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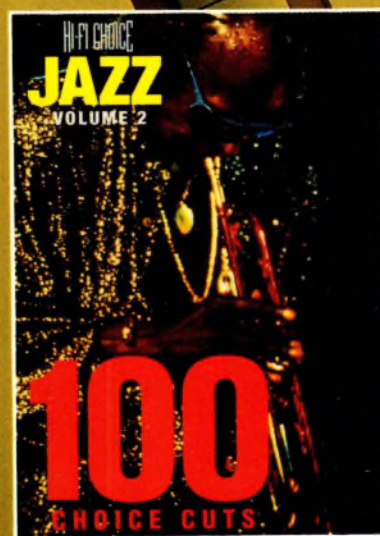
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MENU

Against all odds, this month's *Choice* brings you exhaustive tests on a whole host of integrated and pre/power amplifiers. Our reviewer, Paul Miller was working on the test project during one of this country's rare hot spells – and at one point the soaring temperature in his test laboratory played havoc with the measuring gear. We all breathed sighs of relief when, a couple of expensive repair bills later, the testing programme was finished and the reviews could be completed.

And they were completed just in time, too. Shortly afterwards, Paul Miller's house was struck by lightning and I can't even begin to describe what havoc that wreaked on the expensive equipment in his test lab. Much gear was damaged, despite the fact that during the thunderstorm Paul had rushed around the house disconnecting everything from the mains! The summer of '89 is destined to become a summer which Paul would rather forget . . .

In addition to the comprehensive amplifier tests, by popular demand this month's issue includes reviews of a small bunch of miniature loudspeakers. For many of you, it seems, space is at a premium and the smaller the speaker the better. One or two of the models we tested just about managed to deliver a performance worthy of the term 'hi-fi', but the real fact of the matter is that a small loudspeaker can never equal the performance of a larger enclosure.

Also this month, through an exclusive deal with Maxell, we're able to offer *Choice* readers one of Maxell's brand new *UDI* cassette tapes. Just fill in the card on the front cover and post it to us – and a C90 tape will be sent to you free of charge! Also, the manufacturers of Appolo hi-fi furniture have given us ten equipment tables to give away to ten lucky readers (see page 17), and included with this issue is the second in our series of *100 Choice Cuts* free supplements. This time around it's our favourite jazz recordings of all time; the next in the series, our top classical recordings, will be included free with the November issue.

In the meantime don't miss next month's *Hi-Fi Choice*, in which we'll have reviews on the latest cassette decks and a batch of 20 headphones (at prices to suit all pockets). Plus we're giving away with each copy of the magazine a booklet of money-off vouchers which you can use to obtain substantial discounts on a selection of hi-fi components and worthwhile accessories. The voucher booklet is free with the October issue which goes on sale September 8th.

John Bamford

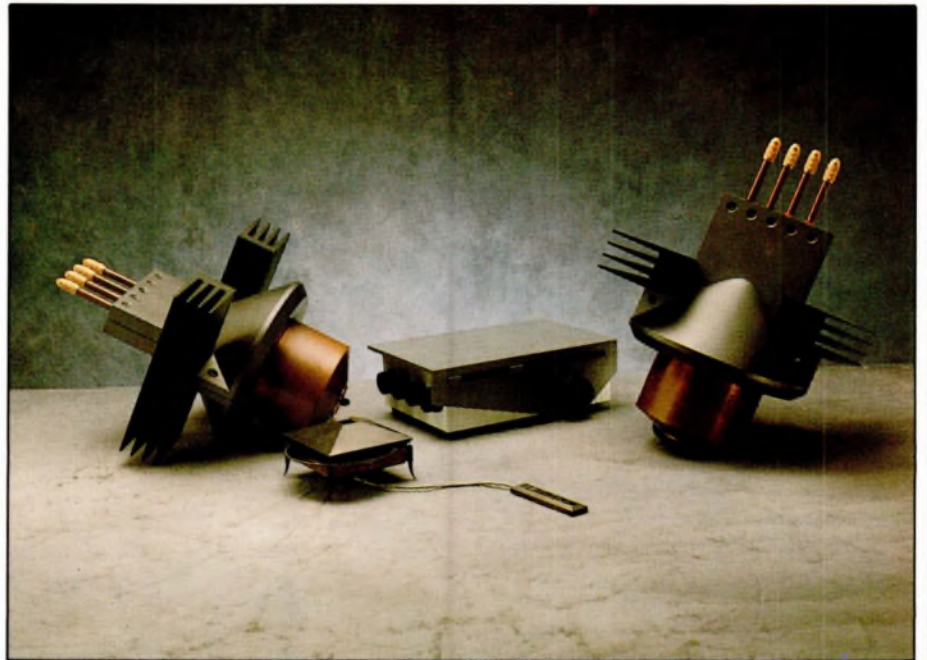


Cover photograph of the
Marantz PM95 by
Chris Richardson.

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The focus is on sound barrier nursing at EMI's CD manufacturing plant (top) while drawing-board pirates show inventiveness (top right). Choice has it taped when it comes to gifts (above). Please note UK readers only.



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READERS WRITE/CHOICE ANSWERS
Comments, questions and answers from and for enquiring audiophiles.

FREE TAPE

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Send off for a Maxell UDI 90-minute cassette totally free with this issue of *Hi-Fi Choice*. Just fill in the card on the front cover, stick it in the post and leave the rest to us.

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MINIATURE LOUDSPEAKER REVIEWS

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Before you even think about buying hi-fi equipment, find yourself a friendly dealer. Check out our listing for one near you.

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OPUS 3 COMPACT DISC OFFER

An opportunity to save money on Opus 3 hi-fi CDs, highly respected Swedish recordings of jazz, classical and world music. We are offering *Choice* readers a discount on eight discs including the Test Records 'Dynamics' and 'Depth of Image'.

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DMP CDs AND WBT PLUGS OFFER

A chance to make savings on the DMP range of audiophile jazz CDs, and cut down on your interconnect costs with special offer state of the art plugs from WBT.

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Send off for back copies of *Hi-Fi Choice* using the order form on this page.

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PERSONAL MESSAGES

An interesting experience with an Isobarik leads Paul to tell the tale.



Aspirations shows you how to hide your hi-fi and just use these wall-sensors (top left), plus the low-down on 25 amplifiers and 10 mini-loudspeakers.

Free Appolo tables (left) are being given away - see page 17.

RICHER Sounds

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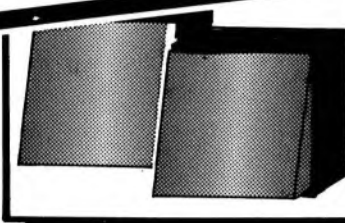
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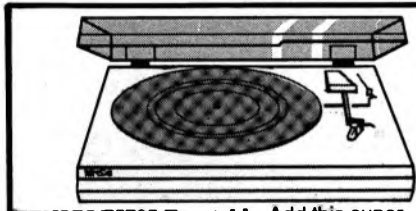
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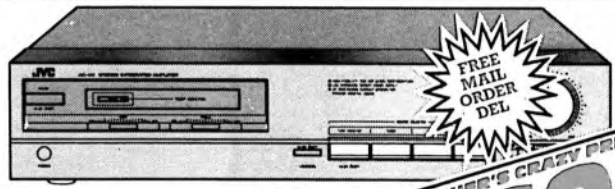
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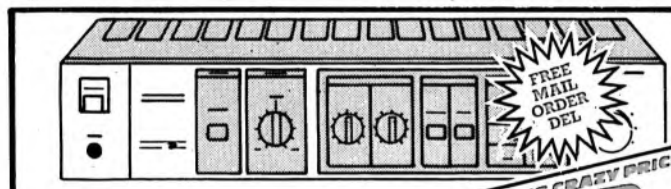
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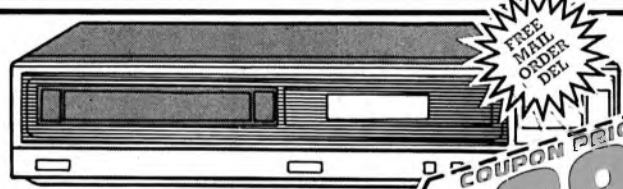
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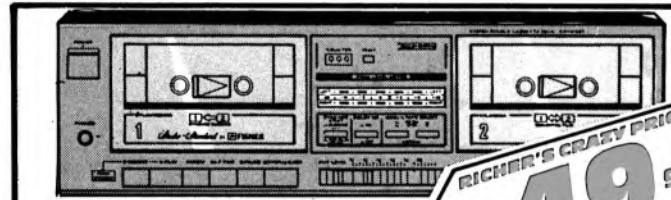
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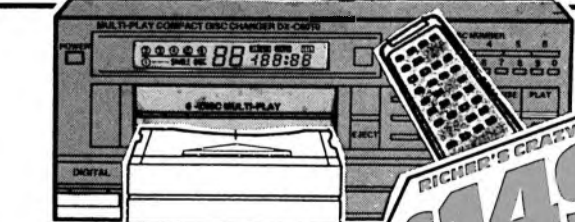
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FISHER CRW35 Cassette Deck This unbeatable value separate has all the bits for half the price! Twin cassette, touch controls and Dolby NR D.C. Voltage. (Also CRW890 £199.95, CRW891 £199.95)

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TECHNOLOGY

RECORDABLE CD

The decision over which giant Japanese manufacturer would take on the task of developing a CD recording machine has been reached, with Sony getting the job. The firm has teamed up with Taiyo Yuden (manufacturers of That's tape) to form Start Lab which will produce CD players capable of recording onto blank discs. Taiyo Yuden pioneered the technology behind the machine and will market proprietary software under the That's brand.

A CD-R price could not be verified. However, in March we quoted £700 for the player with blank discs costing about £5 each. That's importers Harman UK expect the first machines to arrive in Britain before Christmas but said the technology would only be available to professional users at first. CD-R, like DAT will therefore be dogged by unresolved copyright arguments between the record industry and manufacturers.

The machine works by using a low powered laser which will

record a musical or other source onto the blank disc. The WORM (write once read many) disc can then be used on any conventional CD player according to Taiyo Yuden.

Sony's commitment to the project puts paid to the sceptics' argument that such technology was unworkable. But whether public demand for the machine will force the companies to break up the existing copyright deadlock remains to be seen.

AN ALTERNATIVE TO THE BLACK BOX

The highly innovative Pirate Design group has teamed up with B&W to produce some of the most unusual and visually striking audio components to appear in the UK. At present only the loudspeakers, designed by Morton Villiers Warren, have been lined up for production but the pre and power amps and the CD player are working prototypes looking for a manufacturer.

Possibly the most exquisite component in the range is the Sony *Discman* based CD player which has a patinated alloy diecast case and a separate



Some said it wouldn't work: Sony is making a recording CD player to use these blank discs.

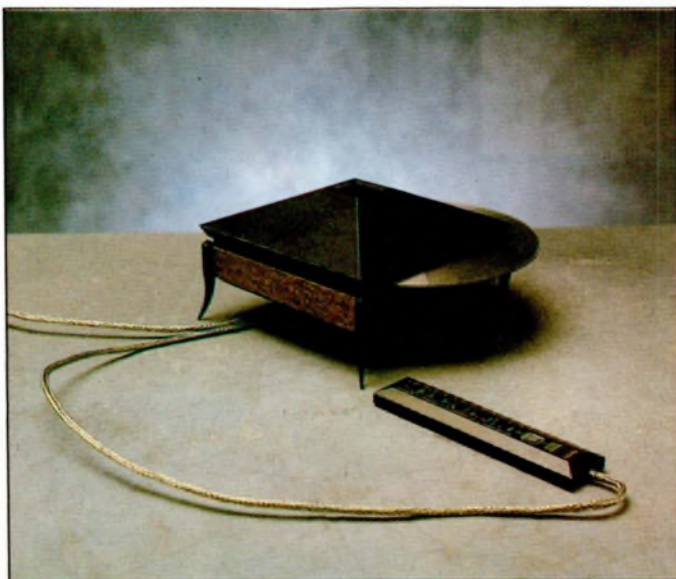
control handset. This, along with the preamp, was produced and exhibited in Japan where it created a lot of interest and may influence future Oriental audio equipment.

The power amplifier is based on B&W's *MPA1* monoblok, an export oriented product which uses GRP mouldings and spun

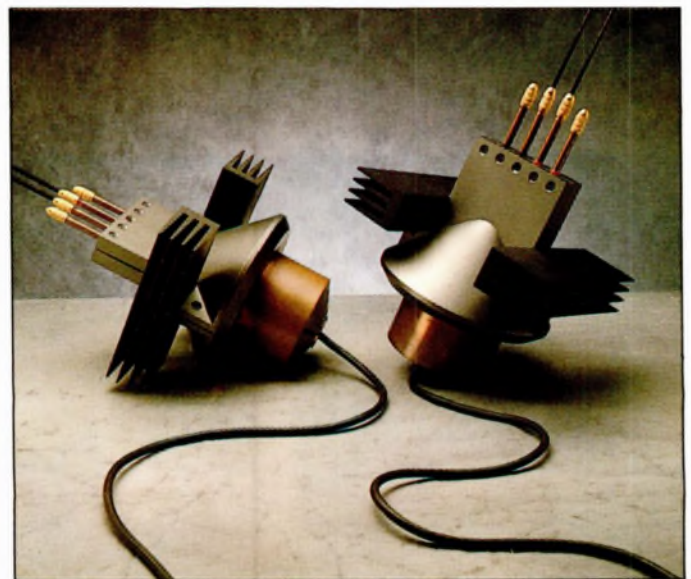
copper in its construction, whilst the preamp is housed in high quality injection mouldings.

Anyone interested in seeing and hearing the complete system should visit the new Design Museum in Butlers Wharf.

Pirate Design Associates, 30-40 Dalling Road, London W6 0JB. Tel: (01) 741 0706.



Piratical trends: a Buccaneer's CD player (above).



Would these amplifiers suit a sonic Freebooter?

PRODUCTS

TOSSING THE . . .

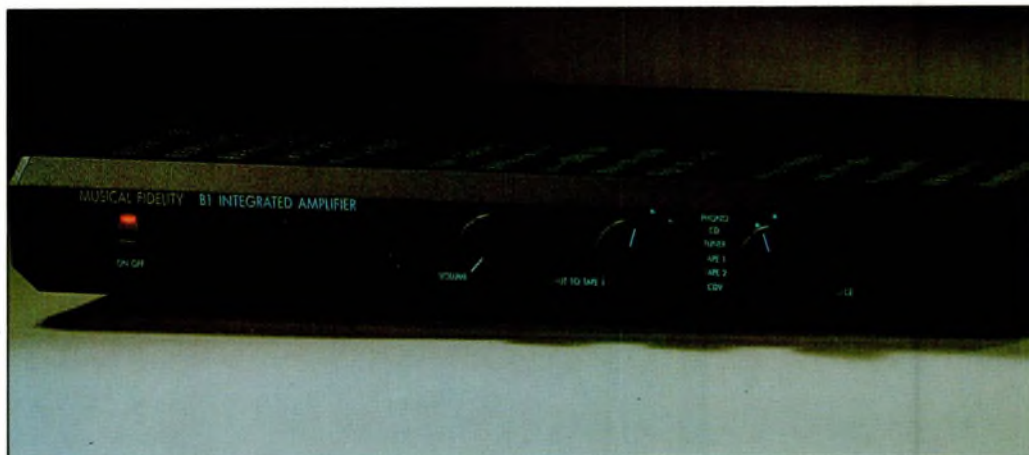
Kaber LS500 is the latest loudspeaker from Glaswegian manufacturer Linn Products. The floor-standing £989 speaker uses two specially developed five inch drivers for bass and midrange above and below the tweeter which is an 'improved design' on that used in Linn *Isobariks*. At just over seven inches the baffle width has been kept to a minimum to reduce coloration and please the eye. A frameless grille maintains minimum diffraction.

Linn is also keeping *Azis* turntable owners on their toes by introducing the *Akito* tonearm on *Azis* decks. The £149 *Akito* uses technology learned in the



Glaswegian Highlander? Linn's Kaber stands tall.

Hot but staying cool: the B1 looks like a Best Buy before it's in production.



development of Linn's flagship (flagpole?) *Ekos* arm with a one-piece headshell for added strength, and larger diameter bearing arrangement creating less friction than the *Basik Plus* tonearm.

HOT NUMBER STAYS COOL

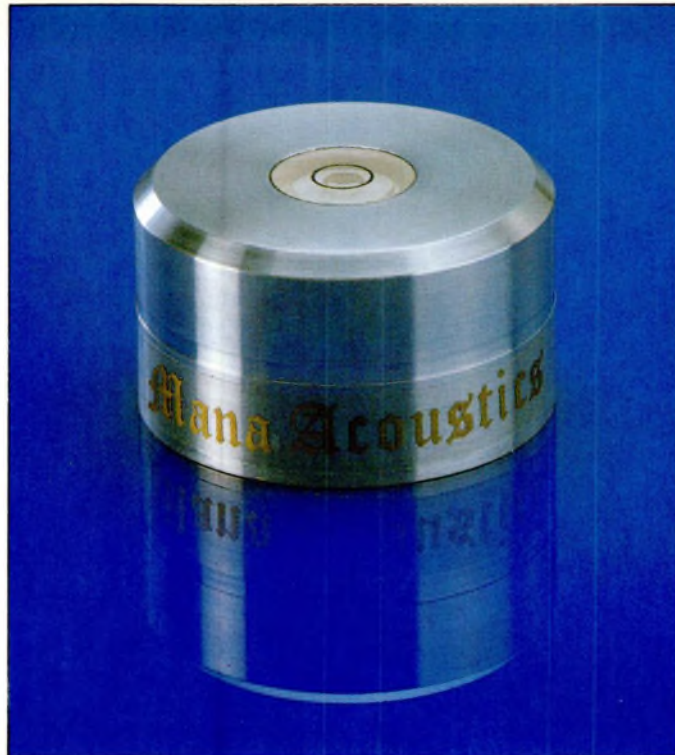
Musical Fidelity claims its new budget *B1* integrated amplifier is already sold out until January 1990. The *B1*, brainchild of audio wizard Tim de Paravacini and MF boss Antony Michaelson, was only due for launch in August but early models had received enthusiastic support from dealers and reviewers alike according to the firm.

The £200 model is an evolution of the MF style, being slim in appearance with simple controls on a bevelled fascia. Six inputs cater for the usual range of sources, including CD-Video, and the *B1* sticks to audiophile principles by having a balance control but no other gizmos such as tone controls. "Sonically," says the firm, "the sound is nearly as sweet as the £269 *A1*." However, bass performance is apparently better than that of the more expensive model and the amplifier is aimed at a customer looking for "remarkable dynamics" and a full but not too sweet sound quality.

The firm has also worked on the reliability problems which have dogged some of its other models in the past. Musical Fidelity says the *B1* will be reliable, and that from the first batch of 100 models none have been returned. And shrugging off previous descriptions of Musical Fidelity amps doubling as hot-plates, the company says this model stays cool.

MANA FROM PINNER

Not just any old angle iron is used in a new range of equipment supports from Mana Acoustics,



Turntable siting becomes a doddle with this spirit level from MANA.

based in Pinner, Middlesex. The firm has produced wallbracket, turntable and amplifier supports which are solidly welded to appeal to stringent audiophile tastes. The £175 *Mana* turntable support uses a 10mm toughened slab of glass coupled to the frame by four spikes. The frame also uses carpet-piercing spikes and weighs 10kilos with its glass top. Glass was preferred "because it integrated the sound better" according to John Watson, the designer.

Mana has also come up with an ingeniously simple turntable-siting spirit level which sits over the spindle at the centre of the platter. "Normal spirit levels can never be totally accurate because they are not at the centre," Watson explained. The £25 (£15 if you buy the table) spirit level is machined from a block of aluminium and makes record deck alignment 'a doddle'. "I've used it on many other decks and they have all been out. This is so

easy and it means records last longer and the stylus tracks better," Watson enthused.

He added that by using his turntable support one could hear an improvement in sound quality as the deck settled into its bearings after an hour of listening. "This is something we had never heard before. It's quite strange, but it sounds as if the deck is warming up!"

CHEAP TWEAKS

Audiophiles wishing to enhance the sound quality of their compact discs may find a new range of CD mats irresistible. The clear plastic stick-on roundels are marketed by the mail order firm Which Digital Tweaks, and are appropriately dubbed *500 RPM*. Richer bass and better ambience is the promised reward from these mats which cost 50 pence each. They were given the thumbs up after initial listening tests in the *Choice* office. Which Digital Tweaks, 72 Hightrees House, Nightingale Lane, London SW12 8AH. Tel: (01) 675 1691.

MORE LINX

Vega is the latest pre and power amplification combination from the Linx stable. The £425 pre and £455 stereo power units have been designed and built at the firm's Essex base and are in the lozenge style of other Linx products. Gold plated phono inputs cater for moving magnet/moving coil cartridges, CD player, tuner, video or auxiliary and two tape machines allowing dubbing between them.

WAKE UP LITTLE CD

A combined CD and cassette player has been incorporated in the latest Ross clock radio. The £200 Ross *R1 Anthem* has the company's soft-styling with rounded corners, and consists of a main unit with two 'satellite' loudspeakers. Its features allow those who need to be woken up to listen to AM/FM radio, a favourite cassette or even pre-recorded message (made with the unit's own microphone), or a compact disc.

The *R1* runs on both mains and battery and measures 33x20x10cm (wxdxh). Ross also has a new personal (*RCD-2000*) CD player which retails at £120 including a £25 pair of

headphones, and a £70 personal stereo radio-cassette player (*RW-1000*) packaged in a natty black or cream carrying case and including a pair of 'satellite' mini-loudspeakers.

LUCRATIVE SKYWALKER

Soft-selling to the younger (8 to 14 year-old) consumer is the strategy behind two cassette tapes from Memorex. The packaging on and inside the wrapping features space exploration themes for both the 60-minute *Sound Invasion* and 90-minute *Out Of This World* tapes which youngsters will find impossible to resist (if the marketing men have got it right).



Memorex homage to Darth Vader et al is suitable for In-Rocket Entertainment perhaps.



Digital dawn: the Ross clock radio/CD player.



The Linx line develops with a pre and power amplifier.

STREET BEATS

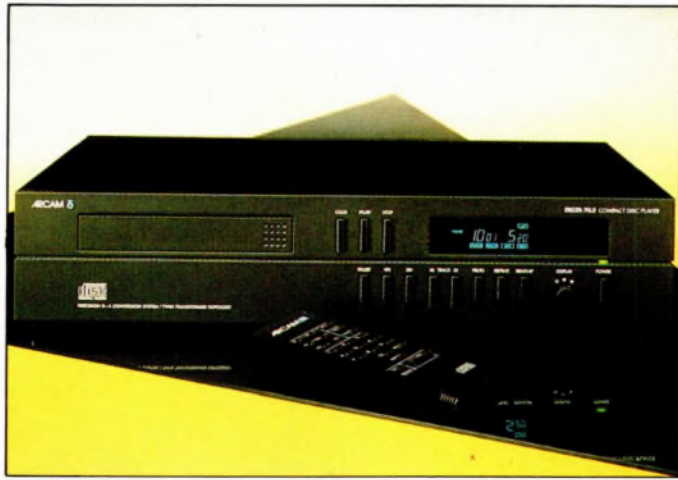
Granite grey with a dash of pink and yellow is the colour combination for a new range of personal and portable stereos from Philips in July. Dubbed the Moving Sound range these teen machines are priced between £15 and £100. The innovative styling includes a lightweight triangular personal radio (£18) and a bazooka-style stereo radio cassette recorder which offers twin high speed dubbing facilities with continuous play and a built-in microphone for £70.

PLUGGING AWAY

Thorough design and attention to engineering principles are behind a new RCA plug from Quantum Audio, of Kilmarnock, Ayrshire. The patented gold-plated phono plug uses two sprung brackets to give better overall contact and maximum conductivity with the socket. The bracket extends within the body of the plug to clamp the cable with 18 tiny teeth, which Quantum says does not deform a cable's shape and eliminates clamping or impedance and capacitance errors.



Quantum plug: conforming to energy physics at £60 for four.



Button-down style and electronics from the Arcam stable.

SPEAKER'S CORNER

They say the Japanese are crazy about this new folded horn loudspeaker system from Vitavox. And not surprisingly the firm exports 80 per cent of its 1940s-style loudspeakers to the land of the rising sun. System 191 (pictured) houses a multi folded bass horn which uses the walls and floor of a room for the development of sound; listeners sit inside the horn. A second dispersive horn caters for high frequencies above about 700Hz and you will need two of these massive (100 kilos) cabinets if you want stereo. Superb sound quality with a frequency range between 30 and 18,000Hz is the promised performance.

The 191 is finished in Walnut veneer with gilt ornamentation

and costs £2,500 per mono unit. All you need is a Bakelite telephone sitting on top to be 40 years out of date!

PAIR OF CARVERS

Two new American Carver CD players have arrived in Britain to complement and match the existing range of amplifiers and tuners. TL-3300 and TL-3100 are priced £695 and £340 respectively. Both are remote control models featuring Bob Carver's Digital Time Lens, said to 'restore the lost ambience and balanced response originally intended by the musician' which is often missing from digital sound reproduction systems. The 19-inch Carvers are therefore touted as being sonically accurate.

The more expensive model is a

high-resolution 18-bit eight times oversampling player with dual digital to analogue convertor chips – one for each stereo channel. TL3100 is a plainer 16-bit, four times oversampling design.

EVOLUTIONARY MODEL

Arcam has upgraded its Delta 70 CD player with the Delta 70.2. The £550 70.2 is slightly more expensive than its forebear but retains much of its simple and ergonomic styling. A headphone socket goes, but a better remote control handset (including volume and direct programme entry) and a claimed better sound quality combine to make this a more capable product. Twin power transformers cater for digital and analogue signals and the 16-bit four times oversampling machine boasts ten separate regulated power supplies and S1 Crown precision digital to analogue convertors.

SWELLING MARANTZ RANKS

Marantz has given us details of its early Autumn line-up of separates equipment which will complement or replace existing products in the range. A tuner, an integrated amplifier, two CD players and three cassette decks promise the combination of build and sound quality which make the Marantz range hard to beat in terms of value for money.

BUSINESS

SORE SARAY

Saray Electronics, a London chain of Hi-Fi dealers, has been fined £50,000 for contempt of court after disgruntled customers complained to the Director General of Fair Trading. Two directors of Saray, Vashi and Naraindas Tulsiani were also fined £10,000 each and sentenced to three months imprisonment suspended for two years, the latter's involvement being related to another firm – Audio Marketing. On July 6th Bloomsbury and Marylebone County Court heard that the firms' branches had sold equipment which was not as described or fit for its purpose, and had failed to carry out proper repairs; repairs had taken too long and customers hadn't been properly reimbursed.

The prosecution also said that 'Saray and its directors' had verbally abused and physically threatened customers. This was in breach of the Sale of Goods Act and Saray's own undertakings at

the same court in 1978. Judge Martin QC concluded that customer complaints had been treated with contempt and that the 'firm's conduct must have been the result of a deliberate policy or extraordinary negligence on the part of the directors'. Saray was involved in a similar case in 1985 resulting in a £1,950 fine.

SHOWING UP

Diaries at the ready; here are details of the Autumn UK hi-fi shows.

The first will be held at the Penta Hotel, near London Heathrow airport over the weekend September 16th/17th. Entry is free and a coach (also free) will take visitors from Hutton Cross tube station to the hotel.

The National Sound and Vision Show '89 once more takes place at the Last Drop Village – a brisk walk out of Bolton in Lancashire. The show runs from noon on Friday, October 6th, through Saturday and Sunday and is open until early evening. Over 50 manufacturers will be showing off the very latest in audio, video and in-car entertainment. Entry costs £1.50.

Cloney Audio, the specialist Dublin dealer, is sponsoring its second 'informal' show in the Irish capital over the weekend October 21st and 22nd. A corridor of rooms at the Jurys Hotel, Dublin, will be used to present the public with a variety of separates systems through ascending price ranges – from a (typically) Rega based set-up to the likes of a Well-Tempered system. Entry premium: £2.

This side of the Irish sea will see the more established Edinburgh Hi-Fi and Video Exhibition running over the same weekend (October 20th 22nd) at The Post House Hotel in Corstorphine Road near the zoo. The free-entry show promises many exhibitors with new products. Details: (031) 220 1535.

Hi-Fi Choice and Zeus Audio are jointly sponsoring the Northern Ireland Hi-Fi Show at The Stormont Hotel in Belfast over the first weekend in November. The show is in its second year following an enthusiastic reception in 1988.

GOOD FOR BADA

Dealers from up and down the country gathered at the Botanical Gardens in Birmingham on the last Sunday in June for the first 'BADADay'. The British Audio Dealers' Association, with some 100



The imperial loudspeaker – designed before Indian independence.

specialist members, presented awards to manufacturers and industry personalities at a charity dinner supporting the Nordoff Robins Music Therapy Centre for handicapped children.

Categories from Charge Card of the Year, to Most Reliable Product Range were awarded according to the votes of the specialist dealers and their staff.

The dealers' favourite hi-fi magazine was *Hi-Fi Review*. Assistant Editor Ian Rankin collected the award saying: "this just proves that some people read and like comics!" Favourite journalist was Ken Kessler who writes a column in the industry's trade magazine *Private Eye-Fi* (among others).

Linn Products got the vote for the Best Manufacturer Advertisement while AT Labs won the Best Dealer Advertisement. Dealers had voted for their favourite source, amplifier and loudspeaker. Awards went to Linn Products for the LP12 turntable, Arcam for its *Alpha Plus* amplifier and Musical Fidelity for the MC2 loudspeaker.

Choice sponsored the Most Reliable Product Range award which went to Quad. The Charge Card Award sponsored by Lombard Tricity Finance was won by Welsh dealer Audio Excellence. BADA's favourite marketing back-up company was Linn Products while the Best Service Department plaque was given to Quad. The dealers' preferred company representative was Steve Reed, of Cambridge Audio, while their Industry Personality of the Year was Mike Lewin – BADA's full-time officer. The Trainee of the Year, referred to as 'The Someone Who's Come A Long Way Award' by Dave Hills of Retail Training Services, went to



Making a DIN is hopefully not the case at this new salon for sound.

Paul Oakman, formerly of AT Labs and now at Teac. The Most Professional Supplier Prize went, unsurprisingly, to Linn Products.

By this stage dealers and their wives had finished their coffee and only two more presentations remained before the Steve Gibbons Band took over the proceedings. The first was a £1,000 cheque for the Nordoff-Robins Music Therapy Centre representing a token starting figure of the money to be raised at the evening and from the sale of manufacturers' donated equipment. A second £1,500 cheque was given to Yehudi Menuhin School violinist Malcolm Allison to help him study at a Canadian University.

Allison had to play for his supper and the formal part of the occasion was rounded off with a

spellbinding violin recital.

SHOP WINDOW

Changes on the specialist retailing front this month belie the rumours that no-one is spending money on hi-fi

Marylebone in central London boasts a stylish new hi-fi shop which aims to appeal to people who are put off by the 'hi-fi buff' approach but who are nevertheless keen on a good sound. DIN is in Melcomb Street (NW1) offering names including Arcam, Roksan and Mission alongside a few orientally-produced ranges such as Nakamichi and Denon.

Also in London, The Listening Rooms, Old Brompton Road, will open in early September offering "surprisingly cheap to surprisingly expensive" systems according to the owners. Paul Tam and John Oliver, former managers of KJ Westone, have over 30 years' retail experience between them and can cater for purist or multi-room equipment demands.

Bournemouth has a new dealer – The Audio Shop – in Poole Road, Westbourne opening in early August. Sound Principles, in Queen Street, Wellingborough, Northamptonshire, offers home demonstrations and installations of a range of equipment including Ariston, Marantz, Mission, Nakamichi and QED as well as others.

Mid Shropshire Audio has expanded into new premises in Holland Court, Dawley, Telford. The shop has two demonstration lounges and was due to open for

business in mid-July.

Meanwhile Dorchester Hi-Fi has taken on the Esoteric Audio Research (EAR) range of amplifiers, and The Music Rooms in both Manchester and Glasgow are now stocking SD Acoustics loudspeakers.

The enthusiast's quarry, ATC Loudspeakers are now available in the northern part of the country – from Lakeland Home Music on the shores of Ullswater, near Penrith in Cumbria. Only the sixth dealer to get the ATC franchise, LHM runs musical weekends where customers can listen to a variety of systems while staying in the comfort and spectacular surroundings of the dealer's home.

Audio Counsel, of Oldham in Lancashire is holding three musical evenings in September to coincide with its own refurbishment. The Arcam Roadshow calls in on Thursday September 7th, followed by a demonstration of Naim Audio products on Thursday September 14th and Linn Products on Wednesday September 20th. Further information/tickets (061) 633 2602.

The Cornflake Shop, Windmill St, London, holds a free Monitor Audio musical evening on August 21st with the new *Reference 1800 Gold* and others. Tickets: (01) 631 0472.

COMPETITION WINNER

Our second Marantz CD7511 compact disc player has been won by Mr D Simpson, from Chatham in Kent.



BADA personality Mike Lewin hands singer Ruby Turner a cheque for the Nordoff-Robins Music Therapy Centre.

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It may seem presumptuous, therefore, to compare this ancient tradition with the art of reproduction found in an Aiwa cassette deck.

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Its many features include the Dolby HX Professional System, which improves recording quality on all tapes; the unique AMTS compartment, which reduces distortion; gold-plated terminals for perfect transmission.

So we have a paradox which any student of Zen would appreciate; because, to perfect the art of "copying," Aiwa engineers have had to make a whole series of original breakthroughs.



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CHOICE SESSIONS

Things we hear... This month, CEDAR Audio salvages historic recordings; auditioning Shan Shimna loudspeakers and Beyer DT990 Pro headphones; and ten Appolo hi-fi tables are waiting for good homes.



CEDAR Audio: removing the crackles with the help of a powerful desktop computer.

cated one – three of its five full-time staff are performing musicians. General Manager Gordon Reid and Senior Engineer Simon Godsill kindly took time out of a busy schedule to show their work to me.

In any system like this, the recording is digitised by a digital audio recorder and then copied digitally onto the memory disk of a powerful desktop computer. The computer runs a program and processes the recording, which can then be re-copied to digital tape and played back conventionally. Simon Godsill explained why this type of process is advantageous.

“What we are trying to do is remove as much hiss, click, thump and crackle as possible from old recordings, without damaging the music signal in any way. Conventional analogue techniques are limited in scope and add distortion and noise. Digital techniques, properly applied, don’t do this. The other big advantage of digital processing is that it doesn’t have to work in real time – it can look forwards and backwards at the recording and can take as long as it needs to process the signal.”

The CEDAR process works in three stages. First, thumps (low frequency spurious noises) are identified and removed. CSR is careful to distinguish between crackle and hiss – crackle consists of many clicks in rapid succession, while hiss is a continuous signal. Finally, the hiss is removed to leave, one hopes, the music, still bandwidth limited and possibly distorted (though they’re working on that one), but no longer buried in noise.

Not surprisingly, CSR was unforthcoming on the precise details of how the system works, but Simon did say that the thump and click removal processes are the most innovative and that the hiss removal is based on standard techniques, suitably modified for audio by CSR. Other systems sample hiss in ‘quiet’ passages and use this as a model to separate music and hiss throughout a recording. Does CEDAR work similarly? Yes, but it does more than just that and can adapt to changing noise characteristics throughout a recording. Clicks are recognised as something that doesn’t fit the patterns of speech or music in a recording, and are replaced with something that does and that matches the surrounding music signal both locally and on a wider scale.”

I ventured to suggest that no such system could be completely without drawbacks – surely there must be a compromise point reached where the processing starts to impinge on the music itself? Gordon and Simon agreed, and stressed that the final arbiter of a satisfactory result was always listening, both by them and by the customer. Interestingly, CSR has to reject many tapes

THE IDEAL RESTORATIVE?

Richard Black investigates a new system for revitalising vintage recordings.

Hi-fi, I suppose, fulfils two intrinsically separate purposes – home entertainment and, perhaps more importantly, historical storage of musical events that can no longer be repeated. The latter service is invaluable to music lovers everywhere, but just think about what we have lost – every note Paganini ever played, for instance.

These days it’s possible to record music to quite a good approximation of reality, but there exists a large ‘grey area’ (roughly, 1890 to 1950-odd) during which time recordings were made that are tantalisingly flawed in their reproduction of artists’ thoughts. If some magical process could be devised that recovered more detail from old recordings, the legacy of the period would obviously be much enhanced.

Magic is out of fashion just now, but for some time people have been looking at computers as a possible rival to magic for improving the fidelity of early recordings. Recordings originally made on cylinders, 78 rpm records and the first tape recorders tend to be noisy, bandwidth limited and distorted, and over the years may have become dam-

aged, all of which comes between us and the performances. It’s tempting to try to improve matters by removing some of the limitations of such recordings, thus easing the listener’s task in working out what is going on. To an extent this can be done by conventional methods such as filtering, but using digital computing techniques on digital copies of old recordings opens up whole new areas of possibilities.

To my knowledge, the first commercial application of such a system was the notorious ‘Soundstream’ reprocessing of some Caruso recordings, at least ten years ago. Last year saw the introduction of Sonic Solutions’ ‘NoNOISE’ technique, and this year probably the most sophisticated system yet was launched by British company Cambridge Sound Restoration, a.k.a. CEDAR Audio.

Some three years ago the National Sound Archive (part of the British Library), which possesses an invaluable collection of old and rare recordings, approached Peter Rayner of Cambridge University’s Engineering Department with regard to developing a computer system for restoring old and damaged recordings. By the beginning of this year the work had borne fruit, and in March CSR was ready to offer its services to the record industry and archives. CSR is a small company and a dedi-

sent for processing as being too poor, because the transfer to digital tape hasn't been carried out properly. Most record decks used for playing 78s are of less than audiophile standard and suffer in particular from low cartridge tip resonance, and early tape recordings are often played back using the wrong equalisation or at the wrong speed. On the 'Garbage In Garbage Out' principle, systems like CEDAR work best with the minimum of added problems due to inexpert transcription.

I sampled one of the first CEDAR-treated recordings; Holst's 'Planets' Suite on PRT, conducted by Boult in 1954. Noise is certainly low, but some modulation artefacts are also audible and the original transcription (apparently from third-generation tapes) is far from perfect. More persuasive was a brief 'before and after' demonstration of CEDAR used on two jazz recordings from the late 1920s. Noise was reduced quite remarkably, and although some modulation noise was still audible the system obviously has impressive potential. I shall await further issues and developments with keen interest.

TIN CANS

Jason Kennedy gets to grips with a Pro version of Beyer's classic DT990 headphones.

Way back in February '88 *Choice* tested the Beyer DT990 and even went so far as to recommend it, ranking it alongside Sennheiser's top of the range HD540 as one of the most transparent dynamic phones in that test.

The standard 990 is equipped with a plastic headband and built-in adjustable strap, which in turn has swivel connections to the phones themselves. It's here that the professional version takes a different approach. The 990 Pro has a two-part sprung steel headband connected to adjustable swivelling steel yokes. The band itself is wrapped in a removable padded strap.

Given that these tweaks only add £10 to the price of the standard 990 I wouldn't be surprised if the Pro started to outsell its parent. It looks considerably more serious and would take a lot of effort to break – a valuable asset if you have small children.

In traditional headphone terms the Pro is an open backed, dynamic design, which in layman's language means that the driver is a traditional voice coil and cone type and the backs of the phones are vented, allowing sound to get both in and out. The advantage of open backed phones is that they create a more 'out of head' sound and are generally more transparent than their closed backed brethren. Of course the disadvantage is that external noise can be heard which in a professional situation may be a drawback.

Ranking alongside sound quality as a criteria for 'can' selection is long term comfort. However good they sound and however low the levels of distortion, all will be in vain if the ears get too hot or bent in the process of listening. The 990s are circumaural, ie the earpads should rest on the side of the head and not a part of the ear. However you do need small ears for them to fit perfectly, although the soft slightly furry pads are reasonably comfy if they don't. The pressure exerted on the ears is fairly high but this is a

near universal problem in headphone design so you'll just hafta grin and bear it. Overall the 990 is a little better than average in the comfort stakes.

I checked out sound quality using the QED headphone amplifier brought in for next October's headphone review project. It was hooked directly to an ADC CD player using both Quantum and Tara interconnect, and the AKG K280 was used as a reference. My initial impressions were of a tonally well balanced headphone with perhaps a hint of mid forwardness and attractive bass extension. This was an area where the 990 Pro easily outdid the AKG, which sounded relatively bright and only a little more open in comparison. Listening to an old test favourite, *Strings Cf Steel* by Michael Hedges I got the impression that transients were being slightly softened but bass notes came off particularly well, displaying nice shape and depth, whilst the steely zing of strings had an almost tactile quality.

Listening to more natural acoustic recordings a slight loss of life was noticeable, quite

a subtle effect that is hard to put one's finger on and one which was significantly reduced when a different interconnect was tried. In fact the improvement in detail retrieval brought about by a fairly subtle cable upgrade was quite distinct.

I also gave them a spin with a Stax dummy head recording, a headphone oriented CD which has some bizarre effects on it, the most impressive being the way sound always seems to be outside of the phones. The 990s managed to reveal information either side of and behind the head but not in front. Another revealing bit of music turned out to be Yello's *Flag* album which showed off the 990's rather tasty bass extension quite effectively.

All in all the Beyer DT990 Pro is a very capable dynamic headphone that has been ruggedly designed and should prove durable in both domestic and professional situations. It would be nice if they were a bit more comfortable long term but as I've said this is still a rare thing to find in a headphone. What more can I say? The standard DT990 is good but I feel the Pro version is better.



BIG LITTLE SPEAKERS

New cabinet materials make for small loudspeakers capable of a big sound. Jason Kennedy takes a look at the Shan Shimna.

Back in February we ran a report on the Belfast hi-fi show, a cosy event organised by Zeus Audio. One of the more interesting new products that turned up there was the Shan Shimna loudspeaker. What is unusual about this speaker is the material from which it's constructed – polymer concrete. But have no fear this particular mix bears little or no resemblance to traditional concrete, rather it has a very smooth and slick finish that's more like plaster. It's said to be more rigid than concrete and is undoubtedly superior aesthetically.

In its standard form the Shimna doesn't have a grille cloth but I believe they are available. The baffle (if it can be called that) is the same matt black finish as the rest of the speaker and the drivers comprise a four inch polypropylene mid/bass unit and a soft dome tweeter held in place with allen head bolts. It has a narrow rear firing reflex port and there

Beyer DT990 Pro (above): one of the best dynamic phones around.



Shan Shimna: polymer concrete cabinet designed to 'disappear'.



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are four binding posts for bi-wiring or parallelamping.

On the wiring front the *Shimna* is fussier than one might expect, initial listening being carried out with a fairly thin good quality solid core cable which gave quite impressive results. However, I subsequently tried using Audio Note *ANSP* – a high quality stranded silver cable which produced an unappealing shoutiness and bass boom. I was surprised at how well they worked with Paul Messenger's Naim *NAC A4* cable during his listening tests. Mark Fetherstonehaugh, the boss of Shan's distributors Audio Dimensions, confirmed my wiring findings saying that there's a Shan cable in the pipeline. In the meantime he lent me some Tara cable which is made up of four single core strands and thus eminently suited to bi-wiring.

Support-wise there are some tailor made Shan stands constructed of the same material as the speaker and which are aesthetically a vast improvement on metal stands. However, I didn't have a pair of these so some heavy two pillar Foundation stands were used instead. Because the Shan's base isn't square the top plates of these stick out either side of the speaker, a bit ugly but functionally acceptable.

Listening to the *Shimnas* one is immediately struck by their ability to sonically disappear and leave a large tactile soundstage that extends well above and to either side of them. On the June blind tests it was interesting to note the panellists' surprised expressions when the curtain was dropped to reveal these diminutive speakers – even the great man himself thought that they were considerably larger boxes. However, this impression doesn't last through everything one plays as they do maintain a sense of scale appropriate to the recording – the more information of the imaging nature that's pumped in, the more they reveal.

Due to their relatively small internal volume bass extension is inevitably limited, but if they're positioned close to a wall and partnered with reasonable equipment they can reproduce enough bass to make most types of music sound feasible in terms of bandwidth. Musically they don't have the naturalness and dynamics of my reference Snell *III*s, but at a third of the price I'd be very surprised if they did. However, they are very revealing and if the rest of the system is on song then the *Shimnas* will give you a better than usual idea of what it's feeding them. They manage to avoid sounding overly 'punchy', or clinical and are only subtly coloured, the lack of a resonant wooden cabinet helping in this respect.

Compared to other good small speakers they are quite neutral and lack the midband emphasis of models like the *LS3/5a*, and are rarely flustered by complex material. Having used them in several different set-ups I've learnt to look further back in the system when the sound gets a bit out of control or boring, because that's where the problem will lie. Give them something with life and vitality and you'll not be disappointed in the results.

If you're after an elegant small loudspeaker and have faith in your system you could do a lot worse than trying a pair of Shan *Shimnas*. Seek 'em out.

For further information telephone Audio Dimensions on (0232) 655135.



TEN FREE APPOLO AT1 HI-FI TABLES UP FOR GRABS!

Those awfully nice folk at Appolo have supplied ten *AT1* equipment tables which we're giving away to ten *Choice* readers this month. The Appolo *AT1* is a two-shelf table with carpet-piercing spikes at the bottom of the legs to hold it rigid, while the top shelf sits on four upward facing spikes to help isolate your turntable or CD player. These spikes can be

adjusted to assist accurate levelling of the top shelf – essential if you're using it as a turntable support.

To win one of these tables worth £55 all you need do is complete the entry form below, answer the simple question, and return it to the address shown at the bottom of the coupon. Closing date is Monday September 18th. The first ten correct entries drawn from our mailbag on that date will each win an Appolo table.

The ten prizes: One Appolo *AT1* table

The question: *How many spikes are on the Appolo *AT1* table?*

4 8 12 (*Tick one box*)

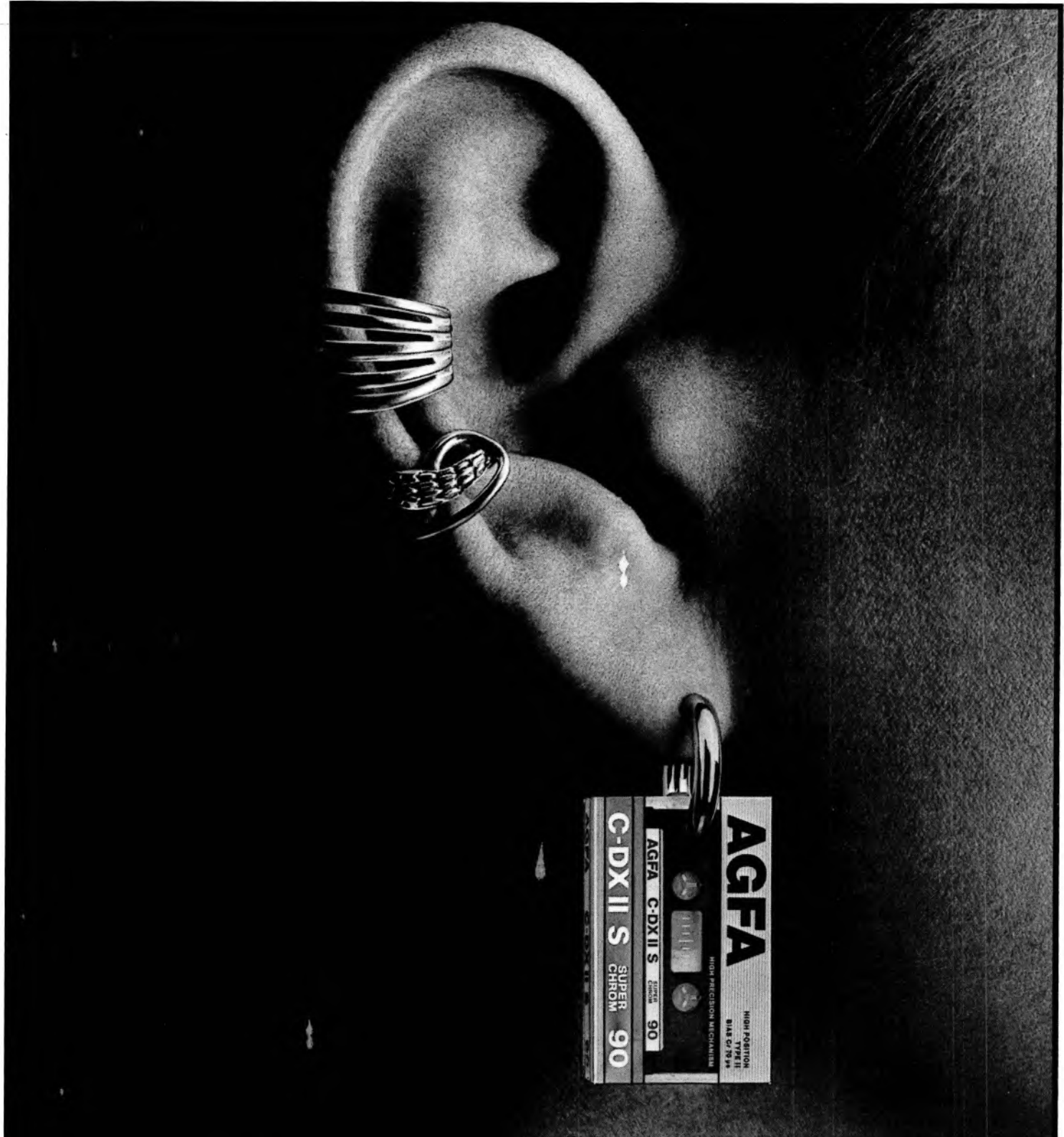
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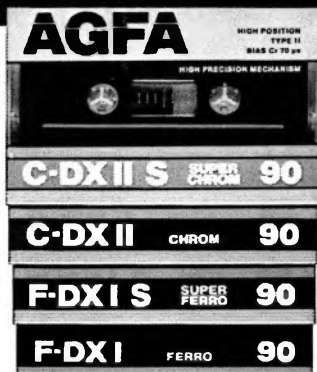
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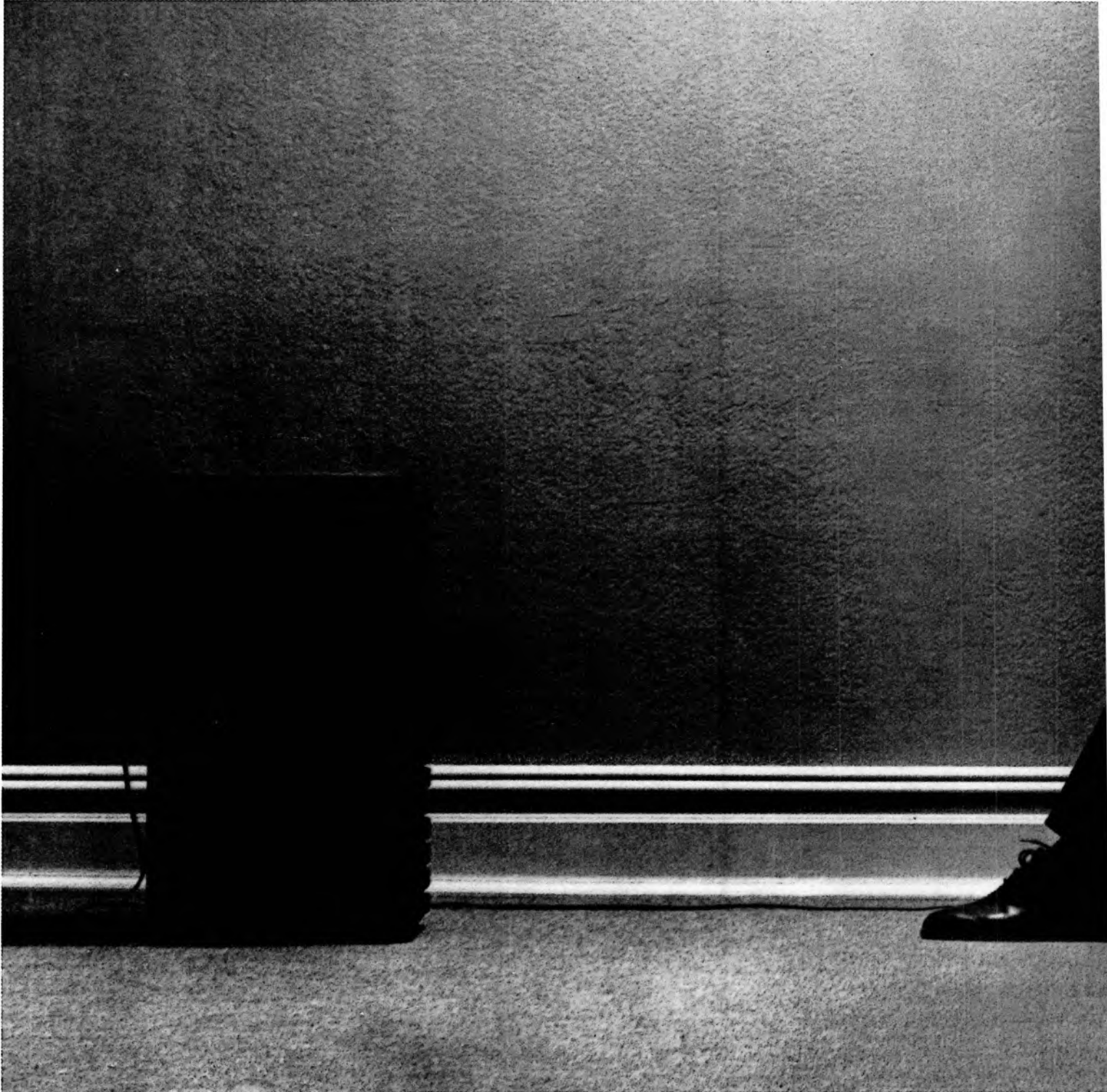
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Tel: 0332 290419
Cameo Cameras,
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Tel: 0332 371513
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Tel: 0332 293634
Jessop Photo Centres,
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Tel: 0302 341323
S. J. Clear & Co.,
Dorking.
Tel: 0306 883340
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Tel: 031 229 9854
Fisher Photographic,
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Tel: 0252 713116/724476

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Tel: 041 248 2457
Jessop Photo Centres,
Gloucester.
Tel: 0452 300689
Cameo Cameras,
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Tel: 0476 73221
Greenford Photo Centre,
Greenford, Middx.
Tel: 01 578 0256
Photofinish, Halesowen,
W. Midlands.
Tel: 021 585 5021
Jessop Photo Centres,
East Precinct, Hanley,
Stoke on Trent.
Tel: 0782 286621
Vic Odden Photographic,
Henley, Oxon.
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Fine Records,
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Jessop Photo Centres,
Hull.
Tel: 0482 226956
Jessop Photo Centres,
Ipswich.
Tel: 0473 210436
J. & H. Russell
(Kidderminster),
Kidderminster,
Worcester.
Tel: 056 22686
Jessop Photo Centres,
Kingston on Thames,
Surrey.
Tel: 01 546 5622
George L. Robertson,
Lancaster.
Tel: 0524 32045
Jessop Photo Centres,
Leeds.
Tel: 0532 430900
Jessop Photo Centres,
Leicester.
Tel: 0533 556468
Jessop Photo Centres,
Leicester.
Tel: 0533 530121
Soni (Leics) Ltd,
Leicester.
Tel: 0533 666136
Televiradio (Shetland) Ltd,
Lerwick, Shetland.
Tel: 0595 3209
Christophers Ltd,
Lichfield, Staffs.
Tel: 054 326 3535
Jessop Photo Centres,
Liverpool.
Tel: 051 709 7887
Vic Odden Photographic,
London, SE1.
Tel: 01 407 6833
Vic Odden Photographic,
London, SE1.
Tel: 01 407 8447
Sound Plus Vision,
Manor Park, London, E12.
Tel: 01 478 1745
College Camera Centre,
Walthamstow,
London, E17.
Tel: 01 527 4633
The Cassette Shop,
London, EC2V.
Tel: 01 606 4102
Jessop Photo Centres,
London, EC4.
Tel: 01 626 1021
Jessop Photo Centres,
Finchley Road,
London, NW3.
Tel: 01 794 8786
Selfridges, Audio & TV
Dept, London, W1.
Tel: 01 629 1234
Ramsons,
London, W2.
Tel: 01 724 2373
Jessop Photo Centres,
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Tel: 01 240 6077
Vic Odden Photographic,
Maidenhead, Berks.
Tel: 0628 22275
Jessop Photo Centres,
Manchester.
Tel: 061 834 8132
Jessop Photo Centres,
Middlesbrough.
Tel: 0642 230707
The Cleveland Camera Co,
Middlesbrough,
Cleveland.
Tel: 0632 210814
Jessop Photo Centres,
Newcastle Upon Tyne.
Tel: 091 261 8280

Fenham Photo Ltd,
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Jessop Photo Centres,
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Tel: 0604 230490
Jessop Photo Centres,
Nottingham.
Tel: 0602 418586
Cameo Cameras
Warehouse, Nottingham.
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Jessop Photo Centres,
Norwich.
Tel: 0603 617724
Jessop Photo Centres,
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Jessop Photo Centres,
Peterborough.
Tel: 0733 558728
Jessop Photo Centres,
Plymouth.
Tel: 0752 672287
Jessop Photo Centres,
Plymouth.
Tel: 0752 669282
Jessop Photo Centres,
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Tel: 0202 676289
Jessop Photo Centres,
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Purley Cameras,
Purley, Surrey.
Tel: 01 668 6363
Jessop Photo Centres,
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Tel: 0734 508755
Salisbury Studio,
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Tel: 0753 693094
Alternative Audio Limited,
Solihull, W. Midlands
Tel: 021 742 0248
Jessop Photo Centres,
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Tel: 0785 213679
H. Telecentre & Co,
Stapleford, Nottingham.
Tel: 0602 399997
Jessop Photo Centres,
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Tel: 091 5100881
John Frost Limited,
Sutton Coldfield,
W. Midlands.
Tel: 021 354 4206
Jessop Photo Centres,
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Jessop Photo Centres,
Taunton, Somerset.
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Parlett, Ullapool,
Rossshire, Scotland.
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P. Claridge,
Walsall Wood, Walsall.
Tel: 0543 373023/373207
Photofinish,
Walsall, W. Midlands.
Tel: 0922 645837
Walton Cameras,
Walton on Thames.
Tel: 0932 246346
Jessop Photo Centres,
Winchester.
Tel: 0962 53982
James Beattie PLC,
Wolverhampton.
Tel: 0902 22311
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Wolverhampton.
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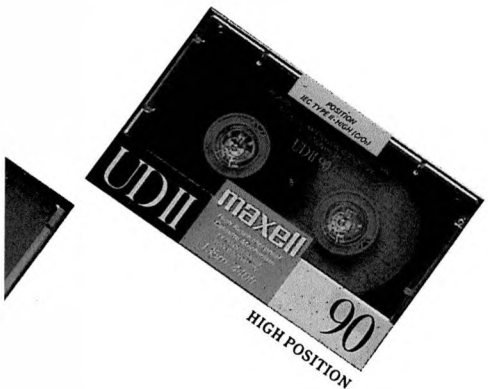
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ASPIRATIONS

Around the house hi-fi offers a flexible alternative to separate systems in different rooms. We look at a Meridian system which is one of the best in terms of sound and sophistication.

Words: Dan Houston. Pictures: Chris Richardson.



The Meridian Line

This month's hi-fi in the home feature aims less at the aspiring purist audiophile than the music lover who nevertheless wants a hi-fi sound throughout his (or her) house.

During May's blistering hot spell we visited a house in the Rother Valley in North Sussex as a welcome break from the confines of a hot city office. The house belongs to Bill and Linda Angell, the 'A' of AGI which owns KEF Loudspeakers, Meridian Audio, Boothroyd Stewart and Design and Cambridge Product Design as well as several corresponding concerns in the States.

Meridian has developed the *200 Series* to make through-the-house hi-fi an aesthetic reality, with switching and control units



linking sources and speakers. And following the principle that if you buy some you'll sell some, the Angells are among the first to have their four-bedroom home kitted out with a comprehensive system to give flexible programming and re-programming of music or radio sources throughout.

The 1920s house has been extensively renovated to give it a Tudor aspect, with imported oak beams recycled from dismantled local barns. Oak furniture, some of it 17th century, adds to the 'old farmhouse' theme, although the refectory table and chairs in the dining-room have been reproduced, again out of ancient oak beams, by Deacon and Sandys of Cranbrook, in Kent. Polished oak floors in the dining-room and drawing-rooms offer a

cooler alternative to carpet in hot weather, though in the dining-room the diners' feet rest on a huge antique Persian wool and silk carpet.

The hallway has been opened up and visitors step straight into the living-room which also houses the nerve centre for the hi-fi – cased in an American wooden cabinet. The room is mainly used by the Angells' three children, allowing parental control of the next door drawing-room. The glass fronted cabinet opens to reveal the main Meridian system (there is another 'local' source in the drawing-room) of a *CD207* CD player, *204* tuner, Denon *D1800* record player, Meridian *201* preamplifier and a pair of Meridian *205* power amplifiers. A television is sited in a separate

enclosure which also houses CDs and records.

The set-up is AV (Audio Visual) compatible and videos can be heard in stereo sound, which through the KEF *C75* floor-standing loudspeakers (positioned either side of the cabinet) is a vast improvement on the television and brings a cinematic reality to films. With the door open the sound drifts out to the little terrace in front of the house. This system then sources separately powered outlets in the kitchen, dining-room, drawing-room and the main bedroom and bathroom upstairs.

It's all made possible using Meridian's (*222*) control box and (*223*) power supply which are linked with cable to infra red sensors situated in each room. These sen-

sors (model 221) are known as 'Smart' wall panels and feature natty little pushbutton controls similar to the remote handset or equipment fascia. They are 'smart' (as opposed to naive) because they allow comprehensive programming, with the display showing the status of up to three systems allowing choice of source, volume, standby, pause, track and preset numbers and setting-up data. You can use the wall-panels themselves or do all this with the infra red handset. In effect you'd only need to touch the main equipment to change the disc.

In each area loudspeakers are driven with pairs of Meridian monobloks, taking the signal from the control or junction boxes. Volume is controlled locally (increasing the level in one room does not increase it all over the house) using a (model 221) three input preamplifier designed for the 222 control unit.

There are eight 205 monobloks priced £425 each! Customers might consider this extravagant especially when you consider the cost compared to the function; do you really need that amount of power and definition in a room such as a kitchen which is using less than state of the art loudspeakers for instance? Steve Hopkins, Meridian's sales director, who was present as a technical expert during our visit, explained that normally a cheaper Meridian 226 stereo power amplifier would be used but that the model wasn't finished when this installation was carried out.

The lounge features a mock inglenook fireplace with a couple of replica muskets hanging above it. At the other end of the room the base of a Welsh dresser houses another Meridian CD 207 with a pair of 205 power amplifiers slung underneath powering the massive KEF 107 loudspeakers. Here one can listen to the CD player while the rest of the house listens to something else on the main system. Or you can use the relay facility to listen to the source playing on the main system.

The drawing-room is also used as a gym by Bill Angell who gets up at five in the morning to exercise using a bench and weights. (So that's what you have to do when you've got your own company!) The bench had been removed in anticipation of our visit but when photographer Chris Richardson tried to move the chest containing all the weights he nearly put himself on the hernia operation waiting list.

Another antique oak linen chest supports a Sony Trinitron television faced by the two sofas. Hi-fi listening is therefore either 'off axis' or with your back to the speakers. However, this is not an important factor to the Angells who prefer to fill their house with sound rather than sit shut-eyed in a favourite chair trying to delimit the sound stage qualities.

A pair of Meridian D600s transduce the living-room source in the dining-room. These (fairly new) digital loudspeakers are the only Meridian models used in this

home – the rest are from KEF. The D600s are floor standing and active, with three on-board power amplifiers dedicated to the drive units. An onboard DAC (digital to analogue convertor) means that signal can be taken straight from the digital outlet of your CD player, although the active speakers also have a conventional analogue input. The main system can be remotely controlled through these speakers which feature a liquid crystal display and infra red sensor. The only other bit of 200 Series kit used here is a junction box.

The kitchen is at the back of the house overlooking a wooded slope and the garden. Oak cabinets have been covered in floral pattern paper, varnished and re-varnished to create a lacquered effect. On top of these, two Meridian 205 power amplifiers feed a pair of diminutive KEF C15 loudspeakers with enough power to make one think: 'overkill'. However, the sound in the kitchen is also of hi-fi quality and not just a relay substitute for the main system.

In the bedroom and bathroom KEF Custom Series loudspeakers have been mounted into the walls. These flush fitting loudspeakers are something to leave in place as are the remote sensors and they will probably be sold along with the house should the Angells ever decide to move. "Once you have that 222 box anything can be put on the end," said Steve Hopkins, "you can even put a midi system on it if you want to be really crass!"

The original alarm clock radio in the bedroom has been replaced by a pair of CR 200 loudspeakers supplemented by a pair of CR250 (bass bins) installed in the gabled ceiling above the bed. "We never wanted the radio on before because the sound was so bad," said Linda Angell. Wired to the 204 tuner/timer the couple now wake up to Chris Tarrant on Capital Radio which, with reasonable sound quality, is their optimum way to start the day.

Another pair of CR200s has been mounted into the bathroom wall along with a natty splashproof control panel



Original oak beams in the drawing-room provided the inspiration to beam the rest of the house, such as the dining-room (below) where the elegant loudspeakers can be remotely controlled.



Music in the kitchen (right) is sourced from the main system (bottom) and controlled by a smart wall panel (below).



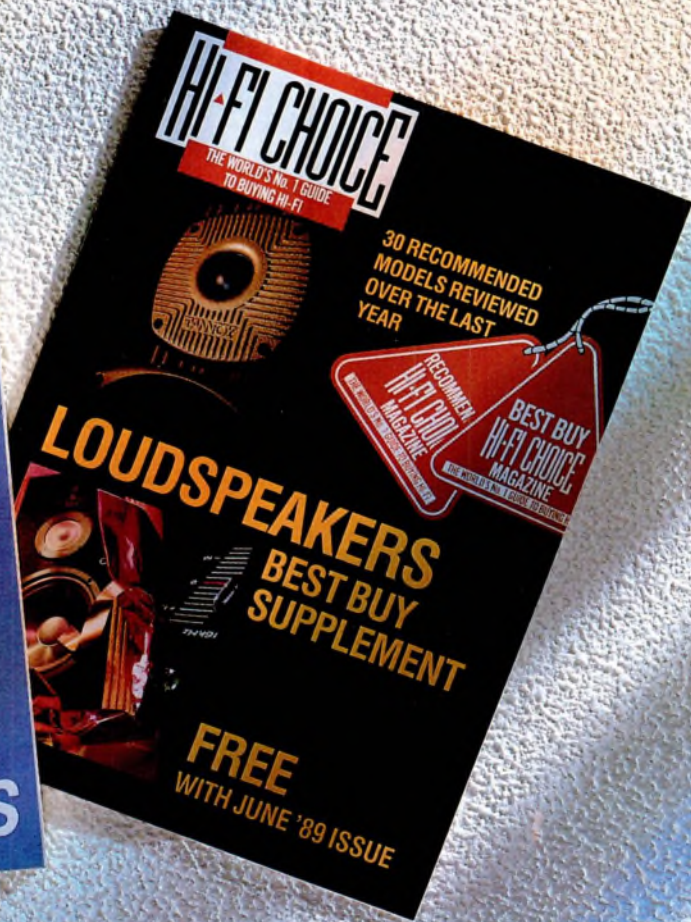
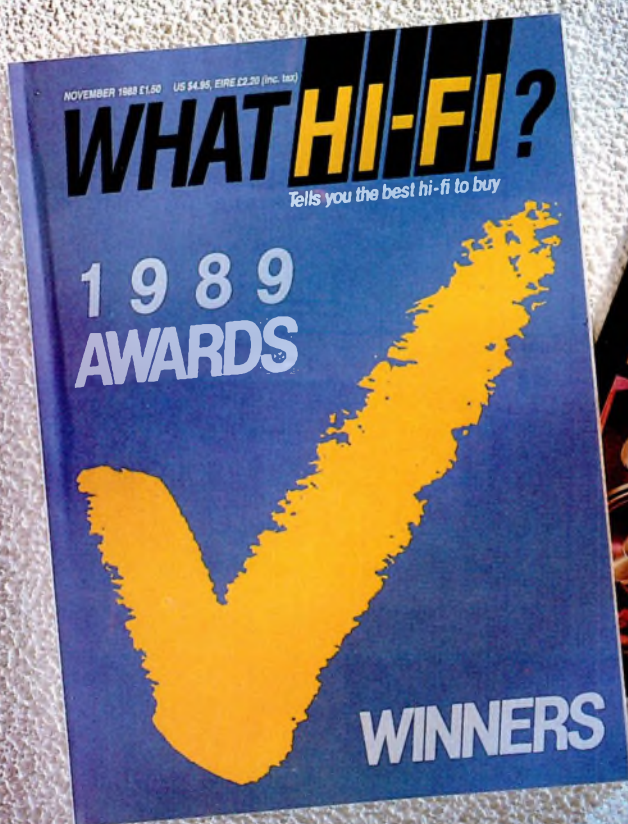
(model 220) which again allows full control (volume, source track or station selection etc) from its light-switch size face. A QED loudspeaker switching unit, described as "a bit agricultural" by Mr Hopkins, allows the sound in these areas to be heard together or in either the bedroom or the bathroom. The system is remote controllable using the 209 handset - which bounces off the bedroom wall so you don't have to crane around to point it at the sensor next to the door. Wiring is hidden and the amplifiers are placed in the rafters above both rooms.

This installation took the Meridian team four and a half days to complete. Steve explained that the lengthy task had been wiring the house to hide all but the shortest links of speaker cable. "People should realise that to set up something like this is not an 'in one day and out the next' job. Ideally it would be done as part of redecorating or building work. Of course, if we can get into a house which is being built then the hassle is negligible." Meridian is also quite firm about the need to use a qualified engineer to carry out such an installation; Steve Hopkins pointed out that even if someone was able to purchase the necessary equipment he would not benefit from the service and back-up available from appointed dealers.

So far such installations have been carried out by Meridian engineers but dealers are being appointed and trained to the company's standard. At the time of writing only three were offering Meridian 200 Series systems, namely Hampshire Audio, of Chandlers Ford; Grahams Hi-Fi, of North London and In Hi-Fi, of Edinburgh.

And the price of this set up? Around £17,000 including labour according to Steve Hopkins.

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FOCUS ON...

John Seabury follows up his article on CD manufacturing with a visit to EMI to report on the procedures for testing compact discs.



CD Testing



In view of those scare stories about disc-life and manufacturing standards, I felt it would be useful to take a look at the degree of effort that goes into CD testing, and see for myself just what tests are carried out. My guide round the EMI factory – and through the technicalities – was Alan McElroy, Technical and Quality Assurance Manager for the CD operation.

CD testing is a complex subject, drawing on disciplines from statistics to materials science, and there are many *levels* of testing, some being done hourly, some every three months. Some are there to pass or fail production discs, while others are used to 'calibrate' the manufacturing process. A third category is the 'environmental' testing or accelerated ageing of discs – very much in the headlines last year.

On paper at least, Alan's task is simple – to make sure that CDs leaving the factory meet the 'Red Book' standard laid down by Philips. Among other things the standard says that 'no audible defect' should be introduced during manufacture. However, this *doesn't* mean box after box of technically perfect discs, but that there shouldn't be anything on the final disc that your CD player can't handle.

As well as block errors (interruptions to the digital stream which can be completely reconstructed), the Red Book allows for some 'interpolation' (or intelligent guesswork) where bigger chunks of information are missing. And no disc can be *perfectly* concentric. So the error-correcting circuitry and tracking servo in your player can expect to work for its living!

To start at the beginning of the chain, all master-tapes handled at Swindon come via Abbey Road studios. And here is illustrated some of Alan's basic quality assurance beliefs – that each section should routinely re-check the work of the previous section, as well as making sure their own work is up to par. However, the chances of Abbey Road making a slip in the PQ coding must be slim!

Each master-tape is *listened to*, and analysed, as are the first CDs pressed from each CD master-disc, even though the master and stampers will have been through rigorous checks. For example, the glass 'substrate' from which the master disc is made is checked for 'scratches, bubbles and inclusions'. Anything over ten microns diameter (1/100th of a milli-

metre) would cause rejection. And the tolerance on the photoresist layer is a mere 0.005 microns. That's 1/200,000th of a millimetre, or in Alan's words "four-fifths of zero!"

The developed and silvered master is checked on a Digital Master Player; a measure called 'symmetry' indicates whether pit length is correct, and digital errors are measured. Block errors are allowed but there must be *no* interpolation at this stage. If the peak block error rate (BER) is 20 counts per second or more, the master has to be scrapped.

"The proportion of masters scrapped is in single figures of per cent," Alan says, "but note that we test *every* master we produce, where some manufacturers don't feel this is strictly necessary".

And how far below the limit should the masters really be? "The difference between a count of 5 and 15 would never be audible. However, the lower the figure, the more margin there is in the later stages."

Before going into stamper-making, the master is inspected for splashes or pin-holes in the silver. Anything over 50 microns could translate to the final CD, so is rejected.

With the nickel 'father', there's room for interpretation. The Red Book specifies 200 microns as the cut-off for blemishes, but sometimes EMI rejects metalwork which is well within specification – on *cosmetic* grounds. Some technically-harmless defects can lead to a slight blotchiness in the CD. "Customers have a very high expectation of the product," says Alan, "and we aim to make our discs uniformly glossy."

So to the nickel stampers. The back of each stamper has to be polished to a high degree to prevent bumps on the playing side of the moulded CD. The smoothness can be measured very accurately, but this *isn't* done routinely since the head which traces the undulations actually touches the back of the stamper. Therefore from time to time the check is made on stampers which have been rejected for other reasons. Stamper eccentricity *is* routinely monitored though.

Another as-and-when test is the 'stamper ductility test', which involves grabbing the sturdy handle of the bend-tester to see how many times you can bend a stamper through 90 degrees before it fractures. The



answer should be 11 to 13. Occasionally stampers are also pulled out and tested for hardness. To promote high-quality metalwork, the metal bath solutions are checked daily for pH and surface tension, and filtered continuously to remove particles above 0.2 microns.

So to the press-shop, and because this is an ultra-clean area, there are daily checks on the air-flow and the air cleanliness. It was certainly a novelty using my medium-format camera gear while dressed in a full protective suit, including surgical-style gloves and face-mask!

One of the biggest problems with moulded discs is stress in the disc. An optical property called bi-refringence is a measure of this stress, and throughout production there are checks on the bi-refringence reading. The discs' centre holes are checked for cleanliness, and discs are viewed under a 'strain viewer' to check for moulding defects like 'cold slug' and 'black spot'. Sounds more like *Gardener's Question Time*, doesn't it?

Testing on the metallising process is done off-line, and from time-to-time, staff check the adhesion of the aluminium layer to the disc using a 'cross-cut adhesion tester'. A grid of one-millimetre squares is cut into the aluminium layer and the technician then applies Scotch tape (Type 810, to be precise!) and counts the number of squares removed when the tape is peeled off.

At the lacquering stage, it's important the aluminium is completely covered but if the lacquer is applied too thickly the disc can become 'dished', so periodically, flatness is checked, as is the adhesion of the lacquer to the aluminium. Lacquering is a clear example of 'more haste, less speed'. As Alan McElroy points out, "if you're



Optical centring of a stamper during the mechanical finishing stage (top), and the daily check on air cleanliness in the press shop.

Left hand page: inspecting a stamper using an Olympus optical microscope under clean-room conditions.

going to make CDs, you *must* understand the technology. You can't rush CD production".

At the end of the production line is an automated laser-scanning machine. Where every single disc is tested, the read-out side being scanned for optical defects. The machine sorts the discs into three piles – 'yes', 'no' and 'possibly' – with the latter being re-tested for a yes/no decision.

"Our reject rate is less than 10 per cent, explains Alan. "On a good day it's a long way under 10 per cent, and on a bad day it's not far under. One in ten thrown away may *sound* a lot, but you have to look at the standard being met," he continued. The good discs go off to printing and packaging, and Alan is keen that the standards applied during manufacture are maintained in the packed product.

A vital part of EMI's test procedure are the checks which the Quality Assurance section carries out. Approximately every hour and for each moulding machine, samples are taken from the end of the production line.

