encouraging sign. The problem with most low cost CD-inclusive systems is that too much trouble is taken over the CD player, to the exclusion of everything else. This one is a little rough and ready sounding. It doesn't have the resolving power or transparency of a really good player, and the treble quality was definitely 'edgy'. But the rest of the system has not been under-engineered because of its presence. The only improvement that would have been valued is less of that annoying mistracking.

#### VERDICT

I've not made light of the limitation and discrepancies that became apparent whilst testing this unit. There were plenty of them in various areas. But the impressive feature of this system was the way in which it withstood this detailed examination without looking totally full of holes. Taking the cost into account — it's just under £400 all in, remember — I don't think this system can be seen as anything other than exceptional value for money. Definitely Best Buy material!

#### **TEST RESULTS**

Cost complete	£399.99
Options?	none
Size main unit - lid open, W/O projections65×33.5×	$37 \text{ cm} (h \times w \times d)$
Size loudspeakers30×20×	18cm (h×w×d)
Turntable	
Wow & flutter wtd	0.9%
Drift	poor
Speed accuracy	
Arm/cartridge resonance	too high
(<10kHz too low, OK,> 14Hz too high)	
Cartridge channel balance	0.2dB
Cartridge channel separation	2 3 JB
Cartridge tracking ability	80uM
Tuner	
Sensitivity	good
Signal/noise	good
Cassette Deck	
Wow & flutter (wtd)	0.25%
Signal/noise ref 0dB Type II	56dB
Distortion 0dB Type II	3.0%
Compact Disc Player	
Weighted signal/noise (measured at amp Tape Out)	>105dB
Amplifier	
Power output/channel (8ohms)	35 watts
(1kHz both channels driven)	
Loudspeakers	
Efficiency	fairly low





# C D M I D I S Y S T E M S

# **GOODMANS MIDI 5200**

GOODMANS LTD, 2 MARPLES WAY, KINGSCROFT CENTRE, HAVANT, HANTS PO9 135.

\_\_\_\_\_TEL:0705 486344 \_\_\_\_



he Goodmans name may be new to the systems business, but the company is well known in two related fields: they used to distribute the Japanese Onkyo brand in the UK, and they are major loudspeaker manufacturers in their own right. From the Onkyo link they have learned much about how to distribute electronics, and with their loudspeaker making skills ought to be in a position to make a somewhat better flavoured mousetrap. And this is what they've done. There's little remarkable about the electronics, but the loudspeakers, simple as they are, are way above class average.

The hardware offers generally adequate but not wonderful standards of finish, which looks best when examined from a fair distance. A trained eye can detect a variety of styling influences, including Aiwa and Fisher, but this does not apply to the CD player whose styling is at odds with the rest of the system.

You might like to know that only the CD player is made in Japan. The rest of the electronics comes from Korea, whilst the speakers are made in the UK.

This system does not offer the linked automation possibilities of centralised power switching, automatic source selection, synchronised recordings etc: instead it is essentially a group of separates in the traditional mould. Included in the package is a graphic equaliser and loudspeakers, but the CD player is optional. In addition to the GCD500S CD player tested here, a slightly more upmarket version is available — the GCD510.

#### **GSP-308 TURNTABLE**

The turntable demonstrates perfectly why separates are better than systems. It has obviously not been designed by anyone who cared deeply about the sound of records. About the only positive thing that can be said is that it isn't the only one . . .

The motor switches on as the arm is moved over the record, and an arm cueing lever is dropped to give a damped stylus descent. Arm return at side end is automatic. The arm is pivoted and the cartridge can be replaced with any  $\frac{1}{2}$ " mounting model — but beware, there is no ready means of adjusting tracking force!

The deck is lightly built and highly microphonic. Ideally it should be used alongside rather than on top of the other electronics. Note the poor measured results: the speed drift, the inadequate channel balance, the limited tracking ability, and the sharply rolled off high frequencies.