In QA, the discs are played on £15,000 Sony CDP-5000 CD player/analyser combinations, as well as on domestic-style Toshiba players with the signal path tapped at the 'block error' and 'interpolation' stages. There's a full investigation of the 'high-frequency parameters' at six radii across the disc, which tells the staff about

the size and shape of the pits.

The QA people also check the cross-talk between adjacent 'grooves' of the spiral, and the eccentricity, 140 microns peak-peak deviation at the outside edge being acceptable. Also available if needed is an oscilloscope display of the digital data-stream, and a Nikon measuring microscope.

In QA they take the time the job needs, even if it slows down production slightly. So how often do they have to start a run again? "Sometimes," admits Alan, "but we never knowingly go outside the spec."

Of course, finding the *cause* of a fault is important, and Engineering section holds all the test results in a computerised database. This helps to identify systematic faults, though most faults are now random. And the biggest problem-area? "Aluminising – which is only to be expected."

As mentioned, the Engineering section brings the test results together for a total look at disc quality, with someone collecting the failed discs – master, stampers and CDs – for analysis each day. Like QA, Engineering has its specialist tools, includ-

In the QA Section, discs are played on Toshiba CD players connected to 'CD checking' machines. Below, the steel-lined chamber used for the 'damp heat' environmental tests.



ing a microtome for sectioning discs and a scanning electron microscope.

It also looks after environmental testing and the laboratory. The laboratory itself is small, and environmental testing is only done quarterly or when new materials or processes are introduced, but it's an important part of the programme.

EMI tests its own discs plus those from other manufacturers who supply the EMI group. The group also buys a range of competitors' discs.

The tests are pretty drastic, with discs being immersed in caustic soda for 15 hours then for a further 168 hours in isopropyl alcohol. Then there's the acid immersion, and finally, there's 'the chamber'. This is a temperature- and humidity-controlled, steel-lined vessel with time-switches to take discs through a 12-hour cycle of heating and cooling called 'damp heat'. Before and after, the discs are tested by QA section, which produces a full table of test results for each disc, including a 'map' showing the disc's performance in ten key areas.

Not all discs fail, but you certainly

couldn't miss the worst cases, with large irregular holes in the aluminium layer. (These weren't EMI's, I would hasten to add.)

The most frequent problem is the printing ink lifting off the lacquer. But the most noticeable defect is when the chemicals penetrate through small holes in the lacquer and attack the aluminium. A few discs even end up as clear substrate again.

The integrity of the lacquer coating is crucial. "If the lacquer coating is good in the first place, there's absolutely no need to worry about any such damage occurring in normal use," says EMI.

Alan's staff see all the CDs returned to EMI and have yet to see one which has suffered any 'ageing' or oxidation of the aluminium layer. "If someone out there has such a disc, he's keeping it to himself," says Alan.

"Because the tests are so severe, it's difficult to relate the results to real life. We couldn't say that our discs have a 300-year rather than 100-year lifetime, for instance . . . But to the best of our knowledge, our discs and those from the other

large manufacturers will last indefinitely under normal usage."

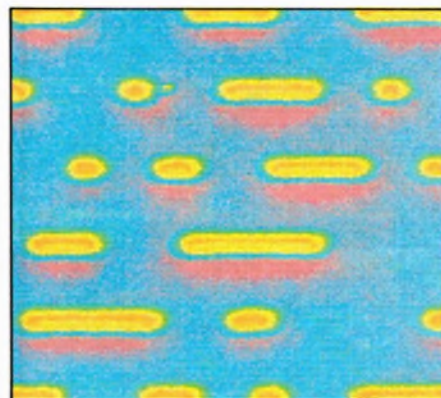
So why do the tests? "It's not so much the absolute results which matter, but the comparative results. We need to know that our current production is like last month's and the month before's."

And how do other people's discs fare? "They're consistent in the way they fail, though they differ both from ours and from each other's in the rate of failure."

And EMI's place in the league? "We're in the top ten per cent."

Finally, Alan McElroy summed up the standards his company currently achieves: "We're not dumb enough to think we couldn't improve in any way, but the manufacturing process is certainly under our control."

The only problem he admits he *can't* do anything about is the recorded imperfections – like squeaking chairs, rattling basson-keys and rumbling lorries – which come over so clearly via CD. At least he can relax in the knowledge that these particular 'audible defects' are someone else's responsibility!



Examining the pit geometry on CDs: this is a colour-enhanced printout from the X-ray analyser which takes its input from a scanning electron microscope.

Left, the daily check on the air flow in the press shop. The rate of flow is measured to ensure the air conditioning system is functioning correctly.

SOUND AND STYLE



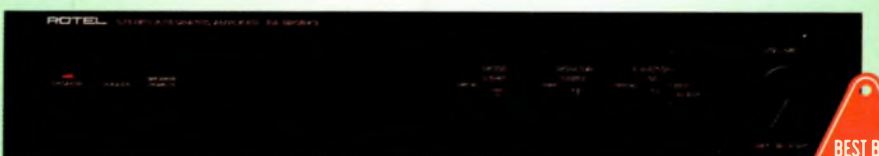
PUT THE BEST TO THE TEST



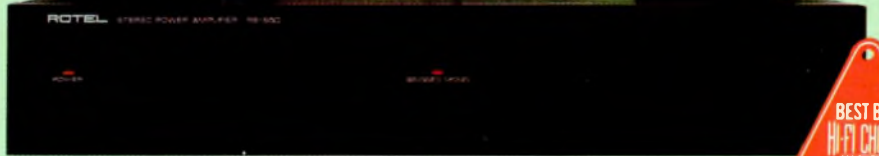
RA810A 20W STEREO INTEGRATED AMPLIFIER



RA820A 30W STEREO INTEGRATED AMPLIFIER



RA820BX3 STEREO INTEGRATED AMPLIFIER



RC/RB850 STEREO CONTROL AMPLIFIER AND 50W STEREO (150W MONO) POWER AMPLIFIER



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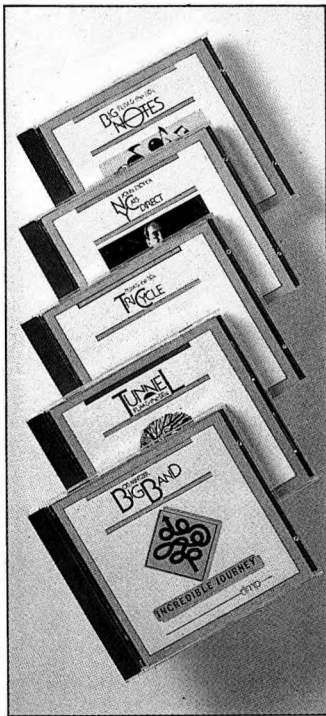
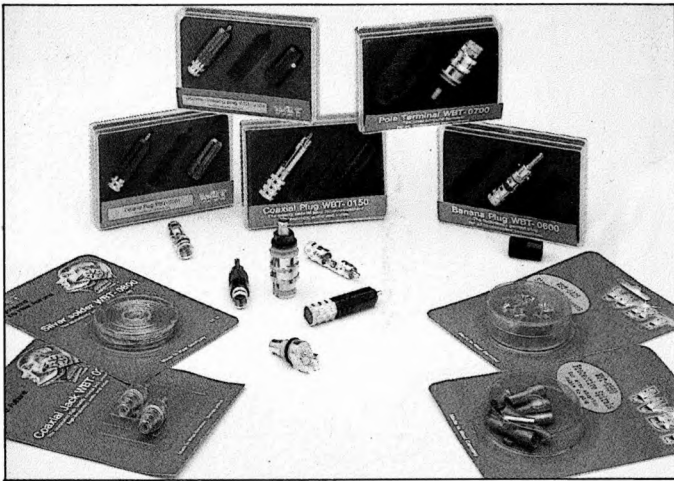
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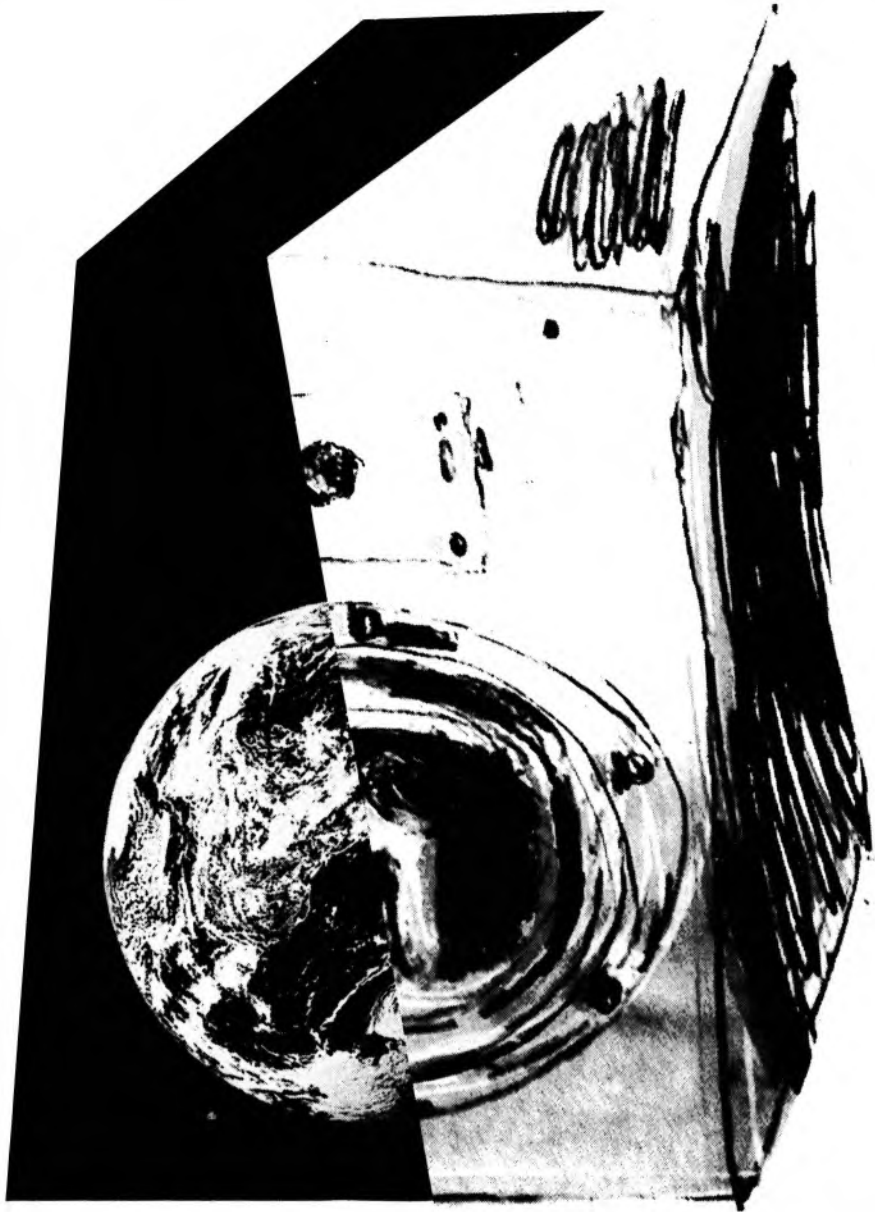
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READERS WRITE CHOICE ANSWERS

TONAL TROUBLES

I recently bought a pair of Jecklin Float *Electrostatic* headphones. The instruction manual states that all tone controls should be set in a linear position. What does this mean?

Second, if I purchase a Yamaha *DSP1* digital processor would it change the tonal quality of the 80 watts per channel receiver that I use?

B. DEAN,
ACCRINGTON.

In this instance the term linear means 'flat', meaning that you set your controls at the 12 o'clock position where hopefully they will have least effect on the signal. However, if this balance proves too bright or bass light then using tone controls to alter this is the most economical way of achieving a desirable sound. Jecklin recommends avoiding tone controls because in absolute terms they're a barrier to fidelity, but that's another story...

As for the DSP1, it shouldn't affect the tonal balance of your system, but the various ambience effects it creates may sometimes give that impression.

SWAYING PANELS

Whenever I'm intending to upgrade my system I always purchase *Hi-Fi Choice* for advice. However, I have noticed an important deterioration in the quality of some of the reviews. I like Alvin Gold's emphasis on value for money, but I have two criticisms of his reviews. One, he has lessened the emphasis on the use of listening panels – surely the more opinions you have the more accurate the reviews will be? Two, Alvin tends to override the panel's verdict with his own opinions. For instance, in his review of the Wharfedale *Delta 30* the panel didn't seem too keen, but Alvin chose not to elaborate on these comments and emphasised his own feelings. In the review of the Toshiba *SS-33* the panel seemed quite impressed, but Alvin criticised the build construction of an £89 loudspeaker! Come on Alvin, let's have more consistency.

V. A. DAVIDSON,
STANLEY, CO. DURHAM.

You criticise Alvin for not using listening panels but go on to cite instances where he has used them. In fact, our loudspeaker reviews are now written by Paul

Messenger and each test involves blind listening. Alvin currently reviews systems, both midi and separate, cassette decks and turntables/tonearms. Because of the complexity of these components or sensitivity to set up they are virtually impossible to blind test. The components for which we use a panel to listen blind are loudspeakers, amplifiers and CD players.

As for Alvin overriding the panel's opinion, this is virtually inevitable as it's the reviewer's name that appears and he has to write what he believes. Alvin's reviews sometimes seem to change the outcome of the panel's views, but that is because he makes the point of telling you what the other listeners thought, even if he disagrees with them. Remember, the panel only gets to listen to the component for a relatively short time under quite unusual conditions – ie an unknown system and often with unfamiliar material – whereas the reviewer will have considerably more time to assess the strengths and weaknesses of the product and thus be better qualified to judge its intrinsic merits.

*As for criticising build quality, which would you rather have? A shoddily built £80 speaker or a relatively well made £90 speaker? Partly as a consequence of that review the Toshiba *SS-33* improved in build quality.*

CHILL OUT

Reading your May issue I became greatly puzzled by your reviewer's findings concerning the necessity of very long warm-up periods for amplifiers. This is apparently considered necessary before some designs can give of their best.

In *Sessions* John Bamford writes that the Analogue Electronics system "needs the best part of an hour before the amp comes on song". In the Rotel *RA840EX3* review it says that it "requires a very long warm-up period". And you are not alone, I've also found references to this in other magazines. David Prakel wrote of the Arcam *Delta 60* that "Out of the box it was steely and thin but after two hours, the sound mellowed considerably". It's not very convenient is it?

Perhaps you could answer a few questions regarding this situation:

1. Is this problem something that



No need to tweak tone controls with Jecklin Floats.

the newer breeds of amp are prone to?

2. Why are other amplifiers not similarly affected?

3. Could the makers not (economically) do something about it?

K. F. JEFFERSON,
SEVENOAKS, KENT.

It is true that the majority of purportedly high fidelity amplifiers sound better if allowed to warm up and often preamplifiers are designed to be left on continually to improve sound quality. With regard to your queries, the answer to the first is that amplifiers primarily designed for good sound have always been sensitive to operating temperature, not always to the same degree but usually to some extent. In a roundabout way this also answers your second question. Other amplifiers, such as those emanating from the Far East, have been designed with ease of use in mind – though this doesn't explain the plethora of switches found on them, but that's another issue altogether. On the whole European and American electronic design seems to be of a higher calibre when it comes to sound quality, but sometimes this has its drawbacks in cost and user friendliness.

The degree to which you notice the difference in the sound when the amp's cold and when it's warmed up depends upon the

transparency of your loudspeakers. Reviewers tend to use as transparent a transducer as is practical when testing amplifiers, which fully reveals the sound of the component under scrutiny. With more down to earth speakers the difference is far less obvious and often only concentrated listening will reveal it. It's a bit like the temperature going up in a room – you don't notice it as it's happening but if you go out and come back it's more obvious.

IS IT WORTH IT?

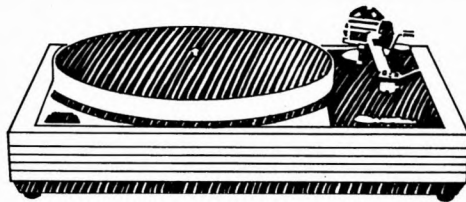
After reading about Radio Caroline in the June issue I had a few queries about broadcasting.

I gather that the source components used by Caroline are Technics turntables and CD players. This seems a bit confusing as radio enthusiasts spend a lot of money on top flight tuners such as the Naim *NAT101* because they only listen to live or pre-recorded classical music. This leads me to wonder whether it's worthwhile for Caroline to broadcast on the FM band – surely this would show up the quality of the equipment that they use? In the hi-fi world a system is considered to be as good as its weakest link – is the broadcasting equipment then the weakest link?

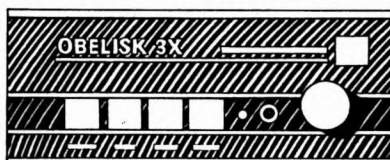
I would also like to say how much I enjoy reading your magazine, it's definitely the most comprehensive guide to hi-fi

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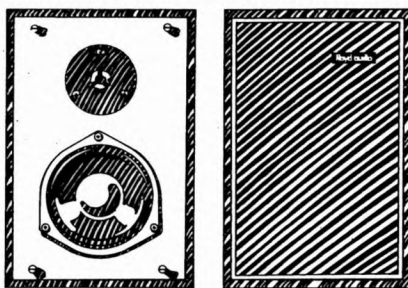
We don't wish to worry you, but had you realized just how many audio components there are around that will never really let you hear the music, no matter how many naughts they have on their price tags.



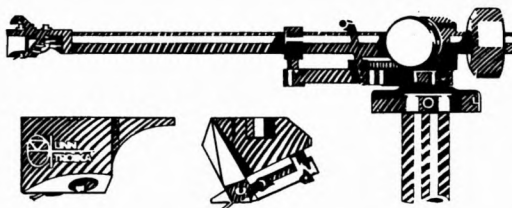
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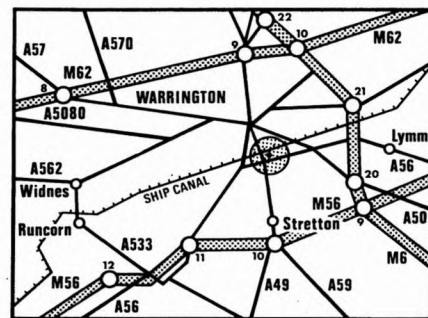


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products on the market.
DUNCAN McIVER,
CLWYD.

You are quite right, the standard of source components used by Radio Caroline, and for that matter, virtually every other radio station, isn't that great. But broadcasters choose turntables for their reliability, robustness and ease of use rather than sound quality. They have different requirements from turntables, including a 0.6 second start-up time, something that is rarely, if ever, met by hi-fi machines. The only time you can expect hi-fi sound quality of air is when there's a live musical broadcast. But this doesn't mean that there's no point in using a good quality tuner – the quality of broadcasting may not be brilliant but it's a lot better than the majority of tuners reveal.

The equipment that Caroline uses is considered "adequate" for FM broadcasting, and for the vast majority of listeners source upgrades at their end will be undetectable.

A FRUSTRATING ORGAN

I've been reading *Hi-Fi Choice* since the mid-'70s and get a lot of pleasure from it as well as help with equipment purchases. However, it can sometimes seem a frustrating organ, and I often feel the need to raise queries on the contents.

Take the May article on satellites and subwoofers. This is indeed an area of some fashionable interest at the moment, so why limit it purely to complete 'one name' systems. What I should like to know is what does a good subwoofer do for a pair of LS3/5as? Are you keeping from me the discovery that I could be equalling a pair of £800 speakers for perhaps half the price?

I would also like to take issue on loudspeakers. The 'Best Buy' supplement (Issue 72, June) seems to have been forced on you by the shortage of such quality amongst the batch in the main review – and if so, that's a creative way of putting the newcomers in context. But are your reviews too selective? I was under the impression that there had been two quite significant events in the loudspeaker world recently – the launch of the Celestion 3 and, at the opposite end of the scale, the Spendor

S100. Yet, to my disappointment, neither of these appear in your June issue. Why not?

In conclusion, I would congratulate you on an entertaining and thoughtfully produced magazine – but please keep the emphasis on high fidelity.

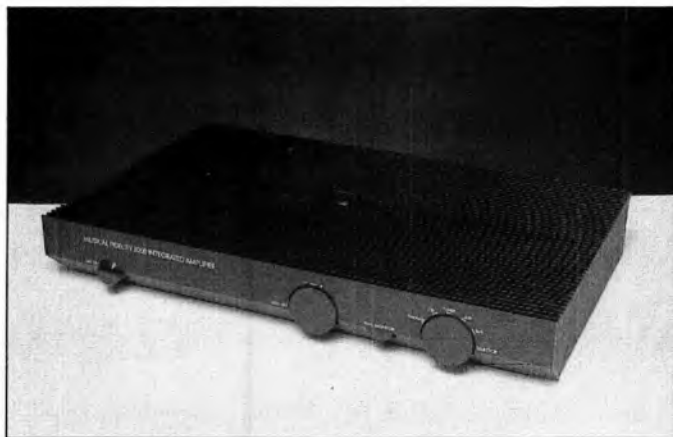
C. J. KEGG,
WOOBURN TOWN, BUCKS.

Let's start at the top; we specifically chose one-name speaker systems because they are representative of a new loudspeaker breed, and are not designed to compete with hi-fi oriented subwoofers of the Audio Pro ilk. Rather, they are intended to create reasonable bandwidth without being an eyesore in the non-audiophile living-room. Oddly enough, within a few days of receiving your letter we received another in a similar vein from a Mr Greaves of Jersey, who says that his LS3/5a/Audio Pro combination 'gives a superb sound'. We haven't tried out this particular combo but experience of the subwoofer alone would suggest that the extra bass extension will lend all the substance and depth that one would expect, but that dynamics and integration will not match a good £800 loudspeaker.

The Best Buy supplement could be considered a way of putting the current offerings into perspective, but was really included to give a broader selection of reviews for those intending to buy new loudspeakers. The reason that the two loudspeakers you mention were not reviewed in June is that the manufacturers didn't want them to be included. The last few new Celestions haven't done too well in recent Choice listening tests and thus the company was hesitant about giving us the 3. And Spendor didn't think that our June group test would be a grand enough debut for the up-market S100. Instead, Paul Messenger had a close look at it in the August issue, in his Personal Messages column.

SYSTEMATIC EVALUATION

I am looking for a new amplifier and given my budget the obvious choice lies between the Mission Cyrus Two and the Musical Fidelity B200. The directory rates the sound quality of the former as 'Very Good' and that of the latter



A strong contender in the sub £300 amplifier stakes.

as 'Good+'. However, the reviews of these two products in issue 62 give the impression that the B200 is the better of the two. Could you please resolve or explain this apparent discrepancy?

Secondly, my current loudspeakers are Mordaunt-Short Festivals – can you tell me what I would have to pay for something with the same capabilities nowadays, and what models would give me a significant improvement?

Finally my current source is a Thorens TD160B/SME IIIIS/Technics U205CM III. Can you give me some idea of how much I would have to pay for a CD player that would produce equivalent sound quality, and which models would you recommend?

I realise that sound quality is subjective and depends on many factors and will let my ears be the final arbiter. However, some guidelines would be appreciated to offset the ten years of development since I last bought any gear.

LES SMITH,
THEALE, READING.

Your first point about the amplifier sound ratings is quite pertinent. As you say, Martin Colloms appears to prefer the B200 but gives it a lower rating. Overall it looks like he rates both of them quite closely so you will have to be the arbiter here. It's worth noting that the Cyrus Two has been updated to MkII form, which is strange as it appears to be the third incarnation of this popular model, and may well be a stronger opponent. Another alternative you should consider is the Cambridge P55, a competent amp with defeatable tone controls that rates Very Good in sound quality.

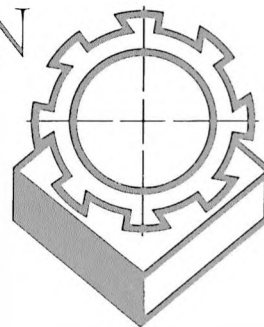
Whichever amp you choose you should do so in the context of the other components that you require, which brings us to your loudspeakers. The Festival was considered a Best Buy in its time and is probably as good as the majority of sub-£200 speakers today. To get a significant improvement would probably involve spending around £300 on something like the Musical Fidelity Reference 2 or a good speaker and stand combination like the Wharfedale 505.2 on heavy Pirate or Foundation stands. In fact it would be worth trying such supports with the Festivals as good stands do wonders for solidity and musical coherence.

As regards your source, the Choice opinion is that as long as the stylus isn't worn you won't find a CD player which competes with it on musical information grounds. By spending £150 on a Marantz CD-583 you will probably get more 'clarity', solidity, speed and less of the trouble caused by dirt and scratches on vinyl, but you'll also get a smaller dynamic range and less musically satisfying sound. In practical terms, if you're a classical music lover then the pros of CD will certainly outweigh the cons, especially given the situation with software, but there's little point in throwing a lot of money at a player unless you're considering an expensive across-the-board upgrade to your system.

EDITOR'S NOTE

Unfortunately we are unable to answer all the enquiries we receive. The letters we publish are those which we think will be of greatest general interest.

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Due to a special deal with Presence Audio, Opus 3's UK distributor, *Hi-Fi Choice* is offering its readers these CDs at a special price of £12.95 plus postage and packing. The two sampler discs *Test Record 1 – Depth of Image* and *Test Record 3 – Dynamics* are especially recommended as excellent introductions.

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CD-8017: RIVER ROAD – Eric Bibb, Bert Deivert

Eric, with his roots in the blues and gospel, and Bert, who is influenced by folk and modern singer/songwriters, perform a selection of warm, inventive songs. A fulfilling sound is achieved with the use of just two acoustic guitars.

CD-8300: TEST RECORD 3 – Dynamics

This is another Opus 3 compilation disc, with musical extracts carefully chosen to illustrate what is meant by musical dynamics and comprehensive liner notes to show you what you should be listening for. How good is your hi-fi system?



CD-8401: KNUD JÖRGENSEN – Jazz Trio

Jörgensen is one of Sweden's best jazz pianists, featured here in a traditional trio with bass and drums accompaniment. Most of the pieces on this disc are familiar tunes on which Jörgensen stamps his own colourful temperament.

CD-8402: LARS ERSTRAND – and four brothers

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CD-8206: LOUIS VIERNE – Symphonies No 5 & 6

Louis Vierne (1870-1937) was one of the foremost organist composers of the late Romantic era. The organist is Torvald Toren who has studied under Flor Peeters in Belgium and Maurice Duruflé in France. Recorded in Hedvig Eleonora church in central Stockholm – the magnificent organ, built in 1975-6, has 58 stops, three manuals and pedals.

CD-8801: CLARINET CONCERTOS – Mozart, Larsson and de Frumerie. Aria by Crusell

Kjell Fagéus, solo clarinetist with the Swedish Royal Orchestra, brings back the use of the basset clarinet (specially made for this recording) which was favoured by Mozart. The distinctive timbre of the instrument coupled with superb recording techniques therefore takes us closer to the sound of the music in Mozart's time. The other recordings here are later works by Scandinavian composers.

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- CD-7900: Test Record 1 – Depth of Image
- CD-8017: River Road – Eric Bibb, Bert Deivert
- CD-8300: Test Record 3 – Dynamics
- CD-8401: Knud Jörgensen – Jazz Trio
- CD-8402: Lars Erstrand – and four brothers
- CD-8206: Louis Vierne – Symphonies No 5 & 6
- CD-8801: Clarinet Concertos – Mozart, Larsson, de Frumerie, Aria by Crusell

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MARKET RESPONSE

In our exclusive reliability survey Dan Houston polls specialist dealers about amplifier sales and the current trends in the marketplace.



For this month's Market Response we spoke to 47 dealers covering 71 brands of amplifier currently on sale in the UK. The sheer range of products available shows the industry is continuing to thrive despite the current economic situation. Hi-fi is traditionally among the first consumer durables to suffer in a recession and many expected companies to be going to the wall. Ironically perhaps, dealers for this survey told us that the more expensive products were continuing to sell well. "People with money are not affected by the interest rates," was the common line. However, many dealers had noticed a drop in the lower and mid-priced areas which even in the slower summer period shows the chancellor's actions are beginning to bite.

Arcam Alpha is a clear winner (above) while Musical Fidelity's A1 (below) has an exciting new brother in the B1.

On a general level (covering the large retail chains as well as the specialists) the amplifier market is rising according to the market research company AGB. Nick Parker for the firm said that 240,300 separate amplifiers worth nearly £53m had been sold in the year before May. The figure was up by ten per cent on the previous year, he told *Choice*. More recent figures show a 15 per cent rise in amplifier unit sales during May this year compared to the same period last year. However, while the numbers sold are up, the corresponding value of the market has fallen slightly reflecting intense competition at the budget end of the market.

Our survey, now in its second year, aims to bring readers a distillation of many dealers' views. In the main we approach

specialists, and *Choice* encourages buyers to use these kind of outlets where the right decision on equipment can be made in relaxed surroundings. The average dealer in this survey stocks around nine brands of amplifier and it follows that by stocking a limited range of equipment his/her knowledge of a product's performance is greater, and advice more considered. In the survey we asked them for their top three selling models in each of three price brackets and also elicited comment on reliability and the standard of service from the manufacturers with which they deal.

The introduction of inputs for a second tape machine or a video recorder makes the modern amplifier an attractive and flexible central link in a multimedia system. Chew & Osborne bemoaned this fact saying "amplifiers retaining only phono, tuner and auxiliary inputs are looking obsolete before their time." Nevertheless the traditional gadget-and-flashing-light-shy purist seems to be thriving and many of our dealers were championing the cause of the simplistic no-fuss models where sound quality was the prime consideration. Paul Green noted: "three years ago it was unheard of for someone to spend £3,000 on a power amplifier, but now it's commonplace".

RELIABILITY

By and large reliability isn't a problem for dealers selling

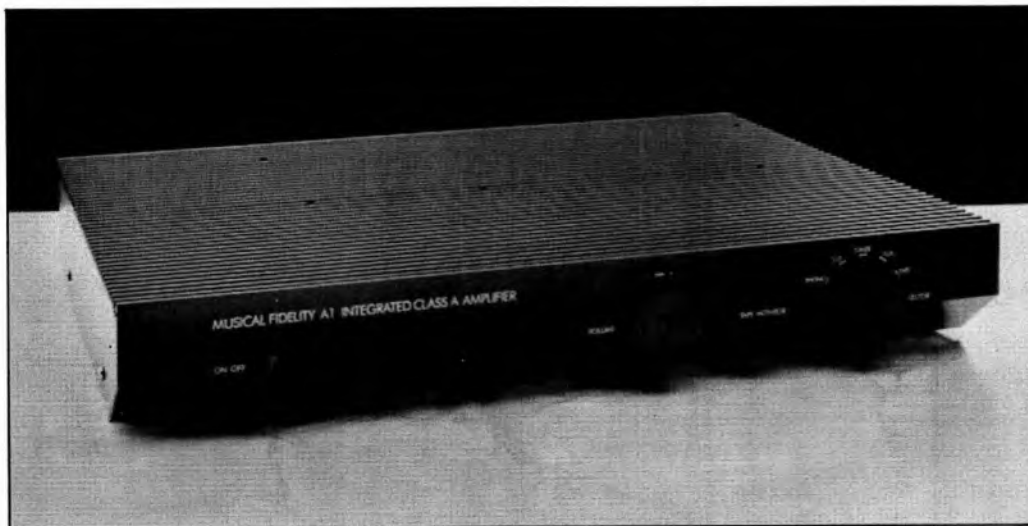
amplifiers. Many replied that component quality over the last few years had greatly improved and that apart from the odd 'batch problem' (which is usually quickly rectified by the manufacturer) they seldom saw amplifiers back for repair. In the past we have noticed that specialists often cease dealing with a manufacturer which is regularly supplying unreliable product, and many dealers vouchsafed the quality of all their brands.

By not having moving parts amplifiers don't suffer the problems caused with cassette decks or CD players where dirty heads or lasers seem to cause regular complaints. Our quality control findings also show a healthy attitude on the part of manufacturers with just over two per cent of amplifiers arriving faulty. However, while in general amplifiers are equally reliable, some are certainly more equal than others.

We asked dealers to name their most and least reliable brands and calculated the results on a points basis. Where a company received points both for and against reliability we have subtracted one figure from the other. Of course the more a dealer sells of one brand the more he is likely to see faulty models returning. We have found that dealers take this into account and give considered responses, based on their records.

Quad was found most reliable with 81 points, followed by Arcam (54 pts), Audiolab (40), Rotel (42), Naim (41) and Technics (28). Quad, Naim and Audiolab also featured as reliable in our March survey. At the other end of the scale NAD was said to be unreliable with -32 points, followed by Musical Fidelity (-22), Cambridge Audio (-17) and Mission (-11).

The big surprise here was NAD which dealers have scored highly consistently in previous surveys. Andy Giles, for importers Hi-Fi Markets, said he didn't know how dealers reached these conclusions since his figures showed a 32 per cent drop in returns of faulty NAD products from the same period last year.



Of course when an amplifier does break down dealers don't always return it to the manufacturer and most of our correspondents hoped to repair it themselves, usually within a week. If amplifiers have to be returned the figure is longer and we calculated a mean of 2.6 weeks turnaround time. Some companies have faster service departments than others and our survey put Quad, Mission, Sugden, Naim and Kenwood on top with Marantz, Denon, Rotel and Sony bottom. In the latter category the average wait in each case was over four weeks - though we did have mentions of 12 weeks or more.

Several dealers mentioned that valve amps tended to be less reliable than solid state owing to their delicate nature. However, with a valve amplifier owners can usually replace the 'tubes' themselves and therefore the question of reliability changes to one of regular user maintenance rather than having to resort to a faceless service department for help.

CONSISTENCY

Dealers were asked to give manufacturer ratings on sound quality consistency of equipment over the last six months. While hi-fi will rarely sound the same in your living-room as it did in the demonstration studio, consistency should throw some light on a manufacturer's commitment to his product; making sure it always sounds or behaves in the same way.

Dealers gave Arcam and Quad their top votes followed by Mission, Naim and Audiolab in that order. The (few) mentions for inconsistency were levelled at Cambridge Audio, Musical Fidelity and Acoustic Research. It should be mentioned that the consistency ratings would cover changes for better as well as worse in dealers' long-running experience of selling brands. Many declined to comment saying they demonstrated one model in their listening room and then gave the customer his choice from their stock. If you are in doubt about consistency then ask for the demonstration model if that is the one you like.

THE BEST SELLERS

We gave dealers three price brackets and asked them for their top selling models. Our results are calculated on a points system: five for the first, four for the second, three for the third and then added up.

Budget Category up to £200

1) Arcam <i>Alpha+</i>	108
2) Mission <i>Cyrus One</i>	66
3) NAD <i>3020E</i>	33
4) Creek <i>40-40</i>	30
5) Denon <i>FMA250</i>	28

All these models were in the top sellers list in our March edition. Arcam still has a strong lead.

Mid Price Best Sellers

£201-£500

1) Audiolab <i>8000A</i>	59
2) Mission <i>Cyrus Two</i>	58
3) Musical Fidelity <i>A1</i>	43
4) Arcam <i>Delta 60</i>	41
5) Arcam <i>Delta 90</i>	29
6) Musical Fidelity <i>B200</i>	28

Arcam and Audiolab have been consistently at the top here, Musical Fidelity is in the ascendant and many dealers were enthusiastic about the firm's new *B1* amplifier to be released in August.

Top Price £500+

1) Quad <i>34/306</i>	87
2) Naim <i>62/140</i>	48
3) Musical Fidelity <i>Pre 3/P140</i>	34
4) Quad <i>34/606</i>	29
5) Mission <i>Cyrus 2 + FSX</i>	24

Quad, Naim and Musical Fidelity remain in poll position while Mission and a second Quad combination have ousted Linn Products' pre and power offering. We received replies on over 40 different amplifier set-ups in this price category.

The random approach of this survey means that only the most common brands can be covered in matters such as reliability. If your particular esoteric amplifier does not feature in our findings it doesn't mean that it's necessarily unreliable (or reliable). For instance Sugden amplifiers, while only stocked by three dealers were given unilateral praise on all counts.

Market Response complements the main review topic every month but



Service with a smile: George Hooley (of Quad) collecting BADA's Best Service Department award from AT Labs' Tony Jones recently.

concentrates on different criteria to bring readers further information on products from the people who deal with them day-in day-out. It is conducted as a poll and should be seen as such.

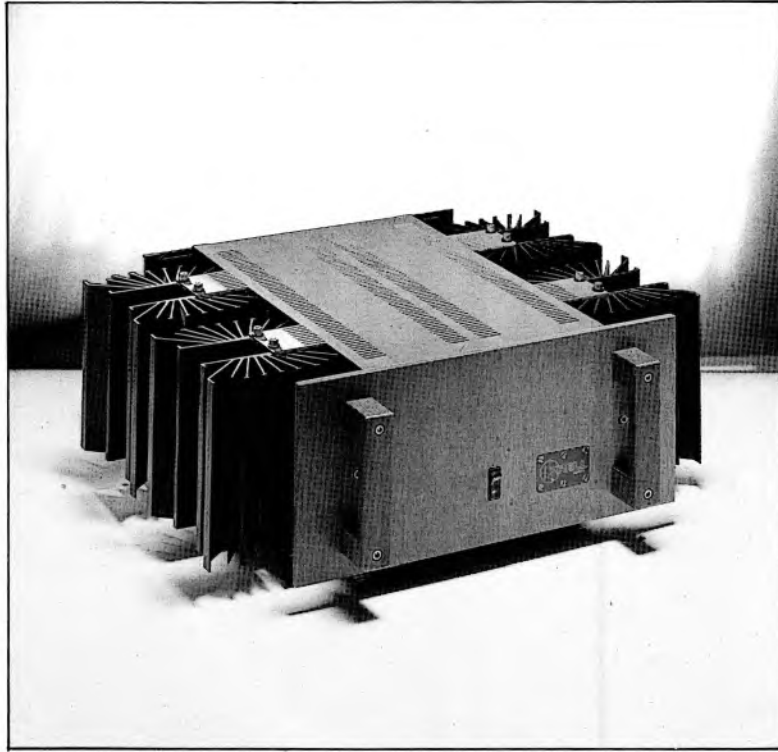
PARTICIPATING DEALERS

Our thanks to the following dealers for helping us compile this survey.

Active Audio, Derby, Derbyshire.
Aerco Ltd, Woking, Surrey.
A Fanthorpe Ltd, Hull, Humberside.
Analog Audio, Finchley, N. London.
Aston Audio, Alderley Edge, Cheshire.
AT Labs, Enfield, Middlesex.
Audio Excellence, Cardiff, S. Wales.
Audio South, Farnham, Surrey.
Audio Venue, Crystal Palace, S. London.
Beaver Radio, Liverpool, Merseyside.
Brentwood Music Centre, Essex.
Cambridge Hi-Fi, Cambridge, Cambs.
Chew & Osborne Ltd, Saffron Walden, Essex.
Covent Garden Records, Charing Cross Rd, London.
Doug Brady Hi-Fi, Covent Garden, London.
Elite Hi-Fi, Harrogate, Yorks.
Francis Hi-Fi, Streatham, London.
Gilson Audio, Middlesbrough, Cleveland.
Grahams Hi-Fi, New North Road, London N1.
Grange Hi-Fi, Burton-on-Trent, Staffs.

Hi-Fi Corner, Edinburgh.
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Hopkins Hi-Fi, Portsmouth, Hants.
Horns of Oxford, Oxon.
Island Compact Disc Centre, Ramsey, Isle of Man.
Lyon Audio, Stanway, Colchester, Essex.
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Peter Russell's Hi-Fi Attic, Plymouth, Devon.
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'I have the simplest of tastes . . .
I am always satisfied with the best'
Oscar Wilde



CHOOSING AND USING . . . AMPLIFIERS

Cliché or not, the amplifier is the heart of the hi-fi system. Its purpose is to accept the different signals from the various sources, conform and order them as necessary, and then provide the power to drive and control the loudspeakers. In what is known as an integrated amplifier, the first part of this task is carried out in the preamplifier 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 preamplifier section. When hi-fi had to make the best of barely adequate source quality, a complicated and flexible pre-amplifier section was a useful means of making the best of a bad job. During the Japanese invasion of the '70s, rival manufacturers vied with each other to invent and incorporate more and more extensive features: tone controls became graphic equalisers, and the often baffled user was encouraged to fantasise that he was on the bridge of the Starship Enterprise. However, improvements in sources have since started a 'simply better' backlash. 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.

PREAMPLIFICATION

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 preamps, so that each source feeds a 'flat' signal at line level to a simple switching and attenuating preamp. But now that the first digital signal source (CD) is becoming accepted, with others (DAT and DBS) planned for the future, we are beginning to see a new type of preamp 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 preamps, though progress will be slow because any preamp section will need to handle conventional signals alongside digital for many years to come.

POWER AMPLIFIERS

This is the part of the amplifier whose job it is to drive the loudspeakers – and a right old job that can turn out to be. Like the cartridge, a loudspeaker is a transducer, and the task is to turn the electrical model of the music signal back into a mechanical (acoustical) signal for the benefit of the ears. The loudspeaker is a form of motor, but its task of covering the whole range of audio frequencies is mechanically almost intolerable, and there is an inevitable lack of control at various resonance points. While the amplifier provides the loudspeaker with a voltage which corresponds to the amplified music signal, it is the

characteristics of the loudspeaker itself which determines the current demand. This current demand can be very unpredictable, particularly at resonance points, which is why serious hi-fi amplifiers are usually designed with plenty of surplus current capacity, and with an eye on the stability of the voltage signal whatever the current demand.

The main measurements on amplifiers relate to power output and distortion, but 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

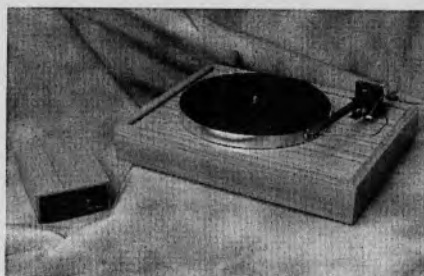
There are a number of criteria one could use when selecting an amplifier, and the most valid is probably sound quality. Despite the attention it attracts, power output comes much further down the list, because the differences between most models is not in fact that great, and measured power is by no means a reliable indicator of subjective loudness capability.

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, 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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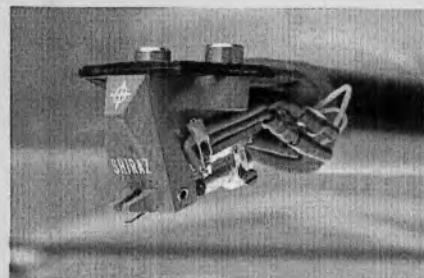
AUDIO CHOICES



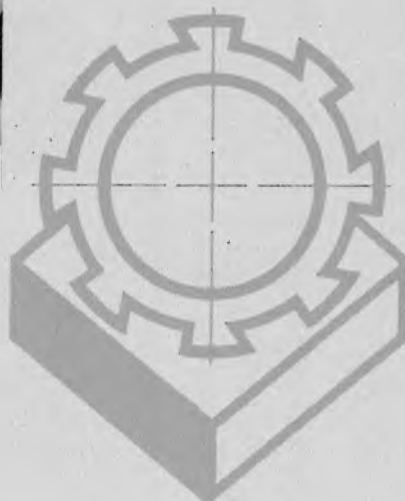
XERXES



ARTIMEZ



SHIRAZ



ROKSAN

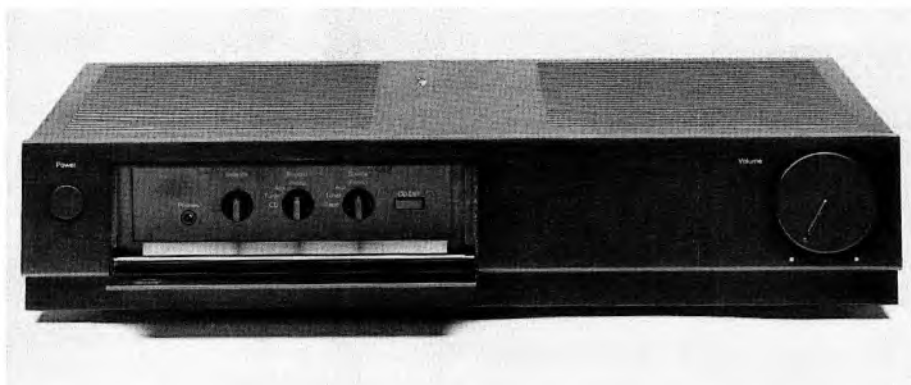
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ACOUSTIC RESEARCH A-03

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The A-03 is the latest in a very distinctive looking range of amplifiers from AR. A minimalist budget model destined to usurp the older A-04, in some respects this newer amplifier might be seen as less competitive, if only because AR has shunned all but the most basic facilities. The power output of the A-03 is also some 10W down on the earlier A-04, but the new unit does feature the more robust and luxuriously finished satin alloy fascia found on more costly Acoustic Research products.

A flap pulls away from this angled fascia to reveal rotary input and record-out selectors that cater for one disc (MM) and three line sources. In addition to these, a separate CD-direct switch bypasses the main rotary selector and feeds this high-level input directly to the volume control. A small balance control is also provided, as is a miniature headphone socket which automatically mutes the main speaker outputs if a headphone jack is inserted.

The internal design is neater than with previous AR amplifiers, while still adopting a dual mono/dual power supply configuration. A total of eight 2200µF electrolytics alongside discrete, local regulation is used to maintain a low supply source impedance. The symmetrical circuit layout comprises a fully discrete, active RIAA EQ stage together with complementary voltage gain and power output stages, separated by a small diecast heatsink.

One minor oddity concerns a flying power lead, used to feed the power-on LED that is inset in the volume knob, which causes the control to 'click' as it rotates.

LAB REPORT

The comparatively lax supply regulation results in a meagre increase of +1dB when changing from 8 to 4ohms; conversely the dynamic prowess is more impressive, achieving +2.1dB on the IHF toneburst test. The output impedance is suitably low, though stereo separation and CCIR IMD (-58dB) were both compromised via the MM disc input. Interestingly, disc overload margins deteriorated above 1kHz, from a healthy +35.2dB to +21.7dB at 20kHz and just +15dB at 50kHz.

The innocuous even-order harmonics noted on the ultrasonic distortion plot (yF_{0-20k} where $y = 2, 4, 6$) are actually caused by nonlinearities in the Sanyo output transistors running at $\frac{2}{3}$ power. The disc EQ response demonstrates a minor +1.5dB lift at 50kHz, but disc sensitivity (2.86mV) and noise (-85dB) are both spot-on.

The line stage measures ruler-flat, with a zero phase shift and very fast 500nsec rise time. An abrupt +25dB demodulation was detected from 1-4MHz on the RF test, a very restricted band and testament to AR's first-order RF input filtering. Unfortunately, ceramic decoupling caps introduce further nonlinearities of their own.

SOUND QUALITY

In common with previous AR designs the A-03 offers a slightly thin and veiled sound. Not harsh or aggressive, it was not terribly convincing either. Listeners commented on 'sat-upon' dynamics together with a loss in stereo depth and image focus. The presentation was moderately detailed and quite forgiving, but was also somewhat bland as a result.

A similarly 'bandlimited' and 'safe' sound was audible from the MM input, though there was also clearly a further reduction in bass weight together with a peculiar 'slowing' of tempo. In fact one listener did indicate a preference for the disc input while also acknowledging a certain lack of refinement about the sound.

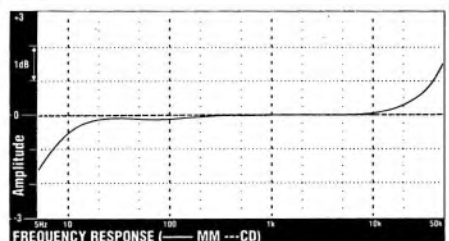
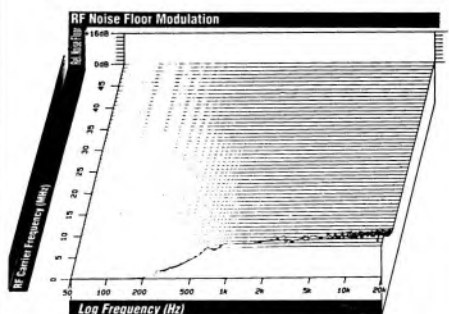
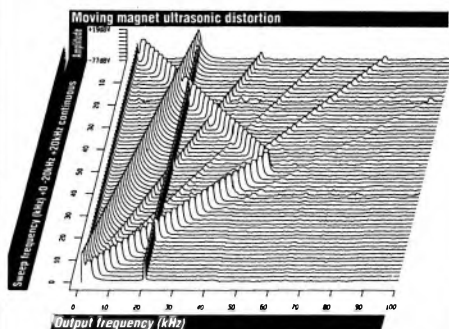
Once again many of the comments tallied with descriptions of the sound of earlier AR amplifiers, though perhaps this packaged and slightly 'fuzzy' sound is more acceptable in the A-03 considering the lower price pertaining here.

CONCLUSIONS

Because AR has pitched this new amplifier squarely at the specialist market, comparisons with market leading brands such as Mission and Arcam, are inevitable. Viewed in this light the A-03 simply fails to shine too brightly. Worth considering, it's nevertheless not a product likely to upset the current status quo.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	34.7W	37.7W	35.0W
- 4ohms	41.2W	47.2W	40.8W
Dynamic headroom (IHF)	+2.08dB (60.9W)		
Output impedance	0.071ohm	0.066ohm	0.0915ohm
Damping factor	112.3	120.6	87.5
	CD/Aux	MM	
Stereo separation (20Hz)	98.1dB	48.5dB	
(1kHz)	81.6dB	70.1dB	
(20kHz)	53.4dB	52.2dB	
Channel balance (-20dBV)	0.89dB	0.82dB	
(-60dBV)	1.49dB	1.34dB	
Total harmonic dist. (0dBV)	-72.8dB	-71.8dB	
(½ power)	-70.6dB	-69.9dB	
CCIR intermod. dist. (0dBV)	-70.3dB	-58.0dB	
CCIR IM dist. (½ power)	-68.1dB	-62.1dB	
Rise time	500nsec		
Power bandwidth	29Hz - 22kHz		
Squarewave linearity	-88.5dB		
Phase shift (20Hz)	0°	352°	
(1kHz)	0°	309°36'	
(20kHz)	0°	280°48'	
Noise (A wtd, 0dBV)	85.4dB	84.8dB	
(½ power)	-97.7dB	-86.3dB	
Residual noise (unwtd)	-63.9dBV	-63.8dBV	
Input sensitivity (for 0dBV)	26.43mV	466.7µV	
(for full output)	164.2mV	2.859mV	
Disc overload (20Hz)	32.34mV		
(1kHz)	288.1mV		
(20kHz)	609.2mV		
(50kHz)	561.7mV		
Tape output/impedance	16.46V (disc)/1.061kohm		
Input loading	17.3kohm/386pF	46.8kohm/240pF	
DC offset, left/right	+6.5mV/+3.5mV		
Typical price inc VAT	£160		





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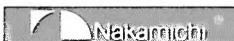
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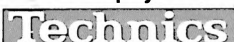
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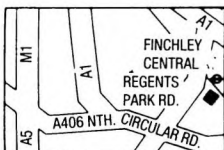


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AKAI AM-52

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Placed somewhere near the middle of Akai's current amplifier range, the *AM-52* is styled to complement the other *52-series* components. The broad alloy fascia is broken up by a large volume control and a column of input selection buttons; the latter are rather clunky in operation and confer a slightly clumsy feel.

CD, tuner, aux, DAT and two tape sources are accommodated but there is no independent record-out selector. Moving-coil or moving magnet cartridge matching, selected on the front panel, alters both the gain and the input loading by switching-in a low-noise FET headamp (single package) to accommodate the 20dB extra gain required by most MCs.

A source-direct switch effectively disables the bass/treble tone and balance controls, but the loudness, muting, subsonic filter and mono/stereo mode facilities remain active. Up to two pairs of speakers may be connected, using conventional binding posts rather than the 4mm sockets favoured in the UK. Furthermore, the use of a common wiring loom for signal routing and power supply cabling is not a particularly clever idea.

Internal construction is a little messy, but the topology is straightforward enough. A DC servo maintains stability at subsonic frequencies; LEDs are used to bias the current sources prior to the main driver stage; a pair of Sanken *C3855/A1491* output devices are employed per channel, mounted underneath a lightly fluted heatsink.

LAB REPORT

This appears to be a fairly well-specified unit offering low distortion (typ <math><0.01</math> per cent), excellent channel matching at low levels (within 0.5dB at -60dBV), and very low A-wtd noise via the MM input. The -70dB figure for the MC input is slightly disappointing by comparison, but the comfortable +29dB overload margin and 240 μ V sensitivity will ensure broad compatibility. The low frequency output of the MC stage is sensibly rolled off, with a -3dB point of 11Hz, which contrasts with the sub-1Hz roll-off of the MM stage.

CCIR intermodulation distortion rarely crept above 0.028 per cent via any of the

inputs. This is reflected in the 3D ultrasonic plot, which indicates but a hint of a summation mechanisms $F_{20k} + F_{0-20k}$ and $F_{0-50k-0} + F_{0-20k}$. Low-order harmonics dominate the spectrum but these are quite innocuous compared to the strong RF IMD (+21dB) at 65MHz on the remaining 3D plot. Secondary areas of demodulation occur at 1MHz, 10MHz and 148MHz, each resulting in a noise floor change in the 5-20kHz region.

SOUND QUALITY

Lacking slightly in warmth and richness, the *AM-52* still avoids sounding cold or thin by projecting a subdued and insubstantial musical soundstage. The potential stereo depth and width available from the PDM digital converter was difficult to discern through this amp, just as percussive sounds were muted in both focus and attack. Brassy recordings often had a slightly splashy, smeared quality, which led more to frustration than obvious fatigue.

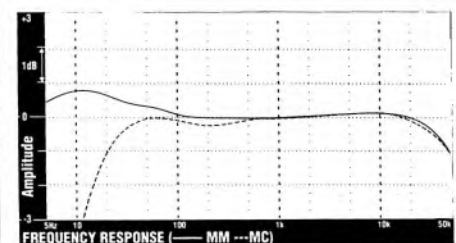
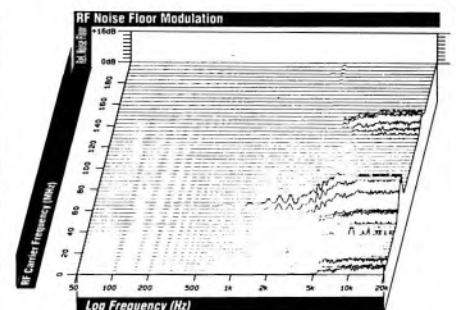
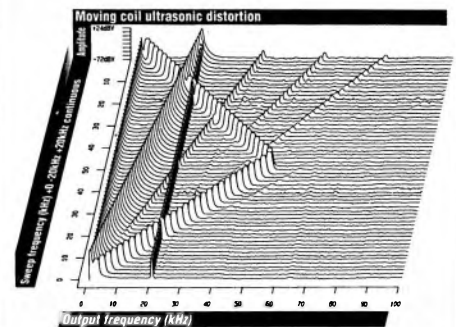
A similar effect was noted via the MM vinyl input which was pleasantly smooth and comfortable on the ear, though not startlingly detailed or musically convincing. In contrast the MC stage was perceptibly noisy, making vocal sibilance all the more obvious: the presentation was muted, stripped of life, sparkle and lucidity, to the point where the moderately syrupy and somewhat two-dimensional character of the MM input was certainly preferred.

CONCLUSIONS

To all intents and purposes the *AM-52* would appear to be competent, if a little uninspiring. Conventional measurements reveal little indiscretion, though the evidence of RF IMD together with a high output impedance does appear to tally with the soft and slightly veiled presentation. Since it also lacks the surfeit of facilities that might bolster its attraction for A/V fans, the *AM-52* is a little disappointing.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	90.9W	95.2W	85.6W
- 4ohms	126.4W	139.9W	120.3W
Dynamic headroom (IHF)	+1.20dB (125.6W)		
Output impedance	0.120ohm	0.117ohm	0.171ohm
Damping factor	66.6	68.2	46.7
CD/Aux	MM	MM	MC
Stereo separation (20Hz)	82.5dB	78.5dB	64.7dB
(1kHz)	69.3dB	68.5dB	66.8dB
(20kHz)	44.7dB	43.9dB	42.3dB
Channel balance (-20dBV)	0.33dB	0.48dB	0.55dB
(-60dBV)	0.45dB	0.50dB	0.52dB
Total harmonic dist. (0dBW)	-85.8dB	-84.9dB	-81.0dB
($\frac{1}{2}$ power)	-78.6dB	-87.5dB	-82.4dB
CCIR intermod. dist. (0dBW)	-88.1dB	-72.4dB	-71.2dB
CCIR IM dist. ($\frac{1}{2}$ power)	-90.9dB	-72.9dB	-72.2dB
Rise time	6.5 μ secs		
Power bandwidth	15Hz - 26kHz		
Squarewave linearity	-95.8dB		
Phase shift (20Hz)	25°12'	10°48'	8°0'
(1kHz)	0°	311°24'	305°30'
(20kHz)	333°	241°12'	240°30'
Noise (A wtd, 0dBW)	-94.9dB	-87.7dB	-69.9dB
($\frac{1}{2}$ power)	-100.9dB	-89.4dB	-70.3dB
Residual noise (unwtd)	-79.7dBV	-79.5dBV	-79.5dBV
Input sensitivity (for 0dBW)	17.15mV	249.3 μ V	24.86 μ V
(for full output)	168.6mV	2.413mV	239.9 μ V
Disc overload (20Hz)	14.08V	1.763mV	1.763mV
(1kHz)	141.7mV	14.3mV	14.3mV
(20kHz)	1184mV	126.3mV	126.3mV
(50kHz)	1466mV	129.9mV	129.9mV
Tape output/impedance	10.56V (disc)/2.519kohm		
Input loading	96.6kohm/355pf	38.39kohm/270pf	101.4ohm/2.8nF
DC offset, left/right	-2.85mV/-2.98mV		
Typical price inc VAT	£230		



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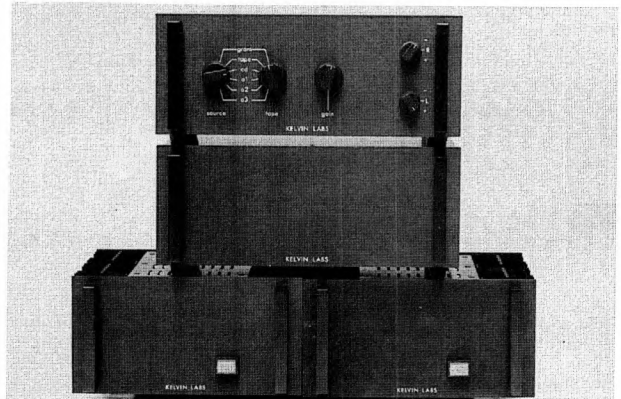
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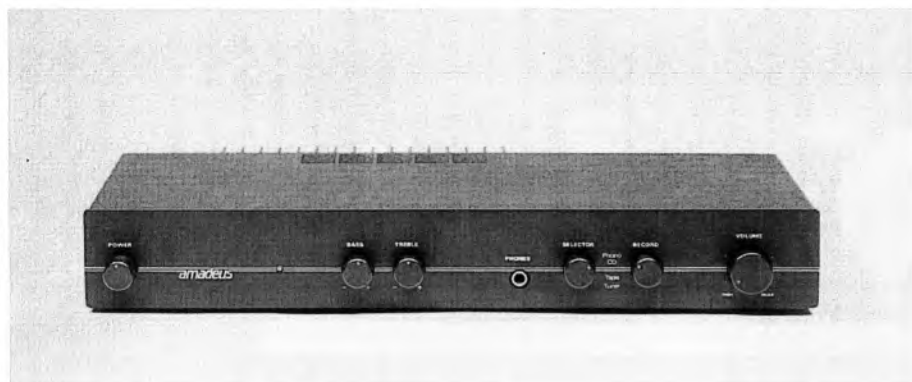


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AMADEUS GOLD

ASTON AUDIO LTD., 4 WEST STREET, ALDERLEY EDGE, CHESHIRE SW9 7EG. TEL: (0625) 582704.



Manufactured and distributed by Aston Audio Ltd, the Sondex *Amadeus* range of amplifiers comprises two integrated and one pre/power combination. Top integrated model is the *Amadeus Gold*, distinguished from the *Silver* model by gold lettering and go-faster stripes on the matt black fascia.

This is a slimline and essentially 'minimalist' amplifier designed to offer good sound with just a modest array of facilities. Four equal-sized control knobs cater for bass and treble tone adjustment, plus source and record-out selection. The latter two operate independently of each other and cater for both MM and MC cartridges, together with tape, tuner and CD line sources. Only one pair of sockets is provided for the phono input, gain and disc input stage loading adjustment being accomplished using separate plug-in cards. Three MM and two MC loading cards are normally available, with other custom-matched versions available upon request.

Pre-out sockets enable the *Gold* to be used with larger power amplifiers if so desired. The headphone socket is driven from the main output via a dropping resistor, disconnecting the 4mm speaker terminals if a jack is inserted.

Sondex performs the final assembly itself. Internal construction is very neat, using separate power supplies for the pre and power sections. The pre-amplifier has a low noise differential amplifier and series-feedback RIAA equalisation, while the final power stages are fuse-protected and comprise SGS D139/140 complementary drivers followed by T1F35/36C 15A bipolars mounted on a rear-facing heatsink.

LAB REPORT

Hawk-eyed readers may notice the absence of a 3D ultrasonic distortion plot in this particular review, two *Gold* samples failing midway through this test.

The power bandwidth is fairly restricted, particularly at low frequencies where maximum output is some -1.4dB relative to the midband. The output impedance is also on the high side at 0.37-0.47ohms while channel balance is compromised to the tune of 5.2dB at -60dBV because of tracking errors within

the volume pot. Noise measured a fairly constant -75dB (rel 0dBW) between inputs, as a result of strong rectifier sampling (100Hz) and hum (50Hz) products in the power amp.

The vinyl disc response looks distinctly tailored. Both MM and MC inputs roll off abruptly at low frequencies and register HF -3dB points of just 50kHz and 23kHz respectively. A poor -79dB was recorded on the squarewave linearity test, while a parasitic RF oscillation accompanied the 10kHz output signal. The amplifier itself demodulates AM/RF noise between 25-50MHz, boosting the noise by a moderate +5-7dB across 1-20kHz as a result.

The subjective consequences of this are unlikely to be damning, however, for any such effect is obscured by a broad carpet of closed-loop THD and IMD products. Data gleaned before each of the amplifiers went unstable on the 3D test indicates that the 0.1 per cent and 0.28 per cent IM distortion registered into a pure 8ohm load worsened into lower and more complex impedances. For example, 0.5-1 per cent IM and THD was recorded using the composite HF signals into 4ohms at 1/3 power.

SOUND QUALITY

All who heard this amplifier were delighted with a seemingly refined and sedate sound, possessing a rich and 'juicy' character much like earlier Inca Tech or Musical Fidelity amplifiers. Much of the depth and width available from the PDM D/A convertor was realised, and the *Amadeus Gold* generally maintained a pleasing sense of space and weight. It was less transparent and perhaps slightly thicker-sounding than usual, but the lack of brashness and vocal sibilance made for an entertaining and convincingly musical performance.

A similarly comfortable, sweet sound was enjoyed via the vinyl disc inputs, though very low bass notes were softened in both impact and stereo focus. There was less sensation of stereo depth than when using CD, the sickly-sweet sound seeming just too safe or conservative for some of our listeners.

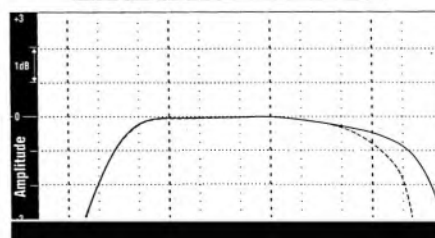
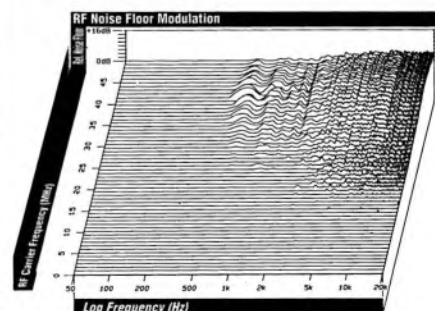
CONCLUSIONS

If our samples were representative then

Sondex should re-examine the PCB layout if only to dismiss the *Gold's* minor but nonetheless real parasitic instability. In contrast, we encountered no real problems in the listening tests, the *Amadeus Gold* acquitting itself in admirable fashion, delivering a rich, 'lush' sound quite devoid of fatiguing 'nasties'.

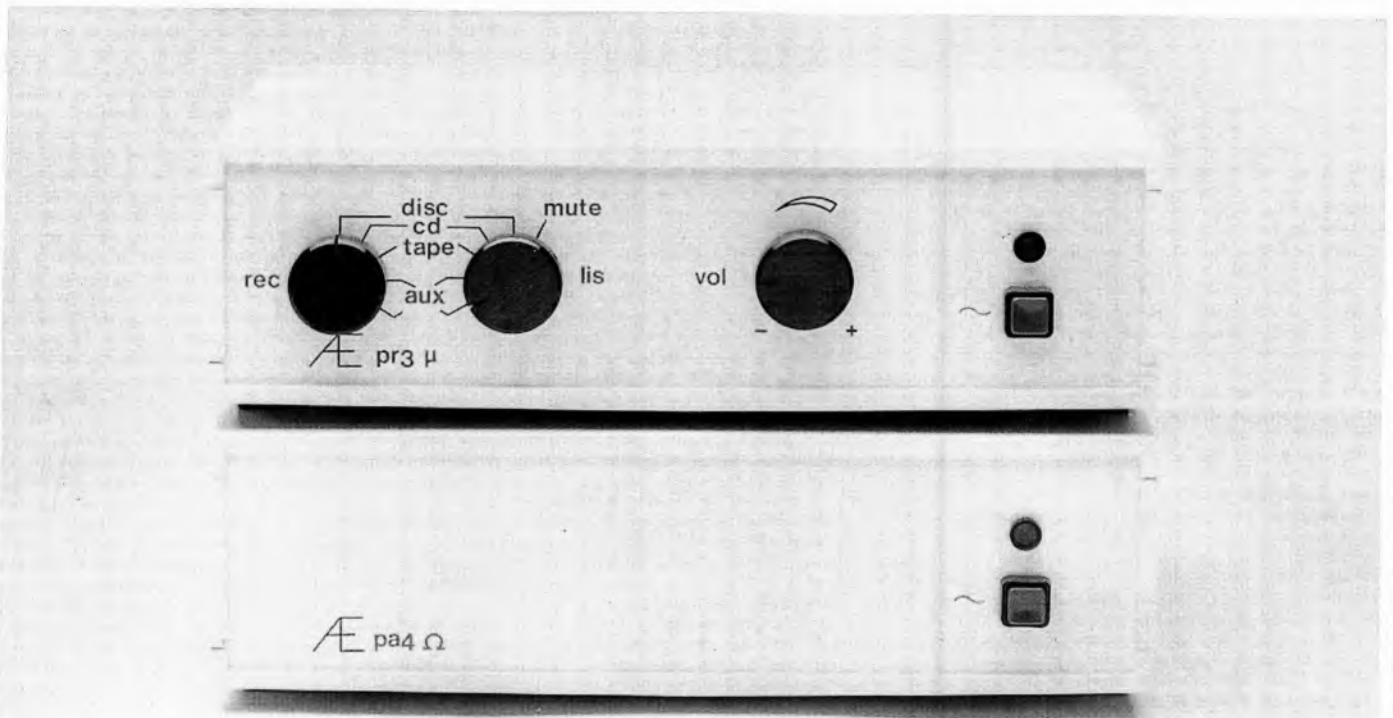
TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	40.8W	55.8W	55.3W
- 4ohms	45.3W	86.9W	76.5W
Dynamic headroom (IHF)	+0.26dB (59.3W)		
Output impedance	0.445ohm	0.368ohm	0.471ohm
Damping factor	18.0	21.8	17.0
Stereo separation (20Hz)	CD/Aux	MM	MC
	59.8dB	56.9dB	56.7dB
	(1kHz)	58.7dB	54.6dB
(20kHz)	44.2dB	41.1dB	40.6dB
Channel balance (-20dBV)	0.27dB	0.09dB	0.04dB
(-60dBV)	5.39dB	5.24dB	5.11dB
Total harmonic dist. (0dBW)	-79.3dB	-78.7dB	-78.8dB
(1/3 power)	-73.8dB	-73.7dB	-73.8dB
CCIR intermod. dist. (0dBW)	-71.2dB	-64.6dB	-53.9dB
CCIR IM dist. (1/3 power)	-59.1dB	-56.2dB	-51.3dB
Rise time	4.5µsecs		
Power bandwidth	120Hz - 21kHz		
Squarewave linearity	-79.0dB		
Phase shift (20Hz)	212°24'	234°10'	236°0'
(1kHz)	0°	133°12'	135°48'
(20kHz)	162°0'	63°0'	65°30'
Noise (A wtd, 0dBW)	-74.9dB	-75.1dB	-75.5dB
(1/3 power)	-89.4dB	-79.8dB	-76.4dB
Residual noise (unwtd)	-52.6dBV		
Input sensitivity (for 0dBW)	32.88mV	257.6µV	35.80µV
(for full output)	247.9mV	1.877mV	270.2µV
Disc overload (20Hz)	9.722mV		
(1kHz)	71.74mV		
(20kHz)	507.3mV		
(50kHz)	658.9mV		
Tape Output/Impedance	9.572V (disc)/34.6ohm		
Input loading	14.9kohm/50pF 42.9kohm/100pF 335ohm/21nF		
DC offset, left/right	+0.65mV/+2.8mV		
Typical price inc VAT	£360		



ANALOGUE ELECTRONICS PR3/PA4

ANALOGUE ELECTRONICS, HARTLEY FARM, UPPER SWAINSWICK, BATH, AVON BA1 8AF. TEL: (0225) 859473.



Hailing from the heart of Upper Swainswick, Analogue Electronics is a relatively new two-man force on the audio scene. Nevertheless it has several models to its credit, including no less than two preamplifiers and three power amplifiers. This review concerns the top pre/power combination in the range, specifically the *PR3* and *FA4*. All the power amplifiers share a common topology, though the *PA4* is touted as offering some 50W and 'a very special sound all of its own'. More of this later...

The construction of the two units does little to allay criticism of AE's kit-like aesthetics, both amplifiers using lightweight VERO plastic cases fronted by a thin strip of alloy. These insubstantial fascias are annotated with what appear to be Letraset transfers, while the preamplifier also has three black plastic knobs, one for volume the other two catering for record-out and input selection (inc. mute). Vinyl disc, CD, tape and two 'aux' inputs are provided, along with a rear toggle switch to select either MM or MC cartridge matching.

Inside, the small PCB is crudely shielded with a thin sheet of aluminium foil, the disc stage physically distanced from a small 30VA toroid. Separate *LM7915/7815* 15V regulators are used for the positive and negative rails, which in turn feed a very simple circuit composed of just two *LM833* op-amps. One is utilised in the vinyl disc stage which features switchable gain and series-feedback to accomplish the RIAA equalisation. The line input is also fed directly to an *LM833* gain block, while the final output is band-limited using substantial 100V 10 μ F Rubycon electrolytics!

Because of the very limited shielding that is available inside, particularly in respect of the vinyl disc input, the box needs to be

physically separated from electromagnetic fields. The *PA3* should therefore not be placed atop the *FA4* power amplifier for fear of picking up hum from its 100VA toroid transformer. This power amplifier is similarly packaged, utilising two pairs of recessed 4mm sockets for loudspeaker connection so as to minimise the chance of accidental shorting. The company adheres firmly to the 'simple is best' policy, an attitude which extends to the use of strip matrix board inside.

Here we find two *NE5532* op-amps (one per channel) which derive a bias signal from the input to control the following voltage gain and output stages. The former uses complementary RCA *T1F41C* and SGS *T1P42* power transistors, the decision to use two manufacturing sources being rather unusual. I was equally perplexed by the use of female IC holders for the *NE5532* op-amps. However, on a more positive note, connecting the negative supply rail (via a 6.8k resistor) to the inverting input of the op-amp will provide some rejection of common-mode noise (such as hum). The final output stage is configured using two pairs of *T1P2955/T1P3055* bipolars per channel, all mounted on a diminutive rear-facing heatsink.

LAB REPORT

Faced with this particular set of results, it's almost impossible to know where to start. The power amplifier, for example, falls some 2.4dB short of its rated output, delivering just 28.6W from an output impedance of 3.07-3.22ohm - figures that would embarrass any self-respecting valve amplifier, let alone a solid-state design.

To be fair, the measurement of output power was hampered by encountering significant levels of distortion. Prior to clipping,

the output waveform was already severely distorted, particularly at higher frequencies where THD approached 3.8 per cent and CCIR IMD one per cent. Crossover nonlinearities were even visible on a scope trace, indicating perhaps that the output stage is fundamentally under-biased. However if this were the case, then I would have expected some improvement in THD with increasing level, which clearly did not occur.

The ultrasonic distortion plot (*FA4*) highlights 2nd-10th harmonics, together with the full range of possible IMD routes including $F_{0-50k-0} \pm yF_{0-20k}$ and $F_{20k} \pm yF_{0-20k}$ ($y = 1-5$). These atrocious nonlinearities may also be at the root of the massive RF demodulation which peaks at +35dB from 4MHz-195MHz. This alone is likely to destroy any detail resolution throughout the upper mid and treble regions, though of course the true subjective effect will be masked by the vast closed-loop nonlinearities. I imagine there are tuners out there that are less sensitive to RF than this amplifier!

The volume pot in the matching *FR3* preamp incurs channel balance errors of up to 9dB at low signal levels while separation falls to 29dB due to capacitive coupling. The preamplifier is very sensitive, requiring just 1.1mV (MM) and 48.5 μ V (MC) for 1V output, but noise (-57.4dB A-wtd) and overload margins (+19dB) are both weak via MC. The 3D plot indicates that the *PR3* is more linear than its accompanying power amplifier, but still shows an increase in THD with frequency, plus traces of 2nd and 3rd-order IMD. Note the track at 86kHz, caused by a through-air coupling with my VDU (CRT fly-back frequency). Disc equalisation is a little inaccurate (perhaps the understatement of the decade) and increases by some +12dB from 1-50kHz.

SOUND QUALITY

Like all the amplifiers in this project, the AE pre/power combination was auditioned under blind conditions before being rigorously tested in the laboratory. Consequently, with no prior expectations, most of the listeners were highly perplexed by the sound of this combination.

On the one hand it was thought to possess superb instrumental separation with a welcome sense of space and excellent midband transparency – much like a valve amplifier, for instance. In fact the *PR3/FA4* combo was one of few which genuinely transmitted the openness and inherently musical sound of the PDM D/A convertor, when replayed at very low levels.

However, at anything over a whisper these very favourable qualities are accompanied by a rather gutless presentation, fundamentally lacking in bass energy and grossly distorted throughout the treble. One wag was heard to enquire whether the amplifier really had a power supply, such as the anaemic and flaccid sound. At progressively higher (ie normal) volume levels, any semblance of harmonic and timbral detail was drowned beneath a wash of coarse, grainy and fatiguing treble colorations.

Unfortunately these failings were simply magnified via both disc inputs. Later measurement revealed the crazy RIAA curve, accounting for the extremely 'tizzy' balance, along with distortion and a total lack of image stability and low frequency impact. In a word: horrible.

CONCLUSIONS

Reviewing what are essentially kitchen table-top amplifier designs is fraught with hazard and not a little soul-searching. All too often reviews of such products become little more than a consultancy exercise, weeding-out faults that the designer was unable or incapable of determining for himself.

Clearly this sort of situation is of little practical benefit for the consumer. On the other hand it is undoubtedly important to give space in a hi-fi magazine to the up-and-

coming manufacturer, if only because there is a possibility he or she might possess the necessary spark of ingenuity to realise a product of significant merit.

In this instance I will not be so uncharitable as to suggest that Analogue Electronics is simply 'experimenting' with the buying public. It certainly remains within the bounds of possibility that the biasing pots in the *FA4* power amp did shift during transit, giving rise to the vast crossover distortions and RF non-linearities highlighted both on test and in the listening room.

Certainly I was assured that both units were tested prior to their departure and that nothing was seriously amiss. However, any performance drift that can occur in transit between a manufacturer and myself can also occur between the manufacturer and his retail outlets. At low listening levels the *PR3/FA4* sounded rather promising, and given the low price it should not be dismissed out of hand – but on the evidence of our review sample Analogue Electronics still has some work to do to ensure that all samples work consistently.

TEST RESULTS

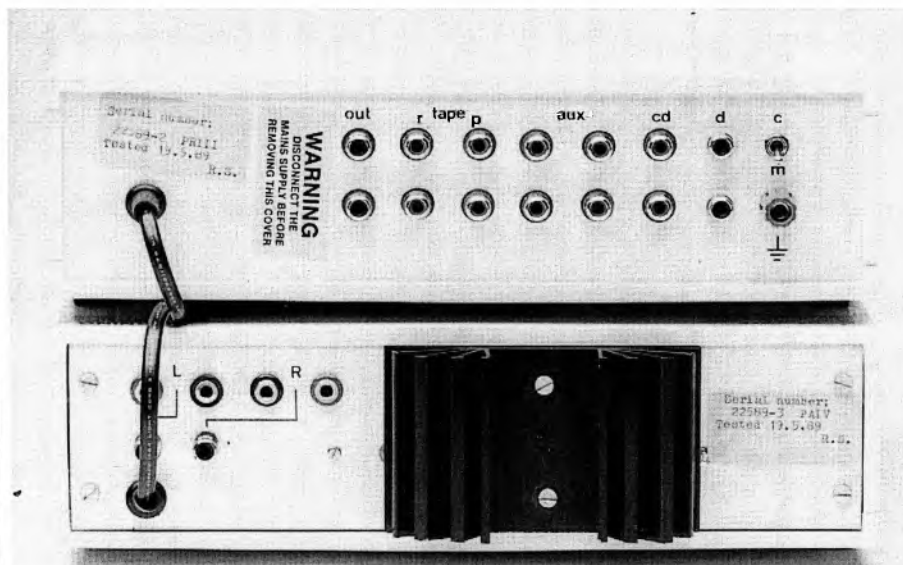
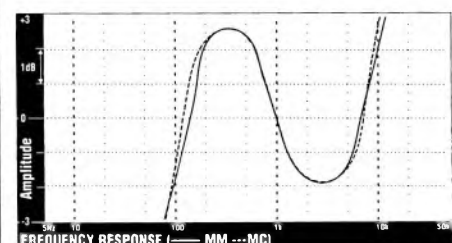
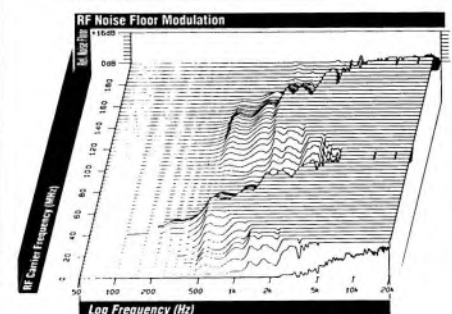
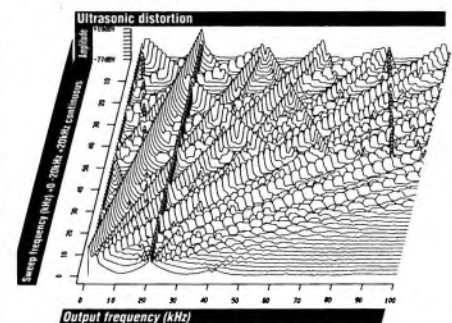
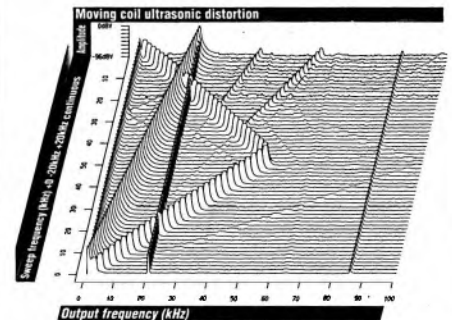
PREAMPLIFIER				
	Aux/CD	MM	MC	
Stereo separation (20Hz)	85.3dB	81.6dB	54.6dB	
	(1kHz)	61.7dB	61.7dB	
	(20kHz)	28.5dB	35.0dB	35.2dB
Channel balance (0dBV)	0.01dB	0.01dB	0.04dB	
	(-20dBV)	1.46dB	1.43dB	1.51dB
	(-60dBV)	1.65dB	5.23dB	8.95dB
Total harmonic dis. (0dBV)	-88.9dB	-93.2dB	-89.6dB	
	(20kHz)	-82.4dB	-83.8dB	-71.1dB
CCIR intermod. dist. (1:1)	-93.1dB	-83.8dB	-73.4dB	
	Phase shift (20Hz)	0°	0°	0°
(1kHz)	0°	293°45'	295°12'	
	(20kHz)	349°55'	329°45'	312°28'
Squarewave linearity	-106.8dB			
Noise (A wtd, 20Hz-20kHz)	-80.6dB	-78.3dB	-57.4dB	
Residual noise (unwtd)	-68.6dBV	-68.6dBV	-68.6dBV	
Input sensitivity (for 0dBV)	64.05mV	1.098mV	48.5µV	
Disc overload (20Hz)	41.45mV	1.002mV		
	(1kHz)	161.3mV	4.462mV	
	(20kHz)	781.4mV	19.10mV	
(50kHz)	857.0mV	27.08mV		
Input loading	115.4kohm/110pF	3.36kohm/60pF	3.5kohm/60pF	
Preamplifier output (max)/impedance		9.49V (disc)/9.5ohm	9.49V (disc)/9.5ohm	
Tape output (max)/impedance				
DC offset, L/R		+1.6mV/+1.1mV		

Retail price inc VAT

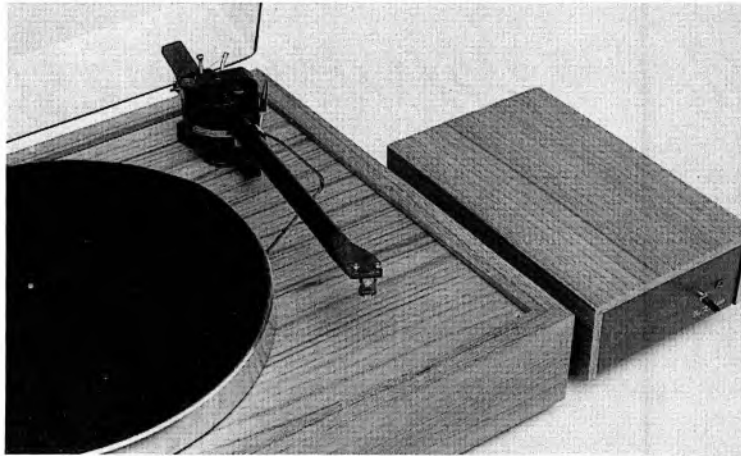
£280

POWER AMPLIFIER

	20Hz	1kHz	20kHz
Maximum Continuous Power Output – 8ohms	26.1W	28.6W	28.2W*
– 4ohms	40.3W	42.6W	42.6W*
Dynamic headroom (IHF)			+1.35dB (38.9W)
Output impedance	3.072ohm	3.223ohm	3.099ohm
Damping factor	2.60	2.48	2.58
Stereo separation (0dBV)	119.6dB	88.9dB	39.9dB
Total harmonic dist. (0dBV)	-32.2dB	-35.4dB	-28.8dB
	(½ power)	-32.1dB	-32.8dB
CCIR intermodulation distortion (0dBV)			-40.7dB
CCIR IM distortion (½ power)			-39.9dB
Rise time (@ 10kHz)			3.9µsecs
Power bandwidth			See text
Squarewave linearity			-84.2dB
Phase shift 20Hz			0°
	1kHz		0°
	20kHz		336°57'
Noise (A wtd, 20Hz-20kHz) 0dBV			-70.6dB
	(A wtd, 20Hz-20kHz) ½ power		-81.6dB
Residual noise (unwtd)			-57.3dBV
Input sensitivity (for 0dBV)			202.2mV
	(for full output)		960.5mV
Input loading			68.5kohm/58pF
DC offset, left/right			+22.6mV/+31.9mV
Typical price inc VAT			£280



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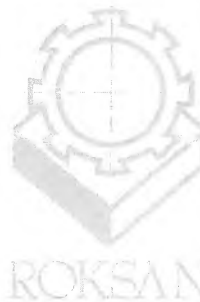
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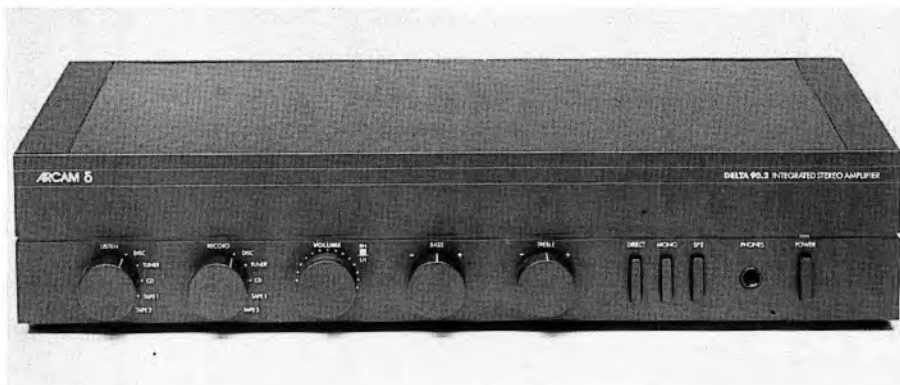
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Demonstration by Appointment

ARCAM DELTA 90.2

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

RECOMMENDED



Hot off the production line, this latest version of the *Delta 90* features one or two potentially important revisions. In terms of aesthetics little has changed: Arcam's sober matt black carcass remains, along with the five rotary knobs that cater for input and record output selection, volume (dual-concentric) and bass/treble adjustment. However, the *90.2* version is graced with a couple of extra coachlines milled across the top of the fascia. Clearly the Arcam design department is letting its hair down!

Inputs are provided for both MM and MC cartridges, together with line inputs for tuner, CD and two tape decks. A further three switches cater for mono, tone bypass (direct) and switched speaker operation, the latter enabling the speaker output to be disabled when listening via headphones, or alternatively opening up a further set of output sockets for use with bi-wired loudspeakers, for example.

Inside, Arcam has equipped the *90.2* with a more sophisticated disc stage than before, using a part-passive part-active EQ network in place of the original full series-feedback topology. Discrete devices (*2SC254?*) are used in the MC headamp and these are followed by low-noise *OP-27* and *NE5534N* single-channel op-amps in the EQ network itself. Similar ICs are used in the tone circuit. Four *A968/C2238* complementary drivers are used per channel, each primary pair biased firmly into Class A, while a pair of Motorola *MJ15003/MJ15004 TO3*-style bipolars suffice for the output stage.

LAB REPORT

A substantial +2.1dB increase in power was developed when changing from 8 to 40hms, though the large power supply is also responsible for a highish unweighted noise (hum) figure of -58.5dBV. Localised feedback around the output stage has reduced the output impedance to 0.047ohms at 20Hz, though this tails off at higher frequencies. Distortion also increases at HF, evident from the ultrasonic distortion plot as a spray of 2nd-6th harmonics together with innocuous 2nd-order IMD routes such as $F_{0-50k-0} \pm F_{0-20k}$. CCIR IMD reached 0.086 per cent via the MC disc stage as a result of premature slew-

limiting; the headroom which measured +28.4dB at 1kHz is down to +21.5dB at 20kHz.

Disc equalisation was extremely well matched between the MM and MC inputs, though the low bass shelf might well be responsible for some 'lightening' of the sound. The RF IMD plot is very impressive, indicating a moderate +5dB modulation with RF signals in the 50-60MHz region.

SOUND QUALITY

The very civilised yet somewhat uneventful sound of the *Delta 90.2* makes quite a contrast to the rich and ebullient character of the cheaper *Alpha II*. Orchestral pieces enjoy a realistic sense of weight, though the ebb and flow of the music itself did seem a trifle ponderous at times. Similarly, the powerful bass line on a Tracy Chapman CD was also considered a little overblown and indistinct in the very lowest registers.

Probably thanks to the very manageable levels of RF IMD, the *Delta 90.2* is endowed with a smooth and quite unfatiguing treble - a quality that led several members of the panel to describe its sound as typically 'British'!

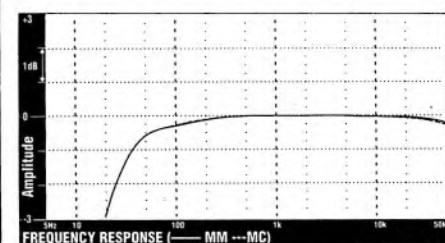
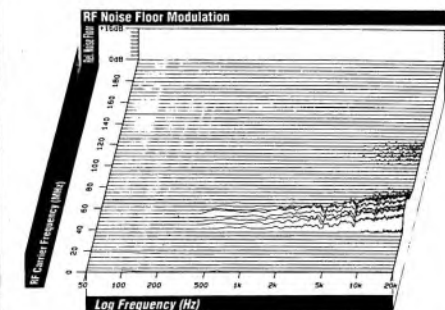
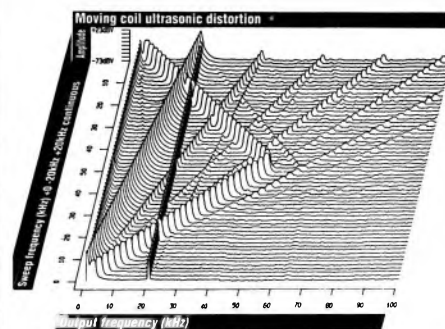
A similarly controlled and detailed sound was manifest via the disc inputs, though the MM stage has the greater clarity, bite and treble 'air'. Both disc stages avoid the bloated character of the line input, reducing any sense of muddling and helping create images from a velvety-black acoustic, if not the most generously dimensioned soundstage.

CONCLUSIONS

This recently revised model has a laid-back and very fluid sound, but also lacks the crisp dynamics and pizzazz of some of its immediate competition. A cautious Recommendation seems most appropriate.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	74.7W	73.1W	70.9W
- 4ohms	112.9W	118.3W	99.4W
Dynamic headroom (IHF)	+1.35dB (99.8W)		
Output impedance	0.047ohm	0.053ohm	0.105ohm
Damping factor	169.5	152.2	76.2
	CO/Aux	MM	MC
Stereo separation (20Hz)	76.8dB	74.6dB	73.6dB
(1kHz)	74.6dB	70.2dB	65.2dB
(20kHz)	56.7dB	63.8dB	62.4dB
Channel balance (-20dBV)	0.41dB	0.39dB	0.36dB
(-60dBV)	1.12dB	1.05dB	0.98dB
Total harmonic dist. (0dBV)	-74.9dB	-78.5dB	-75.9dB
(½ power)	-77.3dB	-80.4dB	-78.2dB
CCIR intermod. dist. (0dBV)	-76.4dB	-76.3dB	-61.8dB
CCIR IM dist. (½ power)	-78.9dB	-77.5dB	-61.3dB
Rise time	6.9µsecs		
Power bandwidth	5Hz - 21kHz		
Squarewave linearity	-93.8dB		
Phase shift (20Hz)	27°18'	113°33'	105°30'
(1kHz)	0°	312°50'	299°52'
(20kHz)	328°41'	296°47'	307°48'
Noise (A wtd, 0dBV)	-74.2dB	-74.2dB	-72.9dB
(½ power)	-88.3dB	-83.7dB	-75.8dB
Residual noise (unwtd)	-58.5dBV	-58.5dBV	-58.4dBV
Input sensitivity (for 0dBV)	26.45mV	247.6µV	22.57µV
(for full output)	227.4mV	2.073mV	194.1µV
Disc overload (20Hz)	16.0mV	1.543mV	
(1kHz)	143.3mV	13.17mV	
(20kHz)	1098mV	59.16mV	
(50kHz)	963.8mV	60.57mV	
Tape output/impedance	8.810V (disc)/1.86kohm		
Input loading	7.733kohm/1.43nF 50kohm/92pF 225.4ohm/1.52nF		
DC offset, left/right	-11.9mV/-9.6mV		
Typical price inc VAT	£350		



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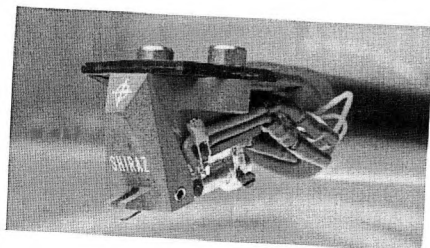
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AUDIOLAB 8000A

CAMBRIDGE AUDIO SYSTEMS, BURREL ROAD, ST. IVES IND. EST., CAMBS PE17 4LE. TEL: (0480) 496496.

RECOMMENDED



Audiolab's longstanding and popular 8000A has featured prominently in earlier issues of *Choice*, but it is now at least two years since a thorough update was performed, and like most other UK designs, the 8000A is a continually evolving product. The characteristic bronze/grey alloy fascia remains, and this is dotted with a variety of plastic control knobs. Full input and record-out selection is provided for phono, tuner, CD and two tape sources. Both MM and MC cartridge inputs have independent sockets, and alternative loads for specific MM cartridges may be implemented.

The phase-compensated tone controls operate over a sensibly restricted ± 6 dB range. A further set of 4mm speaker outputs may be switched into play for use with a second pair of speakers (or to accommodate the extra leads required when bi-wiring a single pair of speakers). The amplifier internals show close parallels with the 8000C/P pre/power combination.

The 8000A is immaculately constructed. A 30V single-rail supply feeding the pre-amplifier section is regulated using discrete C3851/A1488 devices, with additional regulation prior to the moving coil headamp. The voltage and power amp stages are configured as triple Darlington's, in an attempt to minimise both the output impedance and distortion of the amp when driving low impedances.

LAB REPORT

This is a very competent design technically, offering 72W into 8ohms and supplying a full +2.2dB increase (to 119W) into 4ohms. The output impedance registered a low 0.03ohms at 20Hz, and THD via all inputs fell between 0.0034 per cent and 0.0014 per cent midband – an excellent result. The MM and MC disc overload margins are a generous +31.7dB and +26.3dB respectively, though the lower headroom on the MC stage results in a slightly disappointing CCIR IMD figure of 0.039 per cent. Harmless 2nd and 4th harmonics of F_{0-20k} are visible on the 3D ultrasonic distortion plot, as is a trace of $F_{20k} - F_{0-20k}$ IMD.

This minor oversight is compensated by an exceptionally low MC disc input A-wtd noise

of -80dB (rel $\frac{1}{3}$ power = 24.1dBV). The vinyl disc input responses are also sensibly tailored, but note the phase shift encountered at the frequency extremes via the line input. In addition, the RF plot depicts two resonances allowing a bandpass of noise at 25MHz and 58MHz – each responsible for an audible fluctuation in the noise floor of some 8-10dB.

SOUND QUALITY

Compared to the vast majority of integrated amplifiers included in this test, the 8000A's improvement in treble detail and clarity was both immediate and convincing. The CD input demonstrated the extra spaciousness and resolution available when using the PDM convertor. Furthermore, it elicited a strong subconscious reaction from the panel – tapping feet and nodding heads can't be bad!

This amplifier successfully transmitted much of the majesty of our Mahler CD, portraying the thrill of massed strings and thunderous dynamics of the tympani with equal dexterity. All commented on the great control demonstrated by this model, together with an uncanny ability to develop a broad and deep soundstage, resulting in a very musical sound.

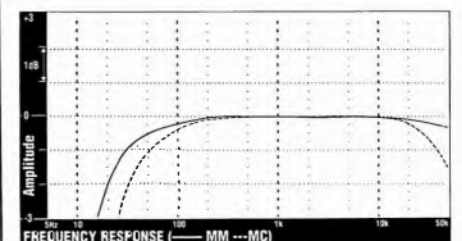
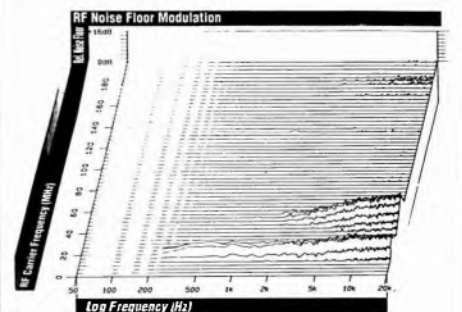
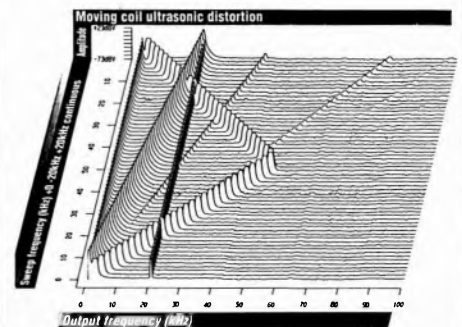
Stereo images are tightly focused – particularly vocals which rarely sounded hard or fatiguing however potent. A tinge of brightness is observed with powerful percussion, however, and this is mildly exacerbated on the vinyl disc inputs. Here the 8000A failed to live up to the promise of the line input, displaying considerable poise in its resolution of delicate details but let down by a musical soundstage that sounds flattened and less involving. A hint of grain and coldness stripped the treble of its earlier sweetness and, it must be said, disappointed many of our listeners.

CONCLUSIONS

Despite the variance in quality between the line and disc inputs, the current 8000A is still one of the most competent and enjoyable integrated amplifiers available. Via CD at least it proves a real winner, and that is justification enough to award a firm Recommendation.

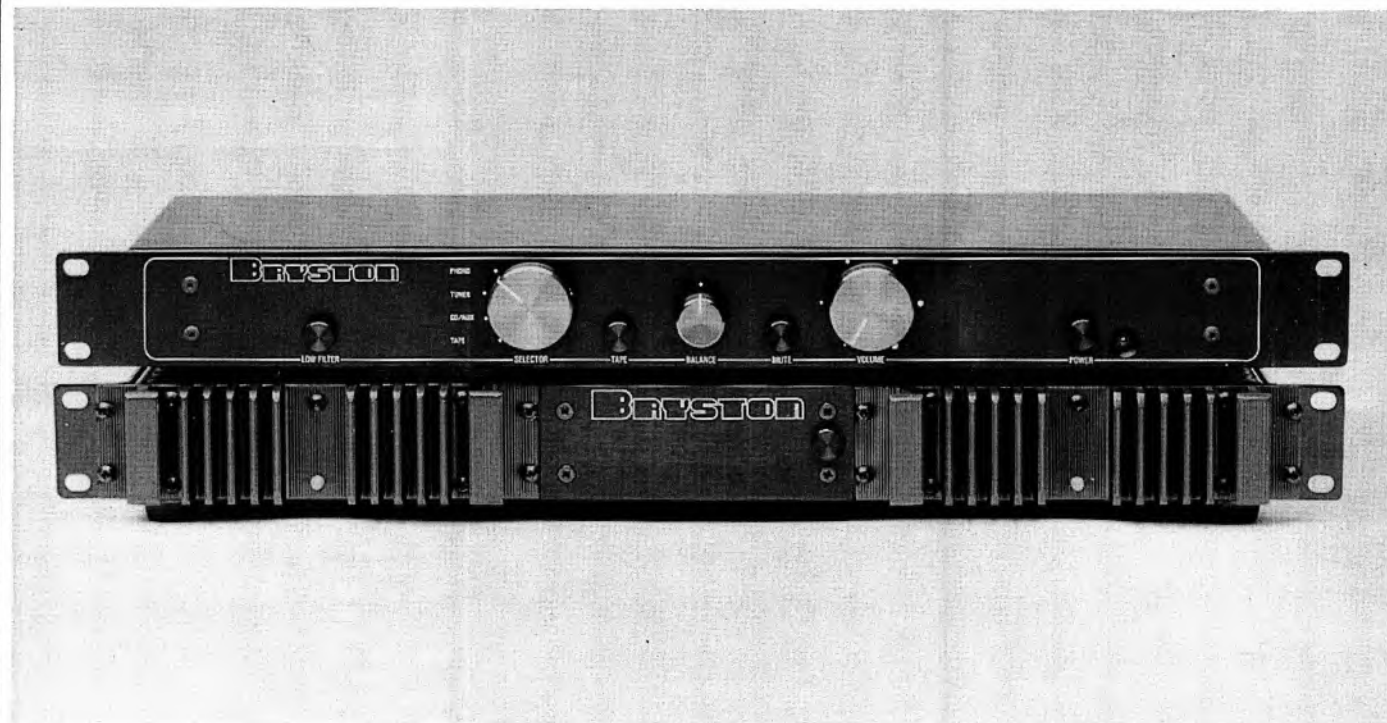
TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output – 8ohms	70.0W	72.4W	70.0W
– 4ohms	112.5W	118.9W	113.9W
Dynamic headroom (IHf)	+1.1dB (93.5W)		
Output impedance	0.0284ohm	0.0306ohm	0.0699ohm
Damping factor	281.9	261.5	114.5
Stereo separation (20Hz)	88.5dB	67.6dB	60.5dB
(1kHz)	67.1dB	63.7dB	62.8dB
(20kHz)	41.8dB	41.7dB	41.8dB
Channel balance (–20dBV)	0.04dB	0.05dB	0.09dB
(–60dBV)	0.73dB	0.65dB	0.57dB
Total harmonic dist. (0dBV)	–89.4dB	–94.7dB	–93.3dB
($\frac{1}{2}$ power)	–90.2dB	–96.9dB	–95.7dB
CCIR intermod. dist. (0dBV)	–87.3dB	–74.3dB	–68.0dB
CCIR IM dist. ($\frac{1}{2}$ power)	–86.1dB	–73.1dB	–66.9dB
Rise time	9.5µsecs		
Power bandwidth	4Hz – 45kHz		
Squarewave linearity	–94.5dB		
Phase shift (20Hz)	3°30'	46°48'	45°0'
(1kHz)	0°	300°36'	313°12'
(20kHz)	334°48'	248°24'	237°36'
Noise (A wtd, 0dBV)	–80.6dB	–77.8dB	–76.3dB
($\frac{1}{2}$ power)	–93.5dB	–81.9dB	–79.9dB
Residual noise (unwtd)	–68.6dBV	–68.6dBV	–68.9dBV
Input sensitivity (for 0dBV)	15.19mV	304.4µV	17.1µV
(for full output)	128.5mV	2.668mV	148.9µV
Disc overload (20Hz)		31.68mV	1.857mV
(1kHz)		192.8mV	10.36mV
(20kHz)		1791mV	100.8mV
(50kHz)		2456mV	95.9mV
Preamp Output/Impedance	10.19V/605.7ohm		
Input loading	21.5kohm/91.1pF 41.9kohm/70pF 110.5ohm/3.6nF		
DC offset, left/right	+3.2mV/+2.5mV		
Typical price inc VAT	£350		



BRYSTON 0.5B/2B

ROKSAN ENGINEERING LTD., 21 DDOLE ROAD, LLANDRINDOD WELLS, POWYS LD1 6DF. TEL: (0597) 4911.



Setting aside a fleeting appearance a decade ago, Bryston amplifiers made their *Choice* debut in our last amplifier issue with one of the top pre-power combinations, so on this occasion we have decided to concentrate on this Canadian company's most cost-effective duo, the *0.5B* and *2B*. Despite slim cases and diminutive stature of these units they still betray Bryston's professional heritage: each model is rugged, foolproof and – in the unlikely event of failure – easily serviceable. For instance, the *2B* power amplifier is constructed as a dual mono unit with two 100VA toroidal mains transformers and separate regulators to the independent L/R circuit boards and heatsinks. Either of the amplifier modules can be unlocked and withdrawn via the amp's fascia for easy access.

Both domestic and 'Pro' versions of the 50W *2B* power amplifier are available, the latter equipped with 600ohm balanced inputs. It is also possible to bridge the *2B* (increasing its output as a monophonic amplifier to 180W), just as the internal ground may be disconnected in the event of an unexpected hum-loop.

The black, fluted heatsinks which grace the front of this very slim amplifier make for an attractive appearance. Dual-colour LEDs peek out from the centre of these heatsinks, changing from a steady green to red if the amplifier is pushed to the point of clipping. However, since each *2B* is burned-in at the factory using a full-power squarewave into a reactive load, a red light is more likely to threaten damage to the loudspeakers than the amplifier itself!

The internal design is symmetrical and very elegant, reflecting Bryston's aim of achieving excellent open-loop linearity without recourse to lashings of feedback. *2N5081/2N5210* bipolars form a differential input,

while specially-produced Motorola *BR6521/BR6521* devices constitute the output stage (one pair per channel). These are mounted alongside a bi-metallic strip which is designed to cut off the mains supply if the temperature rises above 75°C, subsequently reinstating power when the temperature drops back below 55°C.

Bryston's matching *0.5B* preamplifier is equally sleek in appearance and functional in operation. Two large alloy controls on the black fascia adjust volume and switch the three line and one phono (MM only) inputs. (An optional step-up transformer with variable voltage gain is available to suit most MC cartridges if so desired.) The list of facilities concludes with balance, tape monitor, –20dB mute and low filter (<31.7Hz) controls.

The low filter circuit is actually placed between the LF and HF arms of the active RIAA equalisation section, the latter preceeding Bryston's remote input selection switch. High quality polystyrene caps and metal-film resistors are used throughout. The basic design comprises three identical, series-regulated, differential op-amps, each composed of *BC413/BC415* bipolars followed by *2N5087/2N5210* and *2N5681/2N5679* drivers. The first four transistors in each block are gain-matched for linear, complementary operation. Two of these op-amps are used in the disc EQ stage; the third follows the selector, tape, balance, mute and volume controls as a final output stage.

LAB REPORT

Bryston's claims concerning the strict accuracy of its RIAA network was borne out in the measurement programme. Between 20Hz and 20kHz an EQ tolerance of ± 0.1 dB was recorded with a –3dB LF roll-off at a low

2.5Hz. The CD input (dotted line) is essentially flat between 5Hz and 50kHz. The *0.5B* is obviously a very linear design, offering figures for THD in the region of 0.0015 per cent at 1kHz (MM) and 0.0033 per cent at 20kHz (MM). CCIR IMD falls to a minimum of 0.0016 per cent via the CD input but increases to some 0.0083 per cent through the vinyl disc input. Furthermore, with the 16:1 ratio driving signals used in the ultrasonic Distortion test, the level of IMD falls to <–95dB – this plot represents a superb result where only the merest whiff of 3rd harmonic is visible.

The *0.5B* also offers a remarkably low A-wtd noise of –90.4dB via MM disc, alongside an entirely suitable sensitivity of 2.142mV and generous headroom of +35.9dB. The 131° phase shift noted at 1kHz via the disc input is some 180° less than expected.

The 50kohm input impedance of the *2B* power amplifier will not cause any problems, any more than its very low THD of 0.0035 per cent. Power delivery managed 65.2W into 8ohms but failed to achieve the 100W rating into 4ohms; the recorded rise of +1.7dB is nonetheless respectable, as is the IHF headroom of +1.6dB. The very low 0.024ohm output impedance is a reflection of the feedback used around the output stage (which falls with increasing frequency), encouraging the excellent CCIR IMD results (0.00092 per cent). A squarewave linearity of –107.4dB is also very good – just look at the absence of closed-loop nonlinearities on the 3D ultrasonic distortion plot.

However, under the open-loop conditions of the RF IMD test this amp did show some sensitivity to noise in the 165-220MHz region. In fact there are two areas of demodulation, the first a mild +6dB at 178MHz and a second peaking at +11dB at 205MHz. This

latter breakthrough caused a broad increase in the noise floor between 500Hz and 20kHz, though this actually decreased in severity the longer the amplifier was left powered-up!

SOUND QUALITY

Roksan, the importer of Briston electronics, suggests that these amplifiers might require a very protracted warm-up period. This did turn out to be the case, both pre- and power amp sound distinctly smoother and richer after being left powered-up for a day or two.

They initially possessed a very keen and slightly bright sound that, while not piercing, is a little too hard or 'glazed' for long-term comfort. Perhaps reflecting the unusual result obtained in the RF IMD test, vocals tend to appear up-front and hard-hitting via the CD input.

Nevertheless, once the combination has had time to settle down it delivers a very potent, crisp and cool sound which belied its modest power rating. The weight and solidity of classical excerpts is revealed in an impressive manner, and is maintained by the thrill of strings and speed of brass percussion. Much of the natural spaciousness revealed by the PDM D/A convertor is maintained with this duo, although the resolution of stereo depth is superior to that achieved at the sides and front of the soundstage. Images, particularly of bass instruments, sound focused and tactile.

The MM input provides a less distinct and transparent sound but was also thought to be warmer and softer than the raw detail afforded via CD. The fast and tight sound of the power amplifier becomes less obvious when using vinyl; the leading edges of transient notes are blunted, and their subtle decay is slightly muted. Tonal colours are surreptitiously veiled, particularly at low frequencies which are less rich, less well-rounded and generally less convincing in presentation.

CONCLUSIONS

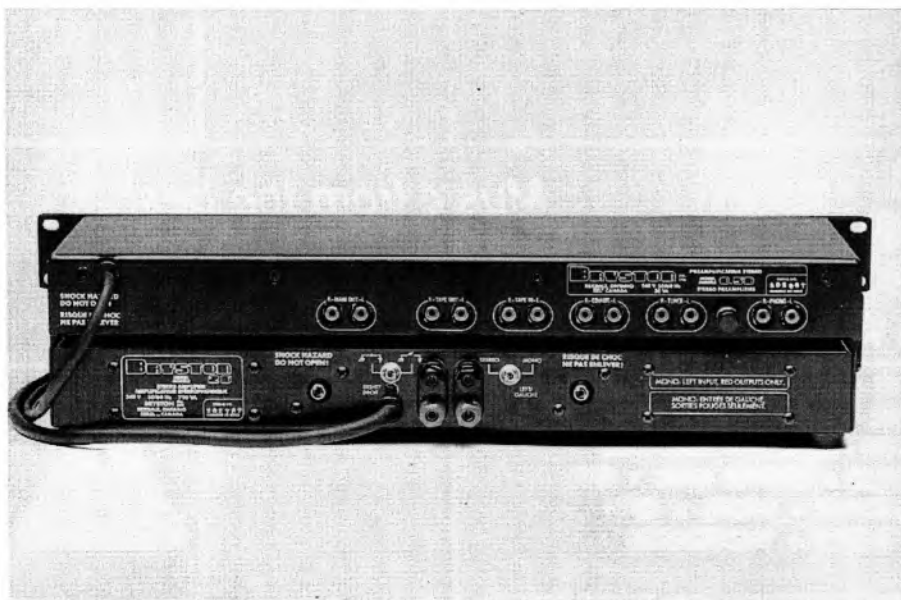
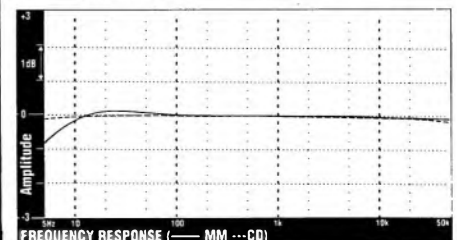
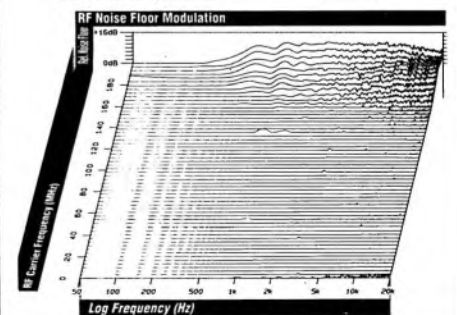
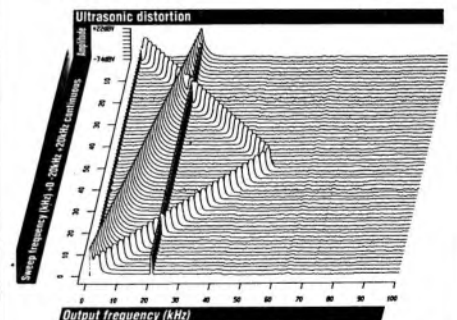
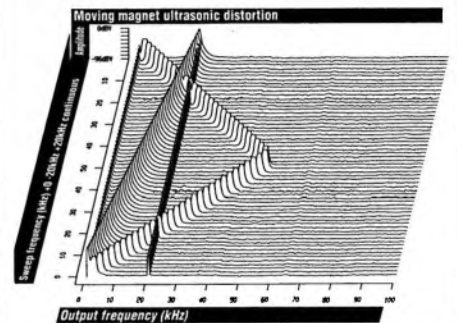
The design of the 0.5B preamplifier and 2B power amplifier shows that it is possible to design a relatively simple amplifier that is both reliable, very linear and (incidentally) sounds pretty good too. The power amplifier emerges as the real winner of this combination but, via CD at least, the 0.5B was certainly no disgrace. Its softer-sounding disc input might even prove attractively relaxing for some listeners, but there remains a disparity between this and the sharper, more coherent balance available via CD. Nevertheless, if their pro-orientated 'aesthetics' are appealing, these Briston amps are well worth searching out at a mite under £1,300.

TEST RESULTS

PREAMPLIFIER		
	Aux/CD	MM
Stereo separation (20Hz)	91.5dB	102.1dB
(1kHz)	56.7dB	72.9dB
(20kHz)	31.1dB	46.2dB
Channel balance (0dBV)	0.08dB	0.06dB
(-20dBV)	0.59dB	0.61dB
(-60dBV)	0.15dB	0.05dB
Total harmonic dis. (0dBV)	-90.5dB	-96.6dB
(20kHz)	-84.5dB	-89.7dB
CCIR intermod. dist. (1:1)	-96.1dB	-81.6dB
Phase shift (20Hz)	7°12'	180°
(1kHz)	0°	131°2'
(20kHz)	358°12'	86°24'
Squarewave linearity	-107.4dB	
Noise (A wtd, 20Hz-20kHz)	-92.3dB	-90.4dB
Residual noise (unwtd)	-98.3dB	-98.5dB
Input sensitivity (for 0dBV)	127.8mV	2.142mV
Disc overload (20Hz)		23.46mV
(1kHz)		219.4mV
(20kHz)		1669mV
(50kHz)		1985mV
Input loading	75.2kohm/60pf	37.6kohm/220pf
Preamplifier output (max)/impedance	13.10V (disc)/105.5ohm	
Tape output (max)/impedance	13.10V (disc)/98.9ohm	
DC offset, L/R		+0.5mV/-0.2mV
Retail price inc VAT		£595

POWER AMPLIFIER

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	60.6W	65.2W	62.8W
- 4ohms	78.9W	96.4W	89.8W
Dynamic headroom (IHF)		+1.64dB (95.1W)	
Output impedance	0.024ohm	0.024ohm	0.049ohm
Damping factor	334.7	336.8	163.3
Stereo separation (0dBV)	132.7dB	104.1dB	100.0dB
Total harmonic dist. (0dBV)	-84.4dB	-89.2dB	-88.5dB
(½ power)	-81.2dB	-85.2dB	-82.7dB
CCIR intermodulation distortion (0dBV)		-94.1dB	
CCIR IM distortion (% power)		-100.7dB	
Rise time (@ 10kHz)		5.6µsecs	
Power bandwidth		12Hz - 18kHz	
Squarewave linearity		-107.4dB	
Phase shift 20Hz		0°	
1kHz		0°	
20kHz		341°16'	
Noise (A wtd, 20Hz-20kHz) 0dBV		-92.2dB	
(A wtd, 20Hz-20kHz) ½ power		-107.5dB	
Residual noise (unwtd)		-79.2dBV	
Input sensitivity (for 0dBV)		86.40mV	
(for full output)		707.9mV	
Input loading		49.6kohm/250pf	
DC offset, left/right		+21.9mV/+20.7mV	
Typical price inc VAT		£695	



Uxbridge Audio

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Wembley Park,
Middlesex.

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A quick phone call to your Shop to find out whether you had them in stock and I was lectured on how a Music System should be purchased . . . "Have you listened to it? How do you know you will like it's sound? It isn't the same as buying a washing machine, when it has to be taken on faith that it will do the job as you want it. It is more like buying a musical instrument, where personal preference dictates. You do not need to be an expert, you only need to listen to it and decide for yourself . . ."

Not too keen on the lecture, I was, none the less, taken up by what he said, and decided to pay you a visit. This turned out to be QUITE AN EXPERIENCE! After listening to a few systems I had already decided I would be buying my own combination and not the one recommended in the magazine. A music system should, indeed, be listened to, before purchasing. In addition, the personal attention, friendly, untiring and "non pushy" attitude of your sales assistant, Jas, turned the daunting prospect of choosing the right hi-fi into a most pleasant experience.

When I first read the letter from a satisfied customer in your advert I didn't think it genuine. But after my experience I know just what he meant. I echo him in commanding you and your staff and I will not hesitate to recommend you. I, once again, thank you for the help in choosing my system and the excellent service and attention I have received at and since it's installation.

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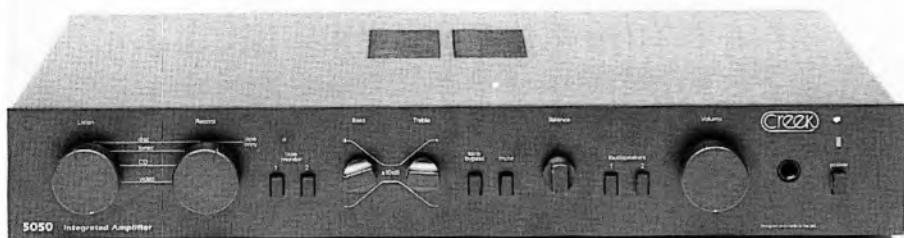
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CREEK CAS-5050

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

RECOMMENDED



This powerful and comprehensively equipped amplifier is the first new Creek model to emerge since the company was taken over by Mordaunt-Short, itself one of the three main hi-fi brands that form the TGI Group plc! Nevertheless Creek continues to operate autonomously, and the characteristic green logos are retained on the CAS-5050.

The amplifier features separate source and record-out switching for disc, tuner, CD and video sources. Alternative moving magnet and moving coil cartridge options are selected by a switch on the rear panel, while the MC headamp (which operates with a fixed gain) can also be attenuated via an internal DIP switch.

A detent-action volume control is joined by balance and defeatable tone controls in addition to speaker switching, mute and tape monitor facilities for two decks. Switches on the rear allow the amplifier to be operated in bridged-mono mode, mono/stereo or indeed as a separate pre or power amp. Localised signal switching is employed in this very neat design which includes discrete regulation for the positive and negative supply rails, together with full thermal compensation in the supply and output stages.

The MC headamp is composed of discrete transistors and a low-noise op-amp, followed by a further two NE5532 dual-channel devices configured for the MM/RIAA EQ stage. Passive HF equalisation follows an active gain stage with LF tailoring effected by a series-feedback network. TL072CP op-amps are used in the unity-gain Baxendall tone controls (as in the cheaper Creek CAS-4040).

LAB REPORT

Creek has opted for a complementary emitter-follower output stage in the CAS-5050, the 72W output clearly within the capabilities of these 25A TIP35/36 devices. A slight tracking error of 1.7dB was detected at low levels in the disc stage. Separation, noise and input sensitivities are all fine. Disc EQ is accurately matched on both MM and MC inputs, though the -3dB point is set at 6Hz, which is too low to counter arm/cartridge resonances.

THD increased from 0.0035 per cent to

0.018 per cent on all inputs when increasing the output from 1W to 1/3 power into 8ohms. The ultrasonic plot indicates that both THD and IMD increase to around 0.25 per cent via the MC input when running at 1/3 power into 4ohms. Second to eighth harmonics dominate, together with summation IMD routes defined by $F_{(1-50k-0)} + yF_{0-20k}$ and $F_{20k} + yF_{0-20k}$ ($y = 1.4$). These IMD patterns serve to indicate the effect of reducing feedback at increasing frequency.

More worrying, however, is the RF IMD plot which highlights a severe sensitivity to RF noise in the 60-80MHz region. Noise modulation reached a peak of +21dB across this passband, which is likely to have audible consequences.

SOUND QUALITY

Considerable disparity was detected in the character of line and disc inputs, possibly as a result of RF intermodulation. Via the CD input, this amplifier struggled to resolve the subtle inflections of vocals, and powerful bass transients lacked both depth and extension. The overall balance is smooth enough but has an odd 'one-note' beat that causes most types of music to plod along in a rather uninspiring fashion.

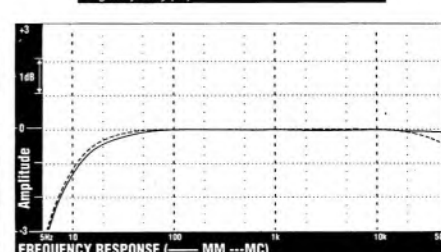
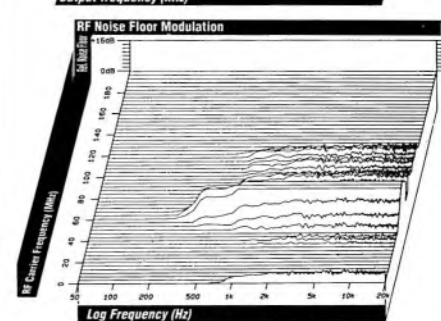
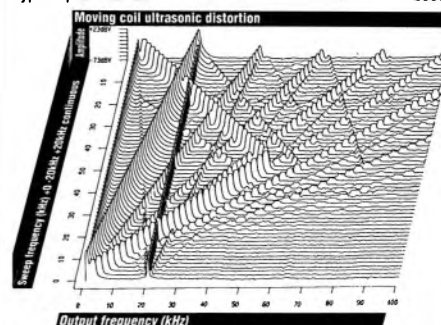
By contrast the disc inputs seem better able to recreate something akin to a living, breathing musical performance. Filligree detail is now revealed within a spacious, unfatiguing acoustic that manages to hold on to individual notes as they decay gently away. The sound is very clean and positive too: rimshots crack with convincing speed and tautness, while plucked strings possess a realistic 'edge'.

CONCLUSIONS

Creek's latest offering is a powerful and versatile design that sounds confident and controlled with virtually all types of music. An RF filter placed ahead of the line stage would almost certainly improve the performance with digital sources, though aside from this there are no major technical discrepancies. Subjectively it possesses one of the better disc inputs in this test, and is therefore Recommended to those enthusiasts who have yet to be weaned off vinyl discs.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	68.8W	72.2W	66.4W
- 4ohms	101.4W	110.8W	98.3W
Dynamic headroom (IHF)	+1.23dB (95.9W)		
Output impedance	0.086ohm	0.085ohm	0.083ohm
Damping factor	92.9	93.7	96.1
	CD/Aux	MM	MC
Stereo separation (20Hz)	103.5dB	78.6dB	73.3dB
(1kHz)	70.7dB	68.9dB	67.4dB
(20kHz)	46.2dB	42.7dB	42.8dB
Channel balance (-20dBV)	1.25dB	0.35dB	0.33dB
(-60dBV)	0.23dB	1.65dB	1.74dB
Total harmonic dist. (0dBW)	-88.7dB	-89.5dB	-90.7dB
(1/3 power)	-74.9dB	-75.6dB	-76.3dB
CCIR intermod. dist. (0dBW)	-78.6dB	-76.4dB	-74.2dB
CCIR IM dist. (1/3 power)	-63.4dB	-65.9dB	-64.2dB
Rise time	5.55µsecs		
Power bandwidth	13Hz - 21kHz		
Squarewave linearity	-99.4dB		
Phase shift (20Hz)	216°	205°30'	205°55'
(1kHz)	180°	133°55'	133°0'
(20kHz)	150°50'	103°27'	103°30'
Noise (A wtd, 0dBW)	-84.9dB	-81.1dB	-76.5dB
(1/3 power)	-83.5dB	-81.6dB	-76.4dB
Residual noise (unwtd)	-64.4dBV	-64.4dBV	-64.3dBV
Input sensitivity (for 0dBW)	36.9mV	276.5µV	8.36µV
(for full output)	316.8mV	2.272mV	71.1µV
			309.4µV
Disc overload (20Hz)		19.39V	2.645mV
(1kHz)		178.1mV	24.12mV
(20kHz)		127.1mV	85.85mV
(50kHz)		1163mV	82.70mV
Tape output/impedance	10.37V (disc)/210.5ohm		
Input loading	20.4kohm/39.5pF 50kohm/133pF 101.4ohm/8.1nF		
DC offset, left/right	-12.5mV/-15.9mV		
Typical price inc VAT	£399		



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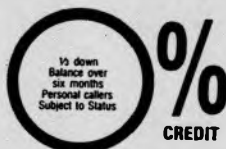
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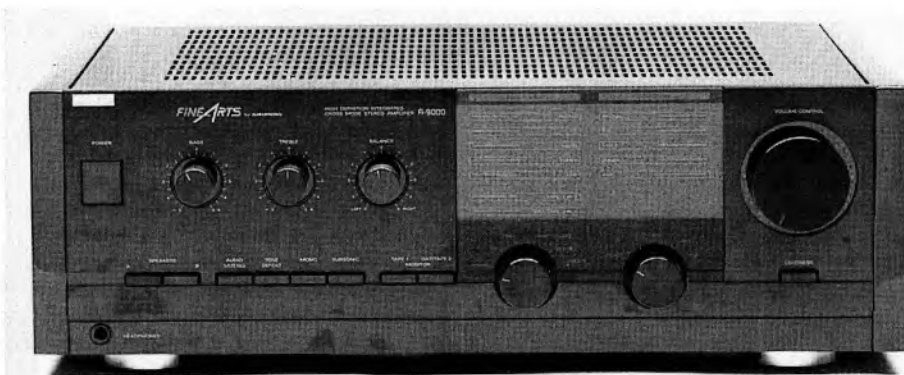
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GRUNDIG A-9000

GRUNDIG INTERNATIONAL LTD., MILL ROAD, RUGBY, WARWICKSHIRE CV21 1PR. TEL: (0788) 77155.



Grundig is a new name to high-cost hi-fi in the UK, making something of a splash when introducing the *Fine Arts* system, not least because the combo includes a DAT player. The *A-9000* is a decidedly upmarket amplifier and is built accordingly. Its massive frame is flanked by two polished wooden side-cheeks and the fascia is punctuated with a variety of controls plus a function display.

None of this gives any clue to its heritage of course, but a quick peep inside reveals topology and method of construction that is synonymous with previous designs from Philips and Marantz, reflecting the strong commercial ties between these three companies/brands.

Not only is the amplifier constructed in the symmetrical (dual-mono) Philips/Marantz fashion, but it also uses the same *STK3102* hybrid regulator/driver and complementary *2SA1265/2SC3182* output transistors as the Philips *FA960mkII*. Similarly, the disc EQ network is also based around a very low noise *LM833N* op-amp, though here the MC input appears to be transformer-coupled.

The independent record-out and input selection knobs are themselves poorly annotated, but the huge display provides vital confirmation of which input or output has been chosen. Two additional tape monitor buttons over-ride the rotary selector, accounting for the obscure 'Cross Mode' logo on the fascia. Subsonic filter, mono, tone defeat and muting options complete the lineup of facilities, together with a standard headphone socket tucked away near one corner.

LAB REPORT

Reinforcing the links with previously assessed Philips designs, this amplifier delivers a healthy 153W output (with +2dB extra into 4ohms) across a very wide 104kHz bandwidth (<1% THD). Furthermore both the output impedance, THD (<0.004 per cent), stereo separation and low A-wtd noise level (-104dB ref 1/2 power) are all directly comparable with the Philips *FA960*. Even the very effective RF filtering is typical of a European design, the *A-9000* suffering a sharp but narrow +20dB increase in noise as a result of RF

in the 1-4MHz region.

The respective MM and MC disc overload margins (+30.6dB and +33dB) no doubt aid the low CCIR IMD figures and prompt the simple harmonic distortion structure visible on the 3D plot. Traces of yF_{0-20k} ($y = 2-5$) are visible, but all IMD is reduced to below the noise thresholds. The *high* parallel capacitance of the MM disc input is likely to modify the treble balance of many cartridges to a degree, but ideal conditions provide equalisation to within 0.5dB from 5Hz-50kHz!

SOUND QUALITY

The differentiation of treble detail via the CD input was initially fairly good, despite failing to achieve the crisp clarity of some models. However, extended listening revealed a peculiar coloration that persisted throughout the upper registers, lending a slightly false or 'clanky' edge to many notes.

The overall balance was softened slightly, bass notes sounding full and rich but lacking both tautness and rhythmic security. Stereo images were also soft in focus just as the three-dimensional soundstages usually developed with the PDM D/A convertor were suppressed via the *A-9000*.

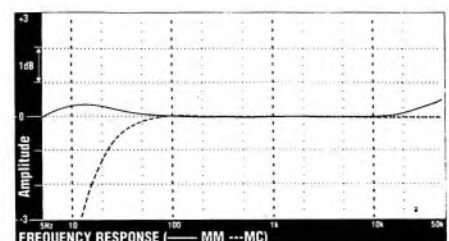
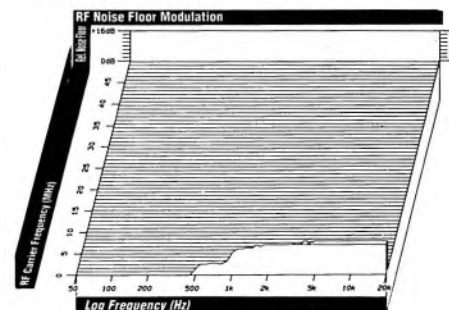
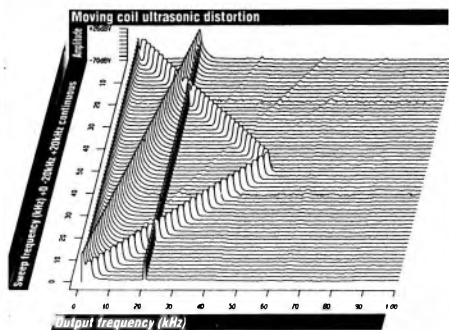
In its favour, the vinyl disc inputs appear to produce very little degradation, though the MC input does sound slightly colder and leaner in tone. Both disc inputs suffer from a smeared and sibilant treble - not unduly unpleasant, this is not particularly revealing or indeed very satisfying.

CONCLUSIONS

Bearing in mind the technological heritage of this large integrated amplifier, Grundig will be hard pressed to justify its very high cost. It is certainly very powerful, and is also unlikely to be upset by the spurious emissions of some CD players. Nevertheless, initially quite favourable impressions were unfortunately replaced by sufficient subjective dissatisfaction to preclude any recommendation.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	140.9W	153.2W	149.9W
- 4ohms	203.6W	241.8W	235.5W
Dynamic headroom (IHF)	+1.28dB (205.6W)		
Output impedance	0.041ohm	0.037ohm	0.046ohm
Damping factor	196.8	213.8	173.8
	CD/Aux	MM	MC
Stereo separation (20Hz)	78.9dB	84.8dB	83.8dB
(1kHz)	78.6dB	77.9dB	77.8dB
(20kHz)	56.8dB	56.1dB	55.6dB
Channel balance (-20dBV)	0.22dB	0.19dB	0.16dB
(-60dBV)	0.23dB	0.10dB	0.03dB
Total harmonic dist. (0dBW)	-89.4dB	-92.7dB	-93.9dB
(1/2 power)	-88.4dB	-92.8dB	-93.7dB
CCIR intermod. dist. (0dBW)	-96.5dB	-81.3dB	-78.2dB
CCIR IM dist. (1/2 power)	-99.1dB	-79.9dB	-77.6dB
Rise time	2.2µsecs		
Power bandwidth	4Hz - 104kHz		
Squarewave linearity	-105.3dB		
Phase shift (20Hz)	23°2'	354°14'	352°14'
(1kHz)	0°	311°2'	310°30'
(20kHz)	347°2'	264°57'	257°45'
Noise (A wtd, 0dBW)	-90.9dB	-84.1dB	-80.2dB
(1/2 power)	-104.1dB	-85.8dB	-80.9dB
Residual noise (unwtd)	-86.3dBV	-86.2dBV	-86.1dBV
Input sensitivity (for 0dBW)	14.91mV	243.9µV	32.5µV
(for full output)	186.1mV	3.041mV	401.7µV
Disc overload (20Hz)	17.88mV	2.421mV	
(1kHz)	168.6mV	22.34mV	
(20kHz)	1476mV	182.4mV	
(50kHz)	1498mV	177.8mV	
Tape Output/Impedance	9.965V (disc)/272.6ohm		
Input loading	89.5kohm/57pF	43.8kohm/985pF	366.7ohm/17.5nF
DC offset, left/right	-7.6mV/-8.5mV		
Typical price inc VAT	£650		



HAFLER DH-110/XL-600

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



The David Hafler company is probably unique in retaining a toe-hold in both the finished product and DIY hi-fi markets. Many of the smaller pre- and power amplifiers are available in a pre-fabricated fit form which is easily assembled by the keen enthusiast who enjoys the participation and saves a few bob.

In fact the *DH-110* preamplifier featured here is also available as a kit, saving the skillful solderer some £70 odd. Perhaps as a result of this dual-role the *110* is very much a nuts and bolts design – high quality where it matters, but unlikely to win any awards for dashing aesthetics!

The facilities are certainly very comprehensive and the milled-alloy controls (particularly the detent-action volume knob) lend a welcome air of solidity. Four equal-sized controls cater for bass, treble, balance and volume, the latter a very high quality Nobel potentiometer. Four smaller 4-pole double-throw pushbuttons provide tone defeat and sub-25Hz filter options, mono/stereo mode and 'EPL' selection. This engages an external processing loop for the inclusion of outside peripherals (NR units, ambisonic decoders, graphic equalisers etc), or indeed will function as an extra line input.

A conventional rotary selector opens up other inputs for tuner, video, 2x tape and 2x phono sources, while a separate selector facilitates monitoring through one or other of the tape outputs. The standard *DH-110* is equipped with two moving magnet disc inputs, each with provision for variable capacitance loading (up to 150pF for input one and 250pF input two). Moving coil cartridges may be accommodated with the purchase of Hafler's *DH-112* MC headamp, an extra board that slots into place ahead of the phono one input.

The circuit design of the *110* is actually a

development of the original *DH-101* topology – fully discrete, complementary components in a wholly symmetrical layout. The disc input uses low-noise complementary bipolars with a paralleled complementary output, equalisation being part active (LF) and part passive (HF). The line amp comprises a double-differential input with complementary output, followed by passive Baxendall-type tone controls.

To partner this established preamplifier, the *XL-600* 'Excelinear' power amplifier is a new and truly gargantuan creation – the bridged mode converts it into a 1.5kW monoblok! Not available in kit form, the *XL-600* looks every inch the monster amp from its sculptured matt alloy fascia (19-inch rack mount), chunky grab handles and grilles that ensure a free flow of air through the heart of the box. A single pair of 4mm binding post/sockets are provided at the rear of this 23kg crate, alongside two 5A fast-blow supply fuses.

Near full power and particularly when driving low impedance loads and under test conditions, these fuses tend to blow rather regularly, in which case they should be uprated to 10A types. This will not reduce the protection, and will certainly not encourage damage to loudspeakers, for the main output remains under the control of a massive relay-fired muting circuit.

Much of the bulk of this amp is due to a huge laminated mains transformer, 4 x 18,000 μ F electrolytics and a large cast-alloy heat-tunnel. All the input and driver circuitry is included on two L/R PCBs that are bolted to the sides of this heatsink, Hafler opting for a double-differential input using 2N5415/2N3440 J-FETs cascode-coupled to a current mirror. Eight pairs of QN113/QP113 MOSFET power transistors are bolted in

rows of four along the edges of the fan-assisted heat-pipe, an underslung thermocouple directly controlling the speed of the fan. At sustained high power levels into dummy loads the *XL-600* can sound like a jet engine!

LAB REPORT

Depending upon the impedance characteristics of the partnering loudspeakers, it is possible to adjust a small air-spaced capacitor inside the *XL-600* in order to achieve a near-0° phase lag from input to output across the entire audio band. This was achieved for the purposes of this test (see phase measurements) and ensure that the *XL-600* would perform ideally under the constraints of Hafler's contentious SWDT (Straight Wire Differential Test).

During the tests, the *XL-600* fairly bludgeoned my 8 and 4ohms loads with mid-band outputs of 426W and 676W respectively (sensitivity is low, however, requiring 2.9V for full o/p). The output headroom is satisfactory, impedance is suitably low (0.05ohm) and rise-time is a very rapid 518ns. However, a 10 per cent overshoot was noted using a 10kHz squarewave. THD settled between 0.0058 per cent and 0.016 per cent at $\frac{2}{3}$ power across the audible spectrum, while A-wtd noise at this level was a superb –114dB.

At $\frac{2}{3}$ power into a 4ohm load (+31dBV) the 3D ultrasonic distortion plot reveals a spread of 2nd-6th F_{0-20k} harmonics, together with the 2nd, 3rd and 5th summation IMD routes $F_{0-50k-0} + yF_{0-20k}$ ($y = 1, 2, 4$) as a result of declining feedback.

More important, the *XL-600* suffers very little from RF IMD, the +5dB break at 22MHz boding well for good sound quality.

The *DH-110* pre-amplifier is certainly

more linear (see 3D plot) with THD typically in the 0.001 per cent region, channel balance better than 0.8dB at all levels and noise a low -81dB (A-wtd) via MM disc. Disc headroom is very generous at +35.3dB and the RIAA response generally very flat apart from a minor +0.48dB lift at 35Hz. Stereo separation could withstand some improvement, but that's about all!

SOUND QUALITY

More than any of the other pre/power amplifiers in this test the *DH-110/XL-600* combination successfully conveyed the wonderfully open and naturally detailed sound available from the PDM D/A convertor. Furthermore, instead of simply sounding louder and perhaps more forward, advancing the volume control simply increases the scope of the soundstage still further.

Auditioned on an individual basis at first, both the pre- and power amplifiers deliver big, friendly and very open sounds. The *XL-600* in particular exercises a real grip on the music without strangling the sound or overdamping the subtle decay of notes. Deep bass notes can sound rich and cavernous, just as percussive sequences might appear flighty but sweet and very convincing.

Together the Hafler amplifiers communicate a wonderful sense of pitch and timing, with a reproduction of music that seems essentially 'right' regardless of whether it be classical or New Age. Perhaps it's the neutrality, the unforced vocal articulation, the excellent portrayal of timbral detail or just the effortless dynamics, but either way the combination succeeded in inspiring our listeners. In fact within a relatively short listening period all were either tapping out the beat with their pens or nodding along with the tempo of the music - a good sign this.

A loss of sweetness and purity is obvious in the highest registers when switching to the MM input, but the very smooth, fluid and remarkably spacious character of the duo is retained. As a result vinyl records sound slightly colder and less assured than CDs, but

the sense of 'air' and freedom surrounding individual instruments remains a delight. In many respects the sound of this combination bears comparison with many highly regarded valve designs - slightly larger-than-life, but eminently enjoyable.

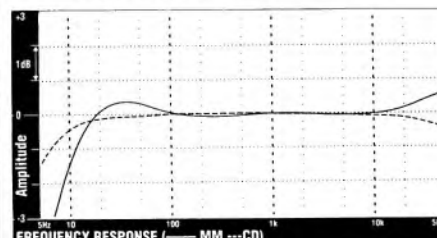
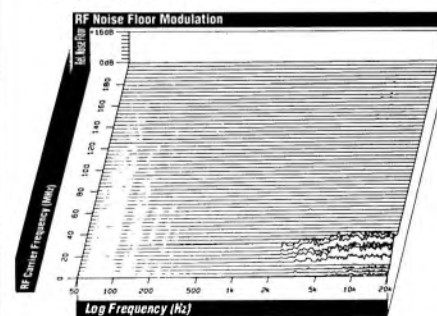
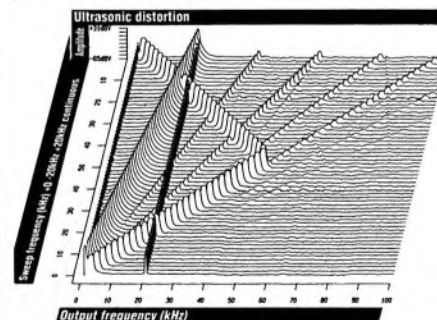
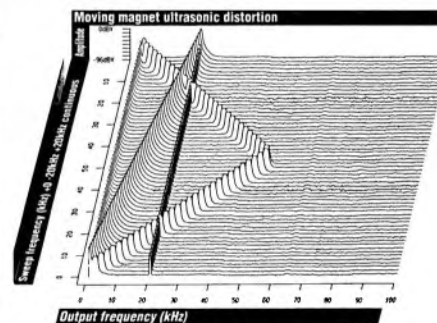
CONCLUSIONS

Hafler set out to build an amplifier that may be 'compared on any standards with the most expensive alternatives', a target pretty much achieved with the new *XL-600* power amplifier. Considering the vast reserves of power at its disposal, this amplifier does indeed represent fine value, while the big and very natural sound quality must surely place it near the top of any enthusiast's shopping list. Many of the *XL-600's* fine subjective and technical qualities are mirrored by the longer established *DH-110* preamplifier. They make a great team, offering flexibility, broad compatibility and excellent sound quality. They are also highly Recommended!

TEST RESULTS

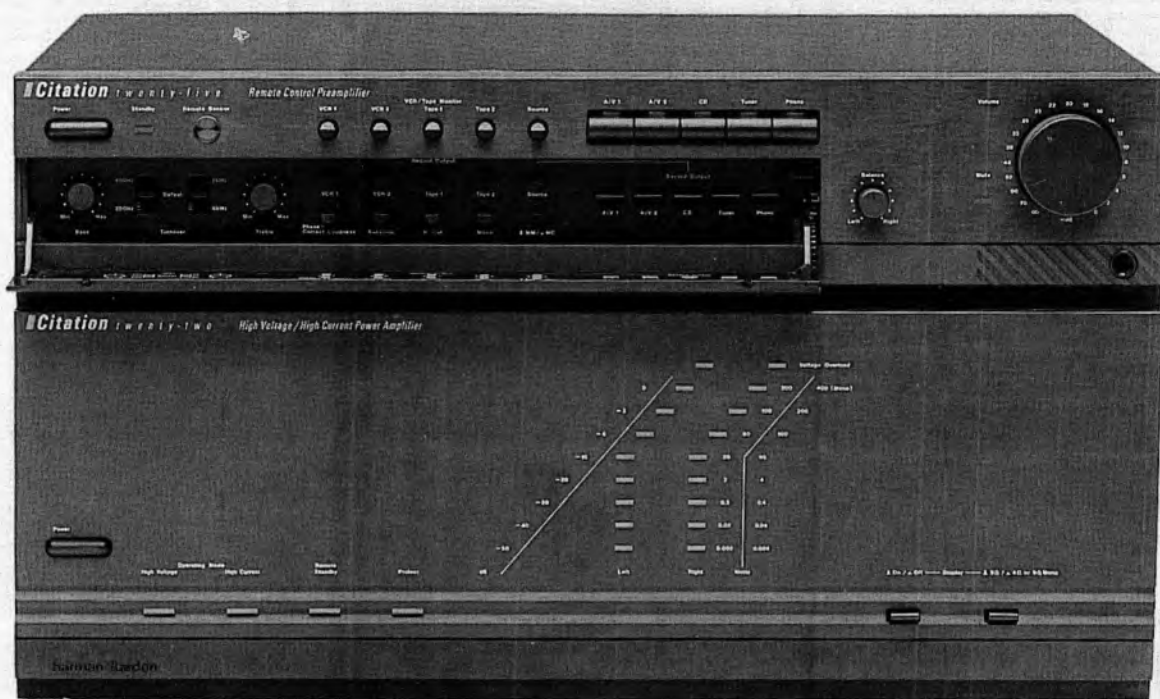
PREAMPLIFIER		
	Aux/CD	MM
Stereo separation (20Hz)	103.3dB	91.4dB
	(1kHz)	70.5dB
	(20kHz)	44.8dB
Channel balance (0dBV)	0.05dB	0.11dB
	(-20dBV)	0.26dB
	(-60dBV)	0.58dB
Total harmonic dis. (0dBV)	-102.3dB	-100.4dB
	(20kHz)	-98.5dB
CCIR intermod. dist. (1:1)	-101.6dB	-81.5dB
Phase shift (20Hz)	12°57'	17°16'
	(1kHz)	0°
	(20kHz)	354°15'
Squarewave linearity	-108.5dB	
Noise (A wtd, 20Hz-20kHz)	-96.3dB	-80.9dB
Residual noise (unwtd)	-90.3dBV	-90.1dBV
Input sensitivity (for 0dBV)	102.7mV	2.145mV
Disc overload (20Hz)		31.9mV
	(1kHz)	291.1mV
	(20kHz)	2756mV
	(50kHz)	3888mV
Input loading	30.7kohm/100pf	42.1kohm/219pf
Preamplifier output(max)/impedance		14.39V (disc)/329ohm
Tape output (max)/impedance		13.94V (disc)/1.597kohm
DC offset, L/R		+68µV/-75µV

Retail price inc VAT £360			
POWER AMPLIFIER			
	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	408.5W	425.5W	393.8W
- 4ohms	654.2W	675.9W	635.9W
Dynamic headroom (IHF)		+1.25dB	(567.1W)
Output impedance	0.052ohm	0.052ohm	0.057ohm
Damping factor	155.4	153.4	139.9
Stereo separation (0dBV)	79.9dB	79.9dB	66.8dB
Total harmonic dist. (0dBV)	-85.8dB	-88.9dB	-85.3dB
(½ power)	-84.7dB	-84.0dB	-75.8dB
CCIR intermodulation distortion (0dBV)			-97.5dB
CCIR IM distortion (½ power)			-92.4dB
Rise time (@ 10kHz)			518nsecs
Power bandwidth			5Hz - 84kHz
Squarewave linearity			-99.7dB
Phase shift 20Hz			0°
	1kHz		0°
	20kHz		0°
Noise (A wtd, 20Hz-20kHz) 0dBV			-91.4dB
(A wtd, 20Hz-20kHz) ½ power			-113.9dB
Residual noise (unwtd)			-57.9dBV
Input sensitivity (for 0dBV)			138.3mV
	(for full output)		2917mV
Input loading			61.8kohm/90pf
DC offset, left/right			-8.5mV/-9.7mV
Typical price inc VAT			£995



HARMAN KARDON CITATION 25/22

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



More than two decades ago *Citation* emerged as the flagship brand of Harman Kardon, beginning with elegant valve designs and culminating in the monstrous *Citation XX/XXP* solid state combination. The latest *Citation* range is not quite as OTT as that, but nevertheless comprises some very substantial and flexible designs. Top of the current power amplifier range is the *Citation 22*, weighing in at 20kg and featuring the same wide open-loop bandwidth/minimum feedback topology (approx 12dB) that was developed with earlier models.

To help combat the ingress of vibration, the *22* is equipped with a solid rubber block that supports both the front section of the amp and also decouples the milled alloy fascia. This satin-black strip is punctuated with a double display of nine LEDs, calibrated (roughly) in a log power scale, running from 0.002W to 200W. Further LEDs denote the use of bridged and 'high current/high voltage' modes.

In bridged mode the left hand input is divided between the 'left' and 'right' voltage gain blocks, the latter being driven by an inverting unity-gain buffer. Theoretically this should quadruple (+6dB) the maximum output power of the amplifier, providing the current capability is available to sustain the full output voltage into the required load. The *22* is fitted with a 8/4ohms speaker switch which connects one of two possible transformer secondaries (43V or 56V AC) to the main supply, so current clipping is avoided by reducing the rail voltage into lower impedances.

The FET-coupled power amp input passes to a wholly symmetrical double-differential gain block, and this in turn feeds complementary voltage gain, 2SA1306/2SC3298 drivers and 130W 2SA1516/2SC3907 output tran-

sistors. Each stage is fully regulated and includes thermal compensation for the output stage. The input board is mounted vertically to minimise electromagnetic interference with the substantial dual-mono power supply, itself comprised of two screened toroidal transformers and 4 x 10,000 μ F reservoir capacitors.

Complementing the very purposeful *22* power amp, the *Citation 25* preamplifier seeks to combine audiophile circuit design with an excessive number of features – clearly there's some conflict of interests here. A rubber block supports the underside, but is also used as a point of styling for the rotary volume, balance, bass and treble control knobs. Remote control is a further feature of the *25*, duplicating much of the basic input switching and also driving the motorised volume control.

The *25* also appears to have been designed with tape/VCR copying in mind. No fewer than ten different components may be connected, including both MM and MC vinyl disc, tuner, CD, two A/V sources with provision for a video channel, two audio tape decks and two VCRs plus a further two video signal inputs and three video outputs, each independently buffered! Each of the tape decks and VCRs are selected on the main fascia, while depressing a 'source' button activates a further five inputs catering for the A/V, tuner, CD and vinyl sources.

Selection between the two phono inputs is accomplished by accessing controls that lurk under a flip-down panel, while variable capacitance and resistive loading options are available on the rear panel. Other facilities include defeatable bass and treble with variable turnover frequencies, phase-correct loudness, HF and subsonic filters, balance and mono. Full tape to tape (VCR to VCR)

and independent record-out selections are also catered for – something for everyone in fact!

LAB REPORT

A major disparity exists between the linearity of the MM/line and the MC inputs of the *Citation 25* pre-amplifier, particularly at high frequencies. THD is normally defined by the common output stage and varies between 0.0056 and 0.022 per cent across 1-20kHz. However, the CCIR IMD test registered 0.013 per cent for the MM input, whereas the 2nd-order product of the MC input amounted to some 0.46 per cent. Nonlinearities in the differential MC headamp fitted to all HK amplifiers exhibit this effect.

This is confirmed in the MC ultrasonic distortion plot which highlights 2nd-order difference products, $F_{20k} - F_{0-20k}$ and $F_{0-50k-0} - F_{0-20k}$, together with 3rd-order difference products $F_{20k} - 2F_{0-20k}$ and $F_{0-50k-0} - 2F_{0-20k}$. Each of these routes increases in amplitude according to the RIAA characteristic, indicating that the nonlinearities exist before the EQ stage; the falling HF EQ explains why conventional harmonic distortion figures do not increase with frequency.

Both vinyl inputs are a mild -0.47dB at 20kHz but the MM stage extends subsonically to -3dB at just 0.6kHz, while MC input overload margins at 1kHz are 26.2dB.

The midband phase shift is some 180° off theory at 129°, implying that the headamp is phase-inverting.

There is less obvious weakness in the *Citation 22* power amplifier, which offers a substantial 226W into 4ohms, a dynamic headroom of +1.53dB and a lowish output impedance of 0.07ohms. The dual-mono construction helps achieve a superb 101dB

separation at 20kHz and a 20Hz-20kHz THD target area of 0.0035 to 0.01 per cent over the bulk of the dynamic range.

However, even the A-wtd noise at 2/3 power (-99dB) was inevitably compromised by the huge 50Hz hum component which clocks in at -50dBV. RF IMD is limited to an acceptable (though still potentially audible) +6dB. The amplifier appears most sensitive to RF noise across a 135-205MHz passband, though three distinct areas of demodulation are apparent.

SOUND QUALITY

It was clear from the outset that the pre-amplifier was responsible for many of the subjective shortcomings of this duo. In general terms the 25/22 combination offers a sound that is mildly sanitised or 'packaged' in a manner that is not unpleasant, but is certainly not musically particularly convincing. Furthermore, this mild but muzzy character is quite consistent from input to input, if most obvious via MC vinyl disc sources, which also sound 'heavier' and thicker at LF. Vocal articulation was both sharp and positive, but was also rather superficial. Singers seemed to be projecting from the head and not the chest, so although the stereo image is distinct, it also lacks conviction and body.

More worrying is the difficulty two of our listeners found in being able to appreciate the wonderfully open and detailed treble of CD via the PDM convertor: this amplifier certainly reduces the distinction between different CD players. As a result it also impedes the process of cutting through to the heart of the music itself; the sound is invariably 'nice', comfortable or 'glossy', but also obscures important emotive clues.

Using the 22 power amplifier with a simple passive pot reveals a far more open, lucid and well-rounded sound. The presentation is cool and confident, bass transients possess greater impact and solidity, while the mid and treble seem more natural and transparent.

Clearly, the true mettle of the 22 is obscured when it's partnered with the 25 pre-amplifier.

CONCLUSIONS

Those enthusiasts who desire a rich and raunchy sound, or one charged with potent emotion will be very disappointed with the Citation 25. Only its great flexibility, particular for A/V fans, helps pull it back from the brink of disaster. In contrast, the macho Citation 22 power amplifier has a lot more good sound quality going for it, and clearly deserves Recommending in isolation, for its fine objective and subjective performance.