#### GST-5200 TUNER

A modern looking 3-band (FM/MW/LW) digital tuner, the *GST-5200* is fully equipped for preset operation. Seven FM and seven AM (random mix MW and LW) stations can be selected this way. The fluorescent display is clearly legible, but note the absence of almost all non-essential information, including signal strength. The mono switch facility is available on the amplifier.

No provision appears to have been made for varying the AM tuning steps, presently 9kHz, when the spacing changes to 10kHz in 1987. This could leave AM listeners high and dry, able

only to tune in very roughly to some of the stations they use.

FM sensitivity was reasonable, but background noise levels — and more damagingly a coarse grating background buzz, evidently grown by the synthesiser circuitry before being injected into the audio — were always high.

#### GSW-5200 CASSETTE DECK

This is a twin transport unit of conventional design, with just one of the transports able to record. Tape type setting is manual (cheap-skates!), but manual record level setting is possible, which is a blessing, and control feel is extremely good. Tape dubbing is at normal or high speed, and Dolby B noise reduction is available. Additional features include continuous play of two cassettes (one side each only), and sockets for headphones and microphones.

Wow and flutter measured a little high, and other tests showed the presence of an unnecessarily abrupt MPX filter, truncating the frequency response about 11-12kHz.

#### GCD-500S CD PLAYER

This player offers a very restricted range of facilities. Headphones can only be connected *via* the partnering amplifier, whilst the display shows elapsed track time or track number, but not at once. The controls are awkwardly stiff, and annoyingly play cannot be invoked directly with the drawer open. Disc handling is slow; but in contrast to earlier samples tracking performance on marked discs is much improved, and now rates as satisfactory. The deck is also well isolated from knocks.

#### GSA-5200 AMPLIFIER, GSQ-5200 EQUALISER & 5200 LOUDSPEAKERS

Tone, loudness, mike mixing and other minor controls are hidden behind a flap on the amplifier, which presents a very clean face to the world with the flap closed. Power is a respectable 42 watts/channel on test — better than specification. With tape monitor selected, the graphic equaliser can be brought into play, the active state denoted by glowing LEDs on each boost/cut control. This equalised signal can be sent to the cassette deck.

The loudspeakers are small, lightly constructed, and are fitted with a paper cone bass unit and Audax tweeter. Side panels are finished black vinyl wrap, and the front, visible with the cover detached, is painted grey and white.

#### How IT Sounds

By system standards the speakers are pretty hot stuff, but by stricter standards they're open to criticism on two counts. First, treble quality always seems to escape only just from sounding seriously harsh and distorted. Secondly, the lower midrange has a 'bloated' balance, intended presumably to make them sound bigger than they are. And at times, especially with simple recordings having a limited number of instruments and voices, it works just that way. At other times the effect is exaggerated, boxy sounding and unnatural. But they only lose a couple of brownie points for these sins, and are really much better than many system speakers.

The cassette deck was a pleasant surprise as tape recordings sounded quite good. It's true that

they seemed a little brighter and coarser than the real thing, and there was also a tendency towards unevenness, as though tape-to-head contact was varying, but also partly a matter of poor speed stability. However, the latter effect, though potentially serious, tended to recede in a matter of moments, and what was left was fairly clean, with a quite detailed and satisfying sound. Surprisingly, high speed dubbed tapes lost less of the quality of the source than usual, though this procedure is certainly not recommended.

The turntable was less good at its job. The cartridge was probably responsible for some of the effects — the coloured, flattened midband, and the limited tracking abilities, while the sound of loud peaks was obviously cluttered and distorted. But the whole deck must be blamed for giving a rather 'listless' overall feel. As expected the stereo presentation was slack — there was stereo all right, but it tended to be poorly focused and all over the place — and the deck proved very microphonic, imparting a characteristic plasticky 'quack' to the sound when provoked. The bass just sounded 'flat'.

On radio, LW and MW interference was well suppressed, but the high frequencies on these bands was restricted to telephone bandwidth or worse, and some people might consider the cure worse than the disease. FM sound quality was basically fair to average, the nature of the background noises referred to earlier setting the upper limits on performance in this case. Sensitive listeners may find the tuner not to their tastes for this reason.