TEST RESULTS

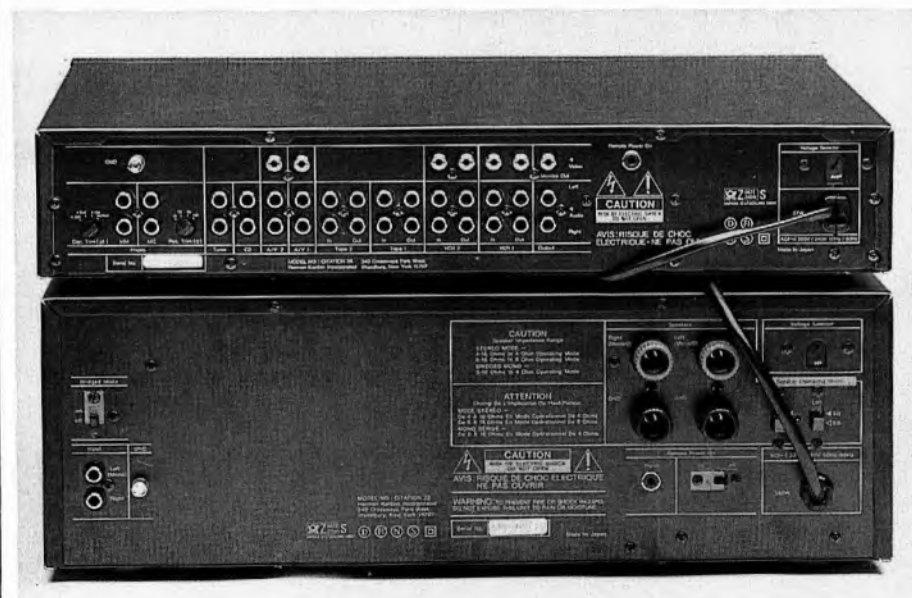
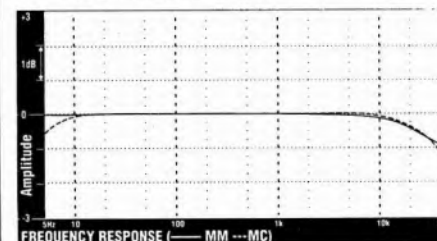
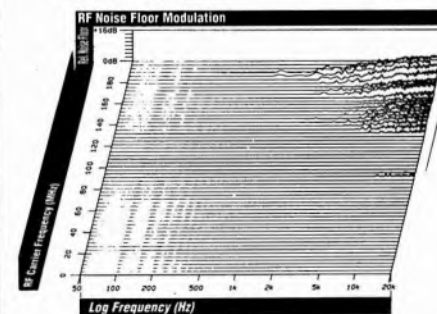
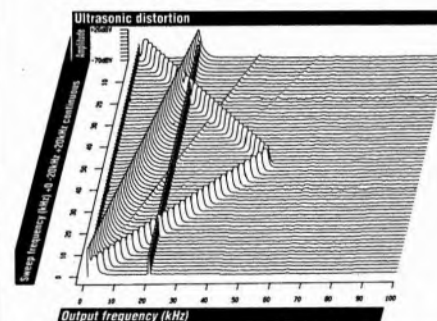
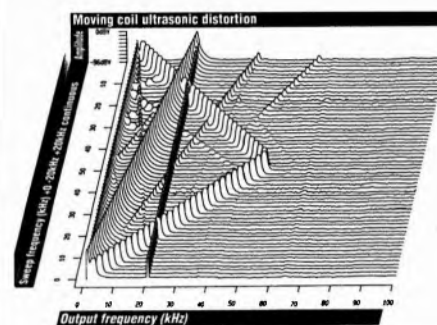
PREAMPLIFIER

	Aux/CD	MM	MC
Stereo separation (20Hz)	111.7dB	86.5dB	48.9dB
(1kHz)	81.8dB	85.8dB	63.7dB
(20kHz)	59.2dB	58.9dB	59.6dB
Channel balance (0dBV)	0.14dB	0.13dB	0.13dB
(-20dBV)	0.15dB	0.13dB	0.11dB
(-60dBV)	1.77dB	1.45dB	1.37dB
Total harmonic dis. (0dBV)	-84.7dB	-83.9dB	-80.6dB
(20kHz)	-73.7dB	-73.7dB	-73.8dB
CCIR intermod. dist. (1:1)	-85.5dB	-77.5dB	-46.7dB
Phase shift (20Hz)	0°	342°43'	167°2'
(1kHz)	0°	309°36'	129°36'
(20kHz)	341°16'	260°38'	82°4'
Squarewave linearity	-107.2dB		
Noise (A wtd, 20Hz-20kHz)	-95.5dB	-81.4dB	-73.7dB
Residual noise (unwtd)	-98.5dBV	-98.7dBV	-98.1dBV
Input sensitivity (for 0dBV)	137.75V	2.291mV	128.5μV
Disc overload (20Hz)		18.72mV	1.053mV
(1kHz)		177.5mV	10.16mV
(20kHz)		1669mV	78.19mV
(50kHz)		3139mV	167.9mV
Input loading	28.5kohm/630pF	61.9kohm/280pF	103ohm/12.5nF
Preamp output (max)/impedance		11.33V (disc)/620ohm	
Tape output (max)/impedance		10.11V (disc)/2.13kohm	
DC offset, L/R		+0.1mV/+0.12mV	
Retail price inc VAT			£599

POWER AMPLIFIER

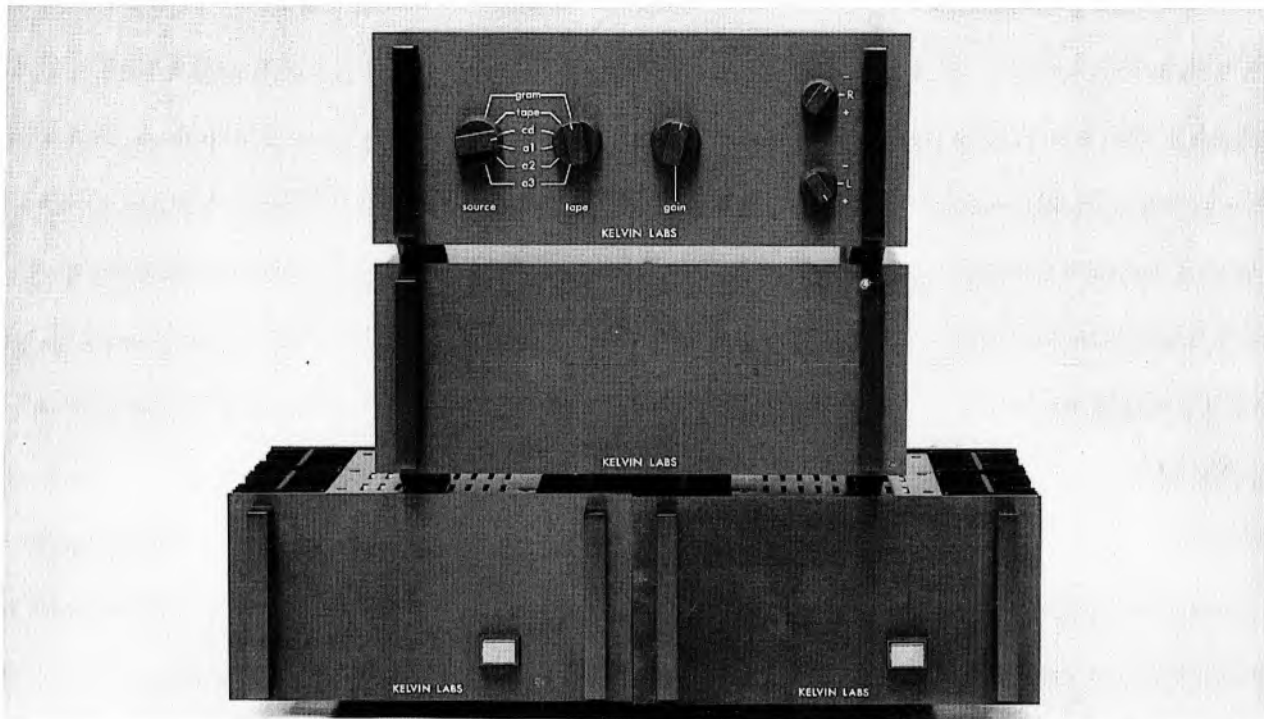
	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	138.5W	138.3W	139.3W
- 4ohms	220.6W	225.6W	224.2W
Dynamic headroom (IHF)		+1.53dB (196.6W)	
Output impedance	0.066ohm	0.066ohm	0.071ohm

Damping factor	120.8	121.0	112.8
Stereo separation (0dBV)	94.6dB	101.6dB	101.2dB
Total harmonic dist. (0dBV)	-83.5dB	-89.6dB	-83.8dB
(2/3 power)	-80.6dB	-80.8dB	-79.7dB
CCIR intermodulation distortion (0dBV)			-88.9dB
CCIR IM distortion (2/3 power)			-78.8dB
Rise time (@ 10kHz)			3.2μsecs
Power bandwidth			9Hz-75kHz
Squarewave linearity			-99.3dB
Phase shift 20Hz			0°
1kHz			0°
20kHz			345°36'
Noise (A wtd, 20Hz-20kHz) 0dBV			-81.1dB
(A wtd, 20Hz-20kHz) 2/3 power			-99.0dB
Residual noise (unwtd)			-50.3dBV
Input sensitivity (for 0dBV)			82.46mV
(for full output)			987.4mV
Input loading			20.94kohm/1.1nF
DC offset, left/right			+57.5mV/+53.9mV
Typical price inc VAT			£859



KELVIN LABS ABSOLUTE ZERO (MC)/M30

KELVIN LABS, 6 SHANKLIN CRESCENT, UPPER SHIRLEY, SOUTHAMPTON SO1 2RB. TEL: (0703) 785123.



With a name like Kelvin it is not surprising to find these Southampton-based audiophiles holding all things thermal close to their hearts! As a consequence Class A operation features heavily in the power amplifier design, the attendant high quiescent current pushing up the temperature of the transistors and therefore the amplifier itself.

The *M30* monoblok power amplifiers occupy the middle ground in the current Kelvin range, each built into a cute black case with matching grab handles, an illuminated blue on-off switch and extremely sharp fluted heatsinking. In some respects they look like scale models of a Krell or Mark Levinson.

Certain revisions have been effected since the *M30s* were first launched, not least to rectify the true Class A rating (now 30W). Latest samples use *2N3716/2N3792 TO-3* style output transistors (each rated at 150W) while the long-tailed pair input (*ZTX107B*) now runs into a current mirror rather than a resistor, increasing the overall open-loop gain and so improving the Class A/B linearity (reducing THD).

Complementing these monobloks is Kelvin's two-box *Absolute Zero* preamplifier, one unit functioning as a control centre, the other providing gain and EQ for MC cartridges. Both cases are painted gloss black and feature the same aesthetic grab-handles as the power amps. The *Absolute Zero* has three identical plastic knobs that cater for master volume (labelled gain), input and record-out selection. There is socketry for aux, CD and one tape source, plus a vinyl disc input (of sorts, see later), quaintly labelled 'gram'. Two additional attenuators are provided for fine L/R balance adjustment.

A $\pm 15V$ power connection is made between the control centre and the separate MC preamplifier. This MC headamp/EQ unit uses an

NPN long-tailed pair input, the collectors of which are connected to a PNP long-tailed pair which then runs into an active current mirror connected to the negative rail. This gain cell structure is employed in all Kelvin preamplifiers, and features a healthy power supply rejection ratio by employing separate current sources (biased with LEDs) at all points. HF equalisation precedes the LF EQ which is effected by series-feedback around the second of these gain cells.

With a massive 55-60dB of overall gain, the equalised output of the MC head amp is fed into the main *Absolute Zero* control centre at line level. The 'gram' input is therefore not a true disc stage, and phono cartridges should not be connected to this input directly. This control amp operates over a wide bandwidth and offers a very linear, very low impedance output.

All bipolar, the *AZ* uses a long-tailed pair input running into a cascode network. This is biased via a constant-current source connected between the positive rail and resistor midway from the emitter of the long-tailed pair and bases of the cascode, linearising the performance of the long-tailed pair, which operates with a fixed voltage over a wide bandwidth. The line-output uses two *ZTX214* single-package common-emitter cascodes, linked to a complementary Darlington output configured to offer the lowest possible source resistance.

LAB REPORT

Kelvin has worked hard to achieve a highly linear preamplifier design, largely succeeding with the *Absolute Zero*. First, the MC disc equalisation accuracy is quite remarkable – the flattest and most extended in this test with a near-DC roll-off ($-3dB$) at just 0.05Hz! With a maximum error of $+0.03dB$ at

50kHz, it is even slightly flatter than the CD stage (dotted line). Stereo separation is also better overall via MC, which offers a fine 71dB at 20kHz, together with suitably low ($-74dB$) A-wtd noise.

The singular flaw concerns a large error in tracking balance at low ($<-55dBV$) volume levels. Figures of 13-16dB at $-60dBV$ indicate that one of the pot tracks has deteriorated completely. That aside there are few complaints; the $+27.8dB$ MC disc headroom is not over generous, but (as demonstrated by the 3D ultrasonic plot), harmonic and IM distortions are typically <0.0056 per cent. Only under the tough CCIR IMD test did 2nd-order products increase to 0.012 per cent, a figure which is still manageably low.

The *M30* monobloks could hardly be described as miniature powerhouses, but the $+2.2dB$ increase in output from 33W/8ohms to 55W into 4ohms is certainly worthwhile. Kelvin has increased the *M30's* true Class A rating by lowering the value of the respective emitter resistors from 1.2ohms to 1ohm. With a 690mA standing current associated with each of the four output devices, this is equivalent to a maximum rms power of 30.5W Class A (or 61W peak) into 8ohms. However, the most efficient Class A transfer will occur into loads above 10.2ohm, whereupon voltage rather than current clipping will take precedence.

Judicious use of feedback around the output stage has reduced the output impedance to a startlingly low 0.0044ohms (midband), while THD is held to a tight 0.003 per cent at all frequencies and power levels, save for a minor increase to 0.006 per cent (20kHz at $\frac{3}{4}$ power). CCIR IMD measures better than 0.001 per cent into a standard 8ohm load, although a trace of the 3rd-order IM route $F_{0-50k-0} + 2F_{0-20k}$ is visible on the 3D plot

where the amplifier is driving a lower, 4ohms load. Note also the increase in odd (3rd and 5th) harmonics.

More important perhaps is the acceptable level of RF IMD generated in the *M30*, the plot highlighting two breaks at 125MHz and 150MHz respectively. Each results in a noise floor increase of just 3-4dB between 2-20kHz, a situation unlikely to introduce audible coarseness or graininess throughout the treble registers.

SOUND QUALITY

Deploying the external PDM D/A convertor, CD sounds slightly mushy at first, and high frequency sounds lose some structure: hi-hat cymbals are not particularly fast in attack or crisp in focus, for example. Simple bass rhythms are handled well, but a more complex beat often sounds softened or slightly lazy.

Individual instruments are reproduced well in isolation, possessing a fair sense of ambience and surrounding 'space'. However, the timbral register of each instrument within an ensemble is compromised, restricting this sense of air or space. Whereas the introduction to many tracks sounded very promising, this initial ray of light was cut short once the full weight of all participating instruments joined in the fray. This effect is less obvious the longer the units are left powered-up, but there is almost always a progressive loss in detail resolution the more complex the piece of music: subtle treble nuances start to clog-up or become shakey, for instance.

This same comfortable if not terribly transparent character is also apparent via the disc input. Vocal inflections are portrayed in a pleasant and articulate fashion, but there is almost always the feeling that some sense of 'occasion' or atmosphere is restricted. The balance is inherently neutral but stereo images could appear overly large and therefore slightly diffuse - squeezed together within a relatively small overall soundstage.

The total presentation is just slightly too thick, failing to grasp the full speed and vitality of the music. But over a period of time our listening panel warmed to the attractive sound of the *M30s* in particular.

CONCLUSIONS

From a development point of view it is clear that this Kelvin pre/power combination is very near to blossoming, the power amplifier improvements uprating its measured and subjective performance markedly over six months or so ago. These Kelvin amplifiers do have real potential, and although this has yet to be realised fully, this duo is still sufficiently beguiling to warrant cautious recommendation.

TEST RESULTS

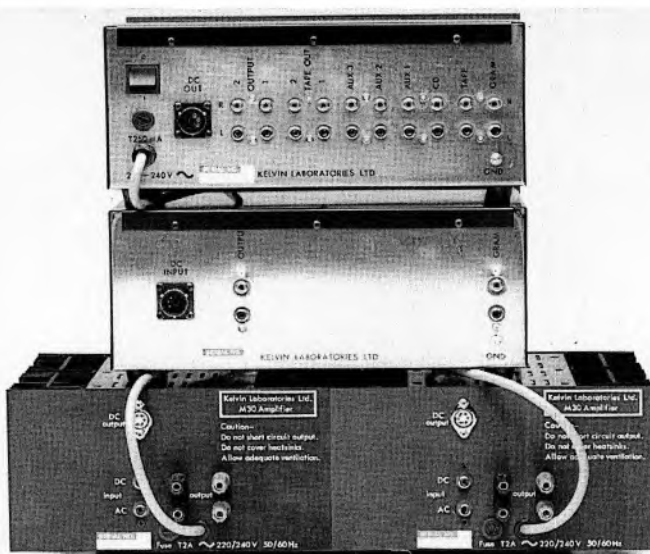
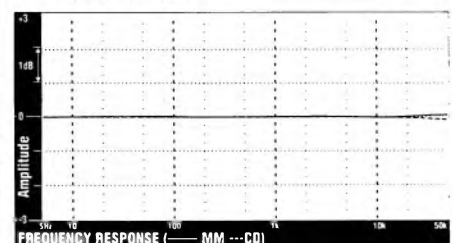
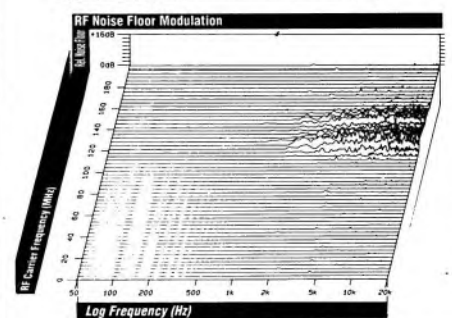
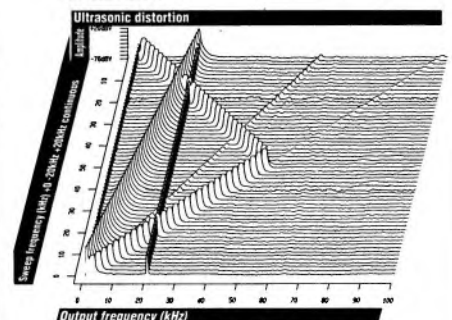
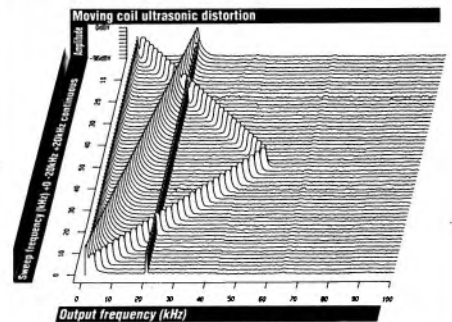
PREAMPLIFIER

	Aux/CD	MM
Stereo separation (20Hz)	101.6dB	98.6dB
	(1kHz)	83.8dB
	(20kHz)	57.8dB
Channel balance (DdBV)	0.23dB	0.22dB
	(-20dBV)	0.19dB
	(-60dBV)	13.7dB
Total harmonic dis. (DdBV)	-90.3dB	-94.7dB
	(20kHz)	-81.7dB
		-84.6dB
CCIR intermod. dist. (1:1)	-100.8dB	-78.5dB
		-78.5dB
Phase shift (20Hz)	0°	339°50'
	(1kHz)	0°
	(20kHz)	0°
Squarewave linearity	-106.7dB	-73.8dB
		-73.8dB
Noise (A wtd, 20Hz-20kHz)	-100.6dB	-97.3dBV
Residual noise (unwtd)	-97.1dBV	-97.3dBV
Input sensitivity (for DdBV)	209.5mV	366.2µV
Disc overload (20Hz)	1.574mV	
	(1kHz)	12.31mV
	(20kHz)	108.1mV
	(50kHz)	207.6mV
Input loading	10kohm/15pF	150ohm/8.2nF
Preamp output (max)/impedance	8.06V (disc)/2ohm	
Tape output (max)/impedance	6.84V (disc)/100.2ohm	
DC offset, L/R	+1.5mV/+0.3mV	
Retail price inc VAT	£395 + £295	

POWER AMPLIFIER

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	32.1W	33.2W	36.1W
- 4ohms	53.5W	54.9W	56.4W
Dynamic headroom (IHF)		+0.64dB	(38.4W)

Output impedance	0.0069ohm	0.0044ohm	0.0073ohm
Damping factor	1149	1800	1100
Stereo separation (DdBW)			N/A
Total harmonic dist. (DdBW)	-89.6dB	-89.5dB	-89.6dB
	(% power)	-88.4dB	-89.5dB
CCIR intermodulation distortion (DdBW)			-102.8dB
CCIR IM distortion (% power)			-100.8dB
Rise time (@ 10kHz)			1.5µsecs
Power bandwidth			4Hz - 61kHz
Squarewave linearity			-103.9dB
Phase shift 20Hz			30°14'
	1kHz		0°
20kHz			355°30'
Noise (A wtd, 20Hz-20kHz) DdBW			-103.2dB
	(A wtd, 20Hz-20kHz) % power		-115.1dB
Residual noise (unwtd)			-83.9dBV
Input sensitivity (for DdBW)			189.0mV
	(for full output)		1105mV
Input loading			10.24kohm/1.2nF
DC offset, left/right			+35.9mV
Typical price inc VAT			£595 (pair)



AKG

ACOUSTICS

Mission

Phase 1

Design headphones that set a new standard by taking a new approach inspired by satellite technology to open up new dimensions of sound and spaciousness.

Phase 2

Said headphones shall provide optimized transient response on the basis of an accepted mathematical model.

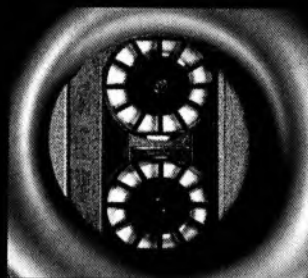
Phase 3

Said headphones shall be very comfortable, light, and cost efficient.

...Completed K 280 PARABOLIC

Phase 1

An "acoustic lens" using two dynamic transducers per channel focuses the sound waves into the ear canal. The result is a new dimension of fullness and spaciousness of sound.

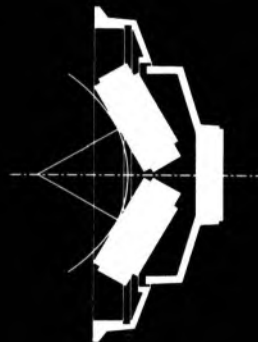


Phase 2

Utilizing the "Wigner distribution", a mathematical model for describing sound events, we made sure the K 280 Parabolic will handle the most demanding of transients without introducing colouration.

Phase 3

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KENWOOD KA-5010

KENWOOD TRIO UK LTD., 17 BRISTOL RD., THE METROPOLITAN CENTRE, GREENFORD, MIDDX UB6 8UP. TEL: (01) 575 6030.

RECOMMENDED



As much or more than any other Far Eastern manufacturer, Kenwood (formerly Trio) has worked hard to produce UK-oriented 'audiophile' amplifiers. Over recent years the products have evolved steadily and with few hiccups, the £210 KA-5010 representing the latest of the line.

The front panel is hewn from a satin black alloy, punctuated with a series of large controls catering for volume, input and record-out selection. Both MM and MC cartridges are accommodated, plus three tape, CD, tuner and auxiliary inputs. A source/direct option permits bypassing unnecessary functions such as the tone controls and 'bass intensifier'. Balance, speaker switching and a subsonic filter complete a facilities line up which is adequate rather than excessive for the price.

The internal design is essentially that of a lower-powered KA-7010 clone, featuring a star-earth system and common disc, line, tone and protection circuitry, but with a single mains transformer and just two 10,000µF reservoir capacitors. The output stage uses two pairs of Sanken bipolar transistors; compared to the 7010 these are lower-rated 2SA1215/2SC2921 devices.

LAB REPORT

I was very pleased with the technical performance of this model: not only was it superior to the KA-7010, but the results also provide good correlation with those obtained on audition.

Power output increases by a healthy +2.48dB when changing from 8 to 4ohms, while the output impedance is an impressively low 0.028ohms. Stereo separation deteriorates to 35-36dB at 20kHz via the disc inputs, but THD, noise and disc input headroom (+32.6dB MM, +30.8dB MC) are all very good. The MM RIAA response is remarkably flat and even, with a -3dB point at a very low 0.75Hz. The MC stage is slightly more tightly bandlimited, with -3dB points at 6Hz and 55kHz.

More important perhaps, the KA-5010 registers very little on the RF IMD test. The minor +5dB breakthroughs at 1MHz and 60MHz have very narrow passbands and are therefore unlikely to influence the sound

quality of the amplifier. Much the same may be said for the ultrasonic distortion plot too, which highlights low-level (-85dB) routes corresponding to the harmonics yF_{0-20k} ($y = 2, 3$ and 5) respectively.

SOUND QUALITY

Interestingly, there was some disagreement over the relative merits of this amp and the costlier KA-7010. However, the impressions of two listeners who preferred the KA-7010 were in direct conflict. One thought the 5010 sounded bright and sibilant, while the other considered it bland and devoid of HF; such are the vagaries of subjective evaluation.

Subsequent listening tests were more enlightening, the consensus coming down wholeheartedly in favour of the 5010. The CD input certainly errs on the lean side of neutral, but remains both pleasantly smooth and integrated with a good sense of pitch and tempo. Vocals sound fresh and alive without appearing falsely impressive, adding to the generally open and relaxed demeanour. In fact only some lack of deep bass impact detracted from an otherwise fine performance.

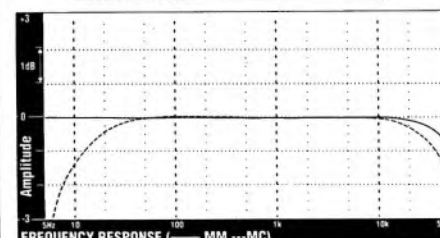
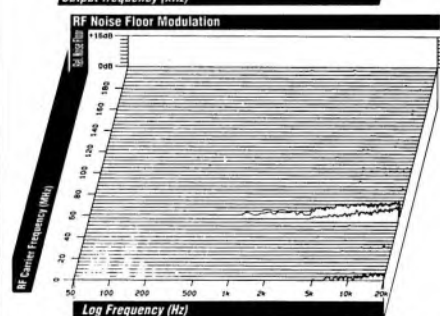
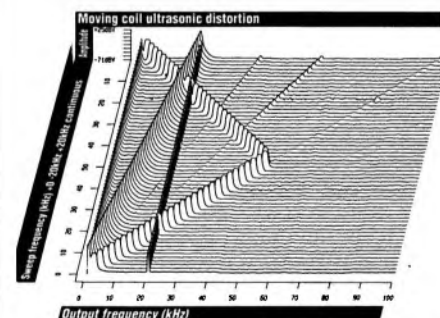
This ability to draw attention away from the amplifier and towards the music itself was maintained using the lush and fluid-sounding MM vinyl input. The MC alternative certainly sounded slower and thicker than either MM or CD, but avoided becoming muddled or treacly and gave a fair result overall.

CONCLUSIONS

Kenwood has clearly succeeded in engineering a classy product in both technical and subjective fields. The suppression of RF IMD must play a role in a smooth and unfatiguing sound which, but for a slight loss of bass weight and impetus, would surely have merited a Best Buy flag. As it stands a hearty Recommendation seems most appropriate.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	99.0W	100.5W	93.4W
- 4ohms	167.9W	178.0W	166.2W
Dynamic headroom (IHf)	+0.83dB (121.6W)		
Output impedance	0.028ohm	0.0246ohm	0.0559ohm
Damping factor	285.5	325.5	142.9
Stereo separation (20Hz)	91.5dB	90.3dB	90.6dB
(1kHz)	75.7dB	60.1dB	61.3dB
(20kHz)	52.5dB	35.6dB	36.8dB
Channel balance (-20dBV)	0.23dB	0.22dB	0.19dB
(-60dBV)	0.77dB	0.92dB	1.05dB
Total harmonic dist. (0dBV)	-89.6dB	-91.5dB	-90.8dB
(½ power)	-91.5dB	-93.5dB	-92.6dB
CCIR intermod. dist. (0dBV)	-93.7dB	-89.6dB	-75.5dB
CCIR IM dist. (½ power)	-91.1dB	-74.3dB	-76.2dB
Rise time	8.7µsecs		
Power bandwidth	9Hz - 18kHz		
Squarewave linearity	-105.1dB		
Phase shift (20Hz)	109°26'	76°19'	136°48'
(1kHz)	0°	308°9'	308°30'
(20kHz)	296°38'	216°	230°24'
Noise (A wtd, 0dBV)	-78.7dB	-77.4dB	-71.9dB
(½ power)	-95.4dB	-90.3dB	-73.8dB
Residual noise (unwtd)	-80.4dBV	-79.8dBV	-79.7dBV
Input sensitivity (for 0dBV)	17.16mV	291.1µV	22.8µV
(for full output)	174.4mV	2.928mV	229.2µV
Disc overload (20Hz)		23.67mV	1.983mV
(1kHz)		213.4mV	17.33mV
(20kHz)		1830mV	154.2mV
(50kHz)		1719mV	265.2mV
Tape Output/Impedance	13.31V (disc)/2.420kohm		
Input loading	95kohm/409pF 43.8kohm/37pF 102.9ohm/1.6nF		
DC offset, left/right	+0.9mV/+1.7mV		
Typical price inc VAT	£210		





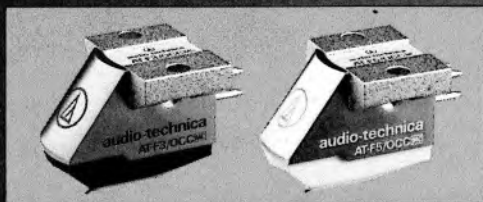
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KENWOOD KA-7010

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Commanding a premium of £90 over the *KA-5010*, there appears to be little to distinguish this costlier *KA-7010*, which is fitted with the same satin-black fascia, identical volume control, input and record-out selector knobs, tone, balance and source direct option. In fact only the -20dB muting facility is an addition to the front panel of this amplifier, plus two sets of chunky 4mm speaker terminals on the rear.

Internally, a further strip of cast alloy heatsinking is added to the cooling fins used in the *5010*, this extra metalwork being required to accommodate the higher power *2SA1216/2SC2922* output transistors. The *KA-7010*'s power supply is bigger too, and featuring a couple of mains transformers together with four $7500\mu\text{F}$ ELNA electrolytic capacitors.

Kenwood's 'Pure Signal Ground Line' star-earthing topology helps minimise interference from circulating earth currents while the main output stage is mechanically decoupled from the mother PCB using a strip of circuit track and flying leads. Paralleling the cheaper *KA-5010*, the *7010* features an identical FET headamp for the MC disc input, followed by series-feedback equalisation around a dual-channel *NJM4560D* op-amp. Such commonality must surely help keep production costs down.

LAB REPORT

The great similarity between the basic measured performance of both *7010* and *5010* must come as no surprise, but it is left to the more advanced 3D plots to help explain some very real subjective differences. The $+2.4\text{dB}$ power increase over the 80ohm rating to 215W into 4ohms is directly comparable with the *5010*, as are the $+0.85\text{dB}$ IHF and 0.028ohm output impedance figures. The disc EQ response and respective overload margins are also near identical, although the *7010*'s separation also falls to around 37dB via the CD input.

THD hovers between 0.0038 per cent and 0.0024 per cent via all inputs and between an output of $0\text{dBW} = 1\text{W}$ ($+9.04\text{dBV}$) and two-thirds power ($+26.4\text{dBV}$). However, both IMD and THD deteriorate as the amplifier is asked to drive lower impedances, mounting

to the 0.02 per cent depicted on the ultrasonic 3D plot. Furthermore, the complement of this distortion is principally 3rd and 5th order, which is less subjectively pleasing.

However, perhaps the most important clue to the sound quality of the *KA-7010* is seen in the RF IMD plot, which reveals a resonance at exactly the same frequency as the *5010* (60MHz) but with a demodulated output of some $+26\text{dB}$. Other smaller breakthroughs are visible at 97MHz , 114MHz and 181MHz , but the 60MHz region most clearly influences the audio band from 200Hz to 20kHz .

SOUND QUALITY

This amplifier is more obviously detailed than the *5010*, but is also less well balanced, the upper mid and treble appearing to stand out ahead of the lower mid and bass. All listeners commented upon restricted stereo depth, and the sound tends to be slightly bland or superficial via the PDM D/A converter. Furthermore the resolution of bass instruments was described as softened, bloated and lumpy, though this latter blight was partially ameliorated when using the smoother and more consistent tone of the disc inputs.

Discrimination of musical dynamics is superior via the MM disc input, just as vocals often sound that much more articulate, benefitting from a slightly more 'airy' treble. A hint of extra sibilance and graininess was evident with the MC input.

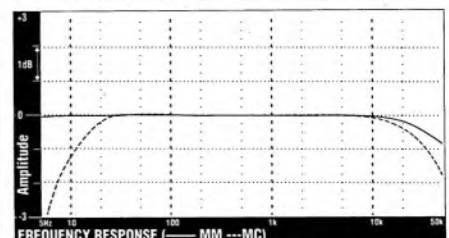
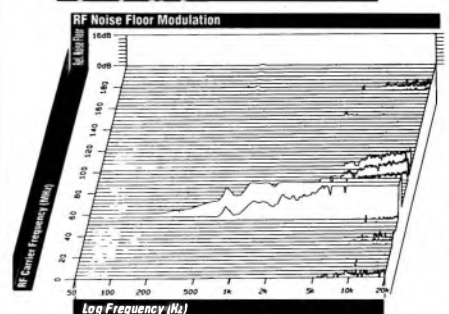
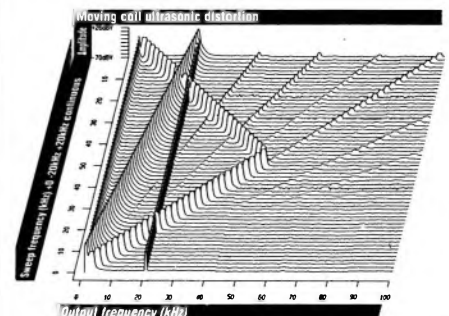
However, perhaps the most worrying comments were that there was something rather 'odd' or 'peculiar' about its handling of the music itself. Superficially detailed and coherent, it nevertheless instilled a sense of unease in listeners.

CONCLUSIONS

On the face of it Kenwood must surely have expected the *KA-7010* to sound like a more powerful, gutsy version of the *KA-5010*. Unfortunately this was not the case, the amplifier offering under a decibel more power for the price of a less well balanced and satisfying if fractionally more transparent sound. The cheaper model remains the better buy.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	120.8W	123.3W	119.0W
- 4ohms	206.8W	214.9W	210.1W
Dynamic headroom (IHF)	+0.85dB (149.9W)		
Output impedance	0.028ohm	0.031ohm	0.072ohm
Damping factor	285.5	255.4	111.7
	CD/Aux	MM	MC
Stereo separation (20Hz)	98.2dB	80.7dB	76.8dB
(1kHz)	61.1dB	61.0dB	61.2dB
(20kHz)	37.2dB	36.9dB	36.4dB
Channel balance (-20dBV)	0.17dB	0.15dB	0.12dB
(-60dBV)	0.58dB	0.89dB	1.03dB
Total harmonic dist. (0dBW)	-88.7dB	-89.5dB	-88.6dB
(½ power)	-91.4dB	-92.3dB	-91.5dB
CCIR intermod. dist. (0dBW)	-87.7dB	-85.8dB	-73.4dB
CCIR IM dist. (½ power)	-84.3dB	-79.6dB	-75.8dB
Rise time	8.8µsecs		
Power bandwidth	10Hz - 19kHz		
Squarewave linearity	-105.6dB		
Phase shift (20Hz)	69°7'	50°24'	99°25'
(1kHz)	0°	306°42'	300°57'
(20kHz)	316°48'	231°50'	230°30'
Noise (A wtd, 0dBW)	-79.1dB	-76.9dB	-72.1dB
(½ power)	-95.5dB	-89.7dB	-74.1dB
Residual noise (unwtd)	-79.8dB	-80.2dB	-79.7dB
Input sensitivity (for 0dBW)	15.9mV	267.5µV	21.6µV
(for full output)	178.2mV	3.043mV	242.5µV
Disc overload (20Hz)	23.12mV 1.970mV		
(1kHz)	214.2mV 17.47mV		
(20kHz)	1681mV 155.5mV		
(50kHz)	1794mV 252.6mV		
Tape Output/Impedance	13.36V (disc)/2.428kohm		
Input loading	95kohm/426pF 41.3kohm/34.5pF 103ohm/1.5nF		
DC offset, left/right	+17.6mV/+14.8mV		
Typical price inc VAT	£300		



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MARANTZ PM-65AV

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



In an attempt to bridge the gap between audio- and video-philes, Marantz has introduced this versatile, high quality AV amplifier as part of its current range. Dubbed the *PM-65AV* this busy-looking £250 unit is built around the same chassis as that employed for the more conventional *PM-55* amplifier. The alloy fascia is split into two regions, with all the input selection, volume and tone controls situated above the peripheral facilities.

A single (MM) vinyl disc input is provided, alongside no less than eight line-level inputs. Five of these, labelled CD1, CD2, tuner, CDV and aux are accommodated by the standard rotary selector while the three remaining (VCR) inputs are selected using a bank of keys on the lower half of the fascia. The CD1 input may be routed 'direct', though this option only serves to disable the main selector and balance control; non-defeatable tone controls remain in-circuit at all times.

The comprehensive record-out selection also caters for the four independently buffered video (TV) inputs, which are remotely switched, using several *LC4966* ICs. The video circuits are isolated from the audio sections on a separate polyester PCB and are fed from a separately regulated power supply. In addition to all this, Marantz has made provision for an external processor, such as a surround-sound decoder, while also incorporating two 'AV Sound' selectors. This latter option appears to be some sort of crude loudness contour however, for the *PM-65AV* does not include a discrete AV surround decoder of its own.

As you might expect, the internal layout is a trifle cramped, though there's still room for the customary *STK3062* hybrid supply regulator/driver, a fair-sized mains transformer, and complementary pairs of Toshiba *2SA1301/2SC3280* output transistors.

LAB REPORT

In basic measurement terms, the *PM-65AV* is little different from any other Marantz amplifier. It offers a healthy output into 4ohms (136W in this instance), good stereo separation, low-ish output impedance (0.07ohm), and a moderately tailored MM RIAA EQ response with a -3dB point of 20Hz. The line response (dotted) is flat from 5Hz to 50kHz.

Channel balance was out by a constant 1-1.5dB regardless of input or level setting, indicating an offset tracking error in the volume control fitted to our sample.

THD reduces from 0.015 per cent to 0.0034 per cent (at 0dBW = 1W) when switching from the CD to the MM inputs, though output stage non linearities dominate at higher power levels, as confirmed by the innocuous 2F_{0-20k} and 4F_{0-20k} harmonics visible on the ultrasonic distortion plot. Less innocuous is the vigorous AM/RF demodulation that persists between 1-30MHz, increasing the 2kHz-20kHz noise floor of the amplifier in an unpredictable fashion.

SOUND QUALITY

Despite using the (rather limited) CD-direct option, there seems no well defined central vocal image, the performer always sounding as if he or she was emanating from the two distinct loudspeaker sources. The sense of stereo focus and tactility actually improves when the *PM-65AV* is used in its non-direct mode, but the overall balance remains noticeably lumpy, with a splashy treble and bass that plods along in a lazy fashion.

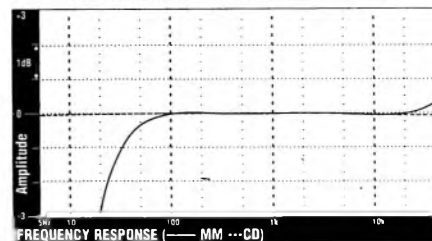
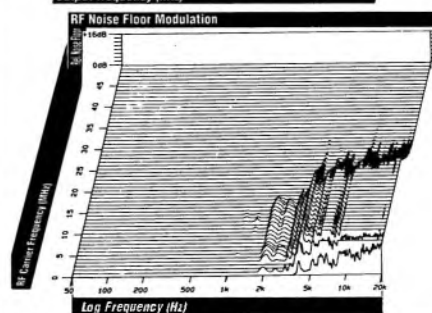
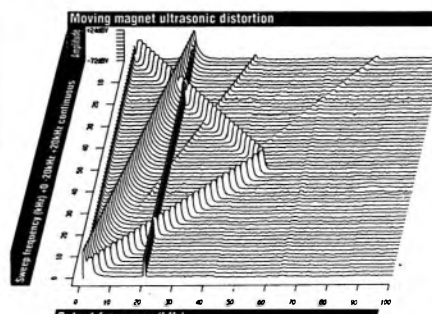
There was little sense of dynamic contrast, using either a conventional multi-bit or the PDM D/A convertor systems, but the amplifier still seemed able to convey a basic sense of rhythm or tempo. Indeed, despite some obvious colorations, it still managed to keep our listeners' feet tapping! Unfortunately the dedicated MM input took a further leap in the wrong direction, offering an unemotive and decidedly monophonic account of most forms of music.

CONCLUSIONS

There are echoes of a *PM-45* struggling to get out of this amplifier, but the free and bouncy sound lacks both structure and resolution. The *PM-65AV* is not a good advert for the audio-only amplifiers that make up the backbone of Marantz's range, but it's certainly worth considering by video buffs who desire both flexibility and a passably good sound quality.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	77.8W	82.2W	81.1W
- 4ohms	123.1W	135.5W	131.4W
Dynamic headroom (INr)	+1.2dB (108.9W)		
Output impedance	0.072ohm	0.075ohm	0.084ohm
Damping factor	111.6	106.3	95.2
	CD/Aux	MM	
Stereo separation (20Hz)	131.9dB	84.5dB	
(1kHz)	87.7dB	87.8dB	
(20kHz)	62.5dB	61.5dB	
Channel balance (-20dBV)	1.56dB	1.54dB	
(-60dBV)	1.05dB	1.17dB	
Total harmonic dist. (0dBW)	-76.3dB	-89.2dB	
(3/4 power)	-70.7dB	-73.6dB	
CCIR intermod. dist. (0dBW)	-81.8dB	-76.8dB	
CCIR IM dist. (3/4 power)	-78.8dB	-74.7dB	
Rise time	2.2µsecs		
Power bandwidth	8Hz - 45kHz		
Squarewave linearity	-105.9dB		
Phase shift (20Hz)	50°24'	89°16'	
(1kHz)	0°	305°16'	
(20kHz)	348°28'	256°19'	
Noise (A wtd, 0dBW)	-87.6dB	-85.3dB	
(3/4 power)	-98.8dB	-90.1dB	
Residual noise (unwtd)	-81.4dBV	-80.9dBV	
Input sensitivity (for 0dBW)	19.59mV	318.4µV	
(for full output)	179.9mV	2.919mV	
Disc overload (20Hz)		28.61mV	
(1kHz)		186.4mV	
(20kHz)		1587mV	
(50kHz)		1750mV	
Tape Output/Impedance		11.53V (disc)/439ohm	
Input loading		50kohm/405pF 61.9kohm/278pF	
DC offset, left/right		-5.9mV/-7.5mV	
Typical price inc VAT		£250	



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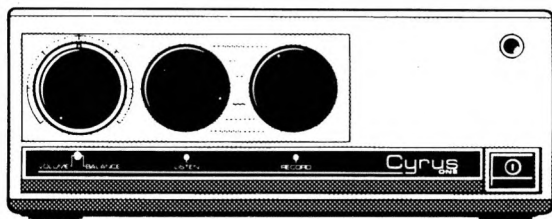
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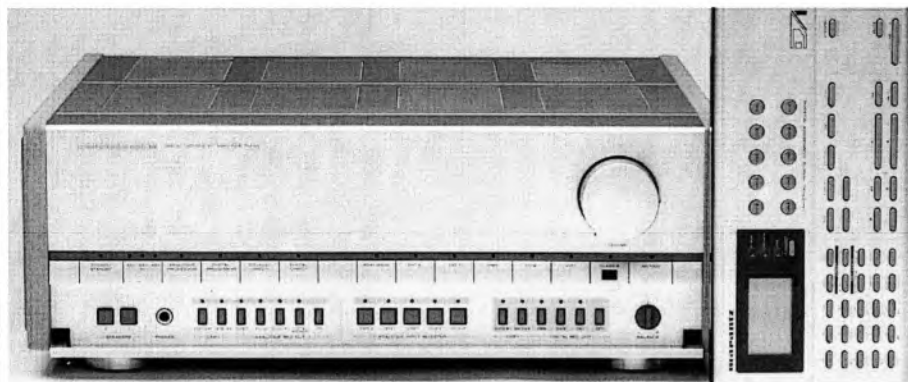
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MARANTZ PM-95

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



Having made a substantial impact on the specialist CD player market, it is perhaps not surprising that Marantz' top integrated amplifier should also incorporate a degree of digital technology. The beautifully built *PM-95* features its own on-board D/A converter section, but the more convincing raison d'être lies in the MOSFET power output stage that operates in either Class A or Class A/B. In the former mode maximum output is restricted to 30W (approx. 20W in Class A), the constant-current source clipping above this point.

Marantz has decided to omit any vinyl disc stage, though an add-on EQ box is available at extra cost. As it stands this massive and exquisitely crafted amplifier only offers inputs for five analogue sources (inc two tape decks) and six digital sources. The latter includes inputs optimistically labelled DAT, CD and DBS, in both coaxial and optical formats – there's even an optical digital output for use with DAT recorders. External processors, in both analogue and digital domains, may also be connected.

The D/A section itself is comprehensively shielded and run from a separately regulated supply. Marantz specifies Philips' top *SAA7220P/B* 4x oversampling filter in conjunction with a *TDA1541ASI* (crown) DAC. A re-timing gate is incorporated between the two to reduce the effects of signal jitter prior to D/A reconstruction.

LAB REPORT

Up to 251W is available into 4ohms (50W in 'Class A' mode) together with a moderate +1.1dB dynamic headroom and a suitably low (0.03ohms) output impedance. THD and IMD typically measure less than 0.005 per cent via analogue or digital inputs over the bulk of the dynamic range.

The ultrasonic plot indicates that $3F_{0-20k}$ and $5F_{0-20k}$ odd-order harmonics dominate at high power levels into low-ish impedances, as does the 3D plot taken via the internal D/A converter. This plot also shows a trace of $F_s - F_{0-20k}$ 2nd-order stop-band noise (max -41.5dB at 24.1kHz) that is inadequately suppressed by the final analogue filter. The *PM-95* proved most sensitive to RF noise in the 1MHz, 50MHz and 90MHz regions.

SOUND QUALITY

Having let the amplifier warm up for some considerable period, a most impressive, deep and powerful sound is developed, with a truly tactile bass line that underpins all musical detail in the upper octaves. There is clearly a limit to the power available in Class A mode, but this barely compromised the awesome dynamic swings of our orchestral CDs. If anything a slightly grainy coloration in the far treble was the most obvious fault.

The *PM-95* certainly sounds faster and perhaps slightly cleaner in Class AB mode, but again a faint 'glassiness' at the top detracts from the sweet but brassy timbre of sax, for instance.

There's a subtle improvement in the speed and conviction of leading edges via the digital inputs, but the musical soundstage also appears slightly flatter than that achieved by using the experimental external 1-bit PDM converter. Music was detailed and emotionally quite 'charged', but once more a hint of grain or coarseness detracted from the top-end purity.

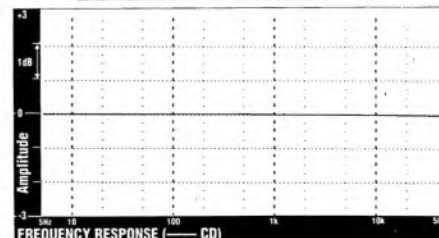
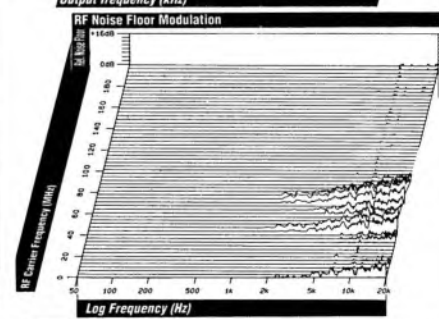
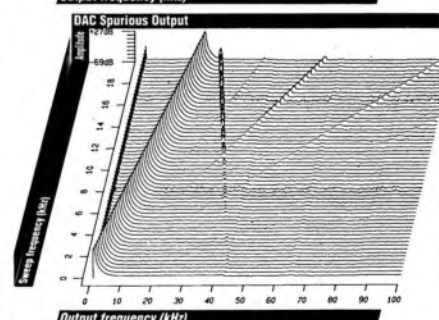
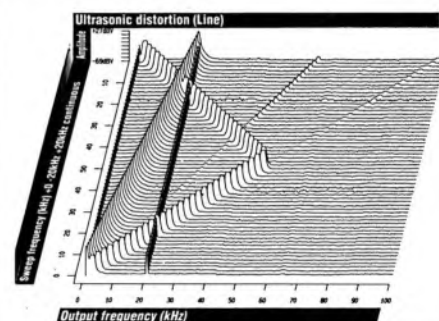
CONCLUSIONS

Visually at least the *PM-95* is by far and away the most stunning product in this test, its champagne gold livery and crackle-finish side-cheeks scoring full marks in the 'ooh' and 'aah' stakes! Flexibility is enhanced with the inclusion of a D/A converter, but of course compromised in turn by the lack of any on-board vinyl disc stage. Consequently, although it sounds very good indeed, and is certainly worth serious consideration by CD fans, it is perhaps not quite good enough to warrant the two-grand price tag.

TEST RESULTS

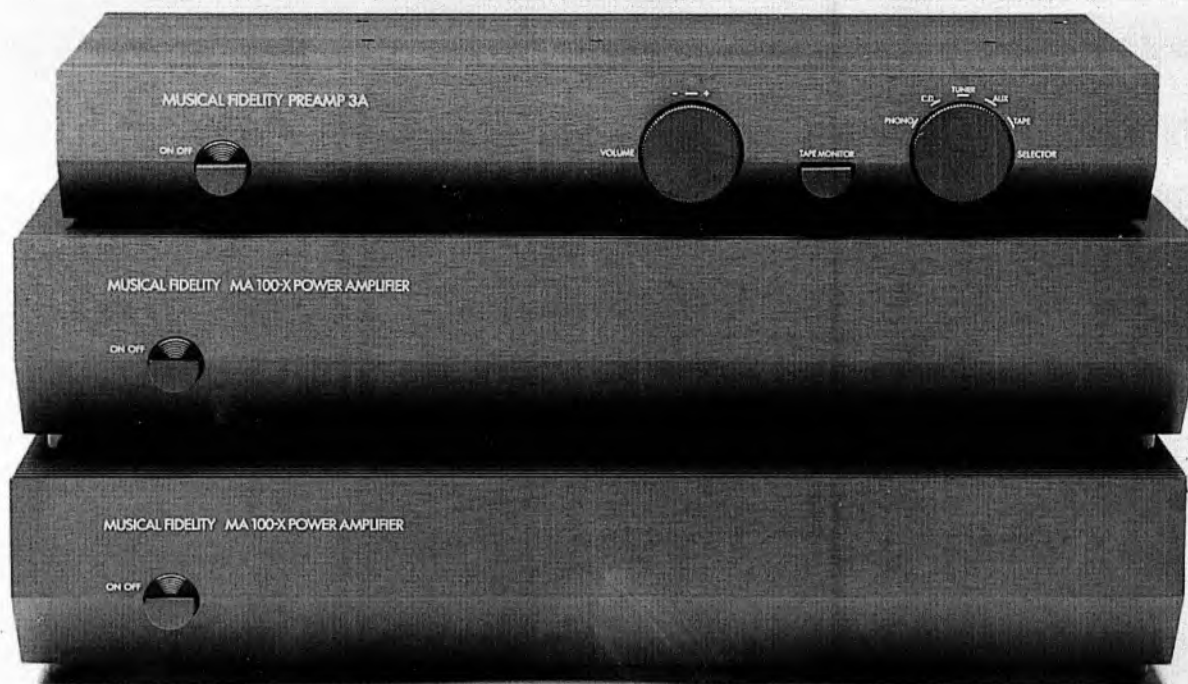
	20Hz	1kHz	20kHz
Maximum Continuous Power Output – 8ohms	149.4W (27.1W)	151.1W (28.5W)	145.7W (28.1W)
– 4ohms	245.2W (48.1W)	250.6W (50.0W)	245.5W (49.6W)
Dynamic headroom (HF)	+1.1dB (192.2W)		
Output impedance	0.031ohm	0.028ohm	0.038ohm
Damping factor	256.6	285.5	209.1
	CO/Aux	Digital	
Stereo separation (20Hz)	123.4dB	115.7dB	

	(1kHz)	96.2dB	91.6dB
	(20kHz)	72.3dB	67.7dB
Channel balance (–20dBV)	0.59dB	0.55dB	
(–60dBV)	1.12dB	1.05dB	
Total harmonic dist. (0dBW) (½ power)	–89.2dB	–96.8dB	
	–90.4dB	–95.6dB	
CCIR intermod. dist. (0dBW)	–86.8dB	–86.9dB	
CCIR IM dist. (½ power)	–90.9dB	–88.2dB	
Rise time	6.4µsecs		
Power bandwidth			5Hz – 50kHz
Squarewave linearity	–105.5dB		
Phase shift (20Hz)	36°		
(1kHz)	0°		
(20kHz)	347°2'		
Noise (A wtd, 0dBW)	–83.8dB		
(½ power)	–97.4dB		
Residual noise (unwtd)	–70.7dBV		
Input sensitivity (for 0dBW)	14.08mV (14.08mV)		
(for full output)	174.6mV (75.77mV)		
Linearity @ –90dB L/R			–2.4dB / –2.3dB
Stopband Rejection			41.5dB
Tape Output/Impedance			15.83V/52.7ohm
Input loading			30.76ohm/322pF
DC offset, left/right			+4.2mV / +6.1mV
Typical price inc VAT			£1,900



MUSICAL FIDELITY 3A-X (+ PSU)/MA-100X

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New and revised amplifiers seem to emerge from the prolific Musical Fidelity stable on an almost monthly basis, this duo comprising the latest *Series-3* preamplifier and a new *MA-100X* monoblok power amplifier. Both are styled in the distinctive manner of all MF designs, with a lightly fluted top-plate acting as both heatsink (in the case of the power amp) and aesthetic 'hallmark'

The evolution of the *3A-X* may be traced back to the early days of Musical Fidelity and the company's first design, known simply as *The Preamp*. Yet today's *3A-X* is a very individual product. Two rotary plastic controls adjust volume and select between tape, aux, tuner, CD or phono sources. Moving magnet or moving coil cartridge sensitivity is distinguished by the push-button selector on the rear, which alters both the loading and gain of an *LM394* dual-transistor headamp. Lying at the heart of this design are several Ferranti *VQ1000J* quad-MOSFET packages, two such multi-transistor arrays forming the central gain cell of the line stage, another two handle the disc EQ network.

The vinyl disc EQ is based around a transconductance topology, wherein the RIAA response is determined by the frequency-dependent impedance of the passive network, while the output current of the gain cell is strictly controlled by the input voltage. An outboard MVX-like power supply accompanied our sample, doubling the retail price of the package, but potentially improving performance by means of a 140VA toroid, two-stage choke filters and a total of 3x6800 μ F electrolytics, each bypassed with either 1 μ F, 0.22 μ F or 220pF polystyrene, polypropylene or polyester caps. Clearly someone at MF takes the sound of passive components very seriously!

Inside the control unit itself, the supply is

further shunt-regulated using a *CA3140* MOSFET-input bipolar-output op-amp, driving *T1F31/52* devices for each positive and negative rail. The idea is to achieve a low noise, low source impedance supply.

Similarly styled, the *MA100-X* power amplifiers are each graced with a power-on switch and red indicator, plus a pair of paralleled 4mm output terminals to facilitate bi-wiring. The internal design is simple but well thought out, comprising *BD139/BD140* long-tailed pairs driving two pairs of complementary *TO-3* style bipolars biased firmly into Class A. The chunky power supply includes 4x10,000 μ F reservoir capacitors.

As a result of the inefficient Class A operation, these monobloks get tremendously hot in a very short period of time, cooling down marginally when actually in use. Two brushless DC fans maintain a constant flow of air through the body of the amplifier, but this does little to ameliorate the high 70°C+ temperature achieved by localised hot-spots on the fluted top-plate. Adequate ventilation is a pre requisite, and nothing should be placed or left on top of these amplifiers.

LAB REPORT

In common with all MF disc stages, the RIAA EQ accuracy is compromised by a slight 0.25-0.55dB shelf above 5kHz, though the LF end is sensibly tailored to a -3dB point at 10Hz. The vinyl disc overload margins are both very generous, but this does little to circumvent the inherent nonlinearities of the line output stage. THD hovers around 0.4 per cent but is remarkably consistent with both frequency and output voltage - from the subjective viewpoint this can be extremely important.

Furthermore, as the 3D plot shows, the complement of THD and IMD is almost

purely even-order, 'nice'-sounding mechanisms such as $F_{20k} \pm F_{0-20k}$ and $F_{0-50k-0} \pm F_{0-20k}$. The only other time I have come across such obviously 'engineered' distortion mechanisms was in the Rowland *Coherence One* pre-amplifier.

Noise is low, registering -100dB (A-wtd) via CD and just -76.9dB via MC. However, the disc input sensitivities are way off the mark at 7.9mV (MM) and 0.8mV (MC) (for 1V out). Stereo separation is a fine 80dB mid-band, while a good channel balance of 0.3-0.6dB is maintained at levels as low as -60dBV.

Under 'closed loop' conditions (with the bare minimum of feedback) the *MA100-X* power amp is clearly less linear than the pre-amplifier. THD deteriorates with increasing frequency and output, reaching some 0.71 per cent at 20kHz^{2/3} power (+25.7dBV into 8ohm). IMD and squarewave linearity (-71dB) are little better, a fact reflected in the ultrasonic 3D plot, which highlights various high-level IMD routes including $F_{0-50k-0} \pm yF_{0-20k}$ and $F_{20k} \pm yF_{0-20k}$ ($y = 1, 2, 3 \dots$).

The A-wtd noise floor is a fabulous -123.4dB (rel +25.7dBV), although this result must be tempered by the RF IMD noise floor modulation of +7dB at 120-150MHz, 160-190MHz and 250-420MHz (off scale). Nevertheless in subjective terms this increase in noise from 5-20kHz is likely to be masked by the broad carpet of closed-loop nonlinearities - a 'cleaner' amp would probably sound worse!

The increase in power output of just +0.2dB (105W to 111W) when changing from 8 to 4ohms is pretty pathetic, but then the output stage is driven from a constant-current source. The standing current in each device settled out at 854mA, leading to a

maximum rms Class A power rating of 47W into 8ohms (93W peak). MF has set the input sensitivity a little low at 1.89V while the output impedance could stand improvement from its current 0.25ohms or so.

SOUND QUALITY

After only a few moments, the entire panel expressed delight at the remarkably natural and fluid quality of the music reproduced by this amplifier combination. Via the external PDM D/A converter it sounds confident but also very rich and attractive, the presentation benefitting from a solid foundation in a bass which punches out a raw, earthy beat. Vocals are very slightly smeared, but are also very warm and approachable, with convincing diction. Treble notes are sweet and delightfully un-fatiguing, recreating the crash of percussion without introducing any additional brashness.

In fact there is very little wrong with the sound of this combination, save perhaps for a slight loss in see-through transparency. It is also just slightly over-rich at times, and this tends to cast a rose-tinted hue over the soundstage. However, by somehow bolstering the euphonous, emotive qualities of our recordings, this pre/power combination can be forgiven any trespass from the road of absolute clarity.

Music pours unabated via the disc inputs, modified rather in the fashion of a valve amplifier but still wholly palatable. Indeed it painted a delightful picture of all the material we tried, eliciting the most favourable response amongst all the amplifiers from our panel of listeners. The excellent portrayal of width and depth, and the unstrained and very natural sound set it apart from all but the Hafler combination in terms of eliciting praise. As such it provides a rare example of music that convincingly escapes the vicinity of the loudspeakers without sounding unnaturally forward or aggressive.

CONCLUSIONS

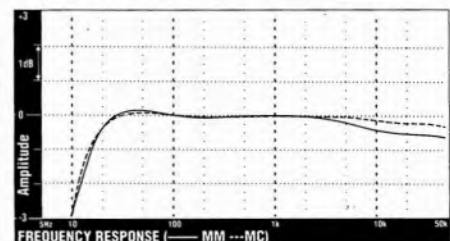
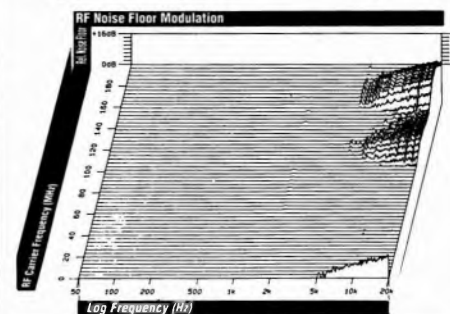
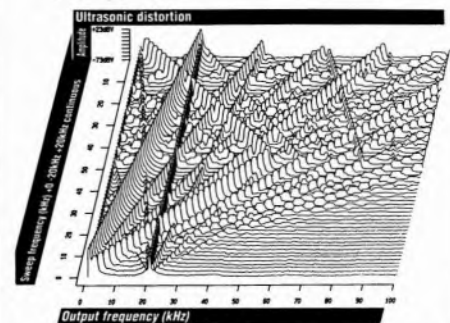
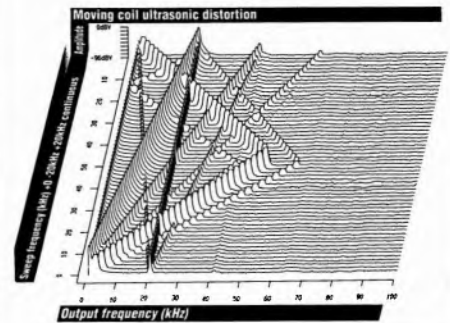
In common with other MF separates, the 3A-

X/MA100-X combination does not possess the speed and leading-edge resolution of the most linear amps available, nor is it as transparent. Nevertheless it reproduces music in a most lucid and accessible fashion, and is a delight to hear regardless of whether CD or vinyl disc is the chosen source. I can well imagine this model sonically seeing off much of the over-hyped and over-priced high-end 'exotica'. After all, there's no other amplifier that offers such superlative sound and doubles-up as waffle irons for the summer barbecue season...

TEST RESULTS

PREAMPLIFIER			
	Aux/CD	MM	MC
Stereo separation (20Hz)	92.6dB	96.7dB	91.9dB
	(1kHz)	80.6dB	81.4dB
	(20kHz)	55.2dB	54.8dB
Channel balance (0dBV)	0.00dB	0.04dB	0.03dB
	(-20dBV)	0.16dB	0.23dB
	(-60dBV)	0.43dB	0.57dB
Total harmonic dis. (0dBV)	-48.5dB	-48.4dB	-48.2dB
	(20kHz)	-49.6dB	-48.9dB
CCIR intermod. dist. (1:1)	-46.1dB	-45.8dB	-39.5dB
Phase shift (20Hz)	5°30'	18°43'	18°30'
	(1kHz)	0°	306°43'
	(20kHz)	336°56'	252°
Squarewave linearity	-72.2dB		
Noise (A wtd, 20Hz-20kHz)	-99.7dB	-86.1dB	-76.9dB
Residual noise (unwtd)	-97.3dBV	-97.0dBV	-97.5dBV
Input sensitivity (for 0dBV)	322.3mV	7.882mV	811.2μV
Disc overload (20Hz)		24.13mV	2.576mV
	(1kHz)	204.1mV	20.92mV
	(20kHz)	938.1mV	96.1mV
		975.8mV	95.3mV
Input loading	39.6kohm/43pF	5.3.1kohm/76pF	37.1kohm
Preamp output (max)/impedance		3.98V (disc)/40.5ohm	
Tape output (max)/impedance		8.18V (disc)/5.6ohm	
DC offset, L/R		+34μV/-56μV	
Retail price inc VAT		£399 + £399 (PSU)	
POWER AMPLIFIER			
	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	95.9W	105.4W	69.1W
- 4ohms	105.6W	110.7W	57.4W
Dynamic headroom (IHF)		+0.70dB	(123.9W)
Output impedance	0.205ohm	0.226ohm	0.322ohm
Damping factor	38.9	35.5	24.9
Stereo separation (0dBV)			N/A
Total harmonic dist. (0dBV)	-83.2dB	-80.8dB	-67.9dB
	(½ power)	-64.8dB	-43.0dB
CCIR intermodulation distortion (0dBV)			-77.9dB
CCIR IM distortion (½ power)			-57.7dB

Rise time (@ 10kHz)	3.79μsecs
Power bandwidth	55Hz - 12kHz
Squarewave linearity	-70.7dB
Phase shift 20Hz	11°31'
1kHz	0°
20kHz	399°50'
Noise (A wtd, 20Hz-20kHz) 0dBV	-106.5dB
(A wtd, 20Hz-20kHz) ½ power	-123.4dB
Residual noise (unwtd)	-84.7dBV
Input sensitivity (for 0dBV)	180.2mV
(for full output)	1892mV
Input loading	10.6kohm/620pF
DC offset, left/right	-16.5mV
Typical price inc VAT	£1499





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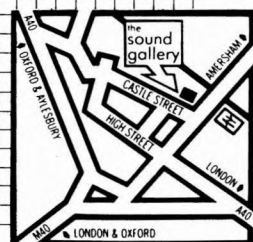
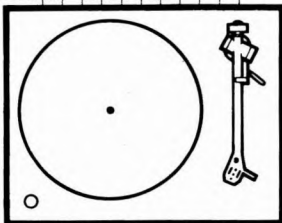
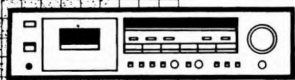
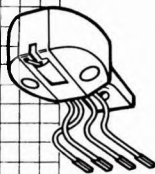
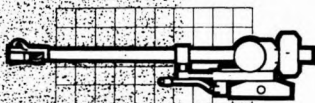
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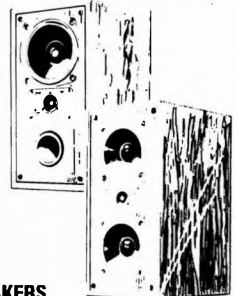
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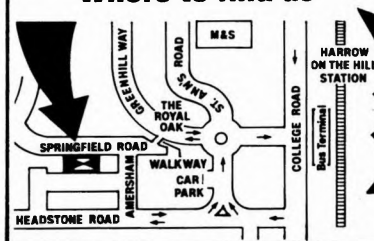
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Amongst a variety of new amplifiers recently introduced by Philips to supplement the flagship *FA960*, the competitively priced *FA880* features a nicely-finished satin-black fascia with the controls concentrated along the lower portion. A series of light touch keys operate CMOS logic switches for input selection, though the ICs themselves are not mounted up against the input sockets as would perhaps be ideal.

Conventional rotary controls cater for volume and balance adjustment, bass and treble tone and comprehensive record-out selection. The tone controls may be removed from the signal path via a 'source direct' facility that routes the selected input directly to the buffered volume control. This volume control is flanked by a glowing blue ring that illuminates once the amp is powered-up, a somewhat garish aesthetic touch which may not be to every taste.

Philips has shunned the symmetrical/non-resonant design of earlier Philips/Marantz amplifiers here, opting instead for a multi-PCB design with relatively flimsy heatsinking. A low-noise differential FET input is used for both MM and MC vinyl sources, followed by all active RIAA EQ around a single *JRC 2068DD* op-amp. Toshiba *A1306/C3298* complementary drivers are on a separate PCB, feeding two pairs of fast *2SA1301/2SC3280* bipolar output transistors.

LAB REPORT

Judging by the abrupt subsonic roll-off on both MM and MC inputs, Philips is adopting the fourth 'optional' IEC time constant at 20Hz. Both responses had levelled out by 200Hz, the MM input extending flat to 50kHz while the MC stage falls gently to -1.5dB at 50kHz.

The 108W/8ohms power output is healthy enough (with an impressive 68kHz power bandwidth), as is the +1.9dB increase to 168W into 4ohms. However the 0.13ohms output impedance is a little high.

Despite what appears to be only a moderate amount of compensation, the levels of THD and IMD are very respectable. THD varies between 0.0035 per cent and 0.0019 per cent via all the inputs, but the disparity is rather greater on the CCIR IM test, between

0.0028 per cent and 0.015 per cent. There is also evidence of low-level crossover non-linearities at HF, particularly as IMD falls with increasing power output. The 3D plot indicates a trace of $3F_{0-20k}$ (3rd harmonic).

The row of first-order RF filters at the input is clearly insufficient to prevent the ingress, and subsequent demodulation, of AM/RF noise in the 1-25MHz region. This is likely to compromise the subjective performance of the CD or line inputs.

SOUND QUALITY

Opting for the 'source direct' facility produces a brighter and less well integrated sound than was obtained with the tone controls in circuit. (It is interesting to note that RF IMD measured significantly less well via source-direct, since the tone controls add a further degree of RF filtering.) Deep bass notes are rather too soft in focus and insubstantial in impact and body, just as the images of performers and instruments are vague and lack crispness.

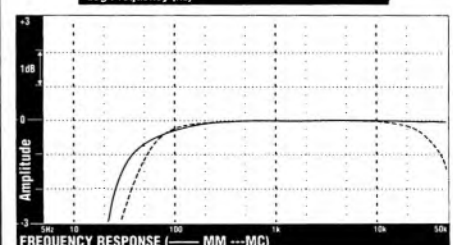
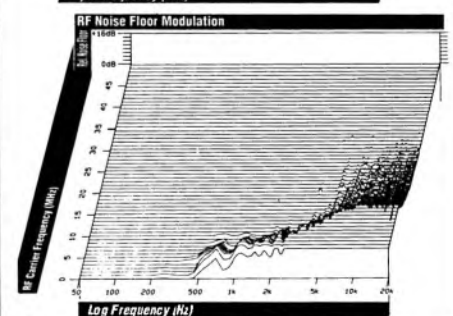
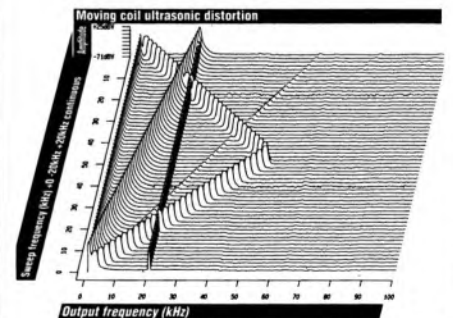
Using vinyl discs (MM), the *FA880* improves on the costlier *DF4888*. Vocals are projected forward with slightly better articulation and the musical soundstage is better resolved. Most types of music sound less compressed or pinched, offering a welcome improvement in the fluidity and 'naturalness' of presentation.

CONCLUSIONS

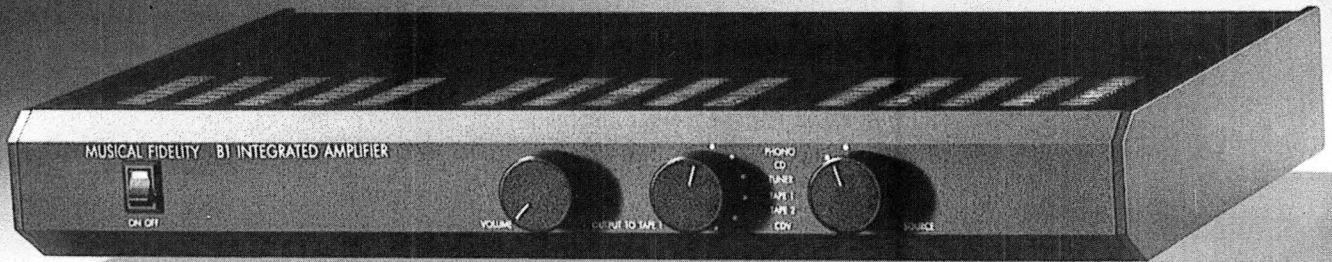
The disc inputs of this amplifier were thought to produce a better balanced and more communicative sound than that obtained using CD, even via the PDM converter. This contrasts with the results obtained with the other Philips model which, if nothing else demonstrates the difficult juggling act performed by all amplifier designers!

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	101.9W	108.3W	105.6W
- 4ohms	144.4W	167.9W	163.1W
Dynamic headroom (IHF)	+ 1.33dB (147.1W)		
Output impedance	0.129ohm	0.129ohm	0.147ohm
Damping factor	61.9	62.1	54.5
Stereo separation (20Hz)	CD/Aux	MM	MC
(1kHz)	107.7dB	100.5dB	99.7dB
(20kHz)	75.6dB	79.5dB	79.2dB
Channel balance (-20dBV)	49.9dB	49.8dB	50.5dB
(-60dBV)	0.21dB	0.45dB	0.32dB
Total harmonic dist. (0dBW)	0.92dB	1.13dB	0.99dB
(½ power)	-89.2dB	-92.3dB	-94.5dB
CCIR intermod. dist. (0dBW)	-89.0dB	-91.6dB	-93.1dB
CCIR IM dist. (½ power)	-87.4dB	-75.8dB	-76.3dB
Rise time	-91.1dB	-78.7dB	-79.4dB
Power bandwidth	4.3µsecs		17Hz - 68kHz
Squarewave linearity	-105.6dB		
Phase shift (20Hz)	38°9'	190°4'	197°17'
(1kHz)	0°	292°19'	298°4'
(20kHz)	331°12'	252°	246°14'
Noise (A wtd, 0dBW)	-85.9dB	-86.4dB	-73.8dB
(½ power)	-98.5dB	-90.5dB	-74.7dB
Residual noise (unwtd)	-75.7dBV	-75.6dBV	-75.7dBV
Input sensitivity (for 0dBW)	17.71mV	289.2µV	31.3µV
(for full output)	185.9mV	3.048mV	332.1µV
Disc overload (20Hz)		30.62mV	3.71mV
(1kHz)		185.5mV	20.01mV
(20kHz)		1613mV	180.8mV
(50kHz)		2362mV	302.2mV
Tape Output/Impedance		11.31V (disc)/609.5ohm	
Input loading	28.8kohm/517pF	38.9ohm/270pF	138.4ohm/7.6nF
DC offset, left/right		+ 25.1mV/+ 25.9mV	
Typical price inc VAT			£200



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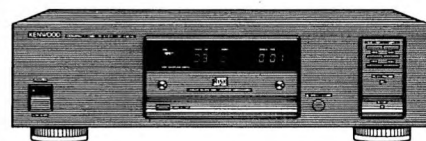
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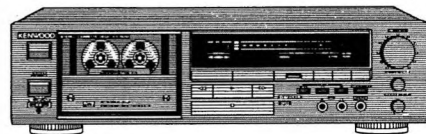
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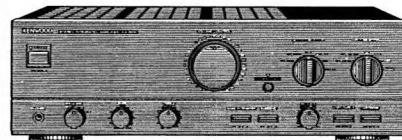
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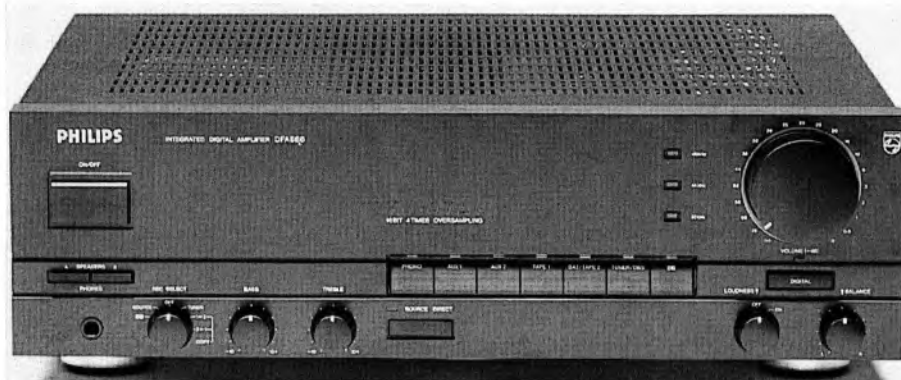


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PHILIPS DFA888

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Take one Philips *FA880*, shift the input and disc EQ circuit board aside and add a full 16-bit 4x oversampling digital chipset and you end up with a *DFA888* at a £100 price premium. This model is also distinguished by a broad 'Digital' logo indented in the fascia, together with a column of three LEDs that indicate which of the possible (32kHz, 44kHz or 48kHz) digital sampling rates is identified.

The internal construction is based on the cheaper *FA880*, though the '888 does employ an *LM833* op-amp in the disc EQ network, in place of the JRC device fitted in the cheaper model. And Philips has used multiple regulated supplies, together with graded examples of the *SAA722GP/B* oversampling filter and *TCA1541A* (crown) dual-channel D/A converter.

LAB REPORT

Bearing in mind the common heritage of the *FA880* and *DFA888*, the similarity in their measured results is no surprise. Perhaps as a result of the different op-amp employed in the vinyl disc stage, the MM and MC overload margins are some 4dB less here, though the RIAA EQ response is identical. The level of THD is also 10-15dB poorer here, though this appears to be a function of the *DFA888*'s output stage and is visible in the stronger 2nd and 3rd harmonics on the 3D plot.

Both A-wtd noise and un-wtd hum levels are some 2dB better with the *DFA888*. More important, the effect of RF IMD on the HF noise floor was reduced to a momentary peak of 16dB, for the same demodulation pass-band as the *FA880*. Therefore the *DFA888*'s CD input is less sensitive to RF noise and ought to sound better.

Low-level linearity via the digital input approached 15.7-bits, with a symmetrical error of just -3dB. However, the spurious output plot shows higher than normal levels of THD, together with anomalous 2.5kHz 2nd and 3rd order sidebands tracking parallel with the F_{0-20k} sweep.

SOUND QUALITY

In contrast to the *FA880*, the *DFA888* displays a very obvious warm-up time, prior to which it can sound very cold and splattery.

After the first hour or so it becomes notably smoother and richer, with a pleasantly warm and rounded bass and solid, nicely focused images. Tunes flow with a pleasing naturalness that is both beguiling and very easy on the ear.

The sound becomes marginally more pinched via the internal D/A converter. It might be described as better focused and more precise, but was also subject to an annoying 'nasal' coloration, and was slightly harder and thinner with a poorer sense of stereo depth. In overall terms the sound is less fluid and musical.

Moving magnet vinyl sources sound remarkably close to the digital CD input both in balance and presentation - slightly thin but well controlled, yet also slightly pinched, dynamics lacking full lucidity and freedom. This effect was successfully ameliorated via the MC input, which sounded both smoother and more open, hinting at better stereo depth and spaciousness.

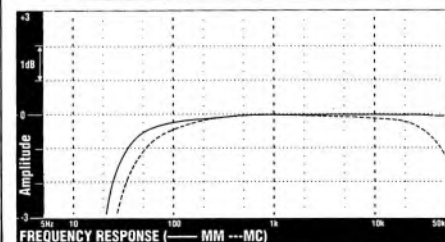
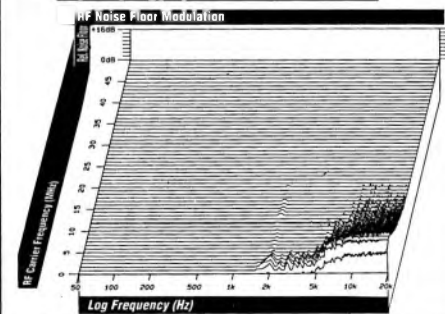
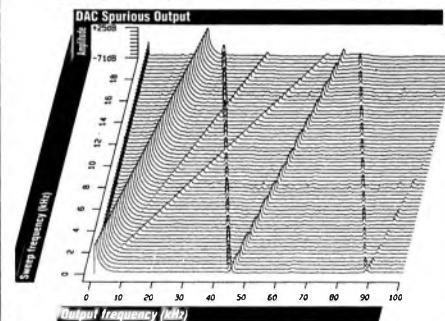
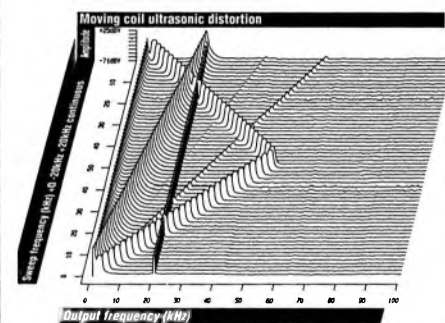
CONCLUSIONS

The panel was very impressed by the detailed and emotive qualities of the analogue CD input, particularly when used with the out-board PDM converter, though its own integral multi-bit converter was less convincing. If Philips was to follow Sony's example, replacing the multi-bit DAC with a 1-bit PDM converter, the outcome might be quite different again...

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	100.3W	107.4W	102.8W
- 4ohms	138.8W	162.5W	154.8W
Dynamic headroom (HF)		+1.32dB (145.5W)	
Output impedance (HF)	0.110ohm	0.103ohm	0.128ohm
Damping factor	72.47	77.66	62.33
	CD/Aux	MM	MC
Stereo separation (20Hz)	106.3dB	99.7dB	99.2dB
(1kHz)	76.2dB	75.4dB	75.8dB
(20kHz)	50.7dB	49.8dB	49.9dB
Channel balance (-20dBV)	1.09dB	1.10dB	1.11dB
(-60dBV)	0.51dB	0.65dB	0.71dB
Total harmonic dist. (0dBW)	-71.3dB	-80.6dB	-82.7dB
(½ power)	-57.6dB	-78.5dB	-79.6dB
CCIR intermod. dist. (0dBW)	-90.8dB	-78.3dB	-76.4dB
CCIR IM dist. (½ power)	-88.3dB	-73.9dB	-75.1dB
Rise time	4.5µsecs		
Power bandwidth		16Hz - 85kHz	

Squarewave linearity	-94.9dB		
Phase shift (20Hz)	1°30'	35°	39°30'
(1kHz)	0°	311°	309°36'
(20kHz)	338°24'	255°36'	255°36'
Noise (A wtd, 0dBW)	-91.0dB	-88.5dB	-75.2dB
(½ power)	-101.3dB	-92.3dB	-76.7dB
Residual noise (unwtd)	-80.7dBV	-77.9dBV	-80.7dBV
Input sensitivity (for 0dBW)	17.54mV	300.6µV	35.7µV
(for full output)	182.5mV	3.153mV	370.1µV
Disc overload (20Hz)		29.43mV	3.622mV
(1kHz)		180.2mV	19.44mV
(20kHz)		1030mV	117.0mV
(50kHz)		996.0mV	118.6mV
Tape Output/Impedance		11.22V (disc)/64.1ohm	
Input loading	28.9kohm/587pf	39.5kohm/283pf	136.5ohm/7.4nF
DC offset, left/right		+19.6mV/+22.8mV	
Typical price inc VAT			£300



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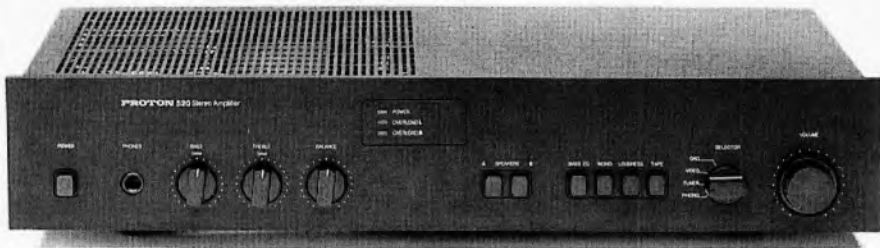
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RECOMMENDED



Proton and NAD have always shared something of a common heritage, and this is reflected in the similar appearance of many of their products, if not necessarily the circuit design itself. So it is with Proton's new 520 budget amplifier, which looks distinctly NAD-like in its matt livery and in the characteristic plastic control grouping.

A trio of LEDs indicate power-on as well as premature overload of either the left or right channel. If these LEDs are found to flash rather too regularly then Proton's 'Anti-Clipping Circuit' can be brought into play. Analogous to NAD's soft-clipping option, this circuit progressively limits the output voltage as the amplifier is driven near to the limit of the supply rails. Thus an abrupt clip, with its dominant odd-harmonic distortion structure, is traded for a slower clip with a preferential distortion complement. This AGC facility should be switched out for critical listening.

The 520 is remarkably well equipped for a budget amplifier. It will accommodate up to four line-level sources (CD is marked DAD in this instance), together with both MM and MC cartridges. Further flexibility is found in variable capacitance loading on the MM input and hi/lo gain options to suit any MC cartridge.

The internal design is rather messy, but there's not a single IC in sight. From the low-noise differential FET gain stage on the MC input to the A1186/C2837 bipolar transistors employed in the output, all the components are discrete.

LAB REPORT

Equipped with a relatively insubstantial and loosely regulated power supply, the output of the 520 struggles to achieve a continuous increase in output of +1dB from 8 to 40ohms. Nevertheless the 1.6dB dynamic headroom is a little more impressive, as is the low 0.072ohms output impedance - plenty of compensation at work here.

Independent regulators are employed for the tone and preamplifier circuits though this does not appear to have helped the -63.5dB A-wtd noise figure obtained via the MC input. The figure of -96.5dB rel to 1/2 output (+20.4dBV into 8ohm) is much bet-

ter. The MM disc input -3dB is at a rather low 1.3Hz, while the MC stage is rolled-off slightly earlier (-3dB at 5.3Hz). Channel balance is poor, with a 2.2-2.5dB error on all inputs at -20dBV, but THD was a very well controlled 0.0037 per cent to 0.0016 per cent across most of the dynamic range. The 3D ultrasonic plot indicates that THD rises slightly into lower impedances, but the 2nd and 4th harmonics (2F_{0-20k} and 4F_{0-20k}) are nothing to worry about.

Unfortunately the 520's inordinate sensitivity to RF noise near full gain will influence its subjective performance. The plot reveals gross demodulation of AM/RF noise in the 10-60MHz region, increasing the noise floor by +28dB over the region 2-20kHz.

SOUND QUALITY

The CD (sorry, DAD) input of the 520 has a light but fresh balance that enables it to sound quite punchy and dynamic without really throwing a great deal of weight behind bass transients. Many CDs were marred by a rather flat and two dimensional presentation, though the 520 never sounded 'impolite'. Stringed instruments sound just slightly coarse or grainy, at times, but an overall lack of conviction and emotivity is the real stumbling block.

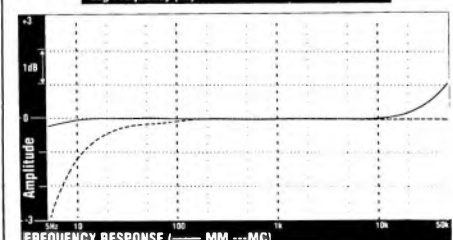
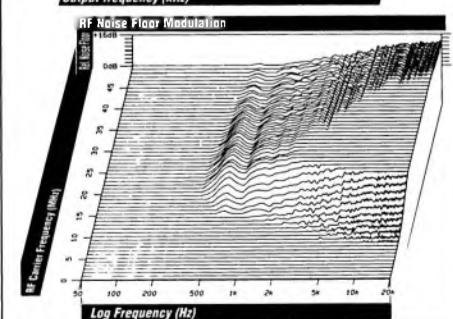
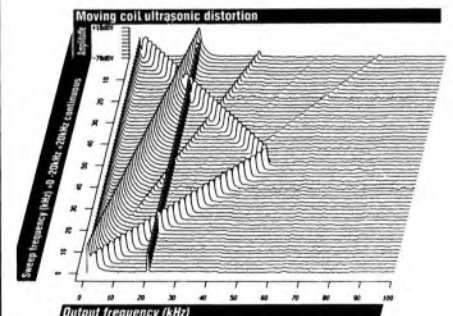
The MM disc input is certainly sweeter in the treble and more transparent throughout the midrange than the MC stage which sounds plummy and lacks 'bite'. The former was more civilised (if no less bland) than the CD input, but its liquid, syrupy sound might prove just the ticket for brush or bright sounding audio systems. Sensitive speakers are a must, however.

CONCLUSIONS

The sound of this amplifier is distinctly cheap and cheerful - yet so is the price. Furthermore it offers considerable flexibility for a product on the bottom rung of the hi-fi ladder, with a dedicated MC input that is more than just a cynical afterthought. Against that background, the Proton 520 may be cautiously Recommended.

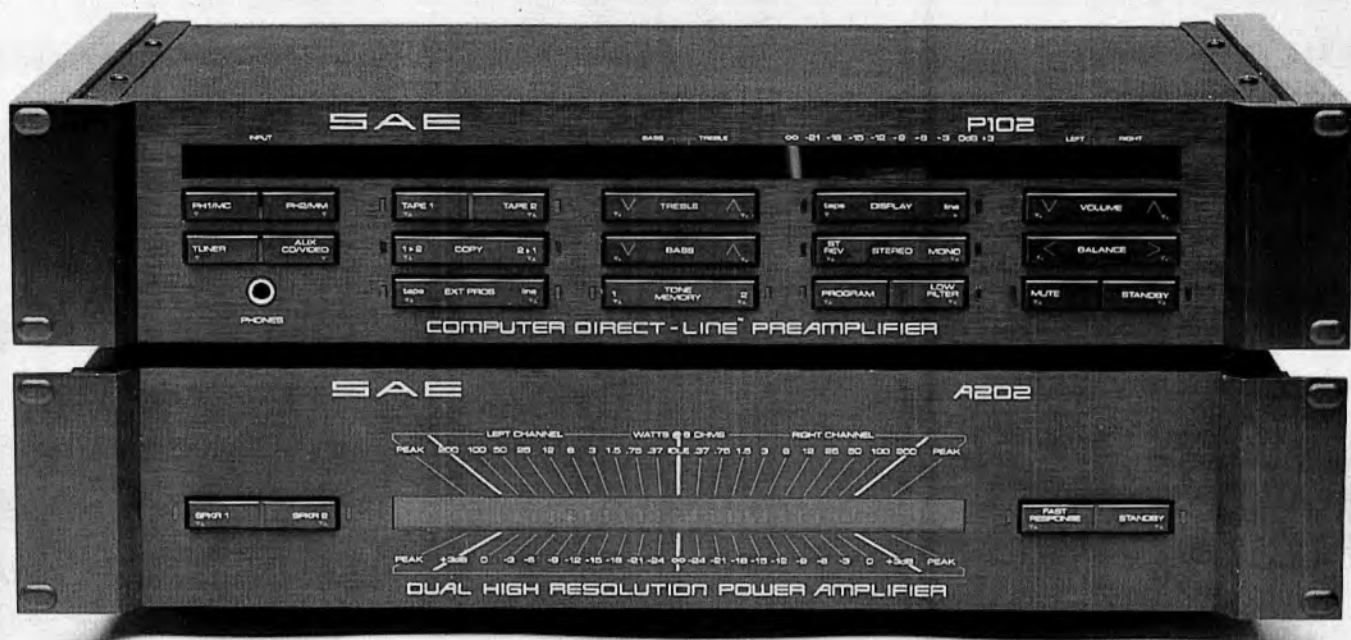
TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	23.8W	30.5W	29.9W
- 4ohms	27.7W	38.9W	40.8W
Dynamic headroom (HF)	+ 1.6dB (44.1W)		
Output impedance	0.072ohm	0.075ohm	0.085ohm
Damping factor	110.7	106.3	94.0
Stereo separation (20Hz)	100.1dB	95.6dB	92.7dB
(1kHz)	75.7dB	74.8dB	73.5dB
(20kHz)	50.1dB	49.6dB	47.1dB
Channel balance (-20dBV)	2.22dB	2.21dB	2.55dB
(-60dBV)	3.22dB	3.45dB	3.86dB
Total harmonic dist. (0dBW)	-88.7dB	-94.6dB	-93.2dB
(1/2 power)	-90.6dB	-95.9dB	-94.6dB
CCIR intermod. dist. (0dBW)	-88.9dB	-76.9dB	-71.8dB
CCIR IM dist. (1/2 power)	-96.1dB	-74.9dB	-73.7dB
Rise time	11.8μsecs		
Power bandwidth	45Hz - 55kHz		
Squarewave linearity	-97.0dB		
Phase shift (20Hz)	64°4'	115°12'	205°55'
(1kHz)	0°	296°38'	180
(20kHz)	292°19'	221°46'	165°36'
Noise (A wtd, 0dBW)	-84.6dB	-85.2dB	-63.5dB
(1/2 power)	-96.5dB	-86.2dB	-63.1dB
Residual noise (unwtd)	-68.3dBV	-68.2dBV	-68.3dBV
Input sensitivity (for 0dBW)	34.18mV	588.2μV	39.3μV/20.4μV
(for full output)	188.7mV	3.311mV	218.5μV/113.4μV
Disc overload (20Hz)	33.23mV 2.436mV		
(1kHz)	288.7mV 21.10mV		
(20kHz)	2670mV 205.6mV		
(50kHz)	3882mV 443.6mV		
Tape Output/Impedance	18.75V/1.708kohm		
Input loading	49.5kohm/54pF 38.9kohm/134pF 103ohm/1.6nF		
DC offset, left/right	+ 9.8mV/+ 6.8mV		
Typical price inc VAT	£100		



SAE P102/A202

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Scientific Audio Electronics is responsible for a fairly broad range of microprocessor-controlled separates, including a tape deck, CD player and several amplifiers. The products have a unique style, clearly aimed at the company's (US) home market, coming complete with 19-inch rack-mount faceplates, and very sturdy pressed-steel chassis.

At the heart of many SAE components is a Rockwell 6502 microprocessor, an ageing 40-pin DIL IC that is able to address up to 64kbytes of memory using multiple 16-bit lines. Said microprocessor in the P102 pre-amplifier is responsible for addressing the TC4508 function and LED latches in addition to the electronic volume and bass/treble control ICs. The CPU effectively acts as a buffer between the stepwise function keys on the fascia, the function latches and the final 2 pole 4-channel 4052 multiplexers that switch the inputs and route the tape outputs.

A total of five columns of step action switches are posted on the busy fascia. The volume, balance, bass and treble switches are linked to a series of 4-digit LED displays which give a numerical readout of level, channel balance and tone boost or cut, in gradations of 2dB. It is also possible to store two tone control settings in a non-volatile memory for later recall. A mute facility automatically attenuates the output by 20dB, which is particularly useful as there is no conventional volume control to grab in emergencies. You can also reverse the left and right channels if so desired, switch from stereo to mono or engage a Low Filter option.

A further 10-segment LED display gives a dynamic reading of level, either of the line output or tape record/playback level depending on the state of the tape controls. Two tape decks are accommodated with full dubbing and recording facilities for the remain-

ing disc (MM and MC), tuner and CD inputs.

A low-noise differential input is provided for the initial MC gain stage and an NJM4558 op-amp covers the RIAA EQ section - all prior to the appropriate 4052 CMOS switch. All circuit stages are buffered by NJM4560 op-amps and the output uses a quasi-complementary pair of 2SK117 MOSFETS!

If the insides of the P102 are more reminiscent of a computer than an amplifier, the A202 power amplifier brings us back to more familiar territory. SAE was unable to resist the temptation to splash a broad LED level indicator across the black alloy fascia, but at least the styling is consistent.

Simple CMOS logic (4027 master-slave flip-flops) is used to select speaker A or B outputs and to alter the response time of the 10-segment display. First-order RF filtering is deployed at the input which comprises both bipolar and MOSFET differential amplifiers, the latter a single package 2SK333F device. The fully protected complementary output stage comprises two pairs (per channel) of Toshiba 2SB755/2SD845 bipolars mounted on cast alloy heatsinks.

Both products are well built, but strike me as looking a little old-fashioned both in terms of the components used and in the complexity of the layouts.

LAB REPORT

As might have been expected, SAE's use of logic switching circuitry has tended to normalise many of the input measurements. For instance, stereo separation is pretty consistent throughout, peaking around 77dB mid-band, just as the electronic attenuator ensures a well matched channel balance with a maximum error of just 0.23dB at -60dBV. THD was remarkably even at higher frequencies (0.019 per cent at 20kHz)

as was the 0.014 per cent 2nd-order COIR IMD. The phase shifts were consistent between CD and MM inputs, which is odd enough, but also differed from that encountered via the MC input (the 1kHz value of 127 degrees is usually closer to 309 degrees).

The MM/MC vinyl disc responses are both a trifle uneven, both have an approximate -3dB point of 20Hz and both are some 2dB down at 20kHz. The disc overload margins are nothing to write home about either, at +27.9dB and +25.7dB respectively. Note the 3rd order IMD routes on the ultrasonic (MC) plot due to $F_{20k} - 2F_{0-20k}$ and $F_{0-50k-0} - 2F_{0-20k}$ (both increasing towards the LF origin as a function of the RIAA characteristic).

Stereo separation, phase shift, square-wave linearity, THD and IMD were all improved in the A202 power amplifier (see 3D plot) which delivers some 151W into 8ohms and 235W (+1.9dB) into 4ohms. Nevertheless the A-wtd noise of -97.6dB (ref 1/3 power = +27.3dBV) is a trifle disappointing. The RF IMD test threw up some interesting results, however, indicating that the A202 is most sensitive to non-correlated AM/RF noise in the 1-15MHz and 115-140MHz regions. The demodulated noise peaked between 6-14kHz and 18-20kHz (+18dB) in the audio band, which may introduce unpredictable subjective colorations.

SOUND QUALITY

Despite being packed to the hilt with potentially noisy CMOS electronics, the P102 did little to compromise the 'dark silence' that accompanies the broad and fairly deep soundstage developed by the power amplifier. At relatively low to moderate volume levels there is no sense of grain or dirtiness

even in the far recesses of the soundstage, the arena being populated with suprisingly solid stereo images. There's also a good sense of dynamic discrimination even if transients – especially bass transients – lack the convincing guts and impact that might be expected from such a powerful design.

At low volume levels this amplifier sounds very civilised indeed – if perhaps a little too polite for most of our tastes. Much of the fillgree detail and tonal colour transmitted via the PDM convertor is maintained through the CD input, but a vital spark of magic or realism nevertheless seems to elude this duo.

At increasingly higher levels, the power amplifier sounds noticeably less refined and sedate, almost as if the amplifier is straining to maintain some semblance of poise. Stereo images become less distinct and the soundstage oddly 'bunched', an effect that is additional to any muddling or confusion between individual instruments.

The sound deteriorates further via the MM and MC vinyl disc inputs. The polite character of the amp is still apparent but stereo perspectives are conspicuously narrowed. The grand dynamic swing of an orchestra in full flight fails to materialise, one of our listeners likening this effect to listening to an orchestra at a great distance. Most of the instruments can be discerned, but the transition from solo violinist to full string section seems less dramatic than it should be. Vocals lose some of the articulation and expressiveness enjoyed via the CD input, just as the image of the performer seems to be pushed back and flattened into the soundstage.

Ultimately, the sound of this amplifier combination frustrated our listeners: the promise of the first few minutes listening failed to be substantiated in the long term.

CONCLUSIONS

SAE has a reputation for producing very individual 'hi-tech' designs, and the *PI02/S202* combination is no exception. If you fancy the

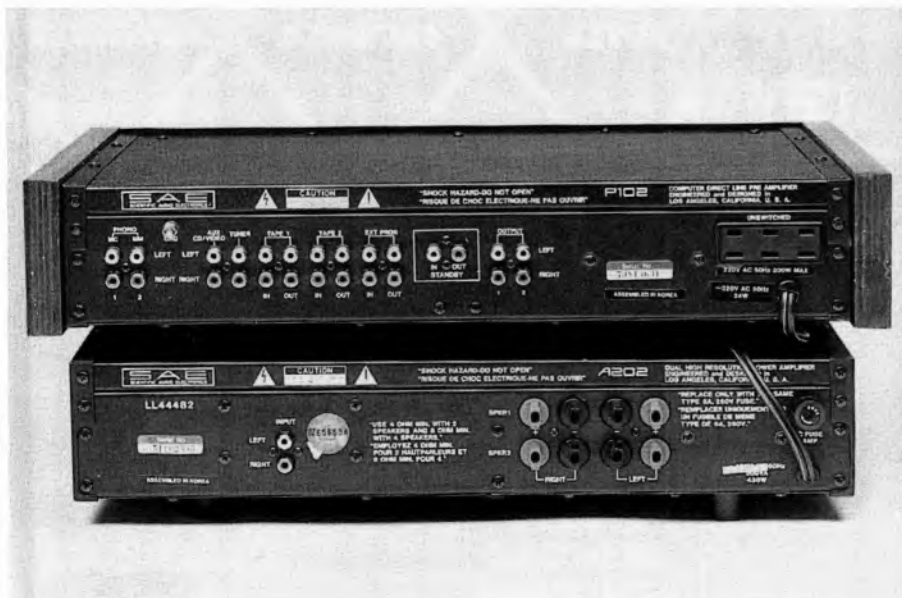
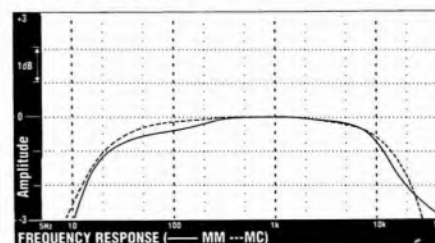
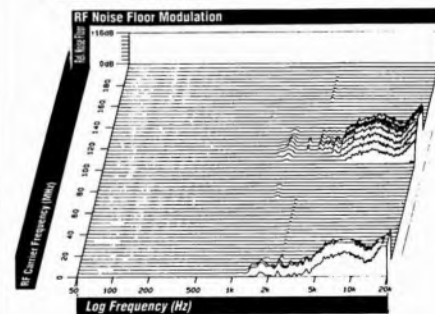
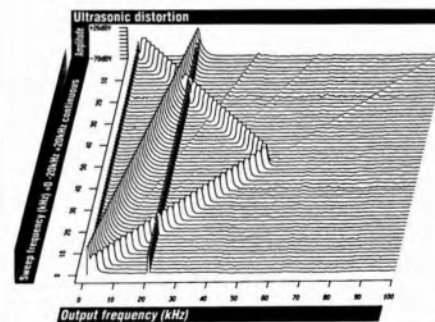
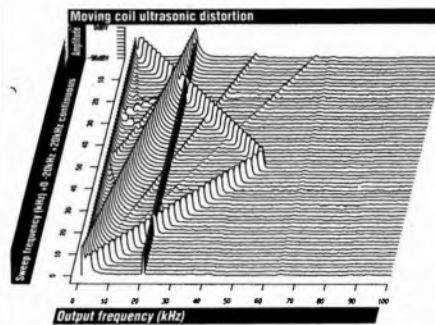
sort of equipment that would not look out of place on a lab bench then the very busy aesthetics might be just the ticket. However, despite offering bags of headroom, the power amplifier would seem most at home with sensitive loudspeakers, as it doesn't really appreciate being driven hard. In a more general domestic context therefore, the applicability of this SAE duo would appear to be rather limited.

TEST RESULTS

PREAMPLIFIER			
	Aux/CD	MM	MC
Stereo separation (20Hz)	65.8dB	69.7dB	72.8dB
	(1kHz) 63.9dB	75.9dB	78.5dB
	(20kHz) 47.6dB	53.1dB	54.8dB
Channel balance (0dBV)	0.09dB	0.13dB	0.20dB
	(-20dBV) 0.09dB	0.14dB	0.22dB
	(-60dBV) 0.07dB	0.15dB	0.23dB
Total harmonic dis. (0dBV)	-77.1dB	-80.0dB	-79.9dB
	(20kHz) -74.2dB	-74.7dB	-74.3dB
	(1:1) -75.4dB	-78.5dB	-77.9dB
CCIR intermod. dist. (1:1)	15°50'	31°41'	250°12'
	(1kHz) 355°30'	306°43'	126°43'
	(20kHz) 292°19'	239°3'	34°30'
Squarewave linearity	-107.5dB	-84.6dB	-74.9dB
Noise (A wtd, 20Hz-20kHz)	-90.5dB	-101.4dB	-101.2dB
Residual noise (unwtd)	-101.7dB	2.485mV	193.4µV
Input sensitivity (for 0dBV)	165.4mV	14.28mV	1.149mV
Disc overload (20Hz)	124.1mV	9.611mV	1186mV
	(1kHz) 949.7mV	125.9mV	
	(50kHz)		
Input loading	29.7kohm/950pF	41.3kohm/470pF	65.4ohm
Preamp output (max)/impedance		4.96V (disc)/149ohm	
Tape output (max)/impedance		7.25V (disc)/3.19kohm	
DC offset, L/R		+1.8mV/+0.7mV	
Retail price inc VAT			£499

POWER AMPLIFIER			
	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	146.4W	150.8W	144.7W
- 4ohms	228.6W	234.6W	230.1W
Dynamic headroom (IHF)		+1.26dB (201.7W)	
Output impedance	0.114ohm	0.110ohm	0.136ohm
Damping factor	70.3	72.9	58.7
Stereo separation (0dBW)	119.5dB	100.7dB	89.6dB
Total harmonic dist. (0dBW)	-84.8dB	-88.5dB	-79.2dB
	(½ power) -87.5dB	-83.8dB	-80.1dB
CCIR intermodulation distortion (0dBW)		-82.9dB	
CCIR IM distortion (½ power)		-90.1dB	
Rise time (@ 10kHz)			3.89µsecs

Power bandwidth	11Hz - 33kHz
Squarewave linearity	-107.5dB
Phase shift 20Hz	0°
1kHz	0°
20kHz	5°30'
Noise (A wtd, 20Hz-20kHz) 0dBW	-79.1dB
(A wtd, 20Hz-20kHz) ½ power	-97.6dB
Residual noise (unwtd)	-67.6dBV
Input sensitivity (for 0dBW)	103.6mV
(for full output)	1285mV
Input loading	153.6kohm/570pF
DC offset, left/right	+11.6mV/+12.6mV
Typical price inc VAT	£599



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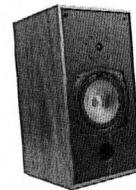


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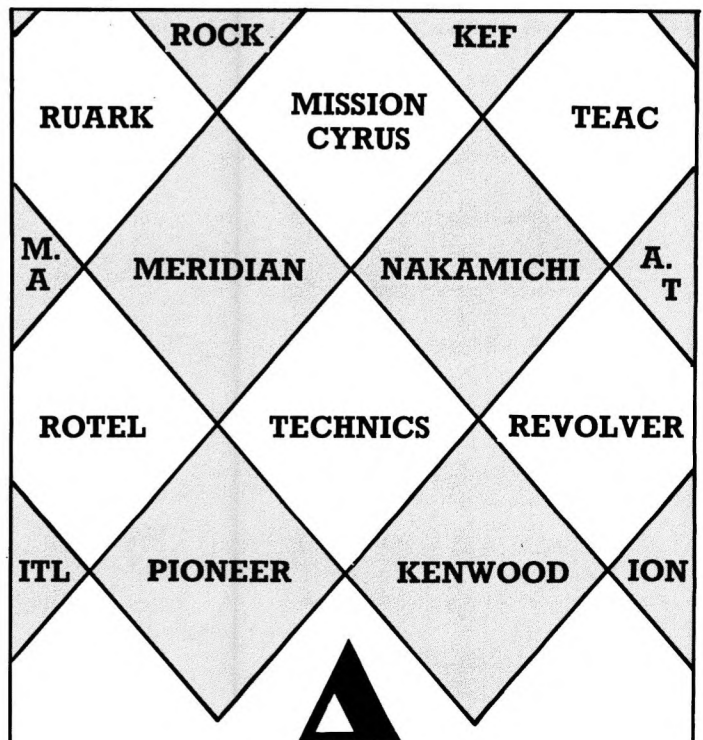
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RECOMMENDED



Sony has announced the introduction of a vast new range of hi-fi separates which includes an entirely revamped collection of amplifiers – most designed with a putative 'UK sound' in mind. Occupying the middle price ground, the *TA-F530ES* is a heavy-weight integrated design constructed on Sony's vibration-resistant 'Gibraltar Chassis'. The satin black fascia is also extremely rugged, and plays host to a variety of well laid out controls.

Bass and treble tone controls may be removed from the circuit using the source-direct option, just as the main input selector can be avoided by connecting any line-source to a pair of direct-in sockets; these two 'direct' options are independent of one another. Up to two tape decks, CD, tuner and phono (MM/MC) sources may still be selected in the conventional manner, just as each in turn can be re-routed via a separate record-out facility. Mute, stereo/mono, balance adjustment and speaker selection completes the list of facilities.

Inside, the amplifier is solidly built with a cast alloy heatsink supporting two pairs of Sanken *2SA1215/2SC2921* output transistors (similar to those used by Audiolab). The disc stage uses discrete devices for the active RIAA EQ section, together with a low-noise differential input and an *STK3102* cascode-current regulated A-Class driver hybrid, as do Philips and Marantz.

LAB REPORT

The use of a fairly substantial and moderately regulated power supply pays off, both in the +2dB increase available when changing from 8ohms to 4ohms loading and in the +1.3dB headroom (160W at 8ohms) on hand for dynamic peaks. However, the output impedance is on the high side and stereo separation is rather weak via both disc inputs. The vinyl disc response is down by about 0.5-1dB below 100Hz, but is essentially very even.

Though ample enough, the +29.6dB (MM) and +26.0dB (MC) disc overload margins are not as impressive as those often found in Far Eastern amplifiers, and may well contribute to the 0.02 per cent 2nd-order IM distortion noted on the CCIR test.

However, there is evidence that crossover artifacts may be compromising low-level linearity, since the level of HF IMD actually decreases by 8dB or so at higher power levels. Hence the relatively clean 3D ultrasonic distortion plot which highlights mainly 2nd ($2F_{0-20k}$) with traces of 3rd, 4th and 5th harmonics. The RF IMD plot is more worrying as it demonstrates strong demodulation of AM RF noise in the 1-6MHz and 15-35MHz regions. The maximum degradation in the noise floor between 5-20kHz measured some +20dB:

SOUND QUALITY

This amplifier benefits from a richness and fullness at low frequencies that lends a substantial foundation to most forms of music, without introducing any significant overhang or bloom. It is clearly not as hard or fast sounding as earlier *ES* models, yet is smoother and better integrated, with a warmer if less direct presentation. Sony has engineered a very full sound; one which bubbles with detail but remains fettered to a slightly undersized soundstage. It avoids sounding compressed, but is just rather 'busy' and lacking in subtlety.

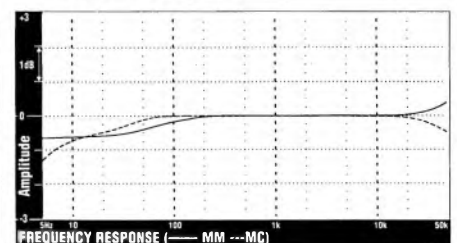
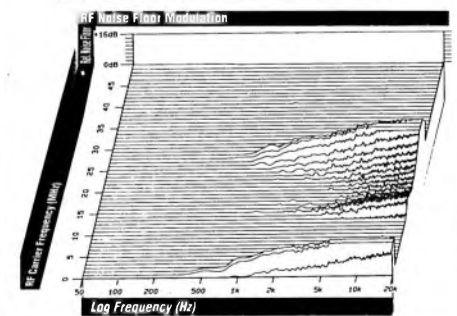
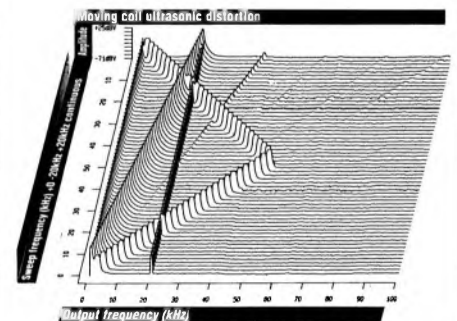
A similarly warm and mellifluous sound is experienced via the vinyl disc inputs, though a general smearing prevents the formation of stable and sharply focused stereo images. Oddly enough image tactility is markedly improved via MC; vocals are less sibilant and the less full bass lines are tauter. Compared to the best specialist designs at this price the *530* does sound a little flat and crude, but its performance is creditable compared to many mass-market creations.

CONCLUSIONS

This product represents an advance on earlier *ES* amplifiers, yet its approach to the art of music making is utterly different. Sony is now opting for a smoother and less 'obvious' mode of presentation, but one which could still benefit from improvement in transparency and image focus. Nevertheless this fully-fledged design is likely to be very reliable and is also reasonably priced; Recommended.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output – 8ohms	119.9W	119.9W	120.9W
– 4ohms	180.6W	191.4W	178.7W
Dynamic headroom (INF)	+1.26dB (160.1W)		
Output impedance	0.177ohm	0.161ohm	0.192ohm
Damping factor	45.3	49.7	42.8
	CD/Aux	MM	MC
Stereo separation (20Hz)	78.4dB	58.5dB	52.9dB
(1kHz)	64.6dB	53.7dB	51.5dB
(20kHz)	39.6dB	39.5dB	39.5dB
Channel balance (–20dBV)	1.21dB	0.95dB	0.79dB
(–60dBV)	1.10dB	0.55dB	0.32dB
Total harmonic dist. (0dBV)	–89.4dB	–94.6dB	–93.8dB
(½ power)	–88.5dB	–95.7dB	–96.3dB
CCIR intermod. dist. (0dBV)	–90.5dB	–73.5dB	–72.8dB
CCIR IM dist. (½ power)	–99.3dB	–80.5dB	–78.9dB
Rise time	2.2µsecs		
Power bandwidth	6Hz – 48kHz		
Squarewave linearity	–105.2dB		
Phase shift (20Hz)	12°30'	350°20'	350°12'
(1kHz)	0°	309°21'	310°30'
(20kHz)	350°18'	275°0'	270°12'
Noise (A wtd, 0dBV)	–81.2dB	–80.9dB	–73.3dB
(½ power)	–95.9dB	–88.5dB	–74.4dB
Residual noise (unwtd)	–77.5dBV	–77.4dBV	–77.8dBV
Input sensitivity (for 0dBV)	18.47mV	307.4µV	19.8µV
(for full output)	204.1mV	3.434mV	221.3µV
Disc overload (20Hz)	17.62mV	1.235mV	1.235mV
(1kHz)	151.0mV	9.956mV	
(20kHz)	1245mV	89.6mV	
(50kHz)	856mV	124.8mV	
Tape Output/Impedance	9.115V (disc)/2.05kohm		
Input loading	35.5kohm/1.8nF 32.4kohm/35pF 103.7ohm/1.4nF		
DC offset, left/right	–23.6mV/–25.9mV		
Typical price inc VAT	£300		



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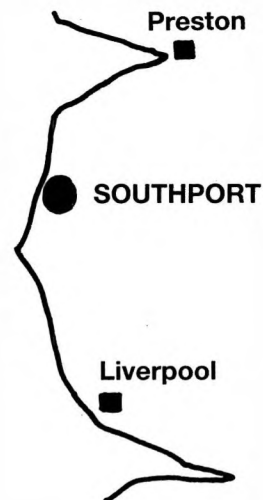
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RECOMMENDED



First encountered in prototype form for the *Perspectives* feature on 1-bit PDM D/A conversion (June '89), this remarkable product is like no other so-called 'digital amplifier'. To all intents and purposes the analogue side of the '630 is identical to the '530, as are the vast majority of its facilities. The £150 price premium is accounted for by the PDM D/A convertor tacked onto the rear of the unit, plus the additional switching circuitry required to distinguish between coaxial and optical digital inputs.

In fact this control takes the place of the direct/normal mode selector found on the '530. All other facilities are exact duplicates of those found on the cheaper machine.

The built-in PDM convertor is based around the Philips SAA7320 chip and Yamaha YM3623B demodulator. This system increases the sampling rate to 256-times, truncating the full-scale digital words down to a single 1-bit datastream, whilst also recovering the original 16-bit S/N ratio by means of noise-shaping. Interested readers should consult the original *Perspectives* article for a thorough treatment of the 1-bit PDM process.

LAB REPORT

Technically the '630 is again a copy of the '530, though distortion was some 10dB poorer at two-thirds power. This is indicated on both 3D plots, as are the 3rd order IMD routes $F_{0-50k-0} + 2F_{0-20k}$ and $F_{20k} - 2F_{0-20k}$. RF IMD showed a similar 'fingerprint' to the '530, while avoiding the minor resonance at 16MHz. On the digital front the PDM convertor has a 15.3-bit linearity, developing a -5.9dB error at -90dB.

SOUND QUALITY

Using the conventional post-conversion (analogue) CD input this amplifier sounds noticeably rough in the upper octaves and slightly leaden in the lower octaves. The mellifluous warmth of the TA-F530ES is replaced by a colder, harder and less musically involving presentation. However, using the onboard PDM DAC brings an immediate improvement in the delicacy, smoothness and poise of subtle treble details. Much timbral detail that was missing when using the

analogue inputs was brought to light via the on-board PDM DAC.

The optical connection was considered smoothest of all, since a slight graininess persisted with the 75ohm impedance coax lead. Interestingly the PDM-type digital input sounds very 'analogue' in the way it paints a broad and deep soundstage populated with believable stereo images and without any exaggeration of vocal sibilance.

Furthermore, it is possible to re-route the signal immediately after the PDM convertor using the tape monitor loop, thereby avoiding both pre- and power amp sections of the TA-F630ESD. Used thus in the role of outboard D/A convertor, along with our reference pre/power combination, produces the most marvellous results. A modified version of this PDM circuit was therefore subsequently employed in order to help assess the CD inputs of all the test amplifiers!

Returning to the '630 proper, the MM input sounds very similar to the '530, delivering a smooth and balanced sound, albeit less tactile or sharply defined as via the line input. Deep bass notes are restricted in both extension and impact, and a trace of sibilance is noted on most vocals.

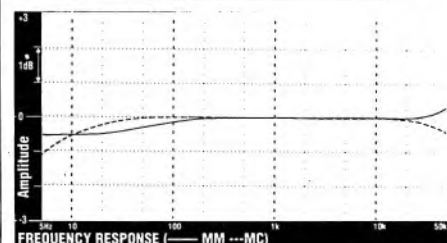
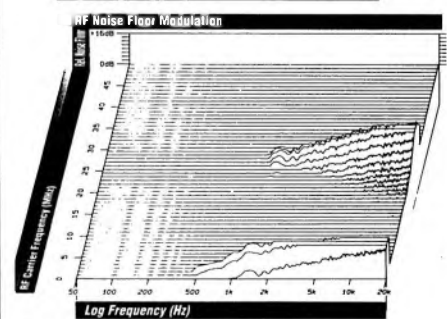
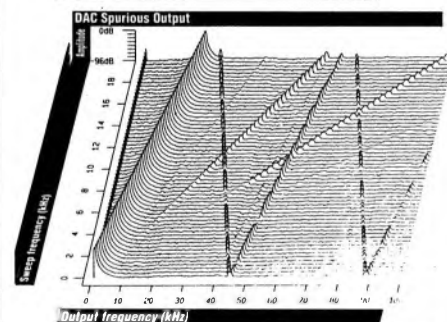
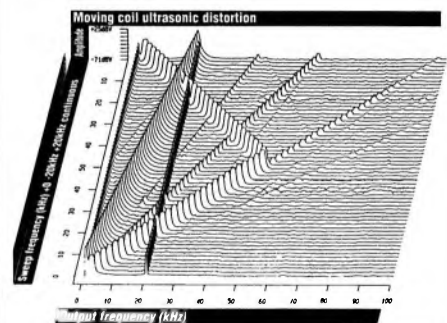
CONCLUSIONS

One must wonder whether Sony is unaware of the potential of the PDM conversion system, having decided to hide it away on the back of an amplifier! Used as a conventional integrated amplifier the TA-F630ESD is a competent if rather average performer. Nevertheless, it deserves a hearty Recommendation for its alter-ego as the first 1-bit outboard D/A convertor - itself a snip at £350!

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	119.5W	128.3W	121.7W
- 4ohms	175.9W	194.1W	180.9W
Dynamic headroom (IHF)	+1.26dB (171.7W)		
Output impedance	0.215ohm	0.212ohm	0.251ohm
Damping factor	37.1	37.8	31.8
	CD/Aux	MM	MC
Stereo separation (20Hz)	76.5dB	58.3dB	52.6dB
(1kHz)	64.5dB	53.9dB	51.7dB
(20kHz)	39.3dB	40.0dB	39.8dB

Channel balance (-20dBV)	1.34dB	1.12dB	0.84dB
(-60dBV)	0.34dB	0.28dB	0.23dB
Total harmonic dist. (0dBV)	-89.4dB	-93.7dB	-95.1dB
(½ power)	-81.2dB	-84.6dB	-85.1dB
CCIR intermod. dist. (0dBV)	-90.5dB	-78.6dB	-73.4dB
CCIR IM dist. (½ power)	-89.4dB	-77.1dB	-74.3dB
Rise time	2.3µsecs		
Power bandwidth	5Hz - 45kHz		
Squarewave linearity	-105.6dB		
Phase shift (20Hz)	10°5'	352°5'	352°0'
(1kHz)	0°	309°36'	309°36'
(20kHz)	348°28'	277°12'	270°0'
Noise (A wtd, 0dBV)	-81.3dB	-80.1dB	-71.9dB
(½ power)	-94.7dB	-88.4dB	-72.8dB
Residual noise (unwtd)	-77.7dBV	-77.5dBV	-77.8dBV
Input sensitivity (for 0dBV)	18.65mV	309.9µV	18.75µV
(for full output)	213.2mV	3.485mV	212.7µV
Disc overload (20Hz)	17.64mV 1.123mV		
(1kHz)	141.4mV 9.880mV		
(20kHz)	1235mV 88.16mV		
(50kHz)	845.8mV 121.7mV		
Tape Output/Impedance	8.928V (disc)/2.00kohm		
Input loading	35.5kohm/1.67nF 32.3kohm/19.6pF 102.8ohm/1.4nF		
DC offset, left/right	-25.6mV/-22.8mV		
Typical price inc VAT	£350		

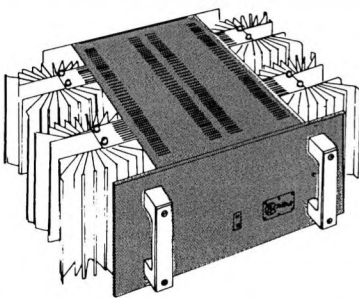


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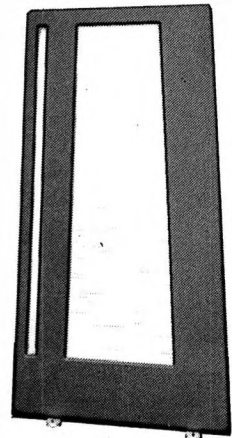


The landmarks this past year must surely be the new Krell range. The KSP-7B pre-amp and KSA-80, 200 and 160 power amps set new standards in being able to combine 'state of the art' sound quality with massive power delivery. Just put one of these amplifiers into your system and we guarantee it will transform it.



New Demonstration Room

The most significant loudspeaker development must surely be the new Apogee Duetta Signature. We are all Apogee enthusiasts here but the improvement in sound quality with this model has amazed us. A true 'state of the art' product. Lower down the price range we must mention the new Magneplanar 1.4 which is a huge improvement in standards but amazingly costs no more than its predecessor at £1098. The P.S. Audio 4.6 with a new power supply is also a big improvement and at under a £1000 is probably the best pre-amp around at the price.



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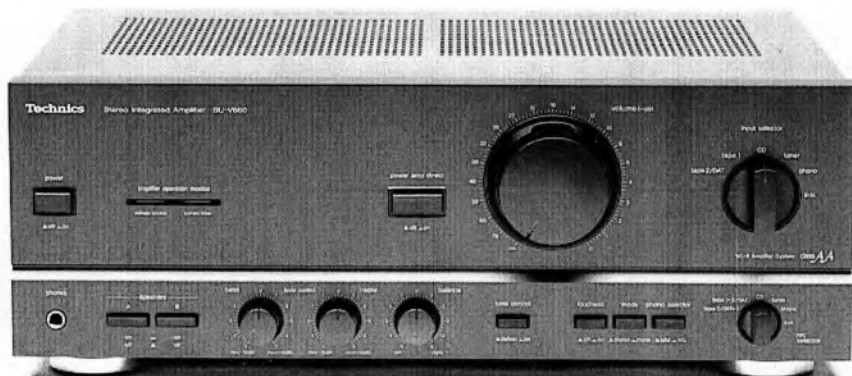
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TECHNICS SU-V660

PANASONIC UK LTD., PANASONIC HOUSE, WILLOUGHBY ROAD, BRACKNELL, BERKS. TEL: (0344) 862444.



Top of Technics' fully-fledged integrated amplifier range the *SU-V660* is a solidly built 100W design decked out in the company's traditional gold and bronze livery. The fascia is dominated by a huge rotary 4-gang volume control with two independent logarithmic scales. These correspond to 'normal' or 'Power Amp Direct' modes of operation, the latter indicated by a small LED mounted in the trim ring. Another large control provides for selection of two tape, CD, tuner, aux and both MM/MC phono sources.

All the remaining facilities are distributed about the lower portion of the fascia, including an independent record-out selector, defeatable tone controls, balance, mono/stereo mode and loudness controls. Two sets of speakers may be connected at any one time, but the terminals will not accept 4mm plugs.

The inside of the *SU-V660* is less impressive. There's a decent enough OFC-wound mains transformer, but the main power amplifier is actually an 18-pin hybrid IC (*SV13205*) - unusual in such a costly product. The driver stage uses discrete *A1535/C3944* devices (with current-limiting) and the disc stage a low-noise differential FET input, although the RIAA EQ is performed around a single *LPC4570* op-amp.

LAB REPORT

The 0.11ohms output impedance is a little high, but the power delivery shows a healthy +1.7dB increase when changing from 8ohms to 4ohms loading, which indicates it will have little trouble driving most loudspeakers. Stereo separation degrades at HF as usual, but the 43.4dB via the MC input at 20kHz is further compromised by a degree of capacitive coupling in the FET input stage.

To all intents and purposes this is a very linear amplifier, which could have been predicted, given Technics' judicious use of wide-bandwidth integrated devices. Similarly, the MM/MC disc overload margins are generous +31.5dB and +29.2dB respectively. THD is typically 0.003 per cent, though best figures of 0.0015 per cent were obtained via the MM input. CCIR IMD deteriorates from 0.005 per cent via CD to 0.016 per cent through the disc stage.

A trace of 3rd-order IM caused by the interaction $F_{20k} - 2F_{0-20k}$ is visible on the 3D ultrasonic plot, but simple 2nd and 3rd harmonics dominate. The RF IMD plot is very interesting though, showing a broad demodulation of 40-55MHz AM/RF noise, but with non-correlated noise products manifesting at 2-3kHz and 5-20kHz.

SOUND QUALITY

A hint of vocal sibilance was almost immediately detected via the CD input, and this, together with a constrained and dead feeling over much of the audio range, led to a degree of listener discomfort. Stereo images tend to bunch towards the centre of the soundstage in monophonic fashion - quite the opposite of the *SE-M100* in fact, which revelled in the spaciousness and atmosphere revealed by the PDM D/A convertor.

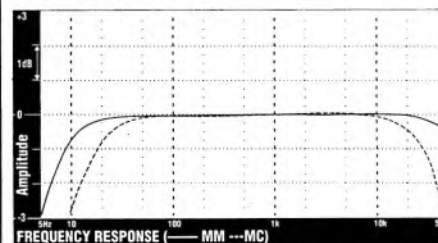
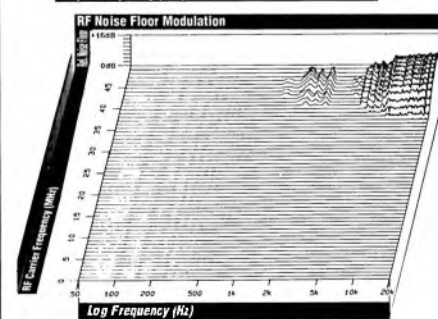
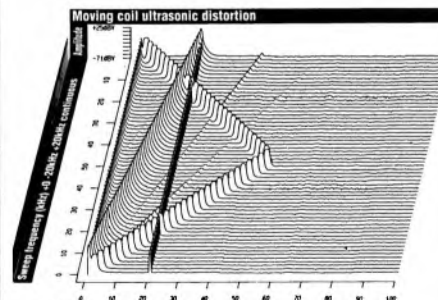
The presentation is essentially neutral but lacks freshness and airiness throughout the upper octaves: not strictly dull, these are nonetheless flattened and bereft of ambient detail. The crash of hi-hat cymbals dies very abruptly, for example, while timbre is simply 'metallic' rather than obviously 'brassy'. Vinyl discs (MM) sound mushier and similarly lacking in that spark of emotivity. Every note, every nuance, sounds as if it was straining to be released, a quality that will undoubtedly prove taxing in the long term.

CONCLUSIONS

The preceding subjective comments may seem harsh, but simply reflect the *SU-V660*'s basic inability to reproduce music in a genuinely convincing manner. That said, the product is beautifully built and offers a wide range of useful features. It is also likely to be very reliable and is therefore worth considering for those listeners who already own other Technics separates.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	102.5W	107.2W	108.7W
- 4ohms	144.9W	159.2W	161.6W
Dynamic headroom (HF)	+1.26dB (143.4W)		
Output impedance	0.109ohm	0.109ohm	0.139ohm
Damping factor	73.6	73.4	57.6
Stereo separation (20Hz)	89.5dB	67.8dB	45.9dB
(1kHz)	75.3dB	67.8dB	45.3dB
(20kHz)	50.2dB	48.5dB	43.4dB
Channel balance (-20dBV)	0.04dB	0.06dB	0.23dB
(-60dBV)	0.42dB	0.55dB	0.98dB
Total harmonic dist. (0dBV)	-89.5dB	-96.6dB	-96.0dB
(½ power)	-87.6dB	-92.8dB	-92.1dB
CCIR intermod. dist. (0dBV)	-85.8dB	-76.6dB	-76.2dB
CCIR IM dist. (½ power)	-89.4dB	-76.9dB	-77.4dB
Rise time	6.2µsecs		
Power bandwidth	24Hz - 32kHz		
Squarewave linearity	-105.2dB		
Phase shift (20Hz)	17°16'	12°57'	74°52'
(1kHz)	0°	300°57'	290°52'
(20kHz)	318°14'	231°50'	201°36'
Noise (A wtd, 0dBV)	-99.5dB	-86.9dB	-71.8dB
(½ power)	-99.1dB	-90.7dB	-73.8dB
Residual noise (unwtd)	-77.6dBV	-77.6dBV	-77.5dBV
Input sensitivity (for 0dBV)	19.58mV	331.7µV	19.45µV
(for full output)	205.5mV	3.453mV	201.4µV
Disc overload (20Hz)		21.09mV	1.647mV
(1kHz)		187.3mV	14.51mV
(20kHz)		1590mV	128.8mV
(50kHz)		1729mV	146.6mV
Tape Output/Impedance	11.34V (disc)/566ohm		
Input loading	45.2kohm/89pF 63.3kohm/197pF 248ohm/7.9nF		
DC offset, left/right	-4.8mV/-4.9mV		
Typical price inc VAT	£250		



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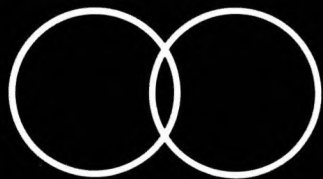
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TECHNICS SE-M100

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RECOMMENDED



All but one of Technics' current range of CD players utilises the company's MASH/PWM D/A conversion system, yet all serve to conceal this fact by plastering a 4DAC/20-bit logo all over their bronze fascias. In contrast, this rather specialised *SE-M100* digital amplifier also features the familiar 4DAC/20-bit banner, yet appears to incorporate no less than four Burr Brown *PCM-56P* DACs as part of its built-in complementary/bit-shifting converter.

The use of complementary DACs avoids the massive glitch that normally occurs in a single converter when all the 16 current sources change state (ie from 0 to 1 or vice-versa). However, the bit-shifting mechanism only improves the effective resolution of the converter when handling digital words that are 2 or more bits less than full scale.

The flexibility of this line-level only integrated amplifier can be augmented by the purchase of a Technics *SU-A40* preamplifier, which features an RIAA phono stage and tone controls etc. By itself it will only accept line-level analogue inputs (CD, tape, tuner) or both coaxial and optical digital inputs. Chunky gold-plated posts at the rear make provision for bi-wiring, while the integral volume control can be removed from circuit by opting for the fixed (direct) analogue inputs - useful for partnering a CD player with its own remote volume control.

LAB REPORT

For this season's range of products, Technics has been stressing high (ie good) 'Signal-to-Noise' ratios. This target is achieved in the *SE-M100*, with excellent measured figures of -98.3dB (rel to 0dBW = 1W) and -116.9dB (rel 1/3 power = +26.4dBV). However, a good S/N is next to useless if an amplifier suffers from RF IMD, so the performance here represents further feathers in the designers' caps. Demodulation is abrupt at 1MHz but trails off to reveal nothing above 5MHz!

The *SE-M100* is also extremely linear under closed-loop conditions (as you would expect), with THD of just 0.00075 per cent at two-thirds of the substantial 123W output. IMD is a similarly low 0.0017 per cent - just look at the 3D ultrasonic plot! The digital input is fractionally less linear at peak level

(due to its integrating op-amps); traces of $2F_{0-20k}$ and $3F_{0-20k}$ are visible on the appropriate 3D plot. However, in terms of reconstruction the complementary/4DAC system gives true 16-bit linearity with minuscule errors of just 0.02dB and 0.05dB at -90dB. Fabulous stuff!

SOUND QUALITY

Drafting in the PDM D/A converter and feeding the *SE-M100* via its variable line inputs, this amplifier sounds exceptionally confident, transparent and detailed. Vocals appear fresh and articulate, albeit slightly fat or diffuse in focus - a minor coloration that is not linked to any instrumental muddling or uncomfortable sibilance. The only real complaint concerned a faint loss in stereo depth; otherwise the *SE-M100* was voted a most competent performer.

Nevertheless, switching the digital input into action brought about an immediate turn for the worse. Female vocals sound harsher and more sibilant, bass appears weaker and less extended while percussion takes on a 'grating' quality. Compared to the open and convincingly paced character of the line inputs, the digital alternative was flatter, colder and simply less enjoyable.

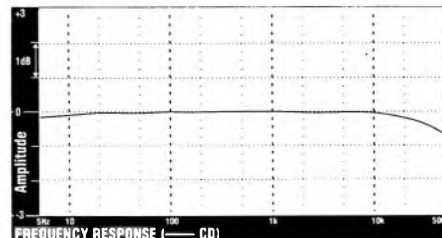
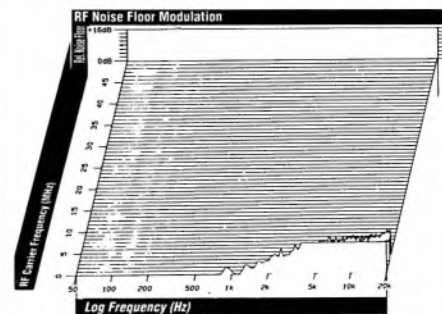
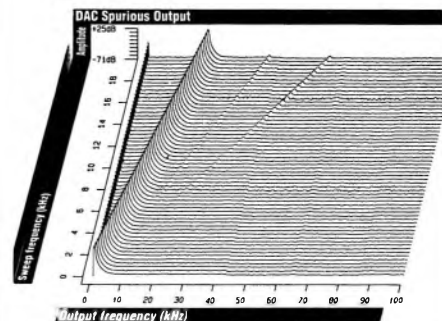
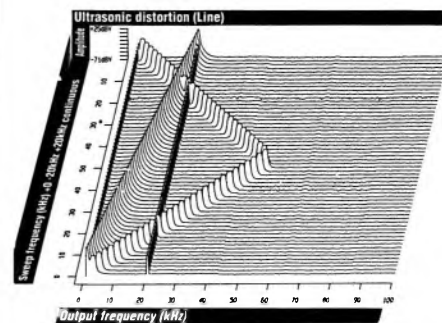
CONCLUSIONS

For those enthusiasts who already own a quality CD player, the *SE-M100* will represent an excellent upgrade from most conventional integrated designs. Nevertheless, such a purchase is considerably less easy to justify for use in the 'digital mode' Better results might have been obtained here if the *SE-M100*'s multi-Bit DACs were replaced by Technics' superior-sounding MASH/PWM converter.

TEST RESULTS

	20Hz	1kHz	20kHz
Maximum Continuous Power Output - 8ohms	118.7W	123.3W	121.8W
- 4ohms	164.1W	175.7W	181.9W
Dynamic headroom (IHF)	+ 1.83dB (188.0W)		
Output impedance	0.091ohm	0.096ohm	0.119ohm
Damping factor	88.3	83.5	67.5
Stereo separation (20Hz)	CD/Aux	81.5dB	Digital
	(1kHz)	78.2dB	83.6dB

(20kHz)	55.6dB	67.9dB
Channel balance (-20dBV)	1.00dB	0.45dB
(-60dBV)	43.7dB	1.16dB
Total harmonic dist. (0dBV)	-94.7dB	-91.8dB
(1/3 power)	-102.4dB	-99.3dB
CCIR intermod. dist. (0dBV)	-90.1dB	-86.4dB
CCIR IM dist. (1/3 power)	-95.2dB	-89.9dB
Rise time	3.7µsecs	
Power bandwidth		18Hz - 63kHz
Squarewave linearity	-99.5dB	
Phase shift (20Hz)	2°52'	
(1kHz)	0°	
(20kHz)	343°26'	
Noise (A wtd, 0dBV)	-98.3dB	
(1/3 power)	-116.9dB	
Residual noise (unwtd)	-88.9dB	
Input sensitivity (for 0dBV)	66.57mV	
(for full output)	1155mV	
Linearity @ -90dB L/R		-0.02dB/-0.05dB
Stopband Rejection		-92.2dB
Tape Output/impedance		N/A
Input loading		25.05kohm/252pF
DC offset, left/right		+ 1.6mV/+ 1.8mV
Typical price inc VAT		£550





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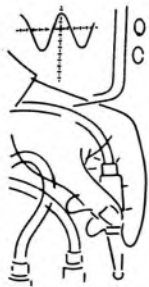
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AMPLIFIERS TECH TALK

Paul Miller explains the test procedures used in the amplifier reviews. Be warned, this is technical talk with a capital T!

In keeping with the *Choice* tradition, each amplifier was auditioned under blind conditions. Both CD and vinyl sources were used, with a range of software chosen for its ability to reveal different aspects of an amplifier's subjective performance.

The ancillary equipment included a Pink Triangle *PTTOO/SME Series V/vdH MC-TOO* and/or Ortofon *MC3000* as the analogue front-end. The digital source comprised an Arcam *Delta 170* CD transport coupled to a prototype outboard PDM D/A convertor – a system capable of retrieving far more detail in a far more musical fashion than any conventional multi-bit convertor. Just how much of the PDM's qualities were retained or masked by an amplifier under scrutiny proved most enlightening.

Another change since our last Amplifier issue concerns the loudspeakers. Magneplanar *MG2.5Rs* replace the stalwart Musical Fidelity *MC4s*, which on this occasion sounded distinctly cold and brittle. Once again, long lengths of Black Sixteen speaker cable were used for connection of all the integrated amplifiers unless a manufacturer specified otherwise. Available reference amplification included a Pink

Triangle *PIP II* preamplifier and a Deltec *LPA-50S* power amplifier, both used for preliminary acclimatisation to the chosen music.

This included excerpts from: *Tracy Chapman* (Elektra CD); *Tanita Tikaram, Ancient Heart* (WEA CD); *Freddie Hubbard, Hub Tones* (Blue Note CD); *Mahler Symphony No 1/Inbal* (Denon CD); *Sting, . . . Nothing Like the Sun* (A&M vinyl disc); *Michael Hedges, Watching My Life Go By* (A&M vinyl disc); *Jan Garbarek, Legend of the Seven Dreams* (ECM vinyl disc).

Following these formal tests and the measurement program I rea auditioned each amplifier myself with alternative digital and analogue software.

MEASUREMENT PROGRAMME

The test programme includes both standard IHF *A202* measurements plus some more advanced and elaborate techniques available with the IEEE-controlled digital test equipment currently used in my laboratory.

Power Output and Dynamic Headroom:

Quoted in good old fashioned Watts this refers to the maximum

output of the amplifier into 8 and 4ohm loads (one channel driven to 0.1 per cent THD). The IHF-A-202 dynamic headroom test employs a gated 1kHz signal, 20-cycles on/480 cycles off, and refers to a maximum of one per cent THD into 8ohms relative to the continuous rating into that same load.

The power bandwidth refers to the high and low frequency extensions of the amplifier within one per cent THD and 1dB of the nominal rating. Output impedances are quoted in ohms and should theoretically be as low as possible, less for the damping factor effect than for the influence this has on nonlinearities reflected at the output of the amp from the loudspeaker crossover network.

Separation, THD, IMD, noise and sensitivity:

All input sensitivities are measured with respect to an output of 0dBW (=1W) and full power at 1kHz for the integrated and power amplifiers, or 1V = 0dBV out (6dB higher than IHF) in the case of the preamplifiers. Noise is measured with respect to the IHF input levels of 500µV (MC), 5mV (MM) and 0.5V (line), input shorted, A-wtd and assessed as the true rms figure of 20 3rd-octave averages.

Disc overload is quoted in mV in the table so that this may easily be related to the peak output of a cartridge, while headroom is discussed in the text as a dB figure relative to these same IHF levels. Separation is measured at some +20dB above the nominal sensitivity, as is the THD of each amp. For CCIR IMD the respective peak composite (19kHz + 20kHz) levels were 10mV (MC), 100mV (MM) and 2V (line).

Broad-Band Radio Frequency Intermodulation Test:

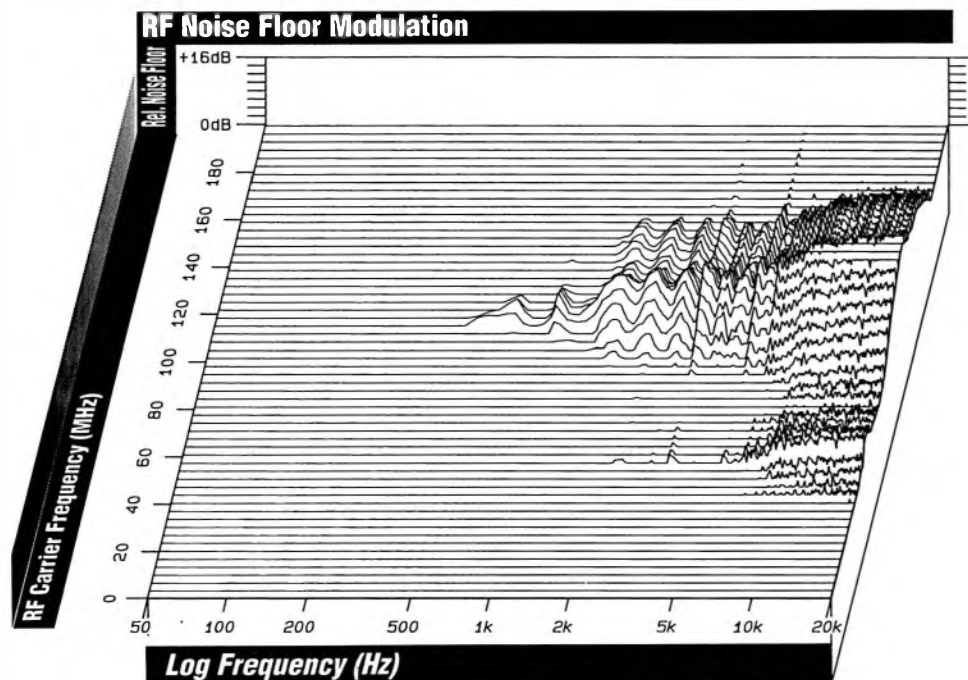
In general terms this very new test reveals just how sensitive an amplifier is to spurious Radio Frequency noise, whether introduced directly or indirectly.

Conventional measurements examine the performance of the amplifier under closed-loop conditions where many of the inherent circuit non-linearities are compensated by the feedback network. By contrast this RF test probes the linearity of the amplifier under open-loop conditions where it is both nonlinear and uncompensated.

A precision RF signal generator produces an RF carrier signal at 20mV_{p-p}, modulated to 100 per cent using an external pseudo-random noise source. The resulting non-correlated AM/RF signal is then ramped between 1-50MHz or 1-200MHz by controlling the generator through an IEEE interface BUS, using a dedicated program developed in this laboratory. The generator and noise source are also synchronised with an FFT spectrum analyser through this same interface.

Once connected to the amplifier (via the line or CD-direct input) any subsequent demodulation/intermodulation between the sweeping carrier and its pseudo-random sidebands results in non-correlated noise appearing at audio frequencies at the output of the amplifier.

This represents a change in the noise floor of the amplifier over a discrete portion of its frequency range. Such a random fluctuation may not necessarily be heard directly, but simply makes it more difficult for the



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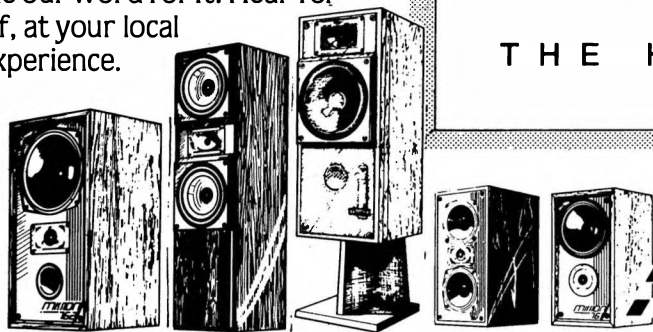
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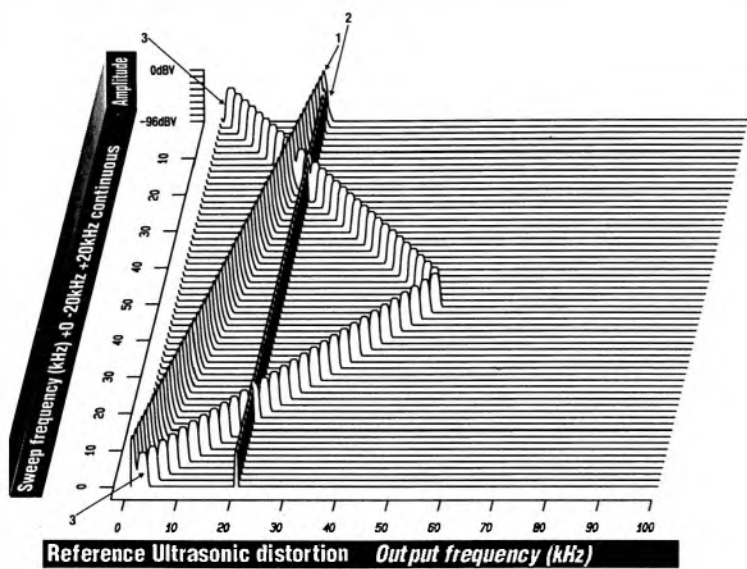
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Reference Ultrasonic distortion Output frequency (kHz)

ear/brain to distinguish subtle dynamic inflections in the music signal itself.

By comparing the steady-state noise-floor of the amplifier with its noise floor under the influence of RF IMD, a measure of the difference and therefore the actual effect of RF IMD can be deduced. It is this change or difference in the noise floor that is depicted on the 3D plots.

The depth of z-axis is either calibrated in steps of 5MHz (for the 1-50MHz sweep) or 20MHz (for the 1-200MHz sweep) and denotes the changing frequency of the RF carrier. By contrast the x-axis is restricted solely to the audio band (in this case 50Hz-20kHz) and is calibrated across a log, rather than linear, scale. The vertical or y-axis gives an indication of relative amplitude and is scaled in steps of 2dB over a maximum range of +16dB.

Clearly, any demodulated RF noise that causes a change in the noise floor greater than 16dB will give rise to a plateau effect on the plot. This situation is seen on the accompanying example plot which demonstrates an amplifier's undue sensitivity to RF noise in the 80-170MHz range, peaking at 117MHz. If an amplifier was singularly insensitive to RF noise (NB: a Good Thing), this plot of relative change would appear as a series of straight, unperturbed lines.

Ultrasonic Distortion Test:

This is a particularly revealing test that highlights the interaction of high and moderate-level signals in the context of harmonic and intermodulation distortions (referred to as 'routes' in the text) caused by such mechanisms as slew-limiting or the progressive reduction of feedback, the latter revealing an

increase in open-loop nonlinearities. It is not a knitting pattern, as one irreverent member of *Choice* would have you believe!

Three driving signals are employed, the 0-20kHz sweep (1 = F_{0-20k}) raising the amplifier to $\frac{2}{3}$ rated output into a 4ohm load while the continuous 20kHz tone (2 = F_{20k}) and 0-50kHz-0Hz reversed sweep (3 = $F_{0-50k-0}$) track at some -24dB below this. For integrated amps a pre-equalised composite signal was used for either the MC or MM vinyl disc inputs (ref. 20mV and 2mV at 1kHz respectively). Each plot is individually calibrated in dBV (0dBV = 1V at 4ohms) as a relative indication of the different power outputs.

These sweeps were chosen to represent the kind of HF and ultrasonic signals likely to be handled by an amplifier in

normal use. The ultrasonic spurious generated by CD players is a well known example, but it is less widely appreciated that the 20-50kHz band noise from a vinyl disc or FM tuner can persist at levels only 10-20dB lower than the peak audio band signals. (This is one reason why I place such store in disc overload margins, which generally fall relative to the excess gain required with increasing frequency, and why such measurements are now taken as high as 50kHz.)

That aside, certain of these ultrasonic distortions will introduce IM products within the audio band of the amplifier - a point of particular interest with vinyl disc stages, since the IM routes will actually increase in level with decreasing frequency as a function of the RIAA EQ characteristic.

In addition to the obvious harmonic products (4-9) related to the F_{0-20k} sweep (1), these in-band IM artifacts are determined by the 2nd-order $F_{0-50k-0} - F_{0-20k}$ (12) and the 3rd-order $F_{0-50k-0} - 2F_{0-20k}$ (13) routes. The equivalent summation routes are given by $F_{0-50k-0} + F_{0-20k}$ (10) and $F_{0-50k-0} + 2F_{0-20k}$ (11) respectively.

There are also 2nd and 3rd-order sum and difference routes associated with the continuous 20kHz tone (2) to consider. These are defined by $F_{20k} + F_{0-20k}$ (14), $F_{20k} + 2F_{0-20k}$ (15) and $F_{20k} - F_{0-20k}$ (16), $F_{20k} - 2F_{0-20k}$ (17) respectively.

In general the presence of 2nd-order in-band IMD products seems to encourage a warmer though softer and richer sound

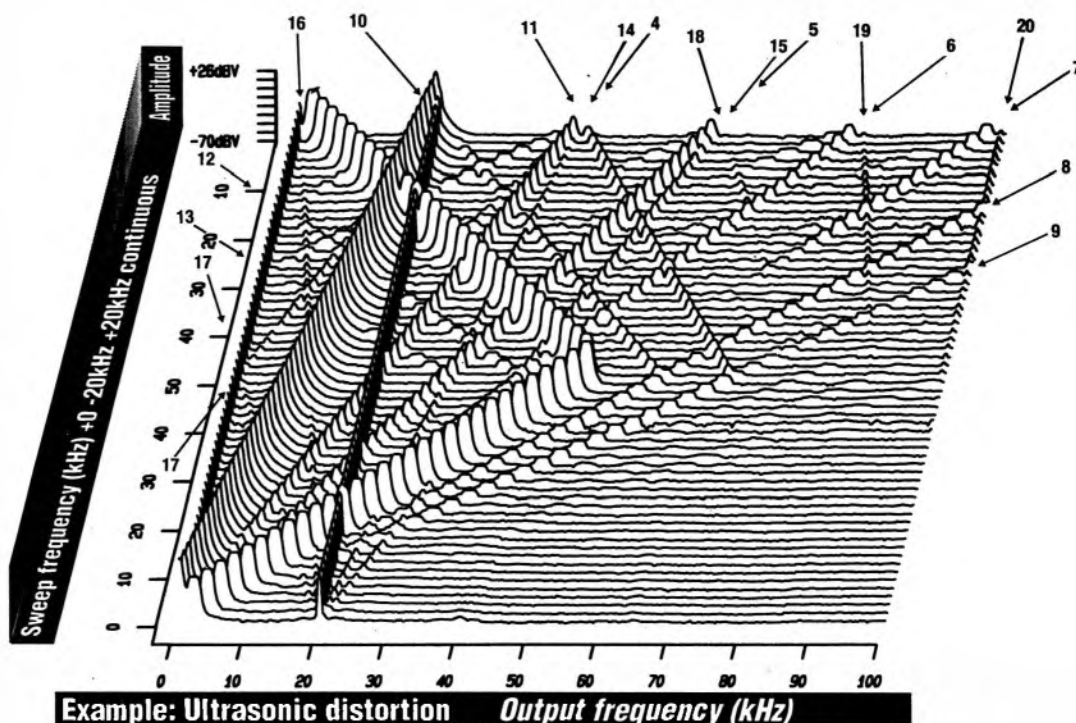
quality, particularly if these distortions arise in the disc stage. The equivalent 3rd-order IMD mechanisms introduce a harder and less beguiling quality.