Standards of CD players are improving fast. Only a matter of months ago, the Goodmans

CD player was a reasonably strong offering. Now it sounds little better than mediocre, with a rather 'grubby', 'congested' character and significant loss of information at frequency extremes. In these characteristics, it was aided and abetted by the amplifier, which was nevertheless capable of quite high and unstressed maximum volume levels. As expected, though, the sound opened up and came to life significantly with the graphic equaliser out of circuit. That device really doesn't do the system many favours.

#### VERDICT

The Goodmans' *pièce de resistance* of course is its price. On the whole the system works adequately, and it's cheap, cheap, cheap.

#### **TEST RESULTS**

Options?    CD playe      Size main unit - lid open. W/O projections78.5×35×36cm (h×w×d      Size loudspeakers    35×22×19cm (h×w×d      Turntable    0.0%      Wow & flutter wtd   0.0%      Drift   0.0%      Speed accuracy   0.0%      Arm/cartridge resonance   15Hz-too higl
Size main unit - lid open, W/O projections78.5×35×36cm (h×w×d Size loudspeakers35×22×19cm (h×w×d Turntable Wow & flutter wtd0.08% Drift008% Drift008% Arm/cartridge resonance15Hz-too higl
Size loudspeakers      35×22×19cm (h×w×d        Turntable      0.08%        Wow & flutter wtd      0.08%        Drift      poo        Speed accuracy      +0.6%        Arm/cartridge resonance      15Hz-too higl
Turntable
Wow & flutter wtd     0.08%        Drift     000        Speed accuracy     040%        Arm/cartridge resonance     15Hz=too higl
Drift
Speed accuracy+0.6% Arm/cartridge resonance15H=-too high
Arm/cartridge resonance15Hz-too high
(<10Hz too low, OK,>14Hz too high)
Cartridge channel balance1.8dF
Cartridge channel separation52.dF
Cartridge tracking ability64uM
Tuner
Sensitivityfai
Signal/noisevery poo
Cassette Deck
Wow & flutter (wtd)0.22%
Signal/noise ref OdB Type II52.dE
Distortion 0dB Type II 3%
Compact Disc Player
Signal/noise (measured at amp Tape Out)94de
Amplifier
Power output/channel (8ohms)42 watt
(1kHz both channels driven)
Loudspeakers
Efficiency very low

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HISTHU

# C D M I D I S Y S T E M S

# **SONY SERIES 90**

Sony (UK) Ltd, Sony House, South Street, Staines, Middlesex twis 4PF.



iewed from any angle (except the sides) the Sony *Series* 90 is an imposing and extremely complicated looking system. Unless you're Bang & Olufsen or a very few others, this tends to be regarded as a desirable property.

To use an expression that Sony themselves have used in the past, the system has an awful lot of spaghetti around the back. Each of the components has a mains lead, most of which plug into the AC outlets of other components. Then there are the audio connecting leads, and finally a smattering of wiring to perform various message-passing tasks to make the automatic systems (such as they are) tick. Wiring up this rat's nest won't be a problem though, no matter how ham fisted you think you are. When a system costs as much as this you can insist that the dealer gets it working for you . . .

Around the front, the system really is well filled. In every sense this is a full features product, and no attempt has been made to buffer that fact from the user. But there are automatic features too, the most useful of which is a common mains power switch which switches the entire system on and off if all the other components are left 'on.'

A number of options are available. One is the SEQ-910 9 band/channel graphic equaliser, which was included with the review system, but which can be omitted if desired — and should be if the decision is made strictly on audio grounds. Not only does it cost you an extra £119, it also helps spoil the sound, merely by its presence in the signal path.

What is supplied with the system as it stands, however, is a remote control for the CD player only, and this adds to the features of the player itself. Additionally, the turntable and loudspeakers are entirely optional, as are additional loudspeakers for the simple surround sound role available with the amplifier. The most elaborate system option is the £350 AVH910 audio/video control unit, though it was not available in time for the review. This uses SIRCS protocol to provide full system remote control, adds extra video and audio inputs surround sound capability, timer, and synchronisation of sources and cassette recorder.