Of course, higher-order routes are also produced and are shown on this demonstration plot by $F_{0-50k-0} + 3F_{0-20k}$ (18), $F_{0-50k-0} + 4F_{0-20k}$ (19) and $F_{0-50k-0} + 5F_{0-20k}$ (20) etc.

A word of warning. Do not use these plots in isolation as some sort of guide to the absolute quality of the amplifiers, because this is simply not the case. Any distortion mechanism represented on the plot will have some subjective consequence. Conversely, just because a peculiar coloration or distortion is heard this does not mean it will necessarily be manifest on the 3D plot. This test is but one piece in a very complex jigsaw, and the results must also be viewed in the light of those obtained via the RF IMD test.

The combination of Ultrasonic Distortion and RF IMD plots can provide a valuable indication of both the amplifier's subjective performance and of its likely compatibility with other audio equipment, particularly CD players. An amplifier that gives rise to a 'clean' Ultrasonic plot but suffers RF demodulation may well sound coarse or muddled as a result. Conversely, a relatively constant carpet of innocuous closed-loop distortions can effectively 'mask' the fatiguing effects of RF IMD.

Taken together, the two plots give more insight than ever before into the potential sound quality of an amplifier.



Example: Ultrasonic distortion Output frequency (kHz)

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AMPLIFIERS: CONCLUSIONS AND RECOMMENDATIONS

Paul Miller rounds up the best of this month's bunch.

It is a longstanding *Choice* tradition to provide an immediate indication of evaluated quality by means of a, Recommended or Best Buy flash, though it is never a foregone conclusion that a certain percentage of the test amplifiers will achieve such status.

To warrant Recommendation, an amplifier must attain a competent overall level of performance, or an acceptable mix of excellent and average subjective results. The product should also be well-built, inherently reliable and sensibly equipped to compete within its particular price bracket. An amplifier with excellent all-round subjective performance which costs less than £300 or so may well be in line for a Best Buy rating.

With these priorities in mind there is little point in having half a dozen Best Buys at any single price point. Rather it is better to establish certain distinct benchmark products on the various rungs of the up-grading ladder. Such yardsticks of the amplifier world are included in the comprehensive *Directory*, and remain as targets for each subsequent collection of review products – targets that were narrowly missed on this occasion.

Nevertheless, amongst the 50 per cent of integrated amplifiers that did warrant Recommendation, some shone just that bit more brightly than others – the Audiolab 8000A, Creek CAS5050 and Technics SE-M100 in particular, each possessing a potent saving grace. In the Audiolab and Technics models this was the CD input, both capturing the effortless spatiality, fluidity and musical conviction of the outboard PDM D/A convertor to yield a truly memorable sound.

By contrast, the Creek disappointed us with CD, seemingly unable to resolve the subtlest musical clues, a situation never encountered via its exceptionally beguiling vinyl disc stage! It seems very likely that the CAS5050's undue sensitivity to RF noise may be the



root cause of this disparity – a line input RC network could be all that stands between Creek and an unreserved recommendation.

Sondex's *Amadeus Gold* and the new *Delta 90.2* from Arcam occupy a similar price territory. The former appears to be marginally unstable, but won through subjectively with a rich, mellifluous but slightly soft sound. Like certain Musical Fidelity and Inca Tech predecessors, the *Gold* is very much a solid-state design with a 'valve-like' heart.

Arcam's latest creation is more cautious or dead-sounding, but still enjoys a predictably solid and unflappable character that tips the balance in its favour. Make no mistake though, the *Delta 90.2* is not to £350 amplifiers what the remarkable *Alpha II* is in the £160 arena.

Kenwood's trimmed-down KA-7010 (the KA-5010) not only offers a saving of some £90 but also has a more balanced and musically enjoyable sound. It does lack the extension and bass impact of its peers, but seems

ideally suited to the abilities of most small, moderate sensitivity loudspeakers. Once again RF IMD plays an important role in the distinction between these two models from the same stable.

Another company making sterling efforts to capture the elusive 'UK sound' is Sony, which has certainly achieved a warmer and more full-bodied character in the new TA-F530ES amplifier. The ideals of transparency and stereo focus still seem a little out of reach, but it offers a good blend of performance and features for the price.

Strictly speaking its partner, the 'digital' TA-F630ESD, was less impressive on audition, manifesting a colder, coarser balance. However, bypassing the amplifier proper by means of its record-out sockets provides more than a glimpse of the marvellous sound available from PDM D/A conversion. If only for use as an outboard DAC the TA-F630ESD is most heartily Recommended.

Last of the integrated models, the Proton 520, is a bargain-basement product with an equally cheap and cheerful

sound. Plenty of inputs ensure recommendation in terms of value more than sound quality. Of the remaining integrated contenders, the luxurious FM-95 from Marantz and the value-conscious A-03 from AR both stand out as warranting serious consideration.

Amongst the seven pre/power combos, four clawed their way to Recommendation. The Bryston and Kelvin amplifiers were both on slightly shaky ground, the former offering a detailed, tactile but slightly lean sound, while the latter provides a more muddled but warmer and more 'comfortable' balance. Neither amplifier is an out-and-out powerhouse, and neither pre-amplifier offers both MM and MC disc inputs. But in a sympathetic system, I am sure that both could really sing!

Leading the pack by more than a few lengths were the Hafler and Musical Fidelity combinations. Hafler has succeeded in blending muscle with finesse, the XL-600 power amplifier being quite content to drive even the most awkward and insensitive loudspeakers – excellent stuff.

Similarly excellent, though not as obviously transparent or tightly focused, the Musical Fidelity SA-X/MA100-X duo captured the imagination of our listeners with a rich and wholly beguiling performance. In the technical sense it is not strictly 'accurate', but in the more tentative emotional sphere it hits the nail right on the head!

To conclude I should like to thank those companies who submitted amplifiers for inclusion in this gruelling test, and specific individuals Martin Jeffries, John Bamford, Jason Kennedy, Robert Watts (Deltec Precision Audio) and Tony Mills (Rotel) for the protracted loan of their ears. Furthermore, in the face of unexpected equipment failure I should also like to thank my colleagues at Rohde & Schwarz and, in particular, Jim Spink of Hewlett Packard, without whose assistance this issue would never have been completed successfully.



Hafler pre/power combo blends muscle with finesse. Top, Sony's TA-F630ESD works superbly as an outboard PDM DAC!

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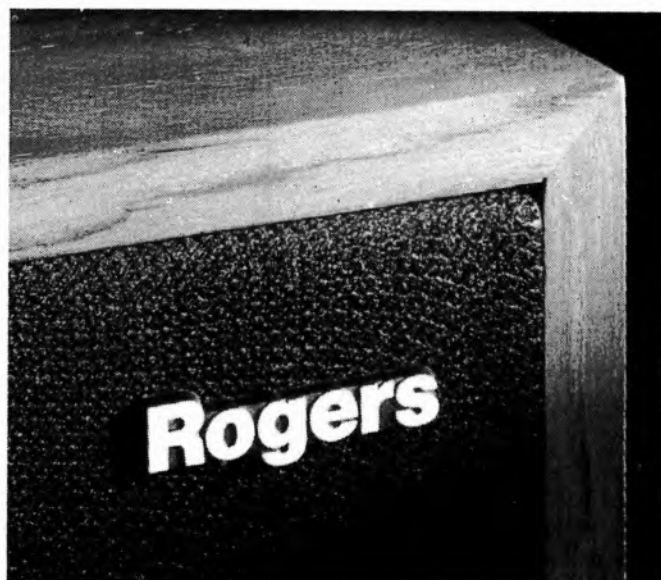


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CHOOSING AND USING . . . MINIATURE LOUDSPEAKERS

In a cramped living room, miniature loudspeakers might be the only option. Paul Messenger has been testing ten small enclosures . . .

General advice on getting the best out of loudspeakers is covered in more detail in the specialist *Choice* issues (ie June '89). The two most important points are first to try them out in the shop before you buy – a pair of loudspeakers should be as comfortable as a pair of shoes if you're going to enjoy them over the long haul. Secondly, do take care where you place them – even the smallest will work better on a proper stand, and if necessary choose a cheaper pair of speakers so there's enough left over to pay for the stands. And if you're going to use tiny speakers, you're going to need high stands.

The batch of miniature speakers assembled here is only a handful of those available on the market, but is pretty representative nonetheless, ranging from a trio of 'microminiatures' no bigger than bookends, four rather more 'normal size' tinies, and three which are closer to traditional 'bookshelf' dimensions. To help me find my bearings in an unfamiliar sector of the market, I also borrowed a pair of Goodmans *Maxim 2s* and Acoustic Energy *AE1s* – the two miniatures at opposite ends of the price spectrum that have received rave *Choice* reviews in the past. Royd *Edens* and BBC *LS3/5As* provided the middle ground reference points.

All such small loudspeakers have real limitations in both bass extension and power handling. Consequently, each involves the designer making a number of compromises, choosing between bass extension and sensitivity, and adjusting the LF (bass) roll-off to take the expected room siting into account. Therefore, anyone contemplating the purchase of a little loudspeaker should try to consider where the speakers are likely to be placed, and how much loudness is needed (bearing in mind the chosen amplifier, and also how little bass extension is found tolerable).

Although the relationship is actually quite complex, it is more or less possible to trade sensitivity for bass extension or vice versa, while the smaller the

enclosure, the tighter the constraints become. In an attempt to make the best of an inherently bad job, many small models are designed to operate close to a rear wall. Placing any conventional box loudspeaker against a wall boosts the bass frequencies relative to the rest by a substantial amount, which is clearly very useful for very small models. The downside is that a nearby wall tends to introduce some extra midband and even treble unevennesses, and also reduces the accuracy of stereo imaging. To some extent this trade-off may be a matter of personal taste.

The room measurement curves which accompany each review show the output of the loudspeaker at various frequencies from extreme bass up to extreme treble. The theoretical straight line ideal is not expected – or desirable (see later). But as guidance to finding the best balance, this has been plotted for both the wall and free space siting; intermediate positions produce more or less intermediate results.

MEASUREMENTS

The basic measurement programme was described in some detail recently (*Tech Talk*, June '89), though there are a few detail changes. For the open air tests, modest sizes and weights allowed these models to be tested over the edge of a flat roof, high off the ground, reducing (though not eliminating, ie 400Hz and 700Hz at 2m) the effects of reflections.

A different technique was used to establish the in-room measurements, using analogue rather than digital equipment. Using several examples, comparison between the two test procedures shows close correlation across most of the audio range, particularly through the midband and crossover region where this test is a particularly powerful predictor. Note that the vertical (dB) scale has been expanded and now corresponds to that used in the other response traces (a change which exaggerates variations a little compared with before).

The 'ideal' room response under these conditions would appear to be a flat and straight line up to around 1kHz, followed by a gentle but steadily increasing downtilt through –5dB at 5kHz to –12dB at 20kHz. This 'target' is derived through measuring some two dozen different models including established references (Quad, Spendor etc.), and correlating the findings of listening tests. In practice, the low frequency levels will be strongly modified by the physical characteristics of the listening room. The c10dB boost at 30Hz (or 10dB suckout at 42Hz if you prefer) are the averaged prime room mode effects, and represent a pretty constant factor. For the rest, even and smooth variations are clearly better than sharp discontinuities – and probably more important than broader balance aberrations to which the ear can adjust quite easily.

SENSITIVITY AND LOUDNESS

All the room traces were taken at the same volume control setting, so the area under each graph is proportional to the voltage sensitivity, and is a measure of the total in-room output of the speaker for a fixed voltage input – comparable with the calibrated (2.83V) 1m on-axis trace. The significant apparent differences in sensitivity actually have more to do with the impedance variations between the loudspeakers than the acoustic/electrical conversion efficiencies.

By adopting 40hms rather than

80hms as the standard impedance, the models from mainland Europe (Heco, Visonik, MB, Opus 3, Canton) all 'pinch' 3dB. (Halve the impedance, and the speaker sucks twice the current and therefore twice the power from the amplifier for the same volume setting.) As Paul Miller's amplifier reviews elsewhere in this issue show, few amplifiers have the capability to deliver this extra 3dB in full, most settling for 1.5-2dB, so the apparent sensitivity advantage is often largely negated in practice.

CONCLUSIONS AND RECOMMENDATIONS

To be frank, this is a disappointing batch of loudspeakers, mustering no Best Buys and but three Recommendations between them; established favourites like the *Maxim 2*, *AE1*, *Eden* and even the *LS3/5a* have little to fear. Only the B&W *CM1* really impressed on engineering grounds, but on balance the substantial price premium to cover the design frills leaves this as 'worth considering'.

Amongst the 'micro-miniatures', the £140 Alexander *514* is Recommended for bettering the other two in terms of balance, but is still flawed and far from cheap. Certainly cheap, and big-hearted to boot, the £80 Videotone *Minimax 2* is also decidedly rough and coarse, but pretty good value for all that. Much the same may be said of the £100 AR *Red Box*, which adds smoothness in proportion to its extra price, but doesn't set any records here either.



The £80 Videotone Minimax 2 – certainly cheap and big-hearted to boot.



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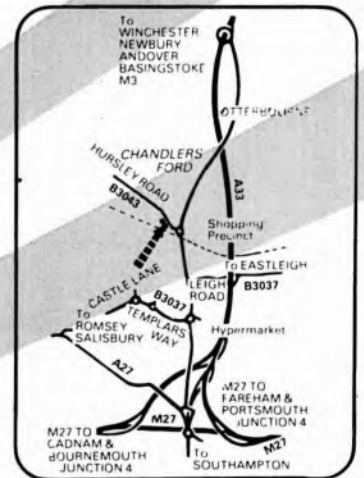
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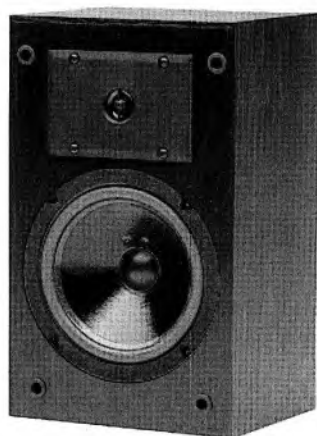
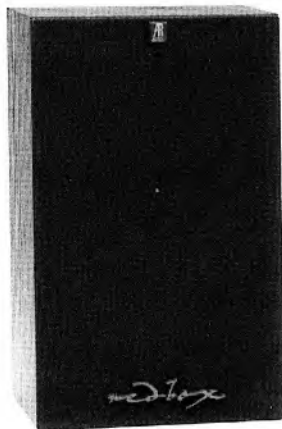
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One of the longest established and best respected names in hi-fi, US specialist AR can claim to have invented (or at any rate formalised) the concept and application of sealed box loading for compact loudspeakers. Despite the American parentage, most of the UK (and European) products have been designed and manufactured from the UK base for something like a decade now, which makes this Teledyne subsidiary a genuine multinational loudspeaker specialist.

Despite the sartorial risk involved when grandad puts on sneakers, the company currently seems to be cultivating a more youth-oriented image, what with the US *Partners* models and rock concert sponsorship. Judging by the eponymous carry-out carton with heavily stylised typeface, these loudspeakers might have been expected to echo this trend, so opening the box came as rather a disappointment.

Inside was a pair of rather ordinary looking small bookshelf size speakers finished in traditional black woodgrain plastic. There was also a note to the effect that these were "not photo samples". Later, during the production schedule of this month's issue a second pair was sent to the *Choice* offices for photography. (This later pair were photographed but not auditioned.) The photographic samples sported thick-framed front grilles with trendy-looking *Red Box* logos flashed across the bottom in a bold red colour. This, of course, ties in with AR's sponsorship deal with the chart-topping band Simply Red.

To all intents and purposes, the *Red Box* appears to be a thoroughly basic, simple econobox, which is all one has any right to expect given the size, weight and £99 price-tag. There is some similarity to cheaper *Spirit* range models such as the '112, but the *Red Box* lacks the extra-thick laminated

baffle and clever stocking-mask grille.

TEST REPORT

The *Red Box* has a sensitivity just a shade below average, alongside a resolutely 'kind' impedance characteristic and respectable enough bass extension for such a small enclosure. The pair match is close enough (which is only to be expected from a pre-production sample).

The responses are generally quite well balanced overall, albeit showing a 'stepped' character and some midband prominence. The limits are respectable enough with good mid to treble integration, though the traces are somewhat lumpy and uneven, betraying the basically low-tech drivers. The room averaged response shows a surprising lack of bass extension with the speaker in free space, but wall loading fills in the gap beautifully, giving respectable in-room extension to around 70Hz. The net result has a slightly 'three-humped' effect, but is well enough balanced overall nonetheless.

SOUND QUALITY

Despite being second from the bottom of the ten model price ladder, the *Red Box* registered several places higher in our panel's subjective rankings. "Not bad as long as it's fairly cheap" is one recorded comment that comes close to the mark.

No under-£100 model known to the author survives blind auditioning without a fair measure of censure. Rather it is a question of doing one or two things passably well, and nothing too disastrously, and here AR's new baby succeeds quite admirably.

The limiting factors here lie mainly in the midrange unevenness, which chips in a good sixpennyworth of coloration, and in the somewhat unruly treble behaviour. And like any such small box, there's a distinct lack of

genuine welly, wall-mounted or not.

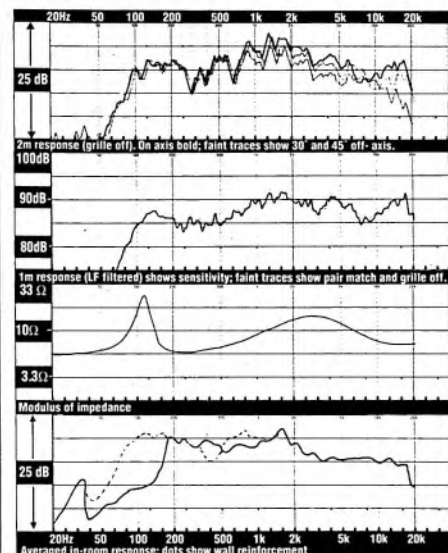
But whatever its cosmetic flaws, the *RB* is fundamentally rhythmically true and quick, and that alone makes listening to music an enjoyable experience. Driven hard, one becomes increasingly aware of both the basic lack of power and of the comparatively coarse and obtrusive tweeter, but conversation stopping levels were easily attained by this subjectively quite sensitive model.

CONCLUSIONS

I doubt that this is the best under-£100 model on the market (though I don't have a JPW *Sonata* handy to prove the point), but it is certainly a very competitive one sonically, deserving Recommendation for a foot-tapping liveliness that transcends the (nonetheless real) cosmetic blemishes. I just hope the finalised production model still sounds good...

TEST RESULTS

Size (height x width x depth)	32 x 19.5 x 17cm
Recommended amplifier power	15-60 watts
Recommended placement	on stands near rear wall
Estimated frequency response (2m)	90Hz-20kHz, ±5dB
Estimated LF rolloff (-6dB ref midband)	85Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	87dB
Impedance characteristic (ease of drive)	good
Forward response uniformity	good
Typical price per pair (inc VAT)	£99



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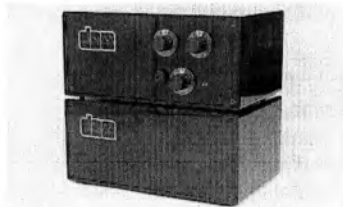
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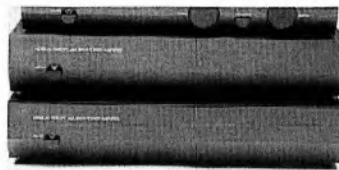
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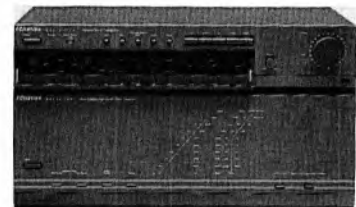
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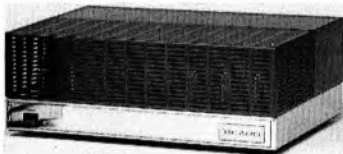
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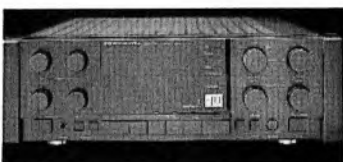


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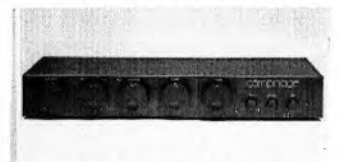


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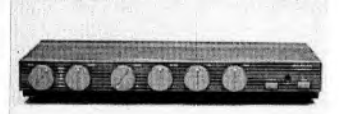
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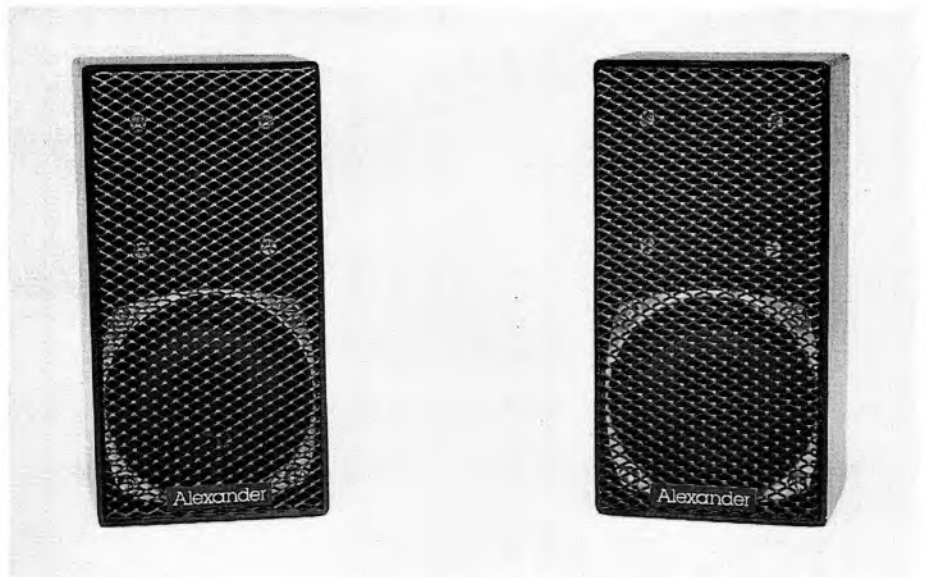
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Although I suspect this was the original Alexander loudspeaker, the 514 is in fact the third model from this relatively new brand to come under *Choice* scrutiny. It is also comfortably the smallest Alex, and one of the smallest models in the book – a genuine miniature of the type which invariably impresses as much by virtue of its dimensional minimalism as any pretensions to sound quality.

That doesn't mean such mighty midgets aren't worth taking seriously, at any rate up to a point. Indeed, both small size and metal jacket cabinets confer their own particular benefits. But it does mean that any assessment must take account of the limited power handling and bass output. Furthermore, any intention to purchase is bound to be partly motivated by size – as distinct, say, from the ability to recreate tympani at realistic levels.

Of the three genuine miniatures, this little English contender is in fact the smallest of all. The baffle area is as small as is feasible, constrained by the physical size of the drivers, while even the front-to-back depth here is tiny.

The reassuringly heavy enclosure is a shiny thin steel, with a wide-mesh metal grille – as with the other Alexanders, though this one uses simple sealed-box loading. Aesthetically it lacks some of the finish of its two German rivals, mainly through the visibility of the SEAS drivers and fixing screws, plus rather tacky badging. But it has its own distinct stylishness nonetheless.

TEST REPORT

The 514 registers the lowest sensitivity rating amongst the ten strong test group, some 5dB less than its two microminiature German competitors, for example. But the twofold reasons are first, that it doesn't start off by pinching 3dB by opting for a current-hungry

Eurostyle 4ohms impedance characteristic. And more important, it does make a sensible attempt to create in-room bass down below around 100Hz – more by dint of a more gentle LF roll-off characteristic than the cut-off point itself.

The open-air responses show a reasonable pair match and the expectedly good off axis conformity, but the traces are dominated by a broad (2-6kHz) and quite deep suckout around the crossover region, which looks somewhat alarming. This apart, the overall balance is quite promising, if somewhat uneven. Furthermore, the room averaged response suggests that this depression is rather less serious than the other curves had suggested, though it remains the most obvious feature – especially the subsequent 6-7kHz prominence – in an otherwise quite promising balance.

The manufacturer's recommendation is for free space siting, but the low frequencies are so neatly augmented by wall loading that I suspect many users will sacrifice a little midrange smoothness for the full octave of extra bass extension on offer here.

SOUND QUALITY

Having pointed out that these very small miniatures involve advocacy of the highest order to persuade one that the inevitable lack of scale is somewhat acceptable, there's no doubt in my mind that in this context the 514 does an unusually convincing job, and will be enthusiastically welcomed by loudspeakerphobes across the country.

The acoustically transparent curtain takes no prisoners, mercilessly revealing the lack of 'body' and 'weight' when the 514 was sited away from walls. Placed back against the wall the overall balance proved much more successful. Even though this positioning does compromise midband coloration

and stereo perspectives to some degree, the balance at last becomes nearly believable.

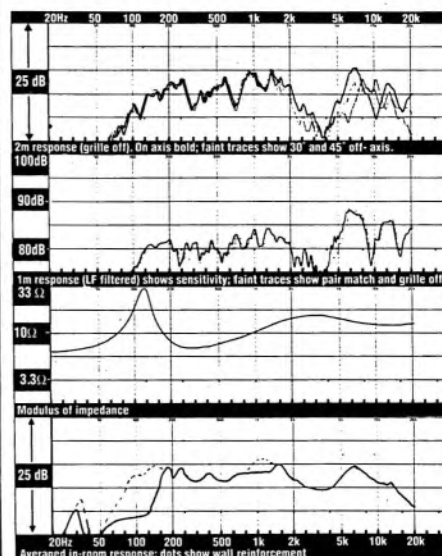
Some criticism was levelled at the rather obvious and isolated tweeter – more acceptable with CD than vinyl – while the somewhat depressed presence band does little to help project detail. But the 514 has a good sense of timing: "a spritely and jaunty pace" in the words of one panelist. Furthermore, it is fundamentally coherent and musically informative, with reasonable enough dynamics besides. High sound levels are unrealistic, especially in view of the low sensitivity, but the application of amplification welly does not unduly upset the 514s, which continue to give a decent account of themselves as long as reason prevails.

CONCLUSIONS

There are better and cheaper loudspeaker systems than the 514, but they're also all significantly bigger. If size (or rather the lack of it) is of prime importance, then this Alexander model deserves Recommendation – simply because it does a better job than its immediate rivals in fooling the ear into believing that it's a real loudspeaker. The sacrifice of a few dB of showroom sensitivity for an effective extra half octave of bass extension seems well worthwhile, providing the loudness limitations are acceptable.

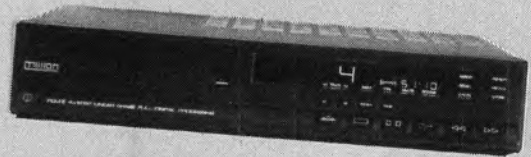
TEST RESULTS

Size (height x width x depth)	22 x 11 x 9.5cm
Recommended amplifier power	25-60 watts
Recommended placement	on good stands near rear wall
Estimated frequency response (2m)	70Hz-20kHz, ±7dB
Estimated LF rolloff (-6dB ref midband)	90Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	82dB
Impedance characteristic (ease of drive)	very good
Forward response uniformity	fairly good
Typical price per pair (inc VAT)	£139



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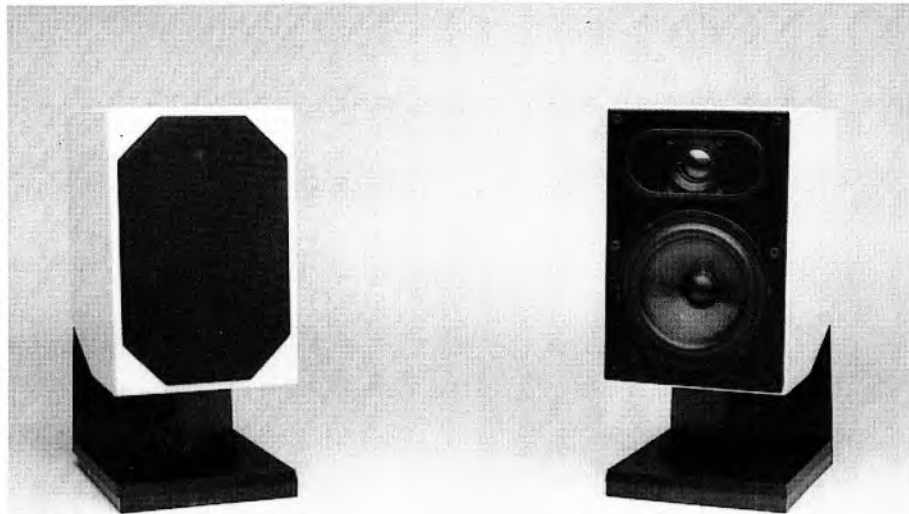
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Of the ten tinies scrutinised in these reviews, B&W's *CM1* is the one that oozes the real design class, as befits a company which has pioneered the use of external design consultancy (Pentagram) for more than a decade. Indeed, design is the central pillar which seeks to justify the fairly elevated price of this upmarket *Concept 90* model. £350 is a lot to pay for a miniature, but less so for what is definitely one of the most elegant, yet also one of the more versatile and technically advanced on the market.

The *Concept 90*... err concept... involves the option of adding a £550 *CM2 SBC* (sub-bass column) to the *CM1*, either from scratch (the £895 full *CM2* package) or at a later date. The *CM2 SBC* is a slim floorstanding pillar which acts as subwoofer and support for the *CM1*, improving power handling, bass extension and raising the small speaker up to the level of the seated ear. *CM1/CM2* combinations would be an aesthetically attractive (albeit pricey) solution to elegant surround sound A/V systems.

The carton feels reassuringly heavy and the packaging might survive collision with a railway locomotive, though I came close to losing my presence of mind attempting to extract the polystyrene inners. Eventually, out came a chunky little pair of pure white loudspeakers (black or Nextel grey being alternatives) with pretty black mesh grilles in moulded white frames. And a pair of small moulded stands which mate the *CM1* and the *SBC* subwoofers, but which can also be used to raise a *CM1* about four inches from a shelf support. That said, the stand is a rather flimsy affair which doesn't feel as rigid as specialist metal stands.

The plastic stand is just one of three options for the *CM1* alone, since the bottom face of the enclosure has an angled section at the back, allowing the unit to be placed with

the baffle either vertical or tilted backwards by 20 per cent, the latter useful for low shelf, floor (or even maybe ceiling) mounting.

Whereas the drivers look conventional enough on the surface, and the inclusion of APOC protection is sensible in such a small loudspeaker, the beauty of this loudspeaker is rather more than skin deep. In fact the whole baffle is an elaborate die-casting, to which cones, domes, magnets, surrounds and crossover PCBs are directly attached. And the box itself is a plastics moulding whose internal construction is based on B&W's proprietary Matrix cabinetwork – a honeycomb of internal partitioning that promotes high stiffness while minimising internal volume loss.

TEST REPORT

Sensitivity is a little below average, though it is still sufficient to provide decent levels from all but the puniest amplifiers. Furthermore, it also provides an easy enough load and pretty respectable bass extension for the box size.

The response traces are certainly the flattest, smoothest and most even amongst this group of ten. The 1m trace holds within ± 3 dB throughout, demonstrating good pair matching and negligible grille effects. The 2m and off-axis curves show fine integration and a seamless crossover region, with a gently falling characteristic. The averaged in-room response confirms much the same story, but with just a slight 2.5kHz crossover notch. Close-to-wall mounting provides worthwhile LF augmentation with only marginal mid-band modification, though the *CM1* should be happy enough in any position.

SOUND QUALITY

The *CM1* did well in the listening tests, less perhaps for its positive qualities than for a

comparative lack of vices in the context of a far from exceptional group of loudspeakers. To quote one panelist: "properly engineered neutrality is a good start".

The overall balance is just a little on the rich side of neutral, exacerbated by the slight but audible presence loss. The little plastic stands confer automatic life membership of the bass pudding club; curiously, their removal seemed to allow higher levels to be maintained without interference from the APOC protection circuitry!

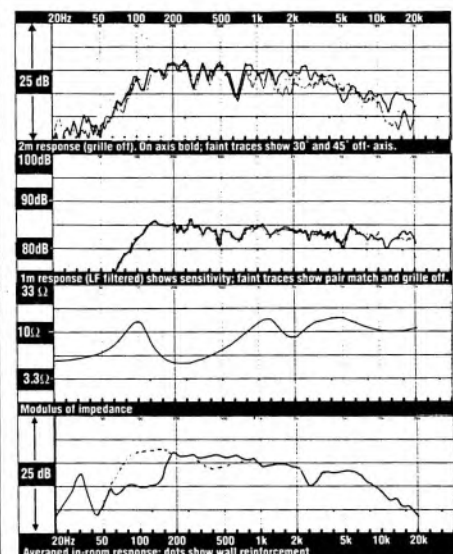
Despite sounding initially eager and encouraging the exploration of the power handling capabilities, the sound does verge on the oversmooth and lazy, and ultimately fails to come properly to life. Wall or space siting seems to be a matter of taste – for myself I liked both the wall and the tilt-back.

CONCLUSIONS

The *CM1* is a small box with concomitantly limited dynamic range and bass welly. Despite being a little short of 'speed', it proved capable of delivering a quite big hearted and enjoyable sound, and is mercifully free of any real nasties. Value for money depends on how much value one ascribes to the designer suit of clothes, but those prepared to pay a little extra for this very stylish near-miniature are unlikely to be disappointed.

TEST RESULTS

Size (height x width x depth)	24.5 x 16 x 22cm
Recommended amplifier power	20–60 watts
Recommended placement	close to rear wall
Estimated frequency response (2m)	70Hz–20kHz, ± 5 dB
Estimated LF rolloff (–6dB ref midband)	90Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	84dB
Impedance characteristic (ease of drive)	good
Forward response uniformity	very good
Typical price per pair (inc VAT)	£345



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If judged purely on grounds of house style consistency, Canton would surely win the prize. This West German brand may be comparatively new to the UK, but should have no difficulty establishing a corporate identity since every model assessed by *Choice* so far looks identical in shape and presentation, differing only in size and weight. Moreover, they've performed very respectably too, the *Karat 20* and *60* both meriting Recommendation.

The formula is undoubtedly a good one – all golden ratios and smart, understated aesthetics, helped by the softening effect of radiusing the horizontal edges. The £140 *Plus S* is a genuine miniature rather than a small bookshelf model, and outwardly closely resembles a miniaturised *Karat 20*, with metal grille and neat badgework.

In fact this particular glossy black enclosure is a plastics moulding, while managing to avoid making the fact too obvious. Furthermore, according to the brochure the *Plus S* is actually the smallest of a three model 'wall and mini-speaker' family which comprise just one range within the vast Canton catalogue. The same brochure claims: "bass down to 45Hz", which must throw the credibility of the rest of the propaganda well out of the window.

The whole package is delightfully self effacing, while being heavy and solid enough to act as a bookend if need be. A small re-entry hole in the rear facilitates wall mounting, clock style, while the bare-wire spring terminals facilitate this by protruding no more than a couple of millimetres.

TEST REPORT

Sensitivity approaches the market average at around 87dB/W, but this is achieved partly because bass extension is severely and rapidly curtailed, and also because a deter-

minedly low 4ohms impedance characteristic chips in with its 3dB's worth, some of which an amplifier might be unwilling to supply in extremis.

The responses look exceptionally well balanced in the operating range, but confirm the rapid roll-off in output below 150Hz – nearly three octaves above the cut-off point of the human body. The overall balance is pretty good within the operating band, especially out at 2m, and the crossover looks nicely enough integrated. But the traces are nevertheless somewhat lumpy with distinct evidence of a rather 'hot' treble above 6kHz. The averaged in-room response shows that wall loading is pretty well essential from the point of view of augmenting the bass, but also that a price is paid in significantly less even output over the vital 200Hz-1kHz region.

SOUND QUALITY

One ought perhaps to make allowances for the size of these microminiatures. That's what customers in the shop do, which is one reason why they sell pretty well. But the Impenetrable Curtain takes any visually inspired emotional sentimentality out of the equation: only the sound gets through, and the *Plus S* doesn't manage all that well.

The: "very thin, tippy, reedy balance with no bass and not much lower mid either" is not a good starting point, even though it refers to free space siting. When moved to the wall, the same panelist continued: "wall mount does help a lot, though acceptance is still distinctly marginal; treble 'sting' remains a (terminal?) problem."

Other panelists fell broadly into line, and my feeling is that the *Plus S*'s problems are not merely a matter of the lack of bass, but have as much to do with the fact that no attempt has been made to curb the treble in sympathy. Subjective balance is pivoted

about the midrange: provide too little bass but let the treble rip and the wretched thing falls over, out of balance.

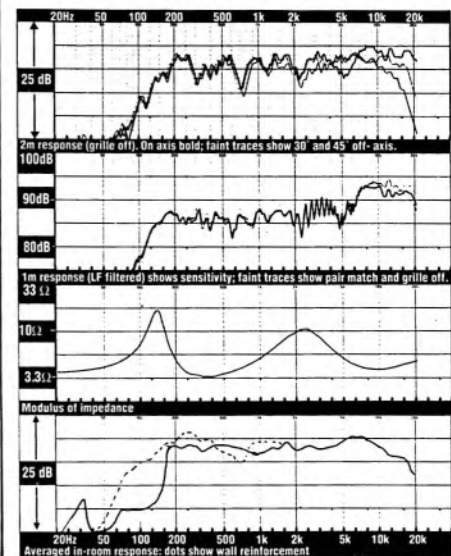
That aside, the *Plus S* does possess the good qualities of a small metal box speaker, being quite 'quick' and detailed with respectable dynamics. But coloration is quite severe, and not aided by wall siting either. In its favour, it is possible to cane this already sensitive model really hard without causing the speaker itself any real distress; that inflicted by the laser-like treble on the listener's ears becomes the limiting factor.

CONCLUSIONS

Frankly the only possible conclusion is that the *Plus S* is simply too small to be allowed out on its own without a subwoofer holding its hand. There's a couple in the Canton catalogue, one dubbed *Plus C*, and in all fairness the manufacturer does stress the importance and suitability of a sub/satellite package. On its own, the *Plus S*'s flaw is in the decision to go for sensitivity and power handling by adopting a very steep bass roll-off, whilst at the same time leaving the tweeter out on something of a limb.

TEST RESULTS

Size (height x width x depth)	20 x 12 x 12cm
Recommended amplifier power	15-70 watts
Recommended placement	against rear wall
Estimated frequency response (2m)	120Hz-20kHz, ±5dB
Estimated LF roll-off (-6dB ref midband)	130Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	87dB
Impedance characteristic (ease of drive)	current hungry
Forward response uniformity	good
Typical price per pair (inc VAT)	£140



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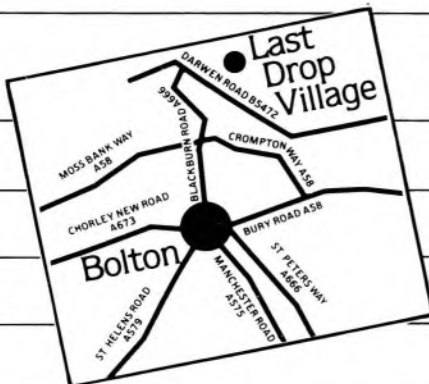
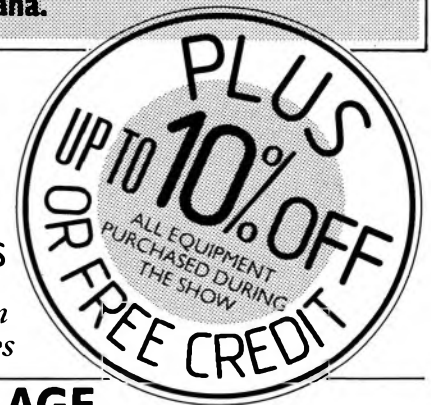
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HECO INTERIOR 90S

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Bit of a mystery model, this. One of the pair claims it's an *Interior 80E*, the other an *Interior 90*. Both labels are handwritten in blue biro with neat joined up writing, yet appear to be a matching pair nonetheless. They were dropped off by the UK product manager en route to the channel ports and a fortnight's holiday. Head office knew nothing of an *80E*, or a *90* for that matter, though the *90S* weighs in at £129 – and turns out to be what we got, despite all attempts to put us off the scent.

Heco is a West German brand that has only recently been available in the UK, though students of hi-fi history will know it as a name which goes back decades, and in fact shared Rank Organisation parentage with Wharfedale and Leak back in the 1970s. Heco has operated entirely independently for many years now, though the engineering of this little budget bookshelf model does somehow remind me of Wharfedale's rival UK models, even though it's difficult to finger any specific common thread.

Essentially the *90S* is a simple, small bookshelf econobox, clearly put together with more than half an eye on minimising the cost of the various components. The wool-stuffed sealed box has 16mm wall thickness, with no additional bracing. The bass/mid duties are handled by a surprisingly small (100mm) driver, while the tweeter is a 19mm aluminium/manganese metal dome unit.

That doesn't mean this *Interior* isn't perfectly smartly turned out – indeed the textured black finish of our samples makes a rather attractive alternative to imitation woodgrain, and a variety of alternatives are available. But the grille has a thick and unchamfered profile which is inevitably close to the drivers, while the drive units themselves look rather undistinguished if the covers are left off.

TEST REPORT

Aided by a current hungry impedance characteristic, sensitivity is bang on the average at 87.5dB/W, while low frequency extension is pretty respectable considering the size of the box.

The responses show pretty good bass to treble balance, along with some lumpiness. There are obvious integration difficulties in the crossover region, but the unevenness is fairly gentle and off-axis traces show good correspondence. Clearly the grilles ought to be abandoned at the earliest opportunity. The treble balance is slightly 'hot', reflecting West German tastes to a degree perhaps, while wall loading certainly provides worthwhile low frequency augmentation, albeit at the expense of less midband evenness (300Hz-1kHz).

SOUND QUALITY

Overall, the panel was pretty underwhelmed by the *90S*. As is the case with so many of these small loudspeakers, the problem seems to centre on the isolated and exposed treble 'brittleness' which was confirmed in subsequent measurement. The treble is isolated here partly because the presence region is sucked out, which in turn is responsible for dulling and colouring vocal presentation. (Removing the grille improves the sound, but not the appearance.)

Elsewhere both balance and dynamics are pretty good, but the loudspeaker still fails to raise any great enthusiasm. Though inevitably lacking real extension, the bass does not seem short of speed or timing exactly, but rather remains remarkably unconvincing in terms of weight and energy. Perhaps it's to do with the slightly rich upper bass/lower mid in combination with the rapid LF roll-off. Wall assistance certainly helps to richen the

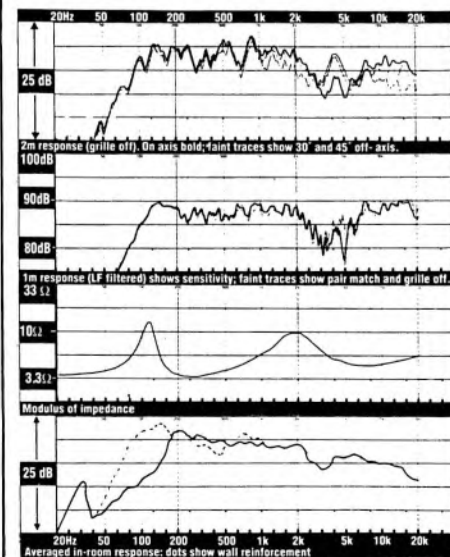
balance, but also degrades clarity further up the band.

CONCLUSIONS

Though the presentation is neat enough, the *Interior 90S* must be regarded as a disappointment at £130, lacking the sonic capabilities of cheaper alternatives. The measurements reveal some of the problems, but the sheer gutlessness of the sound is the real problem. There was something of this in the large floorstanding *Interior 430S*, (reviewed June '89) but that model succeeded largely because of its fine integration in the listening room, which is much less the case here.

TEST RESULTS

Size (height x width x depth)	27 x 18 x 16cm
Recommended amplifier power	15–60 watts
Recommended placement	on high stands
Estimated frequency response (2m)	80Hz–20kHz, ±5dB
Estimated LF rolloff (–6dB ref midband)	90Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	87.5dB
Impedance characteristic (ease of drive)	current hungry
Forward response uniformity	good
Typical price per pair (inc VAT)	£129

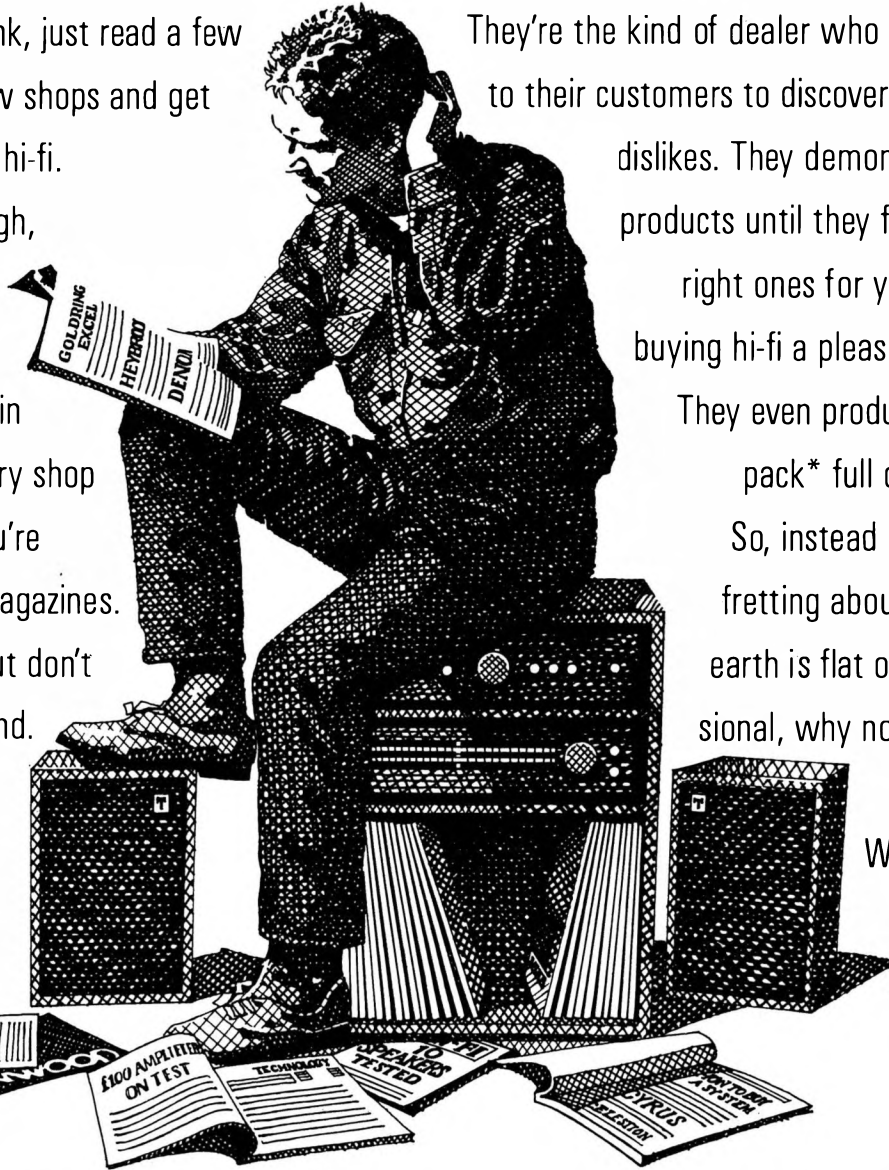


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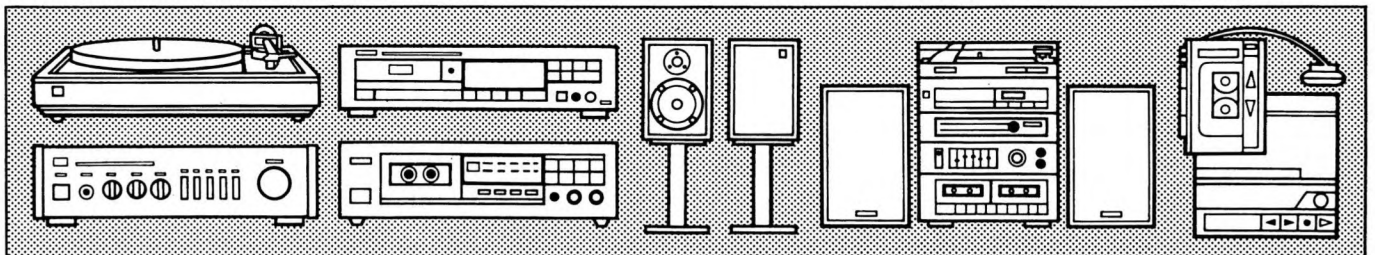


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MB QUART 220

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I confess to knowing little or nothing of MB Electronics and its *Quart* range of loudspeakers, save that it's (yet another) West German manufacturer of good standing which has only quite recently begun UK distribution. *Choice* did in fact review a rather large *Quart* model a year or so ago, with somewhat disappointing results, though that multiway design bears no particular resemblance to the small, luxury model examined here.

I wouldn't really call this a miniature loudspeaker – certainly not in the way that two of the other German models from Canton and Visonik are. In fact it's just about the largest of the ten reviewed here, and at £270 also one of the more expensive. Indeed, in terms of price, size and presentation, the package as a whole is somewhat reminiscent of Canton's *Karat 20*, reviewed in June '89.

However, where the *Karat* radiuses the horizontal edges to give an almost self-consciously discrete appearance, the *Quart 220* is made much more visually assertive by means of radiused vertical hardwood 'cheeks' either side of an inset grille. The combination of various shades of brown and the highly polished wood sides lends a distinctly nostalgic 'furniture' air which is quite attractive in a slightly old fashioned way, and certainly makes a pleasant change from textured vinyl anonymity.

Indeed, the *220* is available in a wide enough range of lacquer and wood finishes to appeal to the most demanding interior design consultant, should you find the browns a shade too *retrové*. Furthermore the build quality is not just superficial. According to the propaganda, the cabinet walls are built up from five layers, each of different density, so as to minimise resonances, while tongue-and-grooving reinforces the corners.

The loudspeaker looks less pretty with the grille left off, and this is a particular pity since the latter's thick frame and proximity to the drivers is unlikely to help the acoustic performance – an observation measurement tends to confirm.

The driver line-up holds few surprises, though I dare say the incorporation of a metal (titanium) dome tweeter must still justify a few brownie points on the price. The bass unit is a small paper cone device, operating in a sealed box enclosure.

TEST REPORT

The distinctly uneven response makes sensitivity hard to specify, though an average of 87.5dB/W is close enough to the mark, with the proviso that the partnering amplifier will be required to supply double the current at low frequencies than that which would be needed by a similar sensitivity 8ohm model.

The *220* is able to deliver a 70Hz to 20kHz bandwidth within ± 5 dB, which is a good start, but within that quite loose specification lies considerable broadband unevenness. Neutrality doesn't enter the picture: this model will impose its own, inimitable and distinctive sonic character on all sources, for good or (more probably) ill. The averaged room response shows that although wall loading may be used, it is probably better avoided, since it exaggerates an already prominent LF bump and adds further midband unevenness (300-600Hz).

SOUND QUALITY

If the up and down response had already caused difficulty in specifying a sensitivity rating, the same factor made it equally hard to 'normalise' the volume during the listening tests – and also tended to dominate the observations of the panelists, downgrading otherwise quite promising ratings.

In fact this loudspeaker does sound very much as the responses suggest. There's sufficient 'boom'n'tizz' factor to create an almost convincing larger than life effect, and provide an image spaciousness that is quite impressive if less convincing in perspective terms.

The consensus favoured siting clear of walls, since wall loading takes an already emphasised bass just a little too over the top: "makes it a bit too much of a thumper", according to one listener.

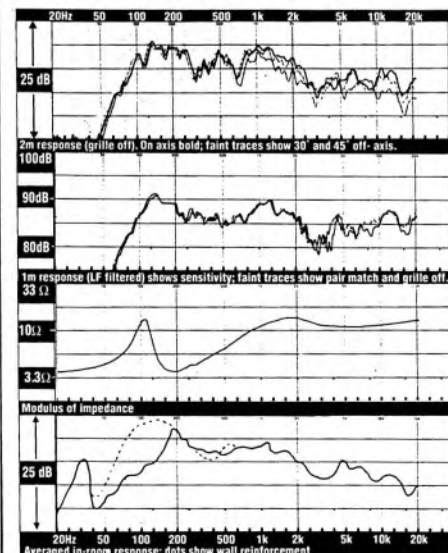
Balance notwithstanding, the quality of bass and impression of dynamics are both pretty good, which suggests that the fancy enclosure construction may well be doing its bit properly, leaving the drivers to muck up the balance. The depressed presence in particular 'thickens' vocals and tends to suppress fine detail and perspectives in large scale material.

CONCLUSIONS

The fact that the *Quart 220* offers an attractive alternative presentation in a prodigious range of finishes will certainly be sufficient to attract some buyers. However, the sonic and measured unevennesses are rather too obvious considering the fairly high asking price.

TEST RESULTS

Size (height x width x depth)	30 x 22.5 x 21cm
Recommended amplifier power	20–60 watts
Recommended placement	onstands in free space
Estimated frequency response (2m)	70Hz–20kHz, ± 5 dB
Estimated LF rolloff (–6dB ref midband)	80Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	87.5dB
Impedance characteristic (ease of drive)	current hungry
Forward response uniformity	fairly good
Typical price per pair (inc VAT)	£270





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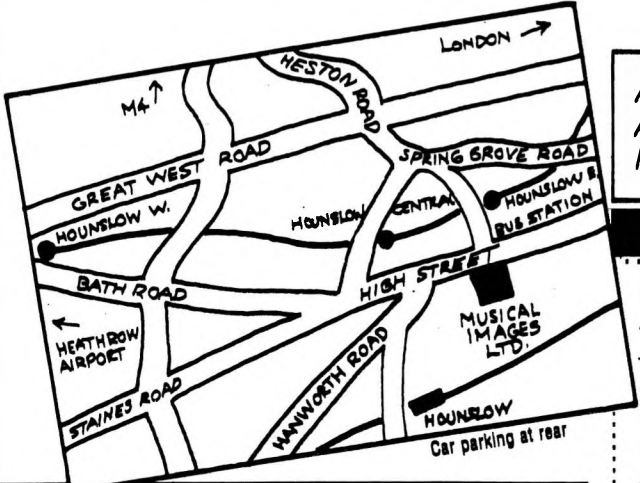
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Long established as a leading brand in the mid-price sector, Monitor Audio has yet to repeat this success at the more competitive, higher volume end of the market. As so many have found, it's difficult to maintain any sort of exclusivity when grubbing around for market share brownie points at \$99.99. MA therefore sensibly concentrates on using in-house cabinet making expertise to appeal to those customers who want a little bit more in terms of finish and presentation, rather than attempting to slug it out with the vinyl print brigade.

If the good quality finish and woodwork provides suitably rustic credentials, the technology credibility factor is taken care of by metal dome tweeters, which now permeate almost the whole Monitor range, including this £150 *Monitor 7*. Although others can claim prior usage, MA (assisted by UK OEM driver manufacturer Elac) can take much of the credit for the rapid spread of this comparatively new loudspeaker design trend.

The *Monitor 7* is neither the smallest nor the cheapest MA model – that distinction is reserved for a £140 *Baby Monitor*, which is the true miniature of the range. But the *BM* is getting a little long in the tooth, whereas the *M7* is brand spanking new, so you don't need three guesses to work out which one came in for review when the call went out.

What we have here then can just about be described as a miniature, helped by a very slim baffle, though it's as tall as most small bookshelf models. The £150 price is sufficiently up from rock bottom to allow for a few luxury touches, like the small metal dome tweeter and the rather anonymous real wood veneer. The whole thing is very attractively styled and commendably discreet when the grille is in place, though it's a bit less tidy if left unclothed, which is a pity, since the grille has one of those nasty thick wooden frames.

The carcass is built up from 12mm MDF, and a small reflex-loading tube exits from the rear. The manufacturer recommends free space siting, and certainly the port needs some space to breathe, but see later. Bass and midrange duties are handled by a 100mm MA/Elac treated paper cone driver, while the tweeter is a SEAS 19mm dome.

TEST REPORT

The *Monitor 7* registers a modest enough 84dB/W sensitivity, though this is partly due to the kind impedance characteristic and also reflects genuine, reflex assisted bass output down to around 70Hz.

The response traces show a reasonable overall balance, marred by significant unevenness nonetheless, especially in terms of the broad energy loss through the crossover region, and in the distinctly over enthusiastic tweeter – a clear recipe for an isolated and brittle-sounding top end.

The pair match is pretty good, but removal of the grille definitely smooths the treble to a significant degree. The room curves suggest MA's free space recommendation may well be appropriate, since wall mounting markedly exaggerates the tendency towards a 'three-humped' response. However, the bass reinforcement provided by a rear wall does help to balance out the otherwise very obvious treble.

SOUND QUALITY

The siting question remains something of a moot point, which divided the panel according to individual preference. For the best stereo and the least coloration a free space site on high rigid stands is advisable. But to get a reasonable facsimile of a full range loudspeaker out of what is basically a small and comparatively insensitive design, the wall adds an important 'welly factor'. Speak-

ing personally, the speaker is coloured anyway, so a little more does little harm, and at highish levels it's the best way to cope with the unruly tweeter.

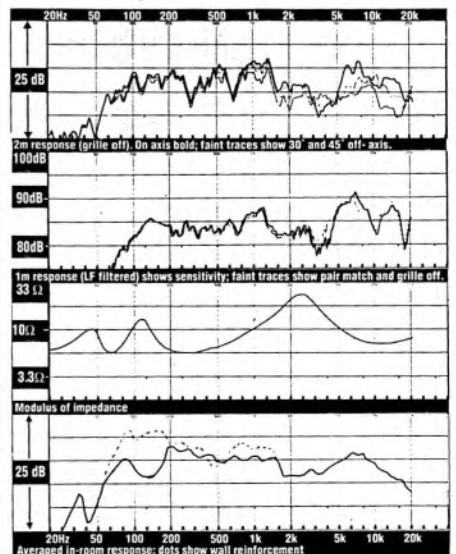
The *Monitor 7* acquitted itself pretty well under 'blind' testing, though the comparatively good bass extension played a substantial part in the approbation: "has some bass" was an unusual comment on the day. There was praise too for the lively dynamics and superior stereo properties, but midrange and vocal detail is rather muddled. There's a degree of inevitable inbuilt inaccuracy in the balance, but power is handled confidently enough, leading to a quite impressive overall sound for the price.

CONCLUSIONS

In the context of this particular group of ten 'miniature' loudspeakers, the *Monitor 7* would have rated recommendation for comparatively good value for money. It's a welcome newcomer in pretty enough clothes to ensure good acceptance, and definitely merits consideration if the package appeals. But in the wider context of the marketplace as a whole, this lively and punchy contender lacks sufficient mid-to-treble subtlety for wholehearted endorsement.

TEST RESULTS

Size (height x width x depth)	34 x 16.5 x 17cm
Recommended amplifier power	25–60 watts
Recommended placement	stands 1ft from rear wall
Estimated frequency response (2m)	65Hz–20kHz, ±5dB
Estimated LF rolloff (–6dB ref midband)	70Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	84dB
Impedance characteristic (ease of drive)	good
Forward response uniformity	fairly good
Typical price per pair (inc VAT)	£150



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Quite how this model got into a collection of miniatures must be something of a mystery, since it's certainly the bookshelf size heavy-weight champion. *Opus 3* is a Swedish company that somehow manages to combine a top quality record label with the production of a range of decidedly unusual – indeed peculiar – loudspeakers. These are chiefly characterised by the use of heavy cast mineral composite enclosures – crushed marble in a resin binder – combined with some of the tackiest presentation and finish in the known universe. There's an element of cause and effect about this, but others have faced similar difficulties with better aesthetic results.

Appearance aside, the mineral enclosure does provide great mass and stiffness, plus a degree of self damping if the compound is well chosen. Moreover, being cast in the solid rather than assembled from sheets creates quite different constraints – it's one reason why good presentation is difficult to achieve, but the creation of irregular shapes (or thicknesses) can offer some real advantages, for example in reducing internal standing waves.

The £400 *Credo* has a hexagonal plan section that tapers everywhere as it rises from an oversize plinth base. The tweeter is offset by a somewhat variable amount, with no attempt to mirror-image, while the front baffle itself is unconventional in widening towards the top (why, I wot not). The rear face carries a generous reflex port.

The original grille designer was a graduate of AG's notorious Ganymede Academy of Industrial Design. The new guy must have achieved his Doctorate. Admittedly the thing now goes and stays on consistently, but the naked condition of four large white nipples on a black background is just too absurd. Both sourced from SEAS, the bass driver is a

125mm polypropylene cone, the tweeter a 19mm aluminium/polyamide dome, while the crossover uses second order slopes. The drivers are simply held in place by goo and/or glue, which should make service access awkward.

TEST REPORT

The fact that this is actually quite large for miniature status is reflected in a performance envelope which combines average sensitivity with 70Hz bass extension and a lowish-but-not-too-low impedance.

The 1m response shows a broadly even balance marred by a substantial crossover suckout. However, this is clearly partly the mischance of the chosen measurement axis (difficult to specify on a slant-front design), since the effect is much ameliorated at 2m and in the room.

The grille is certainly better avoided (that's assuming I managed to get the old-style thing on properly whilst doing the measurement). The room response suggests that either space or wall mounting is appropriate, depending on taste; either delivers a pretty good result overall, but amongst the detail is a fair amount of local unevenness, and something of a 'stepped' effect, exposing distinct 'corners' at 1.5kHz, 4kHz and 7kHz, which is likely to create some audible coloration.

SOUND QUALITY

The simple fact of having near full bandwidth bass extension, even when sited in free space, was more than sufficient to ensure a comparatively high rating on the listening tests, though in absolute terms, and bearing in mind the highish price, the results are a little less impressive.

The cabinet certainly confers substantial benefits, particularly in supporting the fine

dynamic range and stereo imaging. It certainly has a much lower 'sonic signature' than the typical wooden box, but there nevertheless seems to be some fuzzing of information in the low mid which sounds cabinet related, albeit qualitatively different from that normally experienced.

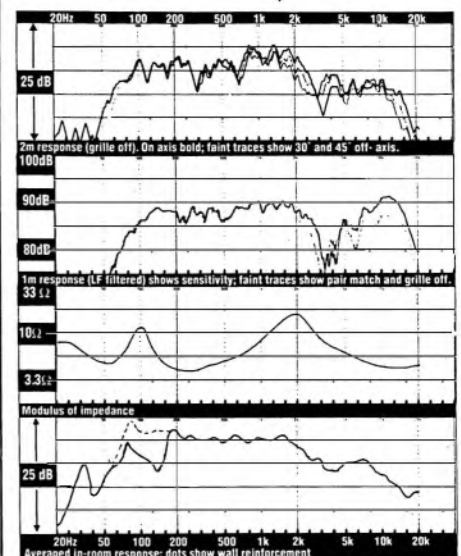
The *Credo* actually has a properly balanced treble – neither too much nor too little, which is a rare distinction amongst this test group. The balance is a little rich – almost fruity near a rear wall – and the presence is audibly slightly dulled, while there is a measure of 'cuppy' midband coloration which alters the timbre of voices somewhat. Bass weight and extension are fine, but speed and clarity is a little lacking here nonetheless.

CONCLUSIONS

The *Credo* has a number of strengths to be sure, but it is also flawed to a rather greater extent than the man holding a cheque for £400 has a right to expect. On sonic grounds it's more than halfway there, though it's hard not to suspect that the cabinet is outperforming the drivers by a significant margin. Meanwhile it loses further brownie points on presentation, finish and so on, though doubtless someone, somewhere will be attracted by the hewn-from-the-solid, anti-tech styling.

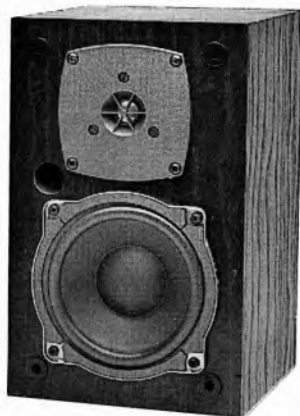
TEST RESULTS

Size (height x width x depth)	32 x 28 x 32cm
Recommended amplifier power	15–60 watts
Recommended placement	stands in free space
Estimated frequency response (2m)	65Hz–15kHz, ± 5 dB
Estimated LF rolloff (–6dB ref midband)	65Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	88dB
Impedance characteristic (ease of drive)	fair
Forward response uniformity	fairly good
Typical price per pair (inc VAT)	£399



VIDEOTONE MINIMAX 2

JOHN A. WALKER LTD., 1ST FLOOR SUITE, 55 NORTH STREET, THAME, OXFORDSHIRE. TEL: (0844 21) 6929.



The *Minimax* is something of a legend amongst miniature hi-fi loudspeakers, and certainly goes back to the beginning of my career in hi-fi journalism, well over a decade ago. I guess it must have been the mid-70s when the advice columns of the various hi-fi mags regularly placed the *Minimax II* at the top of the budget loudspeaker recommendations.

Long after the original Goodmans *Maxim* had ceased production, the Hungarian-built *Minimax* brought fresh impetus and commercial success to the miniature format, if only for a comparatively short time before the mantle passed to the Wharfedale *Diamond*, joined later by the revived *Maxim 2*. Come to think of it, you'd be hard pushed to distinguish a *Minimax* from a *Maxim* at 20 paces...

Besides highly competitive pricing, that early *Minimax* model owed much of its particular character to the slightly old-fashioned engineering virtues which came with the country of origin – a strong little veneered plywood enclosure and paper cone bass/mid and treble drivers.

Attempts to build on the *Minimax* success and produce more upmarket models assembled in the UK were less successful, and Videotone went low profile for a while. But the brand is still available, if less in the public eye than before, and a *Minimax 2* is still available for a very competitive £80, along with a couple of other models, all built in Hungary as before.

For good or ill, the design now lacks much of the idiosyncrasy of its predecessor, the vinyl clad chipboard box, dome tweeter and all looking pretty standard international engineering. Plus ca change, though at least the little 105mm paper cone bass/mid driver is built on a proper metal frame, and it's nice to find a standard production model with

the drivers properly tightened up. The tweeter is a hard plastic 19mm dome lurking rather far down a short horn flare and phase-plugged to boot. The carcass is built up from 13mm chipboard, the rear panel sensibly recessed for extra stiffness, and the reflex port sensibly operating through the front baffle to assist close-to-wall siting. Happily, the horrid spring terminals on the back are about to be replaced by 4mm binding posts (à la Maxim!).

TEST REPORT

The 84dB/W sensitivity rating is below average, but it's achieved with no compromise of the amplifier loading and with reasonable enough bass extension too (as in box size).

The overall balance is actually pretty respectable, albeit stepped up at around 900Hz, but all the traces suffer from considerable unevenness, probably due to comparatively primitive driver technology, which is also reflected in a very poor pair match. On- and off-axis traces correspond pretty well, and the grille actually helps tame a little of the tweeter's unruliness. The room response confirms both the unevenness but also a reasonably good overall balance, and implies that wall loading will help obtain a quite nicely balanced package, at minimal cost in mid smoothness.

SOUND QUALITY

Given that it is comfortably the cheapest model in the test group, the *Minimax 2* by no means disgraced itself, confirming that the overall balance is somewhere near the right ballpark. The limited bass extension is one inevitable source of criticism, but the *Minimax* tries quite hard, handles power pretty well, and responds nicely to a little help from the back wall. There's some sluggishness down at the bottom end too, though the

sound as a whole is quite lively and ingratiating.

The real problem here, however, arises from a near terminal case of unevenness, which lays a crude and splashy patina over what is an otherwise fundamentally honest sound. The result remains reasonably informative – indeed sometimes provides glimpses of genuine transparency – but could never be described as comfortable or properly coherent.

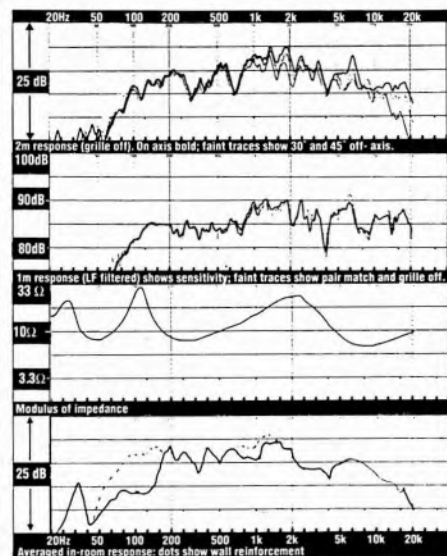
Given the close size and price competition between the *Minimax 2* and an earlier *Choice* Best Buy, the Goodman *Maxim 2* – and given the availability of a pair of latter – comparison was mandatory. Although the *Minimax* offers a shade more bass extension and sounds a touch less boxy, the *Maxim* stays comfortably ahead by delivering a smoother, more coherent and better integrated sound, plus a little extra 'speed' as well.

CONCLUSIONS

The *Minimax 2* deserves Recommendation by delivering a fundamentally well balanced sound that is well suited to wall loading at a very modest price. But there is also a fundamental crudity, in both the driver engineering and the sound, which is just a bit too reminiscent of midi system rather than genuine hi-fi standards for more than qualified enthusiasm.

TEST RESULTS

Size (height x width x depth)	27.5 x 17 x 20cm
Recommended amplifier power	15–60 watts
Recommended placement	near rear wall
Estimated frequency response (2m)	90Hz–20kHz, ±5dB
Estimated LF rolloff (–6dB ref midband)	90Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	84dB
Impedance characteristic (ease of drive)	very good
Forward response uniformity	good
Typical price per pair (inc VAT)	£80



VISONIK DAVID 6001

RJ EDUCATION SUPPLIES CO LTD., UNIT 2 WESTERHAM TRADE CENTRE, LONDON RD., WESTERHAM, KENT TN16 3BR. TEL: (0959) 62255.



West German brand Visonik is almost exclusively known for its little microminiature loudspeakers, the giant killing *David* first appearing more than a decade ago. I'm not sure whether Visonik actually invented the type – at least one other West German brand appeared with a similar product at around the same time – but the company certainly has as strong a claim as any for originating the 'microspeaker' concept.

The original *David* has spawned a variety of successors, plus the odd subwoofer system. There was even, briefly, a range of electronics, but UK distribution was then largely oriented towards the professional market, alongside Uher pro tape recorders. The current distributor too operates mainly outside the hi-fi industry, reflecting the appeal of such an ultra compact loudspeaker for audio/video purposes.

The current version of the *David* is still listed in the catalogue, but the 6001 tested here is a shade larger, rather more contemporary – indeed distinctly 'designer' in appearance – and also somewhat more expensive. The Nextel finish is commonly associated with metal boxes, though in fact this model is built from 12mm foiled wood. The bass/mid driver uses a tiny 90mm pulp cone, crossing over to a 25mm soft dome tweeter, while the rear panel has flat spring-loaded terminals and a slot for wall hanging purposes.

I suspect most people will find the finish and elaborate moulded front cover very attractive, though I'm a little worried about the latter's acoustic properties, and find it aesthetically a shade fussy as well. The middle strap across the cover not only carries the badgework, but also a dinky little LED that starts to flash somewhere around 30V input, presumably as a warning that the fabric of the speaker is under threat, but see later. An

irritating side effect (again see later) is that the grille cannot be easily removed, without cutting wires, scraping off a blob of glue and what have you.

TEST REPORT

This *David* is balanced to give an average enough sensitivity, but at the expense of a lowish impedance characteristic and little output below 150Hz, due as much to the steepness of the roll-off as its turnover point.

The various response traces are quite well balanced overall, but do reflect German tastes for a brightish treble, and also show considerable unevenness throughout the range. The pair match was very close, but the elaborate grille structure must carry much of the blame for the extent of the response zigs and zags through the treble region: grille on or off, output still peaks on-axis at around 11kHz, but the peak is down and the passage smoother all the way from below 2kHz with the cover removed. Wall loading at least helps to provide some output down to 100Hz, but the room responses confirm both the unevenness and the rather exposed mid treble.

SOUND QUALITY

Given the black curtain treatment, this *David's* likelihood of toppling a Goliath becomes risible, though it certainly fared a little better than its Canton compatriot, largely because the treble is considerably less exposed (though exposed nonetheless). Bass is so nearly non-existent – even against the wall – that one longs for a subwoofer to come along and put the bass guitarist out of his miserable inaudibility. Good sensitivity and decent power handling are a definite plus, but the former is comprised by the reluctance of my ears to permit exploration of the latter (that exposed treble again).

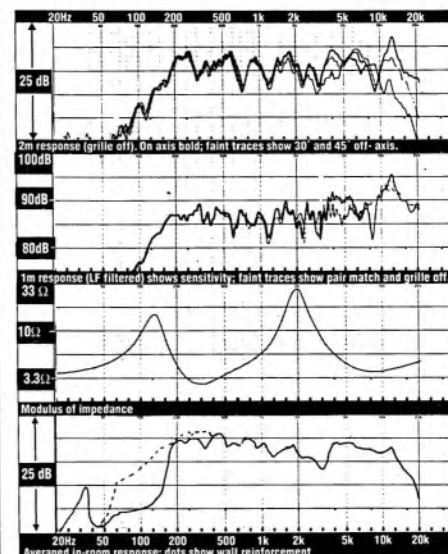
The balance and character remain resolutely thin and pinched, while coloration is also rather obvious, though the sound is at least decently quick, and vocal rendition received some praise for focus. It would be too much to describe the removal of the grilles as revelatory, but certainly these ICE-style moulded covers play a significant part in mangling the sound. Without them mid-treble integration improves enormously, significantly ameliorating otherwise quite severe boxiness.

CONCLUSIONS

It's a great pity that the high tech styling embellishments turn out to have such a negative effect upon the sound of this smart microminiature, for in other respects the 6001 seems quite intelligently engineered. However, like its immediate German rival – and unlike the UK Alexander – the bass alignment has more than half an eye on subwoofer partnership, and this compromises performance as a standalone item.

TEST RESULTS

Size (height x width x depth)	20 x 12 x 13cm
Recommended amplifier power	15–70 watts
Recommended placement	near rear wall
Estimated frequency response (2m)	130Hz–20kHz, ±6dB
Estimated LF roll-off (–6dB ref midband)	130Hz
Estimated midrange sensitivity (ref 2.83V, 1m)	87dB
Impedance characteristic (ease of drive)	current hungry
Forward response uniformity	good
Typical price per pair (inc VAT)	£160



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Rotel RA820A	274.95	309.95	314.95	314.95	339.95	364.95	439.95	
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Nad 3130	249.95	299.95	314.95	314.95	339.95	389.95	439.95	
Rotel RA840BK3	299.95	299.95	314.95	314.95	339.95	389.95	439.95	
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Arcam Alpha II	289.95	299.95	314.95	314.95	339.95	389.95	439.95	
Rotel RA870BK	299.95	299.95	314.95	314.95	339.95	389.95	439.95	
Yamaha A4400	299.95	299.95	314.95	314.95	339.95	389.95	439.95	
Nad 3225	299.95	299.95	314.95	314.95	339.95	389.95	439.95	
Marantz PM45	299.95	299.95	314.95	314.95	339.95	389.95	439.95	
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Denon DC3910	354.95	354.95	354.95	354.95	354.95	354.95	354.95	
Denon DC3910	354.95	354.95	354.95	354.95	354.95	354.95	354.95	
Marantz CD383	354.95	354.95	354.95	354.95	354.95	354.95	354.95	
Marantz CD383SIST	354.95	354.95	354.95	354.95	354.95	354.95	354.95	
Nad 5225	354.95	354.95	354.95	354.95	354.95	354.95	354.95	
Nad 5225	354.95	354.95	354.95	354.95	354.95	354.95	354.95	
Philips CD380	354.95	354.95	354.95	354.95	354.95	354.95	354.95	
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Philips CD782	354.95	354.95	354.95	354.95	354.95	354.95	354.95	
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- Technics SLP353 add £110
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- Dual CS430 deduct £20
- AB 15-101 deduct £20
- Nad 3170 deduct £20
- Revolver back inc. arm add £20
- Systemdek inc. arm add £150
- Systemdek inc. arm add £225
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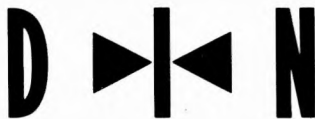
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CAMBRIDGE HI-FI, 31 Cuthbert St, Bedford. (0234) 325035. Mission-Cyrus, Rotel, Kenwood, Pioneer, Manticores, Revolver, Ariston, ITL, KEF, Monitor Audio. Single speaker dem room. 9.30-5.30 6 days. Free installation. Service Dept. Visa, Access. Credit facilities.

BERKSHIRE

NEWBURY AUDIO, 2 Weavers Walk, Northbrooke Street, Newbury, Berkshire RG13 1AI (0635) 33929. 6 days 9.30-6.00. Linn, Naim, Roksan, Exposure, A&R Cambridge, Ion Systems, Revolver, Ruark, SD Acoustics, Monitor Audio, Manticores, Nakamichi, Dual, Rotel, Royd. Dem room. Home trial facilities. Free installation. Late appointments. Interest free credit. Access, Visa.

READING HI-FI CENTRE, 4 Queen's Walk, Reading RG1 7QF. (0734) 585463. 'The best equipment, advice and service from Berkshire's premier Hi-Fi emporium'. BADA MEMBER

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TECHNOSOUND, 7 Gravelle Square, Wilen Local Centre, Milton Square. (0908) 604949. Bang & Olufson, Denon, Rotel, Technics, Yamaha. Selection of enthusiasts products. Multi-room hi-fi installations. Branches at Luton and Dunstable. BADA MEMBER

AUDIO INSIGHT LTD, 53 Wolverton Rd, Stony Stratford, Milton Keynes. (0908) 561551. A&R, Audiolab, Heybrook, KEF, Linn, Mission Cyrus, Musical Fidelity, Nakamichi, Nitech, Rotel. BADA MEMBER

AYLESBURY HI FIDELITY, 98 Cambridge St, Aylesbury. (0296) 28790. Denon, Dual, Exposure, Heybrook, Marantz, Musical Fidelity, NAD, Roksan, Rotel, Systemdek 2 Dem rooms, appointment reqd. Mon-Fri 10-6, Sat 9.30-5.30. Home trial, free installation, credit to £1,500. Access, Amex, Diner, Visa. Service dept.

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CAMBRIDGE HI FI, 1 Hawthorn Way, Cambridge. (0223) 67773. Ariston, ITL, KEF, Mission Cyrus, Monitor Audio, Pioneer, Revolver, Technics, Thorens, Kenwood. All credit cards.

STEVE BOXSHALL AUDIO, 41 Victoria Rd, Cambridge CB4 3BW. (0223) 68305. 10-6 - 6 days. Denon, Rotel, Dual, Monitor Audio, Tannoy, Quad, KEF, Roksan, Nakamichi, Revox, SME, Audio Research, Krell, Magneplanar. 3 dem rooms, home trial, appointment preferred. Free installation and service dept. Access, Visa and credit facilities. BADA MEMBER

STILTON AUDIO, 489 Lincoln Road, Peterborough. (0733) 558838. A&R, Cyrus, Exposure, Harman Kardon, Linn, Meridian, Mission, Musical Fidelity, Roksan, Yamaha. Home trial, free installation. Credit facilities. Access, Visa, Amex. Mon-Fri 10-6. Sat 10-5.30. Service dept.

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ASTON AUDIO, 4 West St., Alderley Edge. (0625) 582704. Wide selection of equipment in N.W. 2-year guarantee. 3 dem rooms. Tues-Fri 10-6, Sat 9-5. Closed for lunch 1-2. BADA MEMBER

DOUG BRADY HI-FI, Kingsway Studios, Kingsway North, Warrington. (Padgate 0925) 828009. 'Largest choice of specialist Hi-Fi in N.W.' All credit cards. 3 Dem rooms. Open 6 days. BADA MEMBER

NEW DAWN HI-FI, 1-3 Castle St, Lower Bridge St, Chester. (0244) 24179. Linn, Quad, Technics, National Panasonic, Denon, Rotel, Dual, Meridian, Aiwa, Philips. BADA MEMBER

SWIFT OF WILMSLOW, 4-8 St Annes Parade, Wilmslow. (0625) 526213. A&R, Aiwa, Denon, Marantz, Mission, Monitor-Audio, Pioneer, Trio, Yamaha, NAD. Dem facilities. Tues-Sat. BADA MEMBER

RICHER SOUNDS, 4 Wellington St, Stockport SK1 3RN. (061) 480 1700. Cheerfully small store by BR station with virtually all major 'budget' names; many on special offer. Facilities: expert advice; free 48 page Hi-fi Guide and monthly Newsletters; part exchange. Mon-Fri 10-6, Sats 10-5. Access, Visa, Richer ChargeCard. Mail Order for all Richer Sounds stores from this branch.

CHRIS BROOKS HI-FI, 29 Gaskell St, Stockton Heath, Warrington. 0925 61212/3. Tues-Sat 10-6. 2 dem rooms. Credit facilities. All credit cards. Total absence of bull****. BADA MEMBER

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ACTIVE AUDIO, 12 Osmaston Rd, The Spot, Derby. (0332) 380385. Arcam, Ariston, Celestion, Denon, Heybrook, Kef, Cyrus, Musical Fidelity, Marantz, Revox, Rotel, Rogers, etc. Demostration and home trial facilities. Account and credit cards. Ring for opening times and free 'Fact Pack'. BADA MEMBER

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AT. LABS, 442/4 Cranbrook Rd, Gants Hill, Ilford. (01) 518 0915. Mon-Sat, 10-6. Two single speaker dem rooms. Access, Amex, Visa. BADA MEMBER

RAYLEIGH HI-FI, 44a High Street, Rayleigh, Essex. (0268) 779762/747571. 216 Moulsham St, On-the-Parkway, Chelmsford, Essex. (0245) 265245. A&R, Audiolab, Beyer, BLQ, Cyrus, Celestion, Denon, DNM, Epos, Gale. Access, Visa 3 years parts and labour guarantee on hi-fi systems. BADA MEMBER

BRENTWOOD MUSIC & HI-FI CENTRE, 2 Ingrave Rd, Brentwood. (0277) 221210. Alphason, B&W, Cambridge Audio, Denon, Harman Kardon, Marantz, QED, Quad, Yamaha. Dem and home trial facilities. Mon-Sat 9.30-5.30 (Thurs from 10am, Sat from 9am). Free installation, credit facilities. Access, Visa, Hi-Fi Markets. Service dept.

LYON AUDIO, 16 Peartree Business Centre, Peartree Road, Stanway, Essex CO3 5JN. (0206) 560259. Audiolab, Celestion, Oracle, Rogers, Denon, NAD, Rotel, J.A. Michell, Roksan, Marantz, Quad, Mission. Dem facilities. Mon-Sat 9-6. Installations. Credit facilities up to £1000. Access, Visa, Hi-Fi Markets, Eurocheque. Service dept available.

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ABSOLUTE SOUND AND VIDEO, 40/42 Albion St, Cheltenham. (042) 583960. A&R, Denon, Dual, Linn, Meridian, Mission, NAD, Rotel, Technics, Yamaha, etc. (Closed Wed). BADA MEMBER

AUDIO EXCELLENCE, 58 Bristol Road, Gloucester. (0452) 30046. Audio Research, Dual, Krell, Linn, Magneplanar, Naim, NAD, Yamaha and lots more. Closed Mon. BADA MEMBER

HAMPSHIRE

ABSOLUTE SOUND AND VIDEO, 4 Feathers Lane, Basingstoke, Hants RG21 1AS. (0256) 24311. A&R, Audiolab, Denon, Dual, Linn, Mission, NAD, Rotel, Technics, Yamaha. Dem and home trial facilities. Mon, Tues, Thurs, Fri 9.30-6, Sat 9.30-5.30. Closed Wed. Free installation. Credit facilities. Access, Visa, Connect, Amex, Diners. Service dept. BADA MEMBER

HAMPSHIRE AUDIO LTD, 2-12 Hursley Rd, Chandlers Ford. (0703) 252827/265232. Quality CD and analogue agencies 5 dem studios. Large free car park. BADA MEMBER

HOPKINS HI-FI, 38/40 Fratton Rd, Portsmouth PO1 5BX. (822155) 830753. Technics, Quad, Monitor Audio, Tannoy, Denon, Nad, Heybrook, Ariston, Onkyo, plus others. Dem facilities, appointments necessary. Access, Visa. 9-5.30. Open to 6 Thurs. Closed Wed. Service dept.

HERTFORDSHIRE

ACOUSTIC ARTS Ltd, 101 St Albans Rd, Watford, Herts. (0923) 45250. A&R, Audiolab, Denon, Magneplanar, Quad, Rogers, Meridian, TDL, Jadis, Krell. Mon-Sat 9.30-5.30. BADA MEMBER

THE AUDIO FILE, 40 Hockerill St, Bishops Stortford, Herts CM23 2DW. (0279) 506576. 9.30-5.30 6 days. Linn, Roksan, Rega, Naim, Denon, Mission, Cyrus, Marantz, Quad, Tannoy, Sony. 2 dem rooms. Home trial, free installation service dept. Interest free. Bada Charge Card. BADA MEMBER

ISLE OF MAN

ISLAND COMPACT DISC CENTRE, Parliament Square, Ramsey. (0624) 815521. Musical Fidelity, Sugden, Celestion, Harman Kardon, Teac, Castle Acoustics, Philips, A&R, JBL, Luxman, Bose, Sansui. Mon-Sat 9-5.00. Dem and home trial facilities. Free installation. Full credit, no limit. Access, Elite. Service dept.

KENT

JOHN MARLEY HI-FI CENTRES, 2 Station Rd West, Canterbury. (Canterbury) 69329. Also at Dover - (0304) 207562. B&W, Heybrook, Magnum, M.Y.S.T., Nakamichi, Pink Triangle, Rotel, Sansui, Technics, Quad. Dem and home trial facilities. Mon-Sat 9-5.30 closed Thurs. Free installation. Credit to £1,000. Access, Visa, Creditcharge. Service dept.

VJ HI-FI, 29 Guildhall St, Folkestone. (0303) 56860. Mon-Sat 9-6. NAD, Yamaha, Marantz, Cambridge Audio, Denon, Kenwood, Rogers, Dual, N.V.A., Quad. Dem and home trial facilities, free installation, credit to £1000. Amex, Diners, Visa, Access Service dept.

PHOTOCRAFT HI-FI, 40 High St, Ashford. (0233) 624441. No. 1 in Kent for Linn, Naim, Rega, Roksan, Exposure, Onix, Epos, Royd, Creek. But before you choose equipment choose where to buy it. Dem room, appts. necessary. Home trial and free installation. Visa, Access, Bada Chargecard. 9-5.30 Mon-Fri (Wed & Sat to 5 only). Service Dept.

LANCASHIRE

MONITOR SOUND, 54 Chapel St, Chorley. (02572) 71935. A&R, Dual, Mission, Quad, Rogers, Rotel, Spendor, Thorens, Nakamichi, Yamaha, etc. 2 dem rooms. Open Mon-Sat, closed Weds. Free installation. Credit to £1,000. Access, Visa Service dept.

LEICESTERSHIRE

SOUND ADVICE, The Sound Factory, Duke St, Loughborough LE11 1ED. (0509) 218254. A&R, Creek, Linn, Epos, Mission, Cyrus, Naim, Rega, Roksan, Rotel, Yamaha. Dem facilities, appointment reqd. Mon-Sat 9.30-6. Free installation. Credit facilities. Access, Visa, Amex. Service dept. BADA MEMBER

ALPHA AUDIO, 1-3 Guildhall Lane, Leicester, LE1 5FQ. (0533) 518597 or 530330. Aiwa, Akai, Ariston, Bose, Cambridge, Celestion, Denon, Harman Kardon, Musical Fidelity, Rotel, etc. Mon-Sat 9.30-5.30. Free installation. Credit to £1,000. Dem facilities. Access, Visa.

MJS HI-FI, 80 Stapleton Lane, Barwell, Leicester LE9 8HE. (0455) 46977. The Rock, Audio Innovations, Kelvin Labs, Snell, Helius, Sugden, Ruark, Concordant, Valdi, JPW. Our main aim is for our customers to enjoy music. Dem and home trial facilities. Mon-Sat 9.30-7.00. Free installation and service dept. Visa, Access.

THE LEICESTER HI-FI CO, 6 Silver Walk, St. Martins Square, Leicester LE1 5EW. (0533) 539753. 6 days 9.30-5.30. A&R Cambridge, Heybrook, Marantz, Mission, Musical Fidelity, Nakamichi, QED Hi-Fi, Quad, Revox, Roksan "and oodles more". Largest selection in Leicestershire. 2 dem rooms. Home trial arranged + free installation. Credit facilities. Hi-Fi Markets, Access, Visa, Am. Exp. Service dept.

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BOSTON HI FI CENTRE, 65a Wide Bargate, John Adams Way, Boston, Lincs PE21 6SG. (0205) 65477. Quad, Naka-

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michi, Creek, Ariston, NAD, Denon, Marantz, Castle, JPW, B&W. Separate demo studio. Home trial, free installation, service department. Access, Visa, Hi-Fi Markets Chargecard. Tues-Sat 9-5.30 pm.

LONDON

A.T.LABS, 159 Chase Side, Enfield, Middlesex. (01) 367 3132. Mon-Sat 10-6. Two single speaker dem rooms. Service dept, car park. Amex, Visa, Access. BADA MEMBER

AUDIO T, 190 West End Lane, London NW6. (01) 794 7848. Mon-Sat, 10-6. Two single speaker dem rooms. Access, Amex, Visa. BADA MEMBER

CORNFLAKE SHOP, 37 Windmill Street (just off Tottenham Court Road), London W1. (01) 631 0472. Mon-Sat 10-7. DNM, Epos, Koetsu, Marantz, Naim, PS Audio, Rega, Roksan, SME, Yamaha. 2 dem rooms; full delivery and installation. Credit facilities. Access, Visa.

COVENT GARDEN RECORDS, 84 Charing Cross Road. (01) 379 7635/7427. Quad, B&W, Meridian, Mission, Yamaha, Sony, A&R Cambridge, Nakamichi, Rotel, etc. Dem facilities - no appointment reqd. Mon-Sat 10-7.30. Home trial facilities, free installation. Access, Visa, American Express, Diners Club. Service dept. BADA MEMBER

DOUG BRADY HI-FI, 14-18 Monmouth St, London WC2H 9HB. (01) 379 4010. Wide range of top specialist hi-fi from Britain, America and Japan. 3 Dem rooms. BADA MEMBER

GRAHAMS HI-FI, Canonbury Yard, 190a New North Rd, London N1 7BS. (01) 226 5500. 'FBA Dealer of the year 1985'. Linn, Naim, Rega, etc. £300-£3,000-£13,000. BADA MEMBER

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KAMLA ELECTRONICS, 251 Tottenham Court Road, London W1. (01) 323 274. Amadens, Ariston, B&Q, Gale, Incatech, JPW, Linn, Mordaunt-Short, SME, Systemdek, Thorens, Townshend, Ruark, Wharfedale.

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RICHER SOUNDS 2, 6 London Bridge Walk, London SE1. (01) 403 1988. Major names in esoteric hi-fi, unusually matched to discount offers and special end-of-line purchases. Dem facilities, expert advice, free local delivery & installation (£500+), plus 2 Yr G'tee. Hi-fi Guide and monthly Newsletters; part exchange. Mon-Fri 10-7, Sat 10-5. Access, Visa, Richer ChargeCard. Service Department.

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A.T. LABS, 173-175 Station Rd, Edgware, Middx. (01) 952 5535. Mon-Sat 10-6. 2 single speaker dem rooms. Access, Visa, Amex. BADA MEMBER

UXBRIDGE AUDIO LTD, 278 High St, Uxbridge, Middx UB8 1LZ. (0895) 30404 (Multi-line). A&R, AR, Ariston, Creek, Cyrus, Denon, Dual, JPW, KEF, Manticore, Meridian, NAD, Nakamichi, Quad, Rotel, Wharfedale, Yamaha, etc. 2 dem rooms. Mon-Sat 10-6. BADA MEMBER

HARROW AUDIO, 27 Springfield Rd, Harrow. (01) 863 0938. Mon-Sat 9.30-5.30. A&R, Audiolab, Cyrus, Denon, Dual, Heybrook, Linn, Monitor Audio, Musical Fidelity, Quad, Rotel, Tannoy etc. BADA MEMBER

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IN CONCERT HI-FI, 144 Seaview Road, Wallasey, Wirral, Merseyside. (051) 630 5055. Denon, Kenwood, QED, Alexander, Spica, Shan Acoustics, Monitor Audio, Tannoy, Audio Dynamics, Dual, Systemdek, Ortofon, Audio Technica, Target, Musical Fidelity, Alphason. Single speaker dem room. Home trial + free installation. 10-6 - closed Mon. Open till 8pm Thurs and Fri.

W.A. BRADY & SON, 401 Smithdown Rd, Liverpool L15 3JJ. (051) 733 6859. 'Largest choice of specialist Hi-Fi in N.W. £100-£20K'. All credit cards. 3 dem rooms. Closed Monday. BADA MEMBER

PURE SOUND - Birkenhead 051 645 6690 24hrs. Acoustic Energy, Aragon, Audio Technica, Beard, Celestion, Deltac, Denon, Michel, Cyrodec, Ortofon, SME. Home demonstration a pleasure, plus evenings and weekends (Sundays by appointment).

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SOUND APPROACH, 161 Unithank Road, Norwich. (0603) 622833. Kuzma, Ariston, Castle, Denon, Exposure, Ion, Royd, NVA, QED, Roksan, Ruark, Revolver, etc. etc. Dem and home trial facilities. Mon-Sat 9-6.30. Free installation. Credit to £1,500. Visa, Access, Diners Club. Service dept.

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CLASSIC HI-FI + VIDEO, School Lane, Kettering, Northants. (0536) 515766. ADC, Marantz, Onkyo, Sansui, Teac, Harman Kardon, Pioneer, Proton, Ariston, Thorens, Mantra, Goodmans, Castle, JPL, Mordaunt Short, Seleco TV, Monitor Cable + others.

THE AUDIO SHOP, Coffee Tavern Court, High St, Rushden. (0933) 56651. Audio Technica, Denons, Goodmans, Rotel, Tannoy, Ion Systems, Thorens, Gale, BLQ, Royd. Dem room. Home trial and free installation. Mon-Sat 9.30-5.30 (Thurs 9.30-2). Service dept.

NOTTINGHAMSHIRE

DEFINITIVE AUDIO, Nottingham. (0602) 813562. Voyd, Valdi, Systemdek, Helius, Audionote, Golding, JPW, Snell, Target, Pirate. Home demonstrations throughout Nottingham and East Midlands. Please telephone (0602) 813562 for further information.

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RICHER SOUNDS 2, 12 Smallbrook Queensway, Birmingham B5 4EN. (021) 643 6664. Popular esoteric hi-fi for upgrades, monthly special offers. Dem facilities, expert advice, free local delivery/installation (£500+), 2 Yr G'tee. Hi-Fi Guide and monthly Newsletters; part exchange. Mon-Fri 10-6, Sat 10-5. Access, Visa, Richer ChargeCard. Service Dept.

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FIVEWAYS HI-FIDELITY LTD, 12 Islington Row, Edgbaston, Birmingham. (021) 4550667. Alphason, A&R, Denon, Meridian, Musical Fidelity, Nakamichi, Quad, Revox, TDL, Thorens, etc. Dem and home trial facilities. Tues-Sat 9.30-6. Free installation. Access, Visa. Service Dept.

BRIDGE HI-FI, 3 Tudor House, Bridge St, Walsall. (0922) 640456. NAD, Dual, Yamaha, Kenwood, Technics, Pioneer, Mission, Celestion, Denon, Mordaunt Short. Appts required. Home trial and free installations. Access, Visa, Diners, Amex. Credit to £1,000. 9.15-5.30 Mon-Sat. Service dept.

OXFORDSHIRE

ABSOLUTE SOUND AND VIDEO, 19 Old High St, Headington, Oxford. (0865) 65961. A&R, Denon, Linn, Mission, NAD, Rotel, Yamaha. Also 256, Banbury Rd, Summertown. BADA MEMBER

ASTLEY AUDIO LTD, 3 Marketplace, Wallingford. (0491) 39305/34349. AR, Dual, Kenwood, Mordaunt-Short, Mission, Monitor Audio, Philips, Technics, Tannoy, Yamaha. Tues-Fri 9-5.30, Sat 9-5. Records, tapes, 1000+ CD's. Service Dept. Access, Visa, Diners.

WESTWOOD AND MASON, 46 George St, Oxford. (0865) 247783. Linn, Naim, Rega, A&R, Heybrook, Dual, Mordaunt-Short, Mission, Tannoy, Quad, etc. BADA MEMBER

WITNEY AUDIO & VIDEO, 28 High St, Witney, Oxford. (0993) 2414. A&R, Aiwa, Akai, Bose, Denon, Dual, Goldstar, JBL, Mordaunt-Short, NAD, Pioneer, Sony, Yamaha. Dem facilities. Mon-Sat 9-5.30. Free installation, credit to £1,000. Access, Visa. Service dept.

OXFORD AUDIO CONSULTANTS LTD, Cantay Hse, Park End Place, Oxford OX1 1JE. (0865) 790879. Oxford Acoustics, Audio Research, Krell, Magneplanar, Apogee, Aragon, Stax, Marantz, Wharfedale, Cambridge Audio. Home trial and free installation. Instant Credit. Access, Amex, Visa. 10-6 Tues-Sat. Service dept.

HORNS OF OXFORD LTD, 6 South Parade, Summertown, Oxford. (0865) 511241. Alphason, Ariston, B&W, Celestion, Marantz, Nakamichi, Pink Triangle, Quad, Sony, Technics. Free installation. Service dept. Access, Visa. 9-5.30. Closed Thurs. BADA MEMBER

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AVON HI-FI Ltd, 12 Barker St, Shrewsbury. (0743) 55166. A&R, B&W, JBL, Dual, NAD, Nakamichi, Revolver, Trio, Quad, Yamaha. Dem and home trial facilities. Mon-Sat 9-5.30, closed Thur. Free installation, credit to £1,000. Access, Visa. Service dept.

MID SHROPSHIRE AUDIO, 24 Peverill Bank, Dawley, Telford. (0952) 502828. Agencies include Alphason, Apollo, Ariston, Audio Innovations, Goldring, Ion Systems (full range), Marantz, Michell, Ortofon, QED, Royd, Ruark, Sansui, Sennheisser, SD Acoustics, SME, Target. Guaranteed used equipment also available. Free delivery nationwide. Mail Order. Access/Visa. Credit facilities. Part exchange.

CREATIVE AUDIO, 9 Dogpole, Shrewsbury. (0743) 241924. Marantz, Meridian, Linn, Naim, A&R, Mission, Nakamichi, Revolver, Castle, Audio Technica. Dem room. Home trial and free installation. Credit to £1000. Access, Visa. Tues-Sat 9.30-5.30. Service dept.

SOMERSET

WATTS RADIO - THE ENGINEERS, Jim Badman, 1 West Street, Somerton. (0458) 72440. Castle, Dual, Denon, KEF, Mordaunt-Short, Ortofon, Quad, Rogers, Thorens, Yamaha. Dem and home trial facilities. Mon-Sat 9-1, 2-5.30, Wed 9-1. Free installation. Credit to £1,000. Access, Visa. Service dept.

STAFFORDSHIRE

GRANGE HI-FI LTD, 153 Branston Road, Burton-on-Trent. (0283) 33655. Pink Triangle, Voyd Valdi, Marantz, Audiophile, Systemdek, Audio Innovations, A&R Cambridge, Quad, Rotel, Snell, Manticore, etc. 2 dem rooms.

Mon, Tues, Thurs, Fri, Sat. 9-6. Closed Wed. Free installation. Credit facilities. Visa, Access. Service dept.
ACTIVE AUDIO, 29 Market Street, Tamworth, Staffordshire. (0827) 53355. Arcam, Ariston, Celestion, Denon, Heybrook, Kef, Cyrus, Musical Fidelity, Marantz, Revox, Rotel, Rogers, etc. etc. Demonstration and home trial facilities. Account and credit cards. Ring for opening times and free 'Fact Pack'. BADA MEMBER **BA**

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SURREY

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ROGERS HI-FI, 13 Bridge Street, Guildford (0483) 61049. Ariston, Acoustic Research, Akai, Denon, JPW, Mordaunt-Short, Marantz, Onkyo, QED, Tannoy etc. Mon-Sat 9.30-6. Dem. facilities. Instant Credit. Access, Visa Service dept.

SURBITON PARK RADIO, 48 Surbiton Rd, Kingston-Upon-Thames, Surrey. (01) 546 5549. Quad, Dual, Denon, Kenwood, Nakamichi, Rotel, Pioneer, QED, B&W, Tannoy, Mordaunt Short, Castle, KBL. Dem and home trial facilities. Access, Visa. 9.30-5.00 Tues-Sat. Service dept.

TRU-FI SOUND AND VISION, 2 Central Parade, Redhill, Surrey. (0737) 767400/766128. Akai, Aiwa, B&W, Nakamichi, JPW, Mission, Mordaunt-Short, Nagaoka, Sony, Technics. Dem. facilities. Mon-Sat 9.30-6. Free installation, credit to £1,200. Access, Visa. Service dept.

UNILET PRODUCTS Ltd, 35 High St, New Malden, Surrey KT3 4BY. (01) 942 9567. Mon-Sat 9-6. Thurs 9-7. Dem facilities. Large stock. Amex, Access, Diners, Visa.

SPALDINGS HI-FI, 352-4 Lower Addiscombe Rd, Croydon, Surrey. (01) 654 1231. A&R Cambridge, Audiolab, Denon, Linn, Marantz, Mission, Musical Fidelity, Meridian, Naim, Quad. 3 dem rooms and home dem. Free installation, credit facilities. Twice nominated Sony E.S. Hi-Fi Dealer of the Year. Mon-Sat 9-6, Tues to 8. Closed Wed. Service dept. BADA MEMBER **BA**

TRU-FI SOUND & VISION, 10 Church St, Leatherhead, Surrey. (0372) 378780. Sony, Technics, Panasonic, Mitsubishi, Ferguson, Aiwa, Pioneer, Sanyo, B&W, Mission, Wharfedale. Free installation. Credit facilities. Access, Visa. 9.15-5.30 Mon-Sat. Closed Wed. Service dept.

SUSSEX (EAST)

DEFINITIVE AUDIO BRIGHTON, 30 Islingwood Street, Brighton, East Sussex BN2 2UR. (0273) 672796. Voyd, Systemdek, Helius, Audio Note, JPW, Snell, Pirate Stands, Goldring, etc. Wed-Sat 11-7. Home dems throughout Sussex. Credit facilities. Visa.

JEFFRIES HI-FI, 69 London Rd, Brighton, East Sussex. (0273) 609 431. 2 dem rooms, closed Mon, late night Wed. Parking, bus route. Credit facilities. BADA MEMBER **BA**

JEFFRIES HI-FI, 4 Albert Parade, Green St, Eastbourne, East Sussex. (0323) 31336. 2 dem rooms, closed Mon. Late night Wed. Parking, bus route. Credit facilities. BADA MEMBER **BA**

HASTINGS HI-FI, 31-32 Western Rd, St Leonards On Sea. (0424) 442975. A&R, B&W, Mission/Cyrus, NAD, Nakamichi, Quad, Rotel, Systemdek, Tannoy, Yamaha. 2 dem rooms. Mon-Sat 9-6. Home trial facilities. Free installation. Credit facilities. Access, Amex, Visa. Service dept.

SUSSEX (WEST)

BOWERS AND WILKINS Ltd, 1 Becket Buildings, Littlehampton Rd, Worthing (0903) 64141. B&W, Cambridge, Dual, JVC, Mordaunt-Short, Nakamichi, Philips, Shure, Quad, Sony, Technics. 2 dem rooms. Mon-Sat 9-5.30, Weds 9-1. Home trial facilities, free installation, credit to £1,000. Access, Visa. Service dept.

CHICHESTER HI FI, 40 Little London, Chichester PO19 1PL. Tel: (0243) 776402. Linn, Naim, Rega, Creek, Nakamichi, A&R, Denon, Roksan etc. Tues-Sat, 10-1, 2-5.15 (closed Mon). BADA MEMBER **BA**

TYNE & WEAR

RED RADIO SHOP AND HI-FI CENTRE, 11 Olive St, (Off Park Lane) Sunderland. (Sunderland) 5672087. Bose, Castle, Denon, JVC (Hi-Fi and Portable TV), Luxman, Michell, Mordaunt-Short, Pickering, Tannoy. Dem facilities. Mon-Sat 9-5.30. Free installation, interest free credit. Visa. Service dept.

LINTONE AUDIO LTD, 7-11 Park Lane, Gateshead. (091) 477 4167. Linn, Naim, Rega, Musical Fidelity, Audio Lab, Quad, Cyrus, Denon, Nad, plus all leading Japanese manufacturers. Dem and home trial facilities. Free installation. Access, Visa, Amex, Diners. Credit to £1000. 9-6 Mon-Sat. Service dept. BADA MEMBER **BA**

WILTSHIRE

ABSOLUTE SOUND AND VIDEO, 60 Fleet Street, Swindon. (0793) 38222. A&R, Denon, Dual, Linn, Meridian, NAD, Rotel, Technics, Yamaha. (Closed Wed). BADA MEMBER **BA**

YORKSHIRE (NORTH)

ELITE HI-FI, 178 Kings Road, Harrogate HG1 5JG (0423) 521 831. Voyd, Valdi, Avalon, Systemdek, Helius, Audionote, Goldring, Audio Innovations, Sugden, Marantz, Mordaunt-Short, JPW, Infinity, Snell. Mon-Sat 9-5.30. Free installation. Service dept.

THE AUDIO CLINIC, 2A Brunswick St, Bishopthorpe Rd, York YO2 1ED. (0904) 646309. ADC, Allison, Hafler, JPW, Luxman, Proton, Quart, Studio Power, Systemdek, Thorens and more. Second hand hi-fi available. Appt's req'd, home trial and dem facilities. Free installation. Access and Visa. 10-5 Mon-Sat. Service dept.

SCARBOROUGH HI-FI CENTRE, 53 Dean Road, Scarborough YO12 7SN. (0723) 374547. A&R, Bose, QED, Denon, Nad (incl. Monitor series), Thorens, Onkyo, Tannoy, Marantz, Ruark. Dem Room. Appts preferred. Home trial facilities. Mail order and part exchange. Visa, Access, Diners, Hi-Fi Markets, 6 months interest free credit. 10-6 Tues-Sat.

RICHER SOUNDS, 6 Feasegate, York YO1 2SQ. (0904) 645535. Probably the smallest hi-fi store in York; but stocks the A-Z of popular budget hi-fi at special discount prices. Facilities: expert advice; free 48 page Hi-fi Guide and monthly Newsletters; mail order; part exchange. Mon-Fri 10-6, Sat 10-5. Access, Visa, Richer ChargeCard.

YORKSHIRE (WEST)

AUDIO PROJECTS, 45 Headingley Lane, Leeds. (0532) 304565. A&R, Audiolab, Creek, Heybrook, Linn, Musical Fidelity, Naim, Quad, Rega, etc. Tues-Fri 9.30-6, Sat 2.30-5.30. BADA MEMBER **BA**

ERRICKS, Hi-Fi Experience, Fotosonic House, Rawson Square, Bradford (0274) 309266. Dem facilities. Sales/service agents for A&R, Linn, Quad, Naim, Nakamichi, Mission etc. BADA MEMBER **BA**

HUDDERSFIELD HI-FI CENTRE, 4 Cross Church St, Huddersfield. (0484) 544668. B&W, Kenwood, Denon, Dual, A&R Cambridge, Musical Fidelity, Quad, NVA, Audio Lab, Philips, Mission, etc. Dem facilities - appointment reqd. Mon-Sat 9-5.30, Thurs 9-8. Closed Wed. Free installation, credit facilities. Access, Visa.

IMAGE HI-FI Ltd, 8-10 St Annes Rd, Headingley, Leeds. (0532) 789374. AR, Audio Lab, Denon, Linn, Marantz, Meridian, Mission, Monitor Audio, NAD, Quad. BADA MEMBER **BA**

RICHER SOUNDS, 55 The Headrow, Leeds LS1 6LR. (0532) 455717. Affordable special deals on every big budget line from Akai to Yamaha; separates & systems. City centre store opposite Lewis's. Facilities: expert advice; free 48 page Hi-fi Guide and monthly Newsletters; mail order; part exchange. Mon-Fri 10-6, Sat 10-5. Access, Visa, Richer ChargeCard.

SELECTIVE AUDIO, The Forge Cottage, 19 Crossgate, Otley. (0943) 467689. Exclusively handles Alphason, Roksan, NVA, ProAc, TDL, JDI, in the area and other minimalist British designer products for the discerning listener. Dem facility. Member of the Cognoscenti. Mon-Sat 10-6.

IRELAND

CEOL PRODUCTS, 185 Lower Rathmines Road, Dublin 6. Tel: 0001 975984 961358. Alphason, Ariston Acoustics, ATC, Audio Innovation, Epos, Exposure, Heybrook, JPW, Linn, Marantz, Monitor Audio, Mordaunt Short, Musical Fidelity, Naim, Quart, Rega, Roksan, Sound Organisation, TDL. Single Speaker listening rooms. Free installation. All major cards. Mon-Sat 9.30-6.00.

CLONEY AUDIO, 34 Main St, Blackrock, Co. Dublin. 0001 889449. Linn, Naim, Roksan, Rega, Rogers, Spendor; Musical Fidelity, Cambridge Audio, Accoustat. Tues-Sat 10-6, Thurs & Fri til 9. Free installation. Visa, Access. Service dept.

SCOTLAND

EDINBURGH

RICHER SOUNDS, 1B Chambers St, Edinburgh EH1 1HR. (031) 226 3544. Discount hi-fi near the Royal Scottish Museum; affordable culture with monthly special offers on major names. Facilities: expert advice; free 48 page Hi-fi Guide and monthly Newsletters; mail order; part exchange. Mon-Fri 10-6, Sat 10-5. Access, Visa, Richer ChargeCard.

BILL HUTCHINSON Ltd, 43 Clarke St, Edinburgh. (031) 667 2877. AR, Aiwa, Denon, Dual, JVC, Mission, Mordaunt-Short, Omar, Technics, Yamaha. Dem facilities. Mon-Sat 10-6. Free installation. Instant credit. Credit cards: Access, Visa. Service dept.

GLASGOW

RICHER SOUNDS, 24 Gordon St, Glasgow G1 3PU. (041) 221 9147. The affordable hi-fi alphabet in an unpretentious atmosphere; regular special offers. Facilities: expert advice; free 48 page Hi-fi Guide and monthly Newsletters; mail order; part exchange. Mon-Fri 10-6, Sat 10-5. Access, Visa, Richer ChargeCard.

STEREO STEREO, 278 St. Vincent St, Glasgow G2 5RL. (041) 248 4079. Linn, Naim, Rega, Arcam, Creek, Epos, Exposure, Revox, etc. Mon-Sat 10-6. Interest free credit. BADA MEMBER **BA**

BILL HUTCHINSON Ltd, 43 Hope Street, Glasgow. (041) 248 2857. A.R., Aiwa, Denon, Dual, JVC, Mission, Mordaunt-Short, Omar, Technics, Yamaha etc. Dem facilities. Mon-Sat 10-6. Free installation, instant credit. Access, Visa. Service dept.

GRAMPIAN

HOLBURN HI FI Ltd, 441 Holburn St, Aberdeen (0224) 585713. Linn, Rega, Quad, Audiolab, Mission Cyrus, Rotel, QED, NAD, Krell, Nakamichi, Denon, Sony, KEF, Wharfedale, Monitor Audio, Kenwood, etc. 9.30-5.30 Mon-Sat. BADA MEMBER **BA**

WALES

GLAMORGAN

AUDIO EXCELLENCE, 134 Crwys Road, Cardiff. (0222) 28565. Audio Research, Dual, Krell, Linn, Magneplanar, Naim, NAD, Yamaha, etc. Closed Mon.

AUDIO EXCELLENCE, 9 High St, Swansea. (0792) 474608. Audio Research, Dual, Krell, Linn, Magneplanar, Naim, NAD, Yamaha, etc. Closed Mon. BADA MEMBER **BA**

RICHER SOUNDS, 5 Central Square, Cardiff CF1 1EP. (0222) 383311. From Akai to Yamaha on a budget - regular end of line special offers. Facilities: expert advice; free 48 page Hi-fi Guide and monthly Newsletters; mail order; part exchange. Mon-Fri 10-6, Sat 10-5. Access, Visa, Richer ChargeCard.

GWENT

A. E. HUGHES & SONS LTD, 28 Clarence Place, Newport. (10633) 58851. Bang & Olufsen, Kenwood, Mordaunt-Short, Roberts Radio, Dynatron, Mitsubishi, Sheraton. Cabinets plus audio accessories. Dem and home facilities. Free installation. Access and Visa. 9-12.45, 2.15-5.30 Mon-Sat. Service dept.

THE DIRECTORY

The *Hi-Fi Choice Directory* was conceived as a reference guide to all the audio products reviewed by *Choice* that are currently available. The products are split into suitable categories, each with its own introduction containing information about the product type and its applications. They are particularly relevant to the uninitiated first time buyer and help sort out the order of priorities when buying a piece of equipment.

Each product along with its retail price is placed in its respective category in alphabetical order. For instance the Acoustic Research *EB101* is presently at the beginning of the Turntables and Tonearms section; however, the Ariston *RD90 Superior* heads the Motor Units section as it is sold and was reviewed as a separate component – requiring a separate arm. Where there are several products with the same name but different model numbers these are in price ascending order.

Then come the ratings for the standard achieved in laboratory and listening tests, with the exception of certain product groups where lab tests were not carried out. One important point to remember is that they cannot be used to compare products from different categories – *ie* a cassette deck rated 'excellent' in sound quality will not usually offer the same standard of fidelity as a similarly rated

turntable or CD player (unless you can get hold of first generation copies of the master tape!).

The Comments column contains a potted summary based on the original review, emphasising the salient points of a product's character and sonic performance. The space available doesn't allow for great detail but in the 20 or so words we have attempted to put across the essence of the review, in some cases using quotes from the review itself. Obviously, important information on compatibility or auxiliary equipment used in the test cannot be included, and it is best to refer to the original review for this, of which more later.

The next column(s) varies from category to category but is usually either features or specifications, the former being facilities available on a cassette deck or amplifier or the type of drive system on a turntable.

Specifications vary with product type but usually relate to suitability or capability, for instance arm matching figures are given with the cartridges which tie in with the mass figures for the tonearms themselves, making it easier to avoid compliance/mass mismatches.

Perhaps the most influential letters in the Directory are those found in the Value column, the *Rs* and *Bs* denoting the Recommended and Best Buy ratings that are appended to products we consider meritworthy. The Best Buy tag means that a product not only offers good sound quality but is reasonably priced as well. With source components a price limit of approximately £300 is usually used as a

guide. Recommended means that either the performance of a product is particularly good irrespective of price or, alternatively that a good value standard is achieved but overall attainment falls short of Best Buy classification. An ideal situation would be to choose suitably priced Best Buy or Recommended products from relevant categories and create a Best Buy system, but, due to the variety in tonal balance that exists in much audio equipment (especially the electromechanical elements – *ie* cartridge and speaker) system building is not quite that simple. These ratings make a useful guideline for shortlisting components, but only experiencing the actual combination will tell you whether it works for you.

The final column contains a reference to the issue of *Hi-Fi Choice* which featured the complete review. If you wish to get a better idea of a product by reading the complete review it is possible to order a copy (if still in print) through our back issues department. Every *Choice* issue contains a Back Issues page for this purpose.

The Directory is constantly updated with the latest reviews and price changes as well as having discontinued products removed. If a listed product is updated to a 'mark two' form and the alterations are purely cosmetic or not too extensive we sometimes leave the product in with its current model number and an asterisk to denote that it has changed since our original review was published.

SYSTEM BUILDING

Pre-packaged one-make systems have been commercially very successful, with advantages like cosmetic consistency, competitive pricing, and (assumed) technical compatibility. However, despite the mass market clout of the consumer electronics 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 nowadays, only likely to rear their heads amongst the most exotic components. Here the delicate art of 'supercompatibility' really takes over the major role and might be regarded as the key to 'real' 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 tuner when funds permit.

There will always be controversy over the relative qualities of LP, CD and cassette. 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.

Cassette has never really challenged vinyl's 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 music cassette material. As a hi-fi 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. 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. It is worth remembering that 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 latest 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.

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 here).

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. 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.

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.

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.

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 are designed to operate close to a rear wall, others a metre or so out into the room, but all loudspeakers benefit from being closely mechanically coupled via proper stands to the floor.

There is some debate about the best form of fixing, 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. 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.

Most decent quality turntables are fairly immune to feedback from loudspeakers, so it should not matter too much if these items are sited fairly close to each other. Indeed it is debatable whether any advantages gained from keeping the turntable well away are not lost through the need to use longer connecting cables.

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.

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 question can create a good sound in his own shop. If he can't, there is precious little chance of him doing so in your home. The best dealers should lay on demonstrations so you can hear the differences between components for yourself, and hear the sort of improvements which can be had at different price strata. You can then establish the sort of performance you are prepared to accept within whatever budgetary constraints you have set.

The Directory has been compiled so that it can be used by *Choice* readers as a buying guide. A guide in the sense that you should use the information in it to make a shortlist of equipment suited to your needs and budget, and then audition it at a dealer's before taking the plunge. Because tastes inevitably differ it would be unwise to buy purely on the basis of our recommendation and dealers are the most experienced people around when it comes to making systems work as a whole.

THE DIRECTORY

TURNTABLES & TONEARMS

The schizophrenic split between consumer electronics and 'real hi-fi' is most obvious amongst turntables. The former are supplied simply as a means of playing vinyl in a system context. Cheaply manufactured in the Far East, these are complete players with a variety of automatic facilities, sometimes tied into system remote control. But engineering compromises severely limit sound quality, cartridge choice may be P-mount restricted, and such machines are rarely stocked by specialist hi-fi dealers these days.

Specialist turntables offer big sound quality

improvements, but lack so-called convenience features (that practised users often find irksome). Such turntables at the cheaper end of the market (sub-£350) tend to be supplied with matching tonearm, and often include a 'starter' cartridge. Still better quality is found at higher prices amongst the separate motor units and tonearms. Careful partnering and set-up is essential for these individual components, but 'naturally sympathetic' combinations do exist, and the good dealer can help.

Listed separately as integrated players and as turntable motor units and tonearms, our **sound**

quality rating is based on results achieved using a high quality system – but in point of fact the turntable is usually the limiting factor soundwise in any system. **Lab performance** summarises the speed stability, vibration generation and environmental isolation of turntables, along with the friction, alignment and adjustment of tonearms. The tonearm's physical characteristics also define a range of mechanically compatible cartridges (see cartridge listings).

INTEGRATED TURNTABLES

NAME PRICE	LAB SOUND	COMMENTS	FEATURES ARM EFF. MASS	VALUE	BACK ISSUE FULL REVIEW
Acoustic Research EB101 £230	Good Good	This genuine high fidelity product offers an impressive package at a competitive price	Subchassis, manual, 13.5g	BB	48
Alphason Solo/Xenon MCS £365/£262	Average+ Good	The deck is warm and euphonious with high levels of clarity. Wow artefacts occasionally just audible.	3 point suspended motor unit, optional quartz PSU/speed change 13g		67
Alphason Sonata/HR-100S-MCS £720/£480	Excellent Very Good	Highly capable audiophile system with real resolution and control. Bass is powerful and dynamic ability unbridled	Manual, subchassis, belt drive, 10g	R	60
Ariston Q-Deck £150	Good Average+	Well engineered and good sounding low cost package which is both easy to set up and to use	Semi-auto, belt drive, solid	BB	67
Ariston Forte £350	Below Average Average	Heavy on engineering, short of soul? The Forte almost makes it, losing out only because of some residual pitch variations and a lack of bass power. The arm is modestly good	Manual 2-speed belt drive player and detachable arm, 10g		67
Dual CS430 £89	Average Below Average	Ragged, sometimes unpleasant cartridge mixes with a modest pleasing player in a very sharply priced package.	Belt drive, with cartridge, auto return, 5g	R	67
Dual CS503-1 £114	Poor Average	Slated as a replacement for the CS505, the 503-1 needs careful system matching to mask rumble and microphony, but is good enough to benefit from a better cartridge	Semi auto, belt drive, low mass arm	R	55
Dual CS505-3 £139	Very Good Good	Continuous steady improvements have kept this model at the forefront of the budget market. Practically is excellent and the deck has excellent timing bass/mid and stereo imaging	Semi-auto belt-drive, 8g	BB	67
Dual CS5000 £200	Average Average+	The rare 78 facility may give grandma's collection a new lease of life but the player did not merit recommendation on price vs sound	Electronic, belt drive, subchassis, 10g		48
Goldmund ST4 £4,550	Very Good Excellent	The Studio turntable takes on a cheaper tonearm than the T3F, yet provides a similar reference standard objective and subjective performance at £2,000 less, in a neatly integrated though bulky package.	Solid subchassis, direct drive, parallel arm, detachable headshell	R	60
Heybrook TT2 turntable & arm £349/£249	Average Good+	A gradual process of informed evolution and a sensibly designed arm combine to make this a good sounding middle of the road package. Well supported by dealers	Manual subchassis motor with arm, belt drive, 14g	R	67
JVC AL-FQ555 £170	Below Average Poor	Clear midband sound but woolly bass and crude treble. Ease of use however ranks highly, and there's little to be out of adjustment	Auto, direct drive, 5.5g		67
Kenwood DP-990 £300	Average Average	Smart, slick and massive player suitable for low compliance cartridges only. A good but not inspired performer.	Semi-auto 2 speed direct drive, 16g		67
Kuzma Stabi/Stogi £575/£349	Average+ Stabi: Good; Stogi: Excellent	Stabi is powerful, spacious but not sufficiently subtle. Stogi is an excellent all rounder with even spread of abilities.	Manual, belt drive, subchassis. 12.5g	Stogi: R	60
Linn Axis £379	Good+ Good+	Setting new performance-for-price standards this cleverly engineered and competent deck has many of the qualities of the Sondek LP12	Electronic, belt drive, semi subchassis, 13g	BB	48/Coll
Linn Sondek/Iitok (Troika) £509/£429 (£669)	Excellent Excellent	Superb sound – the best LP12 combination yet. The Troika gives the system real solidity and strength, stretching the deck and arm qualities to the full	Manual subchassis player, belt drive, 14g	R	60
Manticore Mantra £325/£403 (Arm)	Good+ Good+	Fitted with a Rega RB250 arm variant and AT95E cartridge the Mantra fared very well indeed with a fine midrange and good focus	Subchassis, 12g, manual	BB	48/Coll
NAD5120 £89	Average Average	A number of running improvements have given this player a range and tautness denied its lazier sounding antecedents.	Semi-auto belt drive, detachable arm/tube/weight, 9g	BB	67
Omega Point Silver/Black £895/£295	Good Good+	An avowedly stripped down turntable that lacks even an on/off switch, the Omega Point Silver offers fine midrange clarity and good stereo, but some HF compression and a lack of 'wellie'	Manual, solid, belt drive, unipivot, 11g		55
Opus 3/Decca London International (Revised) £399/£99	Poor Good	Heavyweight motor unit with many fine properties, but which needs further development. The idiosyncratic arm is a suitable (though not ideal) platform for the Decca cartridge. For all its faults though, the whole transcends the sum of the parts	Belt-drive manual, damped unipivot arm, 12g		67
Rega Planar 2 £155	Average+ Good	A remarkable product at the price, surprisingly articulate and confident	Integrated turntable, manual, 11.5g	BB	48
Rega Planar 3 £207	Good Good	A long time leader in its price category, the '3 (with its excellent RB300 arm) sounded nicely 'musical' in a balanced and coherent manner	Integrated turntable, manual, 11.5g	BB	48
Revolver Rebel £160	Below Average Below Average	Fat, assured and forward presentation, but ragged and subjective speed stability problems. With a little further development, it will be a winner	Manual, 2-speed belt drive inc cartridge, 13g		67
Revox B291 £660	Average— Average—	Sound quality ranks as below average. Subjective bandwidth is narrow and the music lacks grace and energy. Ease of use however is unrivalled	Automatic, remote controllable, direct drive parallel arm, prefitted cartridge		55
Roksan Xerxes/Artemiz/Shiraz £655, £450, £489	n/a Very Good	Imaginatively designed, sophisticated front-end system, a little drier than some perhaps, with superior stereo, resolution and presence	2-speed manual, MC cartridge, 9g	R	72
Sansui SR-222 Mk V £159	Average— Average	More than acceptable in most areas, the Sansui is detailed and positive, though a little muddled when stressed. Best suited to low compliance cartridges	Manual 2-speed belt drive, 16g		67
Systemdek IIX £248	Good Average+	Poised, clean sounding deck, forward and explicit in character. A good value deck under £250, and a relatively cheap and satisfactory suspended model	2 speed belt drive manual turntable and arm, 11g	R	67
Technics SLBD-22 £90	Average— Average—	Not bad for the price and a great improvement on the L20, it performs reasonably when not stretched	Semi automatic, solid plinth, electronic, 6g P-mount	R	48
Technics SL-DD33 £110	Average Average	As with the QD33 though better value	Automatic, direct drive, solid plinth, 7.5g, P-mount	BB	48
Technics SL-L20 £115	Poor Average—	A rather lightweight parallel tracker achieving a poor overall rating, with little to recommend it unless you dig facilities	Electronic, solid plinth, 5g, P-mount		48

TO ORDER BACK ISSUES OF HI-FI CHOICE SEE PAGE 116

THE DIRECTORY

INTEGRATED TURNTABLES

NAME PRICE	LAB SOUND	COMMENTS	FEATURES ARM EFF. MASS	VALUE	BACK ISSUE FULL REVIEW
Technics SL-QD33 £140	Average Average	The quartz speed controlled version of the DD is short on sound quality but not features. But it did have fair focus and some depth	Automatic, Quartz, direct drive, solid plinth, 7.5g, P-mount	R	48
Thorens TD280 £150	Average Average	Extremely competitively priced package with a trace of lower-mid overhang, but it's very well behaved elsewhere	Semi-auto belt-drive 2-speed, 13g	BB	67
Thorens TD166 Mk II £179	Average Average+	A polished and professional design consisting of a first rate budget suspended subchassis turntable and a mildly disappointing arm	Manual 2-speed, 13g	BB	67
Thorens 160S Mk IV £249	Average+ Average+	Fine, familiar suspended player and arm. Faults are few, but include poor arm bearing adjustment. The arm can sound a little messy	Manual 2-speed, 7g	R	67
Thorens TD320 Mk II £349	Good Good	Good, consistent sounding deck with much improved (but not ideal) arm. A little expensive for performance offered	Semi-auto two speed belt drive, 14g		67
Well Tempered Turntable & Arm £1690	Average Very Good	Intriguing and challenging design. Musically it is not ideal, but it has a limpid quality and a lack of artificiality that sets standards as well as turning the ear, though it's not completely uncoloured. A charmer yet mainstream enough in its virtues to be viable	Manual 2-speed, damped, suspended arm, 7.5g	R	67
Zarathustra S4/Pluto SA Prestige/PSU £1500/£2500/£500	n/a Excellent	The very well made and finished heavy platter S4 with the superb Pluto arm make a devastating combination ranking up there with the very best	Subchassis, manual, available without PSU	R	72

MOTOR UNITS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Ariston RD90 Superior £900	Good+ Good	Good but slightly damped sound quality, with powerful and stable bass. The pro quo is a certain lack of pace, energy and resolution	Belt drive, subchassis, electronic		55
Michell Syncro £265	Good Good	A particularly happy blend of qualities endows the Syncro with a blend of subtlety and force – the mailed fist in the velvet glove. Easy on the ear in the best sense.	Manual, belt drive, suspended motor unit	R	67
Michell Gyrodec £595	Good Good	Sweet and natural sounding player, well exploited by the Rega RB300 arm. Aesthetics, and the acres of acrylic, are unique	Manual, belt drive, suspended motor unit		55
NVA Turntable £499	Average Good	A surprisingly fast and assured performer, but with lightweight bass and a little aggressive. Easy to set up, the price (necessarily includes stand	Manual, belt drive subchassis, stand, 33 $\frac{1}{3}$ rpm		60
Oracle Alexandria Mk III £825 – £995	Very Good Very Good	One of the most beautifully presented players made, and fully supported by superb separation, dynamics and a euphonious style of delivery.	Manual 2-speed belt drive	R	67
Oracle Delphi III £1450	Very Good Very Good	Stable imaging, good bass and refined detail, it's well made and consistent in service – but very expensive	Manual, belt drive, subchassis	R	60
Oxford Acoustics Crystal Reference £1995	Very Good Excellent	This big, open and powerful sounding turntable works beautifully with Airtangent arm to give superb 3-D imagery	Manual, belt drive, subchassis, stand	R	60
Pink Triangle PT T00 £650	Good Excellent	A state of the art player, easy to set up but extremely fussy about partnering equipment and state of tune. The test sample suffered flutter derived roughness (presumed not typical)	Manual 2-speed, outboard PSU	R	67
Rega Split Slab Modification Kit £74	Good Good	Clever and cheap upgrade kit that protects the initial investment and which adds clarity and environmental isolation to a fine but microphonic original	Conversion suspended chassis kit for Rega 2/3		67
Roksan Xerxes £655	Excellent Excellent	This unique design cuts a swathe through the conventions of turntable design, providing superb resolution and stereo. Setting up is best left to an authorised dealer	Manual, belt drive, solid/decoupled	R	67
SEE Revolver £135	Average Average	Nicely balanced, but unimpressive timing and lightweight bass made this deck rather average for the price. Manufacturer has since made several changes, but not re-submitted for review	Manual, belt drive, solid plinth		48
Systemdek IIXE £248	Good Good	Fine, honestly specified and well built player which easily betters its closest stablemate, the IIX	Manual 2-speed, external PSU	R	67
Systemdek IV £495	Good Very Good	The level of wow is a theoretical concern at least, but elsewhere this player shines, combining euphony, information and imaging in a polished, untemperamental package	Two-speed manual belt drive	R	67
Thorens TD521 £629	Average Average+	Nice product. Unexciting, rather undynamic and insubstantial sound quality, but facilities such as ability to accommodate 12 inch arm compensate	Manual, belt, suspended motor unit, 78rpm pitch control,		55
Townshend Avalon £299	Good Good	Some smear and coloration, probably due to structural shortcomings of the plinth, take the edge off this otherwise well turned out and well priced machine. Worth trying if you can't afford the full-blown Rock	Manual 2-speed belt drive	R	67
Townshend Rock £450	Good Good++	Tight, tidy sounding player which works with a wide variety of (non-tangential) arms, giving almost CD like precision and clarity. Good bass depth, dry balance – our Editor's favourite deck, in fact	Manual, belt drive, solid, arm damping, various optional extras	R	55

TONEARMS

NAME PRICE	LAB SOUND	COMMENTS	ARM EFF. MAS	VALUE	BACK ISSUE FULL REVIEW
Alphason Opal £110	Good Average	This is a straightforward adequate sounding low cost arm, priced just above where it rightly belongs	10g		55
Alphason Delta £165	Good Average+	A highly competent design from Alphason gives good sound quality but with slight blurring and treble fizz	16g	R	48
Alphason Xenon £210	Good Good+	A trimmed down HR100S, the Xenon has inferior bearings and a simpler finish, but sounds crisp and coherent. Fits any Linn cutout	12.75g	R	55
Alphason HR100S £395	Good++ Very Good	This S-shaped arm sounds smooth, but nevertheless reproduces transients with fine attack	10g	R	48/Coll
Ariston Enigma £99	Average Average+	Good but not the best in its class: mid-band sounds a little uneven; treble a trifle "brash"	11.5g		48
Audio Technica AT1130 £186	Good Good	Well suited to most cartridges including high compliance ones, the AT is smooth and tonally neutral, if slightly lacking in 'balls'	8.5g	R	67
Decca International £49	Average+ Average+	This uni-pivot design gives a rather rich tonal balance and some bass muddling. Could be good with Decca cartridges, but not well built	12g		48/Summary
Eminent Technology £1000	Good+ Good++	One of the best sounding tonearms around, the linear tracking Eminent delivers impressive stereo imagery, focus and transparent sound	9g (vertical)	R	48/Coll
Goldmund T3F arm £3950	Excellent Excellent	This complex parallel tracker created an "ear-opening" experience when tested with a (since updated) Goldmund Studio turntable	16.5g	R	Coll 2
Grace G707 £299	Good Good+	This venerable is still capable, if not competitive with modern alternatives	7g		48

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TO NEARMS

NAME PRICE	LAB SOUND	COMMENTS	ARM EFF. MAS	VALUE	BACK ISSUE FULL REVIEW
Helius Orion 2 £490	Very Good Very Good	Very expensive but with a performance that merits recommendation	12g	R	48
Linn LV Plus £129	Good+ Good	The fixed headshell provides an improvement over the LVX resulting in better clarity, detail and punch	13g	BB	48
Linn Ittok LVII £429	Very Good Very Good	Suitable for many turntables this top-quality arm performs best with the LP12, the combination exceeding the sum of both parts	13.5g	R	48/Colt
Linn Ekos £895	Very Good Very Good	Superb, state of the art design which builds significantly on Ittok's strengths	9g	R	67
Mission Mechanic £900	Good Good+	Nearly right, but inconsistency with level and vague imagery spoil what is otherwise a firm, powerful advocate for black vinyl	11g		55
Moth Arm £78	Good Good+	The ultimate budget arm? Refined, detailed, sweet and natural – performance improves in line with the rest of the system	12g	BB	60
Rega RB300 £115	Good+ Good+	Despite its modest price this sets exceptional performance standards and could be used on a number of high-quality turntables	10-11g	BB	60
Roksan Artemiz £450	Average Good	Excellent but flawed arm which needs some development and refinement before it can be wholeheartedly endorsed. Watch this space. Fits Rega cutout	8g		67
SME 3009 Series IIIS £165	Good Average+	A simplified less flexible (as regards adjustment) Series III with a similarly 'soft' sonic character	5g		48
SME 3009 Series III £229	Good Average+	Comprehensively adjustable and very well made, suited to MM and high compliance MC cartridges	5g		48
SME 3009R £291	Average+ Average+	A higher mass version of the Series III designed for low compliance MC cartridges	12g		48
SME Series IV £810	Excellent Very Good	Superb engineering and finish with a finely balanced sound giving impressive stereo focus and low coloration	10.5g	R	60
SME Series V £1206	Excellent Very Good	Excellent in terms of design engineering and sound quality, this arm arguably sets a new reference standard regardless of price	10.5g	R	60
Souther Tri-Quartz £895	Average Good	A unique parallel tracking arm that makes up for what it lacks sonically in its unusual appearance	3-4g		48

CARTRIDGES

Very much the 'slave' of turntable and tonearm and to some extent undermined by the supply of free 'starter' cartridges on many turntable systems, the cartridge is still worth taking seriously. The quality of both the stylus itself and the cartridge's tracking performance are important in preserving that most important part of the hi-fi system – the record collection – and the cartridge also plays a significant role in determining the overall balance of a system.

Cartridges fall into two groups: high output models, capable of working directly into any amplifier, and more expensive low output models. Stereotypically, low output cartridges use the moving coil principle of operation, have better mechanical integrity and tighter tolerances, and give better performance but at much higher cost. Most under-£150 amplifiers and many valve designs need either an extra head amp or transformer to cope with the low output. Cartridge/amplifier

interfacing can be very subtle, but even basic high output moving magnet designs benefit in overall balance from optimised amplifier capacitance loading. Still more important, the mechanical cartridge characteristic of cantilever compliance ('springiness') needs to be considered in the light of the effective mass of the tonearm which will be used (see Turntable & Tonearm entries).

NAME PRICE	LAB SOUND	COMMENTS	ARM OUTPUT/TYPE	VALUE	BACK ISSUE FULL REVIEW
A&R C77 £20	Average+ Average+	A sensible moving magnet package with good bounce at a competitive price	6-16g Normal, MM	BB	48
A&R C77Mg £30	Average- Average	Punchy sound quality with plenty of extra energy to liven things up. The solid body seems well worth the extra £10	4-8g Normal, MM	BB	67
A&R E77Mg £47.50	Average Average	Our sample had a disappointing stylus, but gave a coherent, rich and laid back sound, with good 'scale'	3-8g Normal, MM	R	48
A&R P77Mg £60	Average+ Average+	Cautiously recommended, the P77Mg was preferred to its cheaper partner by virtue of a better tip. Channel balance could have been better	4-9g Normal, MM	R	48
Audionote I02VDH £795	Good Very Good	One of the best, giving 'an extraordinarily relaxing midrange clarity'. But it picked up a bit of surface noise and dust and needs a transformer	8-18g Very low (transformer), MC		43
Audioquest MC5 £200	Average Average	Offers high-output benefits but the drooping frequency response and severe VTA error preclude recommendation	10-20g Normal, MC		54
Audio Technica AT95E £17	Average- Average	Clear, dynamic if richly balanced, the magnetic '95E is a definite Best Buy	8-14g Normal, MM	BB	48
Audio Technica AT-420E OCC £30	Average Average	Better suited to pop recordings this MM bears some of the sonic hallmarks of the Linn K5	7-14g (damp) Normal, MM	R	67
Audio Technica AT-430E OCC £42	Average+ Average	A rising high frequency response yields something of a treble sting, not a good all-rounder	3-7g Normal, MM		67
Audio Technica AT-F3/DCC LE £70	Average+ Good	Though the 'limited edition' badge is a trifle tongue-in-cheek the 'F3 still offers excellent value	8-15g Low, MC	BB	67
Audio Technica AT-F5DCC £100	Average+ Good	Decent output, good channel balance and a thoroughly refined sound sets the standard at £100	9-20g Low, MC	BB	54
Audio Technica AT-F5/DCC LE £100	Average Good+	This latest sample demonstrated some technical weaknesses but its spacious, fluid sound quality still represents a benchmark at this price	4-10g Low, MC	BB	67
Audio Technica ATOC7 £250	Good+ Good+	Technically and subjectively this cartridge represents a new dawn for AT, in the twilight of analogue audio	6-13g Low, MC	R	54
Audio Technica ATOC9 £400	Average+ Very Good	Tonal colours were reproduced faithfully while stereo images were clearly isolated and focused despite contributing to a thoroughly integrated whole. Slightly less transparent than more costly MCs	6-14g Low, MC	R	60
Audio Technica ART1 £800	Good+ Very Good	This is a delicate and very fluid-sounding MC that tracks well, offers very low distortion and exceptionally good stereo separation	9-18g Low, MC	R	72
Azden YMT0VE £12.50	Average Average-	A good tracker. Sounds rather bunched-up but not totally incoherent – for very basic systems only	5-15g Normal, MM		54
Azden GM1E £30	Average- Average-	Of academic interest only, this high o/p MC is seriously flawed in sonic terms	8-18g Low/normal, MC		54
Azden GMP5L £108	Average+ Average+	Although no P-mount system will do this cartridge justice, it can still be enjoyed in its universal mode. The subtle balance may prove irresistible to some	4-10g Low, MC	R	54

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CARTRIDGES

NAME PRICE	LAB SOUND	COMMENTS	ARM OUTPUT/TYPE	VALUE	BACK ISSUE FULL REVIEW
B&O MMC5 £24	Average+ Average	Cheapest in the family – smooth treble and good focus, but the bass was left in the wings	5-15g Normal, MM		38 (Summary)
B&O MMC4 £43	Good Average+	Solid and well balanced in the midrange, the '4 lacks bass impact	5-15g Normal, MM		48
B&O MMC3 £57	Good Average	Slightly "laid back" sound quality but a good performer for the price. Best suited to B&O equipment	5-15g Normal, MM		48
B&O MMC2 £87	Good Average+	Only a modest improvement on its cheaper brothers (and sisters)	5-15g Normal, MM		48
B&O MMC1 £112	Very Good Good	Great clarity and detail at high frequencies but a slightly plodding bass. It may appeal more to the classical enthusiast	5-13g Normal, MM		48
Cello Chorale £590	Average+ Good	Now available through a new distributor at a saving of some £300, the Chorale is still blessed with a delicate but highly detailed treble. Arm matching is a problem	3-9g Low, MC		72
Clear Audio Gamma £295	Average Average+	Brimming over with enthusiasm, the unusual-looking Gamma is more than an audio oddity, but it lacks a little subtlety at times	4-11g Low, MC		54
Clear Audio Delta £450	Average+ Good	Midway between the Gamma and exotic Pradikat, the Delta sounds like neither! Nevertheless, it delivers the goods	6-17g Low, MC	R	54
Clear Audio Signature £995	Average+ Good	This latest MC to emerge from Clearaudio features yet another graded version of its proprietary generator. Its sound strikes a balance between the Delta and Prad	4-11g Low, MC		72
Clear Audio Pradikat £1225	Average+ Very Good	Sounded absolutely glorious, creating a full sense of scale and a large well-focused soundstage – but watch for record wear	8-18g MC		Coil
Clear Audio Accurate £2,000	Good Excellent	A remarkable cartridge, not only by virtue of its effortless and highly neutral sound quality but also because this has been achieved with the same basic design as Clearaudio's cheapest MCs	4-11g Low, MC	R	60
Denon DL110 £69	Good Good	Firmly recommended as a fine all-rounder, this high-output moving coil model is likely to perform well in nearly all circumstances	6-16g Normal, MC	BB	48
Denon DL160 £89	Average+ Good	Although listeners just preferred the 110 its brother here proved a twin in lab tests and is still "thoroughly competent"	6-16g Normal, MC		43
Denon DL 103 £99	Average Good	This classic spherical stylus model gives a lively sound with powerful bass, and is popular in broadcast studios	6-16g Low, MC	R	48
Dynavector DV-50X £60	Good Average	A high-output MC model with impressive lab performance, but whose tip and sound quality both disappointed	6-14g Normal, MC		48
Dynavector DV10X IV £60	Average Average+	Fine sounding and realistically priced, damping is recommended to ensure successful tracking ability	8-18g Normal, MC	R	48
Dynavector DV23RS £150	Average+ Good	Sound quality was described as "shut-in", lacking energy and sparkle but with some "edginess" in high frequencies	10-22g Low, MC		28
Dynavector DV XX-1 £360	Good Good+	The XX-1 embodies a power and solidity rarely encountered amongst the breed, nevertheless it did exhibit a peculiarly suppressed character that will suit lively rather than wholly neutral systems	7-17g Normal, MC		60
Empire 800 Mk II £33	Good Average	This very high output MM appears to be based on the classic Ortofon VMS series. A trifle uninspiring overall	7-17g Normal, MM		67
Empire MC-5M £110	Average+ Good	A very low compliance renders this MC best suited to heavy tonearms while its sweet, non-aggressive sound quality earns it a recommendation	13-20g Low, MC	R	67
Empire Benz Micro MC-2 £600	Average Good+	Similar to both the Empire MC1000 and vdH MC2 in design, the Benz offers a warmer and very transparent account of the music. Its tracking prowess is slightly limited	5-12g Low, MC	R	72
Glanz MFG 110EX £24	Average Average	A little bright but giving detailed bass and clear treble this was competitive at the price	6-16g Normal, MM	R	Systems
Glanz GMC-10EH £49	Good Good	The rising HF trend of this high o/p MC may cause problems in certain systems but with a favourable wind its seductive qualities will win out	8-14g Normal, MC	R	67
Glanz GMC-10LX £79	Average+ Average+	Bearing some of the hallmarks of the '10EH, the '10LX is still less competitive in the sonic stakes	7-15g Low, MC		67
Glanz GMC20E £129	Average Average	You could try hagglng but we thought the makers of this number were demanding too much lucre for their product	3-6g Low, MC		48
Goldmund Clearaudio £1500	Average+	Something of a mixed bag overall, its sonic character bears a strong resemblance to the Pradikat though it shares some of the hallmarks of the more expensive Accurate	5-12g Low, MC		60
Goldring Elan £15	Average+ Average	A lightweight and frisky-sounding MM that appears to be based upon the same body as the Nagaoka mm4	7-15g Normal, MM	R	67
Goldring Epic II £23	Average Average+	An excellent budget choice though the limitations of the stylus are rather obvious at higher frequencies	5-12g Normal, MM	R	67
Goldring G1020 £53	Average+ Average-	This one strutted finely onto stage but couldn't project to the "gods"	8-16g Normal, MM		43
Goldring G1040 £79	Average+ Average-	High frequency extension was improved by the van den Hul tip, nice looking model – no great actress	8-16g Normal, MM		48
Goldring Eroica L £95	Average Average+	Open and relaxed sounding, the L version is just that bit more refined than its high output brother	7-18g Low, MC	R	54
Goldring Electro II £149 complete	Average Average+	A pretty decent allrounder that did not excel sufficiently to warrant recommendation	8-16g Normal, MC		43
Goldring Excel £500	Average+ Good	Goldring's most expensive cartridge to date errs on the warm and heavy side of neutral. Strong bass lines are its forte though its ability to resolve subtle treble details is weaker	6-13g Low, MC		72
Grace F9E II £240	Good Good	For lively presentation, excellent separation and generally satisfactory sonic delivery – consider this model	5-10g Normal, MM		48
Grado XTE + 1 £22.50	Average- Average	Bass and treble are a trifle coloured but the midband proved highly enjoyable. Ideal for budget systems	6-13g (damping) Normal, MM	R	54
Grado XF3E + £43	Average- Average	Downtilting balance disguises the brightness of this cartridge, bit of a mixed bag at this price	9-20g (damping) Normal, MM		54
Highphonic MCA3 £360	Very Good Good+	Exquisitely crafted by a group of ex-Denon engineers, this superb tracker had a sweet and seductive (if rather bright) treble	5-12g Low, MC		43
Kiseki Blue Silver Spot £395	Average+ Good	Solid performance from a very solid cartridge but lacks some of the magic of other Kisekis. Compliance too high	5-12g Low, MC		54
Kiseki Purpleheart Sapphire £695	Good+ Good+	Rare, beautiful to look at and sweet to listen to, our review of this high-flyer conjured up images of Japanese art	5-14g Low, MC		Collection
Kiseki Blackheart £1595	Good Good	This cartridge demonstrated refined poise and a delicate but at once potent security, however, the price did seem a little on the high side compared to other Kisekis	6-16g Low, MC		60

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NAME PRICE	LAB SOUND	COMMENTS	ARM OUTPUT/TYPE	VALUE	BACK ISSUE FULL REVIEW
Kiseki Lapis Lazuli £3500	Good Very Good	Combining very sensible design concepts at a silly price, the Lapis Lazuli is best thought of as combining the detail of the MC3000 and the fluidity of the Clearaudios	4-12g Low, MC		60
Koetsu Black S £599	Average Good+	The S is an OEM design built to Koetsu's blueprint. It features a sturdier fixing plate and offers a brighter, faster and more tactile sound than the earlier K	8-15g Low, MC	R	72
Koetsu Red £896	Good+ Very Good	Named like a rare, and perhaps dangerous, little oriental fish this famous cartridge sounded "almost larger than life"	10-25g Low, MC	R	48/Coll
Koetsu Red Signature £1391	Good Excellent	Technically this cartridge suffers no faults whilst on a subjective level it offers rare musical insight	10-21g Low, MC	R	60
Krell KC-100 £700	Average Good	Apparently based around a similar generator as the Cello Chorale, the Krell provides a similarly light and airy sound. Low mass arms with damping are best used	3-9g Low, MC		72
Linn K5 £30	Average Average+	Not as crisply focused as the costlier Linn magnetics, the K5 offers a smoother presentation	7-16g Normal, MM	R	67
Linn K9 £75	Average Good	Linn threw this model into the leading pack by beefing up the Basik's bodywork, adding a super stylus, and keeping the price fair	6-15g Normal, MM	BB	48/Coll
Linn Asaka £299	Good+ Good+	Disciples of Linn who are trying to realise their true "Karma" may find that saving money is not a short cut to heaven	9-18g Low, MC	R	48/Coll
Linn Karma £435	Very Good Very Good	A specialist which is strongly recommended for Linn-based systems; results may be less predictable in more general application	9-18g Low, MC	R	48/Coll
Linn Troika £669	N/A Very Good	Ex-Karma users have been seen with glazed expressions indicating smug self-indulgence the morning after fitting a Troika	8-18g Low, MC		Coll
London Maroon £109	Average Average+	Now manufactured under the London brandname this Decca cartridge is as iconoclastic as ever	9-20g (damp) Normal, MM		67
London Super Gold £248	Average- Good+	Sometimes a bit fierce in emphasising record surface faults, it is perhaps best at revealing the excitement and tension in music	8-20g + damping Normal, MM	R	48/Coll
Madrigal Carnegie One £685	Average+ Good	Looks like a duck but sounds much better, certainly worth auditioning. Compliance too high	5-11g Low, MC		54
Milltek Aurora £198	Good+ Good+	An overall feeling of relaxed ease characterised this clear and atmospheric Kiseki-built cartridge	8-16g Normal, MC	R	48/Coll
Milltek Olympia £298	Average+ Good+	Warm and detailed sound - packs the punch of the best MCs with high output as a bonus	12-20g (damping) Normal, MC	R	54
Mission 773HC £150	Good Good	A sufficiently well-balanced and competitively priced "old-timer" which still warrants recommendation	6-16g Low, MC	R	38
Monster Alpha 2 £479	Good Good+	In the final analysis this fine allrounder is insufficiently exceptional in any specific respect to justify fully its high price	6-14g Low, MC		Collection
Nagaoka MM4 £8	Average- Average-	Clear punchy sound that delivers the rudiments of a good performance	6-16g Normal, MM	R	54
Nagaoka MP10 £17	Average Average	High frequencies sounded "shut-in" with this spherical-stylus model, but mid and mass were energetic, bouncy and punchy	5-13g Normal, MM	R	48
Nagaoka MP11 Boron £38	Average Average+	Responding well overall in PM's equipment and listening room, this model was mildly criticised for low level and dynamic limitations	5-13g Normal, MM	BB	48
Nagaoka MP10SB £40	Average Average+	Stilton's mods have improved the fine detail resolution of this popular budget model	5-15g Normal, MM	R	54
Nagaoka MP11 Gold £45	Average- Average+	There were mild criticisms directed at most areas, but in general the sound was clear, open and even	3-8g Normal, MM	R	48
Nagaoka MP11 Gold SB £70	Average- Average	Excessive price loading for a blob of aluminium	2-6g Normal, MM		54
Ortofon OM5E £15	Average- Average-	The OM10 is a hi-fi cartridge - the OM5E is not	5-16g Normal, MM		43
Ortofon VMS5E II £14	Average Average	Sound quality was thought fair for the price, though a little 'untidy'	8-18g Normal, MM		38 (Summary)
Ortofon OM10 £20	Average Average	One of the leading "cheapies", this gives a fine level of sound quality for the price, with good matching compatibility	5-15g Normal, MM	BB	48
Ortofon VMS 10E II £21	Average- Average-	Some of its stablemates fared rather better, and showed less evidence of tracking problems to boot	Normal, MM		38
Ortofon VMS20E II £35	Average Average	One of the most popular cartridges ever, sound quality was a bit laid-back and tracking could have been better	3-10g Normal, MM		48
Ortofon OM20 £40	Average Average+	This turned out to be the listening panel's favourite among Ortofon's moving magnet models	5-16g Normal, MM	R	48
Ortofon 520 £50	Average Average+	Very sensitive to load capacitance this new Ortofon maintains the company tradition for a lively, effervescent SQ	7-16g Normal, MM	R	67
Ortofon X1 £50	Average Average	The cheaper X1 scored higher marks with our listening panel than the X3, but both were a disappointment	6-15g Normal, MC		48
Ortofon VMS30E II £52	Average+ Average	Rather an old soldier in relation to turntable technology, it will perform undemandingly in demanding circumstances	5-13g Normal, MM		38
Ortofon MC10 Super £70	Average Good	"What a delightfully sweet-sounding cartridge this is..." we said	5-15g Low, MC	BB	48
Ortofon X3 £70	Average Average	A lack of bass power, definition and a "zitty" top end makes this competent but uninvolved	5-15g Normal, MC		48
Ortofon OM40 £80	Average Average+	Highly competent engineering, secure tracking and decent sound quality are major strengths. But it's a little cold, a little polite	3-8g Normal, MM		48
Ortofon 540 £100	Average- Average	Graced with an advanced FGII stylus our sample possessed too high a compliance for broad arm matching. It could also sound a little unforgiving	3-8g Normal, MM		67
Ortofon MC20 Super £170	Average+ Good+	An "inviting" sound quality; polite rather than exciting it approaches much more expensive models, but does not better them	6-15g Low, MC	R	48/Coll
Ortofon MC30 Super £250	Very Good Good+	Beautifully engineered and well-balanced, it was slightly criticised as bland, though some may appreciate the lack of rough edges	5-14g Low, MC		Coll
Ortofon MC3000 £800	Good Excellent	Quite simply, the most accurate transcription device yet created - not one for the faint hearted	6-16g V. Low, MC	R	60
RATA RP20 £22	Average- Average	Good integration, a clear dynamic midrange and the beginnings of fine stereo imagery merits clear recommendation	6-14g Normal, MM	R	48
RATA RP40 £44	Average Average+	The '40 did a good job of sorting out the layers and complexity of the mix, with good focus, excellent stereo spread and fine scale	6-15g Normal, MM	R	48

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NAME PRICE	LAB SOUND	COMMENTS	ARM OUTPUT/TYPE	VALUE	BACK ISSUE FULL REVIEW
RATA RP70 £77*	Average Average+	Clearer and sweeter than the '40 this also seemed heavier and less lively. For £99 you can have a van den Hul stylus	6-14g Normal, MM		43
RATA RP70vdH £99	Average+ Good	Able to retrieve bags of musical detail (thanks to the vdH stylus), RATA's top cartridge ranks as one of the most articulate MM's available	11-18g Normal, MM	R	67
Rega Bias £34	Average Average+	Difficult to mount in some arms due to its shallow build, the bias offers a gentile, refined SQ that certainly makes it worthy of audition	4-10g Normal, MM		67
Rega RB100 £38	Average Average+	Remarkable mechanical performance in the right system context, but "try before you buy"	5-12g Normal, MM	R	48
Rega Elys £74	Good Good	Clearly superior to the Bias, despite their common heritage, the Elys is both more detailed, accurate and musically convincing	8-15g Normal, MM	R	67
Revolver £20	Average+ Average	This modified AT-95E enjoys a very lively mid and treble even if the bass is somewhat 'slower' in protection. A firm budget buy	8-16g Normal, MM	BB	67
Shure M92E £15	Average- Average	Though lacking depth, the overall sound quality was competent, but treble was not its forte	10-15g Normal, MM		43
Shure M99E £26	Average- Average-	Sister to the 92E this is a solid but not particularly exciting cartridge	5-10g Normal, MM		38 (Summary)
Shure ME75ED £24	Average Average-	Rather bright and splashy in the high frequencies but nevertheless a competent model	5-10g Normal, MM		38
Shure M104E £32	Average- Average	Capable in many ways, but giving no substantial improvement over the 92E in our view	5-15g Normal, MM		38
Shure ME97HE £44	Average Average+	It won't turn a sow's ear of a turntable into a silk purse, but will at least keep going and produce an acceptable result	8-20g Normal, MM	R	48
Shure M105E £45	Average Average-	A slightly 'spitty' sound lacking deep bass and dynamic contrast, but can be used in virtually every system where it will perform "unobtrusively"	5-12g Normal, MM		38 (Summary)
Shure M110HE £55	Average Average	Sound quality was thought eminently presentable, but not exciting, smooth clear high frequencies, but a loss of bass definition	5-10g Normal, MM		38 (Summary)
Shure M111HE £67	Average Average	Early reviews of this cartridge complained principally of the price - which has since come down	5-10g Normal, MM		38 (Summary)
Shure ML120HE £95	Average+ Average+	Quite decent sound quality and a generally fine balanced performance	6-18g Normal, MM		48
Shure ML140HE £120	Average+ Good	Qualitatively the treble of this well-balanced moving magnet model was a match for many moving coil cartridges	6-16g Normal, MM		43
Shure V15 VMR £195	Good Average+	Initial listening gave promising results, but extended familiarity gave the feeling of a lack of energy and a "shut-in" sound	5-12g Normal, MM		38
Shure Ultra 500 £452	Good Good	There was no doubting the accomplishments of what could well be the finest moving magnet cartridge around	6-14g Normal, MM		48
Stilton/AT-F3 £110	Good+ Good+	At a premium of some £40 this modified AT-F3 offers a startlingly refined performance and is strongly recommended	8-18g Low, MC	R	67
Supex SM100E £115	Average Average+	Delivers as much musical information as many moving coils - the bass in particular having an attractive bounce	6-15g Normal, MM		38
Supex SD900IV £350	Average+ Good+	The 900 is an inherently fine cartridge, but despite a recent update it is beginning to show its age	10-18g Low, MC		48/Coil
Supex SD901IV £375	Average+ Good+	This high output model delivered sufficient subjective and objective performance, plus good compatibility, to justify its price tag	8-18g Normal, MC	R	48
Supex SDX2000 £651 L £721 H	Good Good+	The high-o/p 2000 was preferred on listening tests to the low-o/p model, which even so has a unique place among the top designs	6-16g Either, MC		48
van den Hul MC10 £699	Good Good+	A neutral balanced performer giving transparent midrange, fine depth and focus with firm extended bass. Gosh!	5-10g Low, MC	R	60
van den Hul MC One £699	Good Very Good	This extended all the positive qualities of the '10 but added greater authority and scale - worth it for the extra money	6-12g Low, MC	R	60
van den Hul MC Two £899	Good Very Good	Connected directly to any standard MM input the vdH MC Two rewards with a highly detailed yet fluid and musically convincing portrayal	6-13g Normal, MC	R	72

AMPLIFIERS

The amplifier sits at the heart of the system, processing the outputs from all the various music sources as necessary and then driving the loudspeakers. These two (quite separate) functions are integrated into a single box at the low-to-middle price points; separated pre- and power amplifiers become increasingly common as one moves upmarket. At the upper end of the specialist market, valve amplifiers provide a popular alternative to the transistor types amongst enthusiasts.