All this flexibility makes the Sony a useful mix'n match product, that can be configured according to a range of requirements. You can even stack the equipment with Sony's 8mm video recorder, which itself can double as a digital audio recorder (albeit using a relatively low grade digital encoding system).

#### **PS-LX910 TURNTABLE**

The deck itself is compact, has a parallel tracking arm and is operable with the lid open or closed, but only by using the very slow acting powered shuttle keys. Fully automatic operation includes detecting whether a record is present, its size, and inferring its speed. Measured performance is right on the button.

#### ST-V710L TIMER/TUNER

The tuner is surprisingly large in these days of slimline designs, but does double as a timer. In total, the *STV710* will remember up to four sets of on and off times, and the tuner channels to go with them, over a seven day period (a sleep timer is included). The times may be one-offs or repeated weekly. As you'd expect the tuner also functions as a clock in its off duty hours, and also switches the other system components on and off. In the timer role, it would typically be used to rouse the cassette deck, which will then record a preselected radio programme in the owner's absense.

The tuner itself works on the usual three bands, FM, MW and LW, and will handle 20 presets, which can be allocated at random across the three bands. Sensitivity seemed low and noise levels abnormally high, but they varied as the aerial input wires were jiggled around because feeble spring clamps were fitted instead of a proper socket. LW wasn't too hot either, but MW was received well and sounded fine.

#### TCV-710WR CASSETTE DECK

There are two decks, one for record/replay the other replay only, but both have auto-reverse. There is a choice of Dolby B or the more powerful Dolby C noise reduction sytems, record level setting is thankfully manual, and some decent record level meters are provided for the purpose. Tape type selection is only automatic for the playback deck, being manual on the record capable deck. Dubbing is possible at normal and high speed, and so is something called RMS play and dubbing, which allows you to shuffle the pack - play back or dub tapes in the track order you specify, using a numeric keypad provided for the purpose. (The cassette being recorded pauses whilst the other deck is finding its way between tracks.)

The lab bench tests have good results apart from a rising record/replay response with Type II tape. (Manufacturers often justify rising responses on the grounds that head wear will gradually put matters to rights.)

#### CDP-103 CD PLAYER

This player is equipped with a 16-track programme memory, track/index skip, audible track scanning, a combined track/time/index display, and a remote control that provides direct track access using a numeric keypad, calculator style. The most impressive feature, however, is the amazingly fast and sure disc handling. Drawer movements are rapid, and track-find commands are as near instantaneous as any player available outside Sony's own separate CD player range. Disc tracking of this  $2 \times$  oversampling player was exemplary — it is a very

slick and accomplished performer.

#### TA-V710 AMPLIFIER

The amplifier gives a very useful 70 watts/channel and is conventionally equipped, with a well rationalised and presented set of controls, not the least of which was a massive volume control. Sources catered for include an extra tape deck and one other item *via* the auxiliary socket. Two pairs of loudspeakers can be connected.

#### **APM-22ES LOUDSPEAKERS**

The loudspeakers, which as mentioned earlier are optional, were designed in the UK using the Japanese parts bin, and are built in a Sonyowned factory in Germany. Build quality is very high, featuring softly rounded edges on the very sturdily built reflex-loaded enclosures (note the size!), and two beautifully made high technology flat honeycomb drivers.

The APM-22ES is nothing less than a *tour de force* in the midi system arena. The frequency response is clearly one that belongs to a high performance loudspeaker.

#### How IT Sounds

This system sounds very good, with well balanced abilities from all the main components, and considerable musical presence and panache into the bargain.

The loudspeakers are considerably better controlled and more neutral than early samples of this speaker, dating from about three years ago, though the B&W *DM110s* used as a reference in this project still beat the Sonys in certain areas, notably midrange punch and projection. The 22s suffer from a touch of reticence in the midband, but redress the balance with their consummate and explicit sense of detail. In the end my only complaint is a negative one: it seems that Sony have put a tremendous effort into an elaborate design that fails to improve convincingly on the cheaper, simpler and more conventional B&Ws. Quality of build and materials makes it a bargain; soundwise, it's only just good value. The optional *APM20ES* speakers offer comparable sound quality in a smaller less distinctively styled package, but at a significantly lower cost.