There is a substantial difference between specialist (sound quality oriented) amplifiers and the consumer electronics style models. The former

are bleakly simple, avoiding all unnecessary features to provide the most direct signal path in the interests of best sound quality. The latter range from models with just basic tone controls and tape recorder switching, to those with elaborate facilities such as graphic equalisers, remote control (including volume), surround sound options etc. etc.

Lab measurement provides some useful data, particularly in regard to an amplifier's ability to drive a wide range of different types of loudspeakers, but this is only obliquely related to sound quality. We also include our measured power output (RMS, 8ohm load, 1 channel driven) - but

again, paradoxically, this doesn't necessarily correspond to the loudness capability of the amplifier, which has as much to do with the elegance of the overload characteristics within a given system (valve amplifiers invariably sound more powerful than their rating would suggest). The listing of features provides some indication to the complexity of an amplifier: many users prefer to retain the option of tone controls to 'shape' the overall sound according to taste; many others have found living without tone controls surprisingly easy, with additional benefits in terms of transparency.

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Acoustic Research A07 £280	Very Good Average+	Relatively smooth but ineffectual sound quality that lacks some weight and impetus at very low frequencies	75W, 4 line, 2AV and MM/MC inputs		68
ADC A-2080E £400	Good+ Average+	Clean and neutral sound but one that lacked depth and spaciousness; MM input favoured above MC or CD	108W, logic sw. for 5 line and MM/MC inputs		68
Akai AM-93 £550	Average Average-	Unfortunately Akai's on-board D/A convertors were less successful than its conventional analogue CD input	112W, coax and optical dig inputs. MM/MC		68
A&R Arcam Alpha II £170	Good Good+	Very confident, convincingly musical and punchy sound that sets the standard for other budget amps	41W, 4 line and MM inputs	BB	68
A&R Arcam Delta 60 £260	Good Good+	Very refined and highly detailed sound via MM and CD without any of the hardness noted via the MC stage	59W, 4 line, MM/MC inputs, no tone controls	R	68

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AMPLIFIERS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Albarr M408 II £895 pr.	Good+ Good+	Unusually styled transistor monoblok power amplifiers reintroduced with improved performance and sound quality. Needs good warm-up for best sweetness and clarity	40W Power amp only	R	56
Albarr M1008 II £1095	Very Good Good	A larger version of the similarly styled M408II, fairly good all round but only of average quality for the price	80W, monoblok		62
Aragon 4004 £1795	Good Good	Despite its imposing bulk the Aragon is something of a softy at heart. It can deliver oodles of power but its musical presentation is more laid-back	231W power amp		72
Aria Acoustics Aria 12 £299	Poor Very Good	A plain looking valve power amp that's something of a wolf in sheep's clothing giving many dearer amps a run for their money	12W	BB	63
Ariston Amp £180-200	Average Average+	Slightly veiled and thin sound but proved suitably attractive in the listening tests	32W, full logic control, MM and 4 line inputs	R	68
Audio Innovations Series 300 £425	Poor Good++	Something of an anomaly the 300 is an integrated valve amp that looks awful in the lab but sounds remarkable in a system	10W, MM, 6 inputs	BB	63
Audio Innovations Series 1000/2nd Audio Amplifier £1299/2250	Poor Excellent	This valve combination offered awesome dynamic range with superb transparency and power to match. Compatibility with other brands is unpredictable	15W, MM, 6 inputs, monobloks	R	63
Audio Research SP9 £1698	Very Good Very Good	This new high performance valve FET hybrid preamplifier sets a high standard for versatility, build quality and sound	5 inputs, MM/MC	R	60
Audio Research SP11 II £5250	Very Good Excellent	Current state of the valve preamp art. A reference point	Straight line MM/MC Disc + phase invert	R	60
Audiolab 8000C £325	Excellent Good	A well established preamp with a highly controlled sound, though it could do with more life and depth	MM/MC, 5 inputs, hdph, tone controls	R	62
Audiolab 8000P £495	Excellent Very Good	A dynamic powerhouse, load tolerant and sonically reliable	100W	R	62
Beard Audio CA35/P35mkII £595/£795	Fair+ Very Good	Good build quality and a very smart finish combine with a characteristic valve sound to make a first class amplifier capable of giving hours of musical enjoyment	35W, MM/MC, 4 inputs	R	63
Beard 506 £1195	Good+ Good+	A versatile valve preamp - the bass sounded lively if a touch softened while the treble was detailed but lacked a little sparkle and air	4 inputs MM/MC		50
Beard M70 £1995 pair	Good Good+	A substantial British monoblok power amplifier, but not a great deal more impressive than the P35 at half the price	70W		50
Bryston 12B/4B Pre/Power £995/£1395	Good+ Good	Bryston's massive 4B power amp stood out as the backbone of this combo, the preamp sounding a trifle unbalanced between MM and MC inputs	272W, bridgeable to 800W. 6 line, 2 disc inputs, subsonic filter		68
Cambridge Audio P40 £200	Good Good+	A very fine sounding integrated amplifier with simple facilities and MC cartridge capability	5 inputs 40W MM/MC straight line	BB	50
Cambridge Audio C75 £279	Good+ Good+	Whilst not quite on par with its A75 companion this preamp provided excellent stereo imagery but was a touch "heavy" in character	MM/MC disc	R	50
Cambridge Audio P55 £290	Very Good Very Good	A grown up P40, the P55 suffers slight noise on the moving coil input but offers great sound for the money	55W, MM/MC, 5 inputs, hdph	BB	62
Cambridge Audio A75 £299	Very Good Very Good	This strong power amplifier sounded open and effortless, with fine bass drive and dynamics, albeit a touch grainy and harsh at high frequencies	100W	R	50
Cello Audio Suite £5280	Excellent V Good/Excellent	Cello's preamp represents a whole new ball game in flexibility and sound quality (or war of attrition on your wallet)	Optional inputs MC etc	R	50
Conrad Johnson MV50 £1699	Good+ Good+	Coupled with the PV5, this CJ power amp performed well on audition	50W		Collection
Conrad Johnson Motif MC-8 £1995	Very Good Very Good	A cheaper alternative to the '7, this preamp is an undoubted success in maintaining the Motif sound but does not compare on sound quality	MM/MC	R	50
Counterpoint SA12 £1250	Good+ Good+	A real power-house power amp, beefy and load-tolerant although like the SA7 a trifle untidy at frequency extremes	100W		Collection
Creek CAS 4040 II £179	Good Good	The Mk II has no problems and is a fine all rounder	30W, MM, 4 inputs, tone controls	BB	62
Creek CAS 4140 S2 £219	Good+ Good	Redesigned for '88, this is a fine allrounder with good moving coil input, plain presentation	40W MM/MC 3 line inputs	BB	62
Croft Micro £150	Average+ Good	A real upsetter, this excellent valve preamp put the cat among the pigeons proving good sounds can be made at budget price levels	4 inputs MM straight line	R	Collection
Croft Super Micro A £500	Average+ Very Good	The looks are somewhat improved, while this 'hot rod' version with tuned components performed very well indeed. There is still no gain on the line inputs	4 inputs, MM, straight line	R	57
Croft Series IV(S) £730	Good Good	The original IV is still available now supplemented by the higher price and power (S); both are fine performers	40(60)W channel	R	57
Croft Series IVSA £1000	Good Very Good	Featuring tuned components chosen for their sound quality, the 'A' variant is an impressive example of Croft's technique in valve design	60W special supply regulation	R	57
Deltac DSP-50S DPA-50S Pre/Power £675/£825	Excellent Excellent	Remarkable pre/power combo based around the highly linear DH-DA32 hybrid op-amp. Unmatched detail resolution, control and transparency	63W, external feedback wiring. 3 line, MM/MC no tone controls	R	68
Deltac DPA 100S £2200	Very Good Very Good	A top-quality transistor power amp, sounding fast, articulate and well controlled, though maybe a touch clinical for some tastes	80W	R	50
Denon PMA 250 II £125	Good Fair	Despite a claimed increase in power this competent model now slips behind the competition on sound quality grounds	30W, MM, hdph, tone controls		62
Denon DAP-2500 PDA-4400A Pre/Power £549/£599 pr.	Very Good Good	Denon's fully-fledged preamp also incorporates D/A converters that did not improve the sound of our £299 CD player. The power amps are brilliant!	172W, monobloks Opt/Coax dig + 2 tape, 4 line and MM/MC inputs		68
Denon PDA-6600 £1,000/pair	Excellent Excellent	Delivers abundant high quality sound, solid engineering expertise and content clearly compensating for any compromising of purist audiophile principles	250W monoblok, remote power	R	60
DNM 3A From £1000	Good+ Very Good	The DNM3 in its acrylic case is a remarkably revealing and neutral state of the art preamp	5 inputs MM/MC twin vol controls	R*	44
E.A.R. 802/509mkII £920/£1550	Average Very Good	Extremely well made and combining the sonic strengths of both transistors and valves this EAR combo warrants attention	100W, MM, 6 inputs, monobloks	R	63
E.A.R. 549 £3,000/pair	Very Good Very Good	A valve monoblok that measures like a solid state amp is itself an achievement, but exceptional power delivery and bass 'slam' is not fully matched by delicacy and transparency elsewhere	200W monoblok, bias setting		60
Exposure VII/VIII £360/£340	Very Good Good	Supplied as a combination without the separate preamp power supply, this pre power combination performed satisfactorily especially on the moving coil input	50W, MM/MC, 3 inputs, straight line		62
Exposure VI/VII Dual/VIIIS Pre/Power £449/£219/£379	Good Very Good	An established company like Exposure could do more to improve the 'look' of these amps which, nevertheless, sounded confident, dry and musical	63W, Super mod. 4 line and 2 disc inputs with full rec-out switching	R	68

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THE DIRECTORY

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Grant G60AMS £948 pr	Good Very Good	This neat and compact 60W valve monoblok gave good sound on the 8ohm tap, better still on 4ohms. The midrange was particularly natural	60W monobloks 41 8ohms	R	57
Hafler DH120 kit form £325	Fair	We didn't build one; see below	60W		44
Hafler DH120 assembled £396	Very Good Fair	Sound quality results were decent enough, but this power amp won't set the world on fire at this price	60W		44
Harman Kardon PM635i £159	Good Good	An improved version of the classic PM635 amp which sounds typically dry and articulate. Price is frozen	49W, 4 line and MM inputs A/B speaker o/p	R	68
Harman Kardon 640 Vxi £225	Good + + Good	Moderately priced but built to HK's high standards; good value and good load tolerance	50W MM, 5 line inputs tone controls		56
Harman Kardon PM645Vxi £300	Very Good Good	Fits in well with the Harman Kardon series, giving a competent all round performance at a fair price	75W, MM/MC, 5 inputs, hdph, tone controls		62
Harman Kardon PM650Vxi £369	Average + Good	A tight and slightly over-damped sound lacks any essential warmth or richness. Reduced headroom on MC	71W, 6 line, MM/MC and true A/V inputs		68
Harman Kardon 655 Vxi £449	Very Good Good	Plenty of well built integrated amplifier for the money, with lots of power to drive almost anything, plus versatile inputs	100W MM/MC 6 line inputs tone controls		56
Harman Kardon PM665Vxi £699	Good Good	A versatile and meaty amplifier with high current capability, but sound quality lags behind certain home grown alternatives	150W MM/MC tone controls (switchable)		60
ITL MA-80 £169	Good Good	A promising start for this young company, the MA-80 gave a fine sound with CD but was less wonderful on the moving coil input	30W, MM/MC, 5 inputs	R	62
Jadis JP30/JA30 £7,425	Fair Excellent	Two-box preamp plus monoblok power amps, classic valve design gives stereotype valve sound. Beautiful build, nostalgic styling and delightful sounding midrange transcend limitations at frequency extremes, in lab, and re cartridge matching	30W 2-box pre-, monoblok power, MM-only, 4 line inputs	R	60
Jeff Rowland Coherence One/ Model 7 £3750/£4950 each	Very Good Very Good	The technical design of these amps is very elaborate but ensures they achieve an extraordinarily transparent and potent sound. However, the CD i/p is clearly superior to the disc inputs	448W monoblok MM/MC with variable loading options. Balanced topology	R	72
JVC AX-222 £110	Good Fair	Not very impressive, JVC need to pull their socks up if their budget amplifiers are to score	35W, MM, 4 inputs, hdph, tone controls		62
Kenwood KA-550D £120	Very Good Fair	Having dropped its moving coil input, this latest version has British style dynamics and rhythm but is not first grade yet	35W, MM, 4 inputs, hdph, tone controls	R	62
Klyne SK5a £2590	Very Good Very Good	Beautifully made and presented this American thoroughbred has a good lab performance, but although versatile, is rather expensive for the quality of sound offered	Balanced output, versatile cartridge loading		72
Krell KSA-200 £5050	n/a Very Good	Value derives partly from excellence of sound, but equally from imperturbability, flexibility, consistency, build and after sales care	200W	R	72
LFD £2,995+	Very Good Excellent	Can set the subjective standards that others merely aspire to, but this outstanding if unconventional multi-box preamp needs careful matching to ancillary components (cartridge, power amp)	MC (with care), passive line extra	R	60
Linn LK1/LK280 Pre/Power £495/£645	Good Good-	A very modern, logic-controlled amp with distinctive and inoffensive sound quality. Its restrained sound could do with extra insight and zip.	84W, compact amp CMOS sw. for 2 tape, 2 line and MM/MC. XLR sockets.		68
Magnum A100 £1995 pair	Good + + Good+	Given their massive power rating a pair of A100's make a fine stereo power amp; ideal for high levels and with a wide dynamic range for digital programme	320W		50
Marantz PM25 £129	Good Fair	Soft and sweet like the rest of the range, the PM25 is inoffensive and undemanding	25W, MM, 5 inputs, hdph, tone controls		62
Marantz PM35 £149	Very Good Good	This new generation Marantz is a good allrounder, and shows that extra care is being taken over sound quality; well equipped and versatile	45W MM/MC 3 line inputs tone controls		56
Marantz PM45 £200	Good + Fair	Generally pleasant and polite with above average clarity; there was some softening in the bass, restricting dynamic output somewhat	40W MM/MC tone controls		50
Marantz PM-75 £449	Good Average	More successful than most amps with on-board DACs but still not as balanced as other Marantz products	136W, opt/coax dig inputs, 6 line + MM/MC		68
Marantz PM94 £1,000	Very Good Good	At 23kg the PM94 is no lightweight in either physical or sonic respects. A very powerful and comprehensively equipped amplifier	140W MM/MC tone controls (switchable)		60
Meridian 201/205 £599/£425 each	Very Good Good+	A fine preamp with additional luxury option of full system remote, plus competent and attractive monoblok power amplifiers with generally good performance	100W MM/MC 6 line inputs remote capable straight line	R/—	62
Mission Cyrus One £180	Very Good Good	A red hot class winner, which caused the whole issue to be re-rated! It's even well built - however, the headphone socket will only take a 3.5mm jack	30W, MM/MC, 5 inputs, hdph, straight BB line		62
Mission Cyrus PSX £230	Very Good Very Good	The PSX does make the Cyrus Two sound better; and also improves the PCM II CD player giving more wallop and clarity	Auxiliary power supply	R	62
Mission Cyrus Two £300	Very Good Very Good	Also a top performer in its group with fine moving coil and compact disc sound. Again, only 3.5mm headphone socket	50W, MM/MC, 5 inputs, hdph, straight R line	R	62
Mordaunt Short MS-A5000 £350	Very Good Good	With a recognisable pedigree, Mordaunt Short engineers have made a good job of this one. A musical all rounder	50W, MM/MC, 6 inputs, hdph, tone controls	R	62
Musical Fidelity A1 £269	Good Good+	Fine-ranking in terms of overall sound quality for money, the excessive heat output could be hazardous to your vinyl if you're careless	20W MM/MC 4 inputs straight line	BB	56
Musical Fidelity B200 £299	Very Good Good+	Running cooler than other MFs, the B200 delivered fine musical and dynamic sounds with plenty of power	80W MM/MC 4 line inputs straight line	BB	62
Musical Fidelity Pre 3/P140 £379/£349	Very Good Very Good	Delivering true audiophile sound quality well ahead of their price, both components shine in their own right	70W MM/MC 4 line inputs straight line	R	56
Musical Fidelity A100 £459	Good + Very Good	This is another one recommended for fine sound with which you could keep your Chinese carry-outs warm	50W MM/MC 5 inputs straight line	R	62
Musical Fidelity P170 £599	Very Good Very Good	Acquitted itself well, later samples showing steadily increasing refinements	85W	R	50
Musical Fidelity MA-50 £875 pair	Good Excellent	An audiophile bargain. One of the best sounding power amplifiers made	50W, monoblok	R	62
Musical Fidelity MVT Mk 3 £1199	Very Good Very Good	The MVT preamp was "strong in its class", providing competition for £1500-plus amplifier systems, now rivalled by the MF3B	MM/MC 5 inputs	R	50
Musical Fidelity P270 £1299	Very Good Excellent	If the hot-box aspect is not a deterrent, this is something of a bargain. A big amplifier scale of sound which is just a little rough-edged	135W	R	50
Musical Fidelity MVX & A370 £2300/£2299	n/a Excellent	In its latest guise, the A370 confirms its status alongside the MVX as amongst the best indigenous components for both sound and presentation	MVX - MM/MC/4 line/phase invert. A370 - 150W	R	72
NAD 3020e £130	Good Fair	A little light in balance and "weight" but superior to run-of-the-mill budget amplifiers	20W MM/MC 4 inputs	R	50
NAD 3225PE £150	Average + Average +	Light and detailed if not as rich or weighty sounding as others. MM input sounds warmer than CD	42W + 70W dyn. headroom; soft-clipping, MM only	R	68

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AMPLIFIERS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Naim NAIT 2 £322	Average+ Fair	Well built with good load tolerance the NAIT delivered a fully competitive sound in spite of its modest measured power output. Recent modifications as yet unchecked	15W pc MM 3 inputs	R*	50
Naim Separates £560-c£8,000	Very Good Good	A consistent and coherent series of 'building blocks' for conventional passive or active operation. Sound quality ignores conventional audiophile standards of presentation, but achieves fine musical communication	40-70W, MM/MC etc	R	60
Nakamichi CA-5E £750	Very Good Good	A fine lab performance and high build quality but rather disappointing sound quality for a preamp of this price	MM/MC, 6 inputs, hdph, tone controls		62
Nakamichi PA-5E £1150	Very Good Good	A strong sound in several respects but one which ultimately failed to satisfy	100W		62
Nakamichi CA7E/PA7E £2500/£1700	Very good Good/Good+	Exceptional build and finish, plus good general performance, remote control and versatility, but expensive	200W MM/MC 6 line inputs, remote, tone controls		56
Nuance £795	Very Good Good	A subtle civilised pre-amp though a little lacking in resolution and detail; suited to some tastes but not top-drawer	4 inputs MC		50
NVA AP30mc £290	Average+ Good	Utilitarian in appearance but offers a very refined and beguilingly musical sound quality on MC and line	22W only. MC or MM options, 3 line inputs	R	68
Dakley Image £425	Poor Very Good	An interesting valve preamp from Yugoslavia, the Image on first impression needs a bit of tweaking to warrant <i>Choice</i> commendation but is a nice product nonetheless	MM, 5 inputs straight line		63
Orell SA-040 £359	Good Good+	This promising newcomer from a brand new company sounded pretty good and should improve as production settles	45W MM/MC, 4 line inputs, straight line	R	56
Philips FA960 MkII £299	Good+ Average	The MkII '960 still failed to grasp our listeners' attention but it remains a competent amp nonetheless	122W, 6 line & 2 disc inputs + tone controls		68
Pink Triangle PIP £2670	Excellent Excellent	This state-of-the-art preamp is one of the few truly high end products to come out of this country this year. It will most certainly worry the competition	MM/MC, 4 inputs, battery supply	R	62
Pioneer A333 £150	Very Good Fair	A rather average but nonetheless competent performer that is pleasant enough	55W, MM, 5 inputs, hdph, tone controls		62
Pioneer A-616 MkII £250	Good+ Average	The disc inputs sounded a trifle smoother than the CD stage which was harder and more aggressive	95W, 3 tape, 3 line and 2 disc inputs. Heavy		68
QED A240 CD II £169	Good+ Good	Latest 240CD is fine value for CD and has competent MM disc input as well	45W MM 5 line inputs straight line	BB	62
QED A240 SA II £219	Good++ Good+	Redesigned 240SA represents a significant allround improvement over its predecessor, and provides a good moving-coil disc input in a competitive price	45W MM/MC 5 line inputs straight line	BB	62
QED A270 £329	Good- Good+	Building on the strengths of the '240, the '270 sounds weighty, fast and dynamic. A bit 'lumpy' via MC	51W, 5 line and 2 disc inputs, pre-out	R	68
Quad 34 £285	Very Good Fair	This well-built durable preamp has useful filtering and above average tone controls but was found lacking in sound quality (viz: detail/dynamics)	4 inputs MM/MC tone controls		44
Quad 405 £349	Very Good Fair	Not an impressive power amp but easy on the ear if not pushed and very reliable	100W		44
Quicksilver Mono £1495	Good Good+	Moderately improved for '88 the Quicksilver still rates well despite up and coming competition	60W monoblok 4/8ohms		57
Radford SC25 £862.50	Very Good Very Good	A very fair price for a solid, well built valve preamp, combining good allround performance and a neutral sound	5 inputs, MM, straight line	R	57
Radford MA75 £977.50	Good Very Good	A fine quality valve monoblok with good load tolerance and a neutral accurate sound, offering significant gains in power and focus over the STA25	75W monobloks	R	57
Radford STA25 Renaissance £1115.50	Good Good+	Offering superb midrange performance if not quite as good at the extremes, the Renaissance valve power amp is a genuine audiophile product	25W	R	50
Revox B150 £875	Very Good Average+	Beautifully constructed but hampered by Revox's convoluted logic control. Open and smooth sound. Still costly.	117W, CMOS sw. for 3 line, 2 tape and MM		68
Revox B250 £1188	Very Good Good	With much improved sound over its predecessors plus amazing remote control facilities, this could form the heart of a round-the-dream-house system	150W MM/MC system/house remote tone controls		56
Rose RV-23 £370	Average Very Good	A very attractive little British valve preamp with a sound that was rich, colourful and reasonably sharp via the CD input but was less impressive on disc	MM, 4 inputs, straight line		63
Rotel RA810A £100	Very Good Fair	As a cut price RA820AII this is a very successful little amp that loses little in sound quality to its predecessor. Excellent value	20W, MM, 5 inputs, hdph, tone controls	BB	62
Rotel RA820A £130	Good++ Good	This A version of an established budget favourite delivers the goods sonically and is fine value for money	35W MM 4 line inputs tone controls	BB	56
Rotel RB/RC850 £150/£125	Good++ Good+	Quality separate pre and power amplifiers at near budget integrated amplifier prices. A notable achievement	60W MM/MC 4 line inputs tone controls	BB	62
Rotel RA820BX3 £170	Very Good Good	The latest upgrade is not that impressive, but the BX remains a fine amplifier and now has a moving coil disc input	30W, MM/MC, 5 inputs, hdph, straight line	BB	62
Rotel RC-870BX/RB-870BX Pre/Power £199/£210	Excellent Good+	Reduced price makes the 870 combo better value but, despite mods to the preamp, it is the power amp that must take the lion's share of credit	128W or 208W in bridged mode. CD direct, 4 line, 2 tape and MM/MC	R	68
Rotel RA840BX3 £220	Very Good Good+	Requires a very long warm-up period but rewards with a refined sound that should suit 'lively' systems	59W, 2 tape, 2 line, MM/MC and A/V inputs	R	68
Rotel RA870BX £300	Very Good Good+	A powerful blockbuster with solid and well focused sound, good versatility and fine load tolerance	85W MM/MC 7 line inputs tone controls	R	56
Sony TA-F200 £130	Average- Average	Over-ambitious protection circuit is hardly in keeping with modern amp design. Lean but 'dead' sound quality	74W, 2 tape, 3 line and MM/MC inputs		68
Sony TA-F400 £200	Good Average+	Some lack of integration across the frequency range but still offers a more open and detailed sound than the 'F200	76W, 2 tape, 3 line and MM/MC inputs. Rec-out		68
Sony TAF 500ES £349	Good+ Fair	Not too hot at the price, lacking in bass action, rating poorly on vinyl, and only marginally improving on CD	75W hdph tone controls MM/MC		50
Sony TAF 700ES £500	Good++ Fair	Scoring higher than the 500 but still not offering the sort of standards set by the competition. But many buttons to push	100W MM/MC tone controls		50
Sumo Nine+ £1200	Very Good Excellent	Macho styling of this class A stereo power amp conceals a sonic subtlety that is exceptional for the price, limited by lots of waste heat and a noisy fan on our sample (being improved)	65W	R	60
Sumo Andromeda £1585	Very Good Very Good	Well made with lots of power from a sensibly sized box. It was good in the lab and demonstrated a sound which offers a fine blend of performance at an almost reasonable price	200W, balanced input	R	72
Tannoy SR-840 £1713	Very Good Good	A "muscle" power amp, capable of impressive levels into difficult loads while remaining quite subtle and revealing	250W		50
Vacuum State FVP £999	Good Very Good	This well thought out valve preamplifier is designed for optimum musicality and transparency, a goal which is handsomely achieved	5 inputs, MM, straight line	R	57

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THE DIRECTORY

AMPLIFIERS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Yamaha AX-300 £100	Good Fair	A lively and dynamic performer, offering a credible if bright sound at a competitive price	30W hdpn tone controls (MM)		50
YBA Model 3 Pre/Power £995/£995	Good Good	Suited to highish sens. loudspeakers this duo produced see-through, ethereal stereo images that were more convincing towards the centre of the soundstage than at the edges	56W stereo amp MM only with 3 line i/p's. Separate L/R volume controls		72
YBA 2 pre & pwr £1395/£1695	Good + + V Good/Excellent	Superbly finished French audiophile separates, with very good space and transparency, slightly softened bass. Needs extra transformer (£300) for MC cartridges	70W MM (MC extra) straight line	R	36
YBA 1 preamp £2895	Very Good Excellent	A front line French audiophile product. Great stereo and a fine Krell style finish	MM/MC, 3 inputs, straight line	R	62
YBA 1 power amp £2995	Good Excellent	This equally well finished power amp offers front rank stereo staging and transparency, and is capable of driving the most difficult loads	85W	R	62

LOUDSPEAKERS

Last item in the hi-fi chain, to some extent the loudspeaker is merely the slave of what has gone before, capable only of reproducing a signal as good as it is fed. Nevertheless the distortions (colorations and stereo effects) introduced by loudspeakers (and rooms) tend to be more immediately obvious than those anywhere else in the chain, so careful choosing according to taste is very important.

The average loudspeaker consists of a smallish enclosure, much of which may have begun life as

part of a tree, plus a couple of drive units hidden behind a removable grille. Inside the box lurks a simple electrical circuit known as a crossover, which divides the incoming (full range) signal into the right bits for the drivers to handle. Variations on the above formula are specifically identified in the entries. The designer's primary task is to balance the sensitivity of the loudspeaker (how loud it goes for a given electrical input) against the bass extension (how low does it go) for the given box size. After that such subtleties as coloration and

dispersion come into the equation.

Careful placement of the loudspeakers within the room is as important as the initial choice of model. For good stereo they need to be more or less the same distance from nearby walls, and preferably on similar rigid stands. The listener should be about the same distance from and listening angle to each loudspeaker. The ideal placement depends on the way a particular model has been balanced (not to mention a number of other factors), and our recommendation is given in the entries.

MODEL PRICE	LAB SOUND	COMMENTS	SIZE PLACEMENT	SENSITIVITY BASS FROM	VALUE	BACK ISSUE FULL REVIEW
Acoustic Energy AE1 £696	Good Very Good	To the author's knowledge, the most awesomely dynamic and articulate miniature ever made	29.5 x 18 x 25cm semi-open space	88dB/W 60Hz	R	59
Acoustic Energy AE2 £1138	Good Very Good	Dynamic, solid and lively, a great allrounder if a bit small considering the price. AE proves that metal cone/dome drivers really work.	39 x 23.5 x 29.5cm heavy stands in free space	88.5dB/W 45Hz	R	66
Acoustic Energy AE4 £1880 (stands £550)	Uneven Uneven	Magnificent but also seriously flawed, the AE4 possesses tremendous dynamic realism but a very mid-dominant balance. Large rooms and wallets only need apply.	54 x 32.5 x 44cm own stands in free space	90dB/W 40Hz		71
Acoustic Research ART12 £125	Average Average—	Nicely presented and engineered, but sounds a bit small and boxy without true coherence.	36 x 19 x 18.5cm stands near rear wall	87dB/W 75Hz		66
Acoustic Research ART22 £150	Average Average	Despite a promising enough list of ingredients, the 222 failed to excite real enthusiasm amongst the listening panel	38.5 x 19 x 22cm stands near rear wall	87dB/W 68Hz		68
Acoustic Research ART32 £200	Average+ Average—	Good presentation and detail engineering was not sufficient to counter bass heavy balance problems on auditioning	44.5 x 23 x 25.5cm stands 1ft from rear wall	87dB/W 50Hz		66
Alexander 566 £159	Good— Average—	Unusual shape, metal-jacket miniature that works well within limited dynamic range capability; needs free space siting.	40.5 x 11 x 16 narrow stands in free space	83dB/W 70Hz		71
Alexander Aurora £379	Average Good—	The unusual metal case and slim shape of this grown up miniature provide welcome diversity. It sounds pretty good too	42.5 x 14 x 19cm matching stands in free space	85dB/W 55Hz		66
Allison CD6 £290	Average Good—	An unusual cube-shaped model designed for wall mounting gives exceptional bass extension from a small box, though it's also a bit heavy, coloured and slow	28.5 x 28.5 x 28.5cm stands against rear wall	88dB/W 45Hz	R	71
Alphason Orpheus £800	Good Good+	Large hi-tech two-way features unusual, sweet-sounding isodynamic tweeter; well engineered and balanced if a shade odd in appearance	65.5 x 28 x 34cm stands near rear wall	87dB/W 43Hz	R	71
Apogee Scintilla £4990	Good Very Good	These take-me-to-your-leader speakers gave exceptional transparency and can achieve excellent results in a true audiophile system	145 x 88 x 9cm free space on floor	79dB/W 20Hz	R	46/Coil
A&R Arcam Three £149	Average+ Average—	Arcam's baby speaker did not delight our listeners, but it might do better in less expensive systems	34 x 18 x 23cm close to wall at head height	88.5dB/W 95Hz		53
A&R Arcam Two £270	Good Average	Most things to most men this compact is unlikely to disappoint with its lively "ballys" character though lacking weight... a bit	38 x 23 x 28cm near wall shelf or 40cm stands	88dB/W 55Hz		59
A&R Arcam One Plus £359	Good Average	Provides a solid, weighty and rich sound, but is a little raw in the treble and indefinite in the midband	22.3 x 28.1 x 37.8cm open space, on stands	88.5dB/W 60Hz		59
Ariston Image £159	Good Average	Good engineering content at a reasonable price, the Image delivers fine stereo with low coloration, but sounded too bassy under our listening conditions	42 x 22 x 27cm stands in free space	87dB/W 55Hz		66

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LOUDSPEAKERS

MODEL PRICE	LAB SOUND	COMMENTS	SIZE PLACEMENT	SENSITIVITY BASS FROM	VALUE	BACK ISSUE FULL REVIEW
Audio Electronics TC10 II £599	Good— Good+	Oddball appearance is rescued by a respectable technical performance, interesting and impressive engineering and fine sound quality at a realistic price.	70 x 33.5 x 33.5cm low stands in free space	87.5dB/W 40Hz	R	68
Avance 120 £279	Average+ Average+	This unusual "after eighties" looking speaker has the recipe for success, but not quite the right seasoning yet	42 x 30 x 30cm 30cm from wall on 40cm stands	86.5dB/W 60Hz		53
B&W DMS50 £149	Good+ Average—	Beautifully presented, well engineered near-miniature with precise sound but a distinct lack of 'wellig'. Ideal for considerate flat dwellers	35 x 20.5 x 22.5cm stands in free space	86dB/W 70Hz		71
B&W DMS60 £200	Average+ Average—	Fine cosmetic presentation and good engineering for the price; overload protection may be handy but listening panel was underwhelmed	49 x 23.5 x 30cm stands in free space	88dB/W 55Hz		66
B&W LMI Mk II £249	Average+ Average	Probably one of the best 'micros' ever made, worth considering for special applications (boats or vehicles). Upgraded since our review	24 x 15.5 x 20cm shelf or flush mount	86.5dB/W 80Hz	*	31
B&W DM1600 £369	Good Good	Crisp, dynamic loudspeaker with tight but not especially deep bass and a tweeter that sometimes sounds overcooked	49 x 23.6 x 30cm free space, open stands	87.5dB/W 60Hz	R	59
BLQ Q2 £275	Average— Average	Nearly a good loudspeaker, the basic balance is good, but the midband is very uneven and there are severe losses of resolution, 'space' and dynamics	43 x 25.1 x 24.5 semi open on stands	87.5dB/W 70Hz		59
Bose Interaudio 3000XL £140	Average Average—	Lots of perceived value and well enough balanced, but low cost cabinet and driver engineering results in a crude and unsubtle sound	46.5 x 29 x 23cm stands in free space	89dB/W 45Hz		71
Boston A4011 £120	Average Average—	Competent performance for size and price but below average relative to the UK competition	34 x 21 x 20cm on stands near wall	88.5dB/W 63Hz		41
Canton Karat 20 £300	Good+ Average+	Very prettily finished and accomplished near-miniature, the bright-sounding '20's only difficulty lies in justifying its high price	34 x 22 x 20cm stands in free space	87dB/W 55Hz	R	71
Canton Karat 40 £550	Average Average	Pretty and compact three-way for those who mourn the passing of the loudness control - definitely errs on the boom'n'tizz side	50 x 27 x 27cm stands in free space	88dB/W 50Hz		71
Canton 60 Karat £630	Average+ Good	Looks a bit of a throwback designwise, but is nicely presented and has a lively, dynamic and generous sound	58 x 31.5 x 31cm stands in open space	90dB/W 48Hz	R	66
Castle Clyde £149	Average+ Average	A tidy little performer packing punch, but beginning to show its age in the light of new competition	37 x 21.5 x 22cm open space on stands	89.5dB/W 64Hz	R	46
Castle Durham £199	Average+ Average	Listening results were encouraging, well engineered and finished, but lean on treble and a bit weak on bass; still recommended	41 x 21.5 x 25cm near rear wall	89dB/W 67Hz	R	46
Castle Pembroke £309	Good Average+	Comfortably recommended, a sweet smooth sound with good overall balance of engineering-based performance	55 x 37.5 x 30.5cm open space on stands	88dB/W 46Hz	R	31
Castle Warwick £169	Good Average—	Excellent presentation and fine engineering with overload protection, but a sonic disappointment in bass and dynamic qualities	46.5 x 25 x 23cm stands 1ft from rear wall	88dB/W 50Hz		66
Celef Cirrus £180	Average Good	It's nice to see Celef back in the UK, with this decent sounding small reflex box that seems unusually tolerant of siting	39 x 20.5 x 23cm stands in free space	84dB/W 60Hz	R	66
Celef CF2 Nimbus £230	Good— Good—	Nicely balanced overall but a little uneven with it, this lively and dynamic large bookshelf model came close to Recommendation	46 x 25.2 x 24cm stands in free space	88dB/W 55Hz		71
Celestion DL6 Series Two £149	Good Average	Good tonal colouring and plenty of bass for the enclosure size; the metal dome tweeter is excellent, but bass and mid lack clarity and 'bite'	45.4 x 24.5 x 26.2cm near wall, on stands	87dB/W 65Hz		59
Celestion DL8 Series Two £199	Very Good Good	A refined middle market speaker has a smooth but slightly dull quality, with good definition and deep, if slightly boxy bass	50 x 27.5 x 27.8cm open, stands	87.5dB/W 60Hz	R	59
Celestion SL12Si £580	Average Average	Careful setting up does reveal elements of fine sound quality, but this 'grown up' SL6 variation has a lumpy response alongside its improved power handling	53 x 20 x 27cm matching stands clear of walls	85dB/W 50Hz		66
Celestion SL600Si £799	Good+ Good	This Aerolam high tech miniature has certain remarkable qualities that some will find irresistible, and which go a long way towards justifying the high price. Needs careful system and room matching.	27 x 20 x 23cm matching stands in free space	82dB/W 52Hz		68
Celestion SL700 £1349 inc stands	Good Good	Very sophisticated, mostly smooth and accurate transducer, with fast but not very deep bass and a rather bright treble	37.5 x 20 x 23.5cm free air on tall stands	83dB/W 45Hz		60
Celestion 6000 £1470	Very Good Very Good	A genuine fullrange audiophile quality speaker system - with Star Wars styling to suit a high tech environment	Complex, on floor in free space	82.5dB/W	R	60
Chameleon 500 £349	Average— Average—	Sounding badly coloured, dull and compressed, it is also amateurishly constructed, despite using good quality materials	38 x 25.3 x 31.3cm free, stands	89.5dB/W 75Hz		59
Energy 22 Pro Monitor £600	Good Good	Presentation is a bit rough for the price, but this Canadian entrant is an impressive sonic allrounder that will appeal to most listeners	62.5 x 27 x 30cm stands in free space	87dB/W 40Hz	R	66
Gale 301 £300	Average Average+	Of unusual, distinctive appearance this produced a mixed response, being lively but lacking depth	44 x 23.5 x 22cm on stands quite near wall	86.5dB/W 63Hz	*	46
Gale GS402 £700	Average+ Average+	Clean but rich and powerful bass; stereo focus was not a strong point, but it is worth considering. (Recent revisions not checked)	61 x 35.5 x 28cm on matching stands near wall	88dB/W 48Hz	*	46
Goodmans Maxim Two £90	Average+ Average	More wham-bam-thankyou-mam sound that imitates much bigger speakers when you let these babies yell. (A well-controlled yell)	26 x 17 x 19cm near wall on shelf or stand	86dB/W 85Hz	BB	59
Goodmans Point 3 £100	Average+ Average—	Recommended as good value for money, but our listeners' differing opinions mean your ears should judge for themselves	47 x 25 x 20cm shelf/high stand near wall	90dB/W 80Hz	R	53
Goodmans Sterling Point 5s £139	Good— Average—	Looks a remarkably good deal with apparently good engineering, but the room drive is mid-dominant and the sound is loud but not that likeable.	56 x 29 x 26cm stands in free space	89dB/W 60Hz		71
Goodmans Point 7 £180	Average+ Average	Basically competent performance-mix and a lot of speaker for the money, but a certain lack of refinement nonetheless	69 x 33 x 26cm free space on 35cm stand	85dB/W 47Hz		53
Harbeth LS3/5A £330	Good Average	Still a classic miniature, though not to every taste, and none the better for the recent update under our listening conditions. Limited dynamic range	30.5 x 19 x 16cm stands in free space	81dB/W 60Hz		66
Harbeth HL Compact From £499	Very Good Average	The clean and neutral sound lacks resolution and gives rather unsubtle though well differentiated stereo. Can be bi-wired to advantage	52 x 27.2 x 28.1cm open space, on high stands	87.5dB/W 65Hz		59
Heco Interior 430s £399	Good Good—	This tall floorstanding enclosure delivers an impressively even sound balance with good bass extension, if not the lively dynamics to satisfy enthusiasts	85 x 24 x 27.5cm free space	88dB/W 43Hz	R	71
Heybrook Point Five £129	Average Average	Disappointingly prosaic performance on listening tests; wooden and hollow, with restricted dynamics and 'space'. Earlier samples sounded better	37.5 x 23 x 23cm near wall, on matching stands	86dB/W 65Hz		59
Heybrook Point 7 £169	Average Average	Physically an attractive package, but not entirely convincing in lab or listening panel test; interesting for all that	40.5 x 23 x 23cm stands against rear wall	85dB/W 60Hz		68
Heybrook HB1 £189	Good Average+	No longer an over-bright character, a strikingly clear sound and fine transient performance now merits recommendation	47 x 29 x 23cm on stands near wall	88dB/W 61Hz	R	46
Heybrook HB100 £249	Average+ Good	Well matched for wall siting, the HB100 is a lively and informative performer in the tradition of the popular HB1	47 x 26 x 28cm stands near rear wall	86dB/W 50Hz	BB	66
Heybrook HB200 £369	Average Average	This luxury successor to the HB2 is lively and informative, but sounded insufficiently balanced to convince our listening panel	46 x 23 x 26cm stands against rear wall	87dB/W 55Hz		66

THE WORLD'S NO 1 GUIDE TO BUYING HI-FI

THE DIRECTORY

LOUDSPEAKERS

MODEL PRICE	LAB SOUND	COMMENTS	SIZE PLACEMENT	SENSITIVITY BASS FROM	VALUE	BACK ISSUE FULL REVIEW
Infinity RS2000 £130	Good Good+	Fast, detailed and assured miniature with quick but not very deep bass. The top end is detailed but sometimes jangly	36.2 x 22.5 x 20cm near rear wall, high stands	91.5dB/W 70Hz	BB	59
Infinity Kappa 6 £725	Good Good	Interestingly styled US loudspeaker has unusual high tech drivers and good neutrality, but the sound seriously lacks excitement	63 x 38 x 24cm stands, free space	85dB/W 35Hz		66
Infinity Kappa 8 £1650	n/a Good++	Very nicely made and unobtrusive but large four-way speakers which have a tendency to sound bass heavy unless used with solid core cables	118 x 51.5 x 17.5cm floor standing, open space	89dB/W 33Hz		72
Jamo Concert 2 £240	Good Average-	A thoroughly respectable 'bookshelf' performer that needs free space siting but includes attractive cabinetwork and a neat grille	41 x 24 x 25cm stands in free space	85dB/W 48Hz		66
JBL TLX12 £149	Good- Average	This smart near-miniature has a 'boppy', lively bottom end, but beware of the fizz in its top	37 x 23 x 23cm stands 0.5m from rear wall	87dB/W 55Hz	R	71
JBL LX44 £340	Good- Average	This generously built model offers good power handling, bass extension and dynamic range, but suffers from the 'three-way syndrome', with middle muddle	58.5 x 30 x 29cm stands in free space	89dB/W 40Hz		71
JBL L 60T £449	Good+ Good	Well balanced and offering realistic value for money, the fine treble and extended bass make it suitable for larger rooms	78 x 30.5 x 26.5cm low stands or floor	88dB/W 40Hz	R	46
JBL L80T £649	Good Average	Large scale, dynamic if rather unwieldy sounding, this is a performer of integrity, if not much subtlety	85.1 x 35.6 x 30.3cm floorstanding, open space	89.5dB/W 55Hz		59
JBL 18Ti £599	Good+ Good	Beautifully engineered, well finished miniature with many good points, but unexceptional overall. Try the cheaper L20T	34 x 24 x 22.5cm 50cm from wall on rigid stands	85.5dB/W 53Hz		46
JBL 250Ti £3599	Good+ Good+	In general this speaker did not show the required level of dynamic presentation transparency and stereo depth expected of a pricey flagship model	132 x 57 x 36cm free space on floor	89dB/W 53Hz		46
JPW Sonata £99	Good Average+	Well balanced and integrated, this near-miniature offers fine sound if limited bass and dynamic range, plus real tree wood at a nearly silly price	32 x 23 x 20cm stands near rear wall	86dB/W 55Hz	BB	71
JPW P1 £125	Good Average+	Honest and basically articulate if not very sophisticated, resolution is good but it can sound a little wearing in bright systems or with rough sounding material	44 x 25.9 x 26.1cm free space on stands	89dB/W 60Hz	R	59
JPW AP2 £145	Good Average+	Few grounds for criticism but purchasers should check out the treble qualities to avoid hammering the ear anvils	46 x 26 x 25cm 40cm from wall on 45cm stands	89dB/W 65Hz	R	53
JPW AP3 £210	Good Average+	Pretty good stereo and well balanced overall it had its own character which is well suited to vinyl replay	52 x 25 x 29.5cm near wall on stands	90dB/W 57Hz	R	46
KEF C15 £99	Good Average	One of the tiniest around delivers a surprisingly 'big' and well balanced sound, with excellent stereo from free space siting	26.5 x 18 x 14cm stands in free space	85dB/W 60Hz	R	71
KEF C75 £349	Good Good	Compact floorstanding model's Uni-Q driver provides fine crossover integration, giving stable stereo and fine dynamic range within a slightly 'rich' balance	72 x 24.5 x 25.5cm floor in free space	90dB/W 45Hz	R	71
KEF R102 £365	Very Good Very Good	High class near-miniature with expressive, articulate midband and clean, accurate bass and top. The sound quality of the Kube circuitry, however, is suspect; what would an audiophile Kube sound like?	33 x 20.7 x 26.3cm near wall or open on stands	89.5dB/W 60Hz	R	59
KEF T03/3 £680	Good+ Good	Technically impressive, excellent bass/power handling for size, but not for the audiophile system. Better among cheaper components, and good in a large room	56 x 27 x 30cm supplied stands free space	90-95dB/W 35Hz		53
KEF T04/2 (inc KUBE equaliser) £895 (£994)	Very Good Good++	A reference point for dynamics, preferred without KUBE, suited to many rooms. Good stereo, high sound levels	90 x 28 x 41.5cm floor standing in free space	92dB/W 50Hz	R	60
KEF T07 £2025	Very Good Good+	A welcome sense of ease and lack of strain at most normal levels. Minor criticisms included a dulling in the extreme treble. Excellent bass extension	116.5 x 33 x 45cm near floor in free space	87.5dB/W 20Hz	R	60
Linn Helix £279	Average+ Good	Attractive presentation is coupled with an attractively lively sound which is more neutral if less committed than earlier Linn loudspeakers	51 x 25.5 x 28cm stands 1ft from rear wall	88dB/W 53Hz	R	66
Linn Nexus £379	Good Average	Good features include a solid, meaty bass plus good imagery and tonal balance. The catch is that Nexus lacks resolution and timing	49 x 23.5 x 30.4cm near rear wall supplied stands	89dB/W 60Hz		59
Linn Sara £795	Good Very Good	The new Sara is now much smoother and sweeter, with much better imaging. Bass power and dynamics are as good as ever, and the system is no longer as fussy as before	43 x 34.4 x 26.5cm stand mounting, near wall	88dB/W 50Hz	R	60
Magneplanar SMGa £675	Average- Average	Tonally 'rich', in the right room it proved a satisfactory musical experience	122 x 48 x 4.5cm on floor clear of wall	85dB/W 56Hz		46
Magneplanar MG1.4 £1098	Good+ Good+	Replaces the stalwart MGic with a revised panel layout. Offers a very crisp and articulate sound, particularly revealing of upper mid vocal details	155 x 8 x 57cm open space	88dB 40Hz	R	72
Magneplanar MG2.5R £1897	Good Good	Offers the low coloration and profound musical insight of better electrostatic loudspeakers but without loss of low frequency extension	183 x 56 x 4.5cm Open space	83-85dB/W 35Hz	R	60
Magneplanar MG11a £2650	Good Very Good	Another excellent true-audiophile loudspeaker this American panel speaker helps to convey much of the original character of the music	180 x 62 x 38cm well clear of walls	84-86dB/W 35Hz	R	46
Marantz LD20 DMS £150	Average Average	Recommended more for CD users than vinyl keepers, soundly engineered and built but should be heard before bought	36 x 23 x 24cm free space on 45cm stands	86.5dB/W 55Hz		53
Marantz LD50DMS £200	Very Good Good-	Well behaved larger two-way has fine balance, stereo and integration with good bass extension, albeit with mild 'boxy', 'chesty' and 'fizzy' effects	42.5 x 27 x 28cm stands in free space	87dB/W 50Hz	BB	71
Martin Logan CLS II £3750	n/a Very Good	Much improved high resolution design, fussy about system set-up and demanding of ancillaries and software alike. It rewards the efforts though	60 x 28 x 7.5cm open space	86dB/W 45Hz	R	72
MB Quart 39D £469	Below Average Poor	An aggressive, messy sounding design whose uncouthness undermines the positive level of detail	52 x 31 x 30.5cm open space, on stands	89.5dB/W 60Hz		59
Meridian M30 £775	Average+ Average	Pricy but easy on the ears and worth considering especially where space is at a premium	38.5 x 18 x 32cm free space on stands	Active 40Hz		46
Mission 761 £120	Average Good	One helluva speaker for the price, if a shade small and short of subtlety and refinement - should prove a worthy successor to the 70 and 700	38 x 21 x 21cm stands near rear wall	87dB/W 60Hz	BB	66
Mission 762 £180	Average Average-	Mission's 'bookshelf middleweight' offers high sensitivity and loudness capability, but at the expense of a somewhat untidy and rather 'heavy' sound	50 x 25 x 27cm stand, experiment advised	91dB/W 55Hz		66
Mission 763 £280	Average+ Average+	A very artful combination of generous volume and good bass extension at a modest price. Works well in the listening room despite a few rough edges	77 x 25 x 32cm near rear wall	86dB 40Hz	BB	68
Mission Cyrus 782 £340 (stands £80)	Good- Good-	Lively, articulate and beautifully finished, this compact wall-mount model with twin main drivers has good integration but a rather rich, 'Loudness' balance	50 x 25 x 32.5cm Cyrus stands near wall	90dB/W 50Hz		71
Mission 764 £400	Good Good-	Large floorstander has fine bass extension but limited dynamic range, and sounds 'lazier' than Best Buy 763	86 x 25 x 32cm 0.5+m from rear wall	86dB/W 43Hz		71
Monitor Audio R100 £159	Average+ Average-	Tonally quite neutral, but with small box character, negligible low bass and a rather 'hard' midrange	40.5 x 25 x 21cm free space on stands	87.5dB/W 70Hz		46
Monitor Audio R300/MD £250	Average Average-	An attractive 'large bookshelf' model that's handicapped by poor crossover and integration between paper cone bass and metal dome tweeter	47.5 x 25 x 30.5cm stands in free space	88dB/W 50Hz		71

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LOUDSPEAKERS

MODEL PRICE	LAB SOUND	COMMENTS	SIZE PLACEMENT	SENSITIVITY BASS FROM	VALUE	BACK ISSUE FULL REVIEW
Monitor Audio R352/MD £299	Average+ Good	A good value large box that sounds more engaging than subtle, providing a good compromise between bandwidth and sensitivity	64 x 25 x 32cm stands in free space	89dB/W 45Hz	R	66
Monitor Audio R452/MD £399	Average Average	This big, efficient, dynamic sounding loudspeaker has a clean, open treble but a pinched, two-dimensional midband. Can be tiring in the long run	64 x 25 x 31.8cm open space, low stands	89dB/W 55Hz		59
Monitor Audio R852/Gold MD £449	Good Good	Luxury build and 'high tech' tweeter or not, this compact model offers good refinement and detail on an open soundstage	45 x 25 x 26cm stands in free space	86dB/W 50Hz	R	66
Monitor Audio 1200 Gold MD £799	Average Average+	This smooth and civilised slimline floorstanding loudspeaker is well built and nicely presented. But it is also expensive	94 x 20 x 26cm in free space	85dB/W 48Hz		68
Mordaunt Short MS10 II £90	Average Average-	One of the best miniatures around. A borderline Best Buy because of the bass limitations, which may depend on your taste	29 x 20 x 17cm wall bracket	86dB/W 75Hz	R	53
Mordaunt Short MS100 £189	Average+ Average+	A 'mid forward' tonal balance is its main drawback but other aspects such as ambience, transparency and stereo depth compensate	32.5 x 22.5 x 21.5cm stands near wall	85dB/W 80Hz	R	46
Mordaunt Short 45Ti £230	Good Average	A sensitive tandem-bass number that can be driven loud but loses its balance a bit and can be unsubtle	63 x 26 x 30cm low (20cm) stand near wall	90.5dB/W 52Hz		53
Mordaunt Short MS300 £319	Average+ Average+	Not considered particularly competitive in its class, though it has good power handling and stereo focus	54 x 22.5 x 25cm on stands near wall	89dB/W 65Hz		46
Mordaunt Short 442 £1150	Good+ Good++	A resounding success with the listening panels. Make sure your room can accommodate the bass	95 x 26 x 38cm floor standing in free space	87.5dB/W 40Hz	R	60
Musical Fidelity Reference 2 £199	Good- Good-	This compact wall-mount design with advanced drivers has good dynamics, balance and stereo, plus flashy styling and some midband 'boxy' coloration	38 x 25 x 20cm stands near rear wall	88dB/W 50Hz		71
Musical Fidelity MC-2 £299	Very Good Very Good	This exceptionally clean and clear design offers real subtlety and finesse. Bass quality is light but exceptionally clear; the treble is smooth if slightly shallow	48.5 x 25.5 x 16.5cm open space and stands	87.5dB/W 65Hz	BB	66
Musical Fidelity MC-4 £499	Very Good+ Very Good	Achieving a very high standard, the MC-4 sounds detailed and coherent like the MC-2, but with more bass depth and solidity, and large image scale	56.5 x 26.9 x 29cm open space on stands	87.5dB/W 60Hz	R	59
NVA Cube 1 £600 (stands £200)	Good- Good+	Attractive, cube-shaped semi-omni is very sturdily built, and gives an idiosyncratic but unusually open, spacious and informative sound	33 x 32 x 32cm own stands c0.5m from wall	85dB/W 52Hz	R	71
Opus 3 Capella £495	Good Good	The sound of this Scandinavian curiosity certainly benefits from the crushed marble enclosure, though presentation is strictly DIY	32 x 40.5 x 26(ave)cm amongst books in bookcase	86.5dB/W 45Hz		66
Quad ESL-63 £1538	Good+ Good++	With its unusual but subtle characteristics this classic electrostatic may not be punchy in the bass, but has strengths that some cannot live without	92 x 66 x 27cm open stand well clear of wall	84dB/W 34Hz	R	60
Richard Allan C05 £242	Average- Average-	This neatly presented small reflex design can sound engagingly communicative, but is flawed sonically and technically and quite expensive too	38 x 19 x 23cm on rigid stands	88dB/W 80Hz		68
Rogers LS7t £399	Good+ Good+	A fine combination of classic qualities at reasonable price produces the "R" tag, but try to get a pair home on approval to check for bass 'heaviness'	56 x 27 x 28cm free space on 40cm stands	88.5dB/W 48Hz	R	59
Rogers Studio 1a £565	Very Good Good-	The classic BBC monitor style sound sensitively updated - transparent and natural with fine stereo, but a touch 'heavy' in balance	63.5 x 30.5 x 30.5cm stands in free space	87dB/W 36Hz	R	66
Rotel RL850 II £130	Average+ Average+	Strongly recommended. Well-balanced, clear, with decent focus and fine stereo, but tendency to 'heaviness' needs decent stands and space	44 x 25 x 24cm free space on 40cm stands	86.5dB/W 50Hz	BB	59
Royd A7 Series 11 £99	Average+ Average	Lively clear sound; good upper bass and dynamics, but treble "ramp" made vocals sound shut in. Try before you buy	31 x 20 x 17cm shelf or 50cm stands near wall	86dB/W 75Hz	R	53
Royd Eden £235	Average Average+	Delightful mid/treble speed and transparency but determinedly bass light, this oddball miniature threatens cult status but could use a sweeter tweeter	31 x 20.5 x 18.5cm stands close to rear wall	87dB/W 85Hz	R	66
Ruark Swordsman £200	Good Average	Very attractively styled and finished, the Swordsman is a well built 'small bookshelf' model that delivered better test than listening results	38.5 x 20 x 27.5cm stands 0.5m from wall	84dB/W 50Hz		71
SD Acoustics OBS £695	Average Good+	Large but unusually pretty, needs a big(fish) room and has a sting at the top, but the transparent dipole midband provides an unusually open and dynamic sound	102 x 35 x 25cm spiked, in free space	86dB/W 45Hz	R	71
SD Acoustics SD1 £1150	Average Very Good	A large scale, airy and unusually detailed system with excellent dynamics. Balance is light and bright, and the original model could upset some systems/listeners. Current model has more civilised top-end and warmer overall balance	123.5 x 38.2 x 31.9cm free standing, away from walls	90dB/W 50Hz	R	60
Shan Shimna £280 (stands £75)	Average+ Good-	Pretty little miniature in cast mineral/plastics has limited dynamic range and could sound smoother, but integration is good and box effects slight	31 x 16 x 17cm stands near rear wall	84dB/W 65Hz	R	71
Sony APM-10TES £99	Good Average	Big hearded sound from small bookshelf successor to BB 10ES, sounds a little untidy at frequency extremes, so suits CD better than vinyl	39.5 x 22.5 x 23.5 stands in open space	86dB/W 52Hz	R	71
Sony APM 10ES £100	-	An obvious Best Buy at its highly competitive price point, it can do justice to a good hi-fi system of Sony or specialist origins	40 x 25 x 20cm, 40cm stands 40cm from wall	87dB/W 55Hz	BB	59
Sony APM 22ES £249	Good+ Good	Sounding notably clear, the 22ES scored well on listening tests was easy to drive and achieved high sound levels	51.5 x 29 x 30cm free space on 40cm stands	88.5dB/W 46Hz	R	46
Sony APM-18TES £300	Very Good Average	Big and beefy but also somewhat fat and bass heavy, this well engineered three-way has notable strengths but lacks transparency and sounds better at lower levels	57.5 x 29 x 36cm stands in open space	87dB/W 40Hz		71
Sony APM 66ES £700	Average+ Average+	Powerful heavyweight sound with a brilliant midband - clear articulate and transparent. But the bass is on the boomy side and the treble can sound grainy	66 x 38 x 36.5cm open space, low stands	89dB/W 60Hz		59
Spendor SP2 £470	Very Good Good+	Conceding little to the SP1, this 30 litre model displayed good tonal balance with a highly articulate midrange, only slightly marred at frequency extremes	50 x 25 x 30cm free space, stands	87dB/W 45Hz	R*	59
Spendor SP1 £710	Very Good Good	A very subtle and musical performer that works particularly well with digital material. An exceptional allrounder	63.5 x 29.5 x 30.5cm stands in open space	87dB/W 41Hz	R	60
Spendor SA3 Passive £1500	- Good+	Same as Spendor SA3 active	85 x 38 x 46cm low	89dB/W 32Hz	R	46
Spendor SA3 Active £2900	Good+ Very Good	Substantial speakers designed to deliver high sound levels and killer bass. Suited to larger rooms and power hungry ears	85 x 38 x 46cm low rigid stands in free space	89dB/W 32Hz	R	46
Spica TC50 £595	Good- Good	This triangular-profile 'grown up' miniature is a shade boxy and laid back but has good rhythmic and musical integrity	40.5 x 33 x 29cm stands in open space	88dB/W 55Hz		71
Spica TC50SE £795	Good- Good	A heavily UK-modified TC50, the SE sounds less boxy and more spacious, but lacks some of the urgency of the standard model	40.5 x 33 x 29cm stands in open space	88dB/W 55Hz		71
Spica Angelus £1195	Good Average	A little bass shy and soft in the bass and lower mid, the Angelus is otherwise tidy, extremely lively and fluid, if uneven overall	116.8 x 53.3 x 26cm free standing away from walls	86.5dB/W 50Hz		60
Studio Power Sapphire £130	Poor Average-	Balance difficulties are improving, though still prevent the potential of this interesting metal-cone new miniature from being fully realised	30 x 20 x 19.5cm stands near rear wall	85dB/W 70Hz		66
Tannoy Eclipse £120	Average+ Good	Although a little bright, the essentials are right: hear-through clarity at all frequencies, good dynamics, firm bass	38.8 x 22.6 x 21cm semi open on stands	87dB/W 65Hz	BB	59

THE WORLD'S NO 1 GUIDE TO BUYING HI-FI

THE DIRECTORY

LOUDSPEAKERS

MODEL PRICE	LAB SOUND	COMMENTS	SIZE PLACEMENT	SENSITIVITY BASS FROM	VALUE	BACK ISSUE FULL REVIEW
Tannoy Mercury S £160	Good Good	A fine budget allrounder in the now established Mercury tradition; good balance and reasonable refinement will ensure wide appeal	49.5 x 25 x 21.5cm stands in free space	87dB/W 50Hz	BB	66
Tannoy DC1000 £199	Average Average—	The smaller of two DC models with dual concentric drivers, the '1000 is much less well balanced than the larger, floorstanding '2000	50 x 24 x 25cm	91dB/W 53Hz		71
Tannoy M20 Gold £200	Good Average+	Luxury version of Mercury S with real wood and bi-wire frills doesn't necessarily sound any better overall, but still fine value	49.5 x 25 x 21.5cm stands in free space	87dB/W 50Hz	R	68
Tannoy DC2000 £300	Good Good	Remarkably high sensitivity from unique dual concentric driver that has an involving but characteristic sound. Bass could be better	68.5 x 26 x 27cm floor in free space	93dB/W 55Hz	R	66
Tannoy Westminster £3400	n/a Good+	These awesome horn loaded speakers are remarkably controlled and impressive, if only suited to a few pockets and rooms	Huge, flat against rear wall, away from corners	96dB/W (manuf.)	R	Coll
TOL Monitor £1600	Very Good Very Good	Fine solidity and good accuracy, with enough bass extension to satisfy even organ freaks. Needs a big room and can sound a bit lazy and a shade tinkly	118.5 x 30 x 47cm 0.5m from walls	85dB/W 28Hz	R	66
Technics SBC 250 £130	Average+ Average—	Despite a fairly even tonal balance, the 250EK sounded muddled in the midrange and dull in character	36.5 x 23.5 x 20.5cm free space, stands	86dB/W 60Hz		46
Technics SB-RX50 £500	Very Good Average+	With its unique coaxial drive unit the RX50 proved a smooth and well balanced loudspeaker, its minor weakness being a mildly excessive low bass	48 x 30 x 26cm free space on 40cm stands	86dB/W 40Hz	R	46
Toshiba SS33-M £90	Average Average	Providing a benchmark for budget loudspeakers, this Toshiba-inspired but UK designed and manufactured model is a lot of loudspeaker for the money, if a shade on the cheap	40 x 26 x 21.5cm stands in free space	86dB/W 55Hz	BB	68
Wharfedale Delta 30 £79	Good Average	Very clear and surprisingly neutral for the price, with good dynamics and stereo within limited volume ceiling	37.9 x 20 x 16.9cm near wall on high stands	88.5dB/W 80Hz	BB	59
Wharfedale Delta 50 £99	Average+ Average—	"There's nothing obviously wrong, but it seems a bit mundane," is what we said when the Delta 50 was £129. But since then the price has dropped by 30 per cent, making it great value	48 x 27 x 19cm near wall on 40cm stands	88dB/W 55Hz		53
Wharfedale Diamond 111 £99	Below Average Average—	This latest version of the long running Diamond sports a better tweeter, but bass, though deep, is soft, and the midband is indistinct and uneven	24 x 18.5 x 20.5cm near wall, stands	86.5dB/W 75Hz		59
Wharfedale Super Diamond £139	Average Average—	Although there are improvements on the basic "legendary" model, listening panelists did not get airborne about this upgrade	24 x 19 x 19cm close to wall at head height	88dB/W 57Hz		53
Wharfedale 504/2 £139	Average Average	Not strictly accurate, this musically involving miniature sounds unusually coherent and well integrated, if a shade dull in balance	29 x 18.5 x 19cm stands against rear wall	84dB/W 60Hz	R	68
Wharfedale 505/2 £169	Average Good	This lively Wharfedale provides plenty of speaker with unusual refinement for the money, and should be fairly tolerant of room siting	44 x 25.5 x 24cm stands 1ft from wall	86dB/W 55Hz	BB	66
Wharfedale 510/2 £299	Average Average—	Even in it's latest guise, this loudspeaker still sounds hard, cluttered and lacking innate clarity. The bass is uneven and midband coloured.	61.5 x 28 x 29.6cm near wall, high stands	89dB/W 50Hz		59
Yamaha NS 1000M £900	Good Good+	Living up to its monitor label, and tonally well suited to digital material, the NS 1000M is superbly crafted and capable of high levels	67.5 x 37.5 x 32.5cm 30cm from wall, stands	90dB/W 40Hz	R	46

* rating refers to original, tested model.

CASSETTE DECKS

The bad odour of copyright theft hangs around the compact cassette, but there is no doubt it is the world's most versatile and ubiquitous music storage medium. Hi-fi buffs may wrinkle their noses pointedly, but are still happy to use cassette decks to make up tapes for the car or personal – at the same time complaining loudly about the quality of pre-recorded material. (In fact the very best decks can do a surprisingly good job with musicassettes.)

There is no problem in connecting a cassette deck to any normal amplifier, but some care needs

to be taken in choosing the best tapes for a specific machine. (Trial and error is one effective technique, but many decks have manual bias adjustment and some match up to the tape automatically.) Lab performance and sound quality often go hand in hand, and are frequently somewhat dependent upon factory alignment. The mechanical integrity of the mechanism itself is another crucial factor, that is often reflected in the asking price.

All modern hi-fi decks have Dolby B and the majority have Dolby C besides; the very worthwhile

HX Pro system is becoming steadily more widespread. Remote control remains rare, though sometimes it is available as a system option. Three-head recorders allow simultaneous checking of the recording being made. Auto-reverse is a useful convenience feature, but usually with some mechanical compromise, while double-mechanism 'dubbing' decks of dubious quality are fashionable at the bottom end of the market. The welter of different 'music search' systems available is some indication of their frequent ineffectiveness.

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Acoustic Research RD-06 £280	Average Average+	Acceptable middle market player with very simple facilities and cramped control section, but unusually good looks	Dolby B/C/HX Pro, fine bias, counter memory, repeat		69
Aiwa AD-F370 £130	Average Average	Adequate but uninspiring recorder with detail shortcomings but good control layout and successful sounding with recorded musicassettes	Dolby B, C, HX Pro, bias adjust		63
Aiwa AD-R470 £150	Average Good	For once, an auto-reverse deck with the performance of a decent unidirectional one at a similar price. The Aiwa is modern in concept and execution, and has good, transparent electronics	Dolby B/C/HX Pro, auto reverse, cue & review, bias adjust	BB	69
Aiwa AD-WX707 £180	Poor Average	Not bad value for a twin deck, but marginal from the high fidelity viewpoint. The review sample was poorly set up.	Dual deck, auto-reverse, Dolby B & C, bias adjust		57
Aiwa AD-F880 £300	Good Very Good	Modern sophisticated deck which manages to include some very sound under the skin development work in a rather ordinary (if well polished) exterior	Dolby B/C/HX Pro, 3 head, remote, manual tape calibration	R	69
Aiwa XK-007 Excelia £400	Good Good	Downmarket version of XK-009 with simplified bias/equalisation adjustment section and more forgiving but less informative sound. Still good, but less exciting than XK-009	Dolby B, C, dbx, HX Pro, 3 Head, tape alignment		63
Aiwa AD-WX909 £400	Good Good	Convenience meets sound quality, and both win. An essentially clean, positive recorder which works alongside an auto-reverse player of lower standard – a sensible compromise	Dual deck, auto-reverse, track search, Dolby B/C/HX Pro, bias adjust, 3 Head	R	57
Aiwa XK-009 Excelia £550	Very Good Very Good	Excellent detail, stable articulate midband and slightly obvious treble. The most interesting Aiwa for yonks	Dolby B, C, dbx, HX Pro, 3 Head, tape alignment, CD direct	R	63
Akai GX-32 £200	Average Poor	Constrained and smeared sum this deck well. It has poor bass and treble definition alike, though it proved well aligned for prerecorded cassettes	Dolby B/C, variable bias, headphone out, track search		69
Akai GX-52 £249	Very Good Very Good	Well finished and a pleasure to use this well specified deck sounds clean and defined with all tape groups, with or without Dolby	Dolby B, C, HX Pro, track locate features	BB	57
Akai GX-6 £350	Good Good	There is a strong sense that someone has really thought this one through; it has an indefinable 'specialness'	Real-time counter, track search, Dolby B, C, bias adjust	R	52
Akai GX-95 £400	Good Very Good	Well designed and finished cassette deck with features well judged to please the audiophile – especially switchable Dolby HX Pro and switchable panel display. The calibration system is simple and effective, and the deck sounds great	Dolby B/C/HX Pro, 3 head, manual tape set-up	R	69
Denon DR-M07 £125	Poor+ Average	There were several problems with the test player that render it an unsafe purchase. This is a pity since despite the antiquated control system, the deck is capable of refined sound quality	Dolby B/C, fine bias adjust		69

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THE DIRECTORY

CASSETTE DECKS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Denon DR-M10HX £180	Good Good	Very well laid out, a sensible range of features and smooth cam-operated transport. Replay-only sound quality suspect, but the deck is successful as a recorder – clean, precise but slightly 'grainy'	Dolby B, C, HX Pro, memory counter, bias adjust	R	63
Denon DR-M12HX £220	Good Good+	Well constructed and pleasant to use, a lack of true pitch constancy kept it from sounding superb	Track search, Dolby B, C, HX Pro, bias adjust	R	57
Denon DRW-750 £229	Good Good	Polished and articulate, the only significant shortcoming is poor performance with prerecorded material	Dolby B/C/HX Pro, twin unidirectional, one records	R	69
Denon DR-M24HX £290	Good Good+	This deck will slot into many high grade systems without disgracing itself – or the cassette medium. Very presentable high resolution sound with good stereo with or without Dolby	Dolby B, C, HX Pro, bias adjust, 3 Head	R	60
Denon DR-M34HR £320	Very Good Good+	Prerecorded cassettes sounded grey and dull, but this may have been a sample fault. As a recorder, the DR-M34 is refined and detailed – and good value	Dolby B, C, HX Pro, 3 Head, manual tape calibration, memory counter		63
Denon DR-M44HX £400	Excellent Excellent	A well designed deck that also performed fine sonically, working very well with ferric and metal tapes	Real-time counter, Dolby B, C, HX Pro, tape alignment adjust, remote control, 3 Head	R	60
Dual CC8010 £110	Average Average+	The only limitation worth noting is a slight opaqueness; the Dual otherwise sounds stable and effective. An excellent low-cost design	Dolby B & C, microphone input	BB	63
Goodmans GSW-5200 £90	Poor Poor	Musically unimpressive but at least it's cheap!	Dolby B, twin, one records		69
Grundig Fine Arts CCT-903 n/a (system component)	Good Good-	[Competent part of complete Grundig system]. Solid and well engineered deck with small but significant problems preventing it scoring highly. Basic