The rest of the system is solid in most departments, but as with other Sony systems the FM noise figure effectively sets the limit on what otherwise would have been a very fine sounding tuner.

It's difficult to get too enthusiastic about the turntable either. It seemed quite microphonic when touched gently, but got no worse when knocked quite heavily, indicating a level of mechanical damping that is probably quite substantial. That at any rate was the impression it made when playing music, but despite the lack of real aural interest, records were not badly catered for.

There are no such complaints about the cassette deck, CD player or the amplifier. The latter is hardly an outstanding success story, and there are quite modest high fidelity amplifiers around that sound considerably better. But the combination of the amplifier and the excellent sounding CD player made for serious music making. I found a level of involvement and discovery with suitable discs that simply wasn't on offer from the majority of systems tested.

The cassette deck worked well too. It made some excellent recordings off records and CDs alike, with a standard of bass to treble resolution and even-tempered clarity at all recorded levels not usual with this medium. At worst, the system tended to sound a little thin and bright, but the standards of clarity, depth and stereo focus achieved were impressive, and bass reproduction too was surprisingly potent and articulate.

#### VERDICT

There are some annoying inconsistencies (like the tuner), an.' the test system wasn't exactly fault free. But the Sony *Series* 90 has considerable under-the-skin competence, and is unusually 'future-ready' in terms of extensive options which can link and automate audio and video together.

#### **TEST RESULTS**

c1207

Cost complete	L1397
Options?loudspeakers, equaliser, turntable (all	included above). A/V
controller and 8mm audio/video	recorder (extra)
Size main unit - lid open, W/O projections87×	$35.5 \times 36$ cm (h×w×d)
Size loudspeakers51.5	×29×29cm (h×w×d)
Turntable	
Wow & flutter wtd	0.10%
Drift	good
Speed accuracy	correct
Arm/cartridge resonance	11Hz, OK
(<10kHz too low, OK,> 14Hz too high)	
Cartridge channel balance	0.6dB
Cartridge channel separation	
Cartridge tracking ability	80uM
Tuner	
Sensitivity	fair
Signal/noise	poor
Cassette Deck	
Wow & flutter (wtd)	0.09%
Signal/noise ref OdB Type II	55dB
Distortion OdB Type II	3.0%
Compact Disc Player	
Signal/noise (measured at CD player out)	>107dB
(amplifier fault prevented normal test method	od)
Amplifier	
Power output/channel (8ohms)	70 watts
(1kHz both channels driven)	
Loudspeakers	
Efficiency	medium







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**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 cart-ridge/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 (33<sup>1/3</sup> 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 driveunits 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, midrange, treble or fullrange in application, from the complete loudspeaker system which combines drive units, cabinet and crossover into a total design. **DROPOUTS:** Momentary reductions of programme level due to inadequate head/tape contact caused by oxide particles shedding off the tape onto the head gap, or inadequacies in tape transport or tape.

**DYNAMIC RANGE:** The ratio in dBs between the quietest sound that can be successfully recorded and the loudest which can be accepted without serious distortion on an average programme.

**EFFECTIVE MASS:** The inertia, or masscontrolled resistance to movement, of a device, particularly important with regard to tonearms. **EFFICIENCY:** The amount of acoustic power delivered for a given electrical input power.

**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 *funda-mental*.

**HARMONIC DISTORTION:** The addition of unwanted harmonics to a signal.

**HUM:** A low frequency interfering sound produced by break-through or interference from mains wiring or circuitry.

**IHF:** American Institute of High Fidelity, an important standards body.

**IEC:** An international standards body.

**IMPEDANCE:** Measure of resistance (and reactance) in alternating (ie audio) signals; this is of some importance in the compatibility of both cartridges and headphones with amplifiers. For convenience 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-** ( $\mu$ ): 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

**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.

**PRINTTHROUGH:** 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.

 $\dot{\mathbf{Q}}$ : 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 turn-table platters with speed drift).

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Same affects.

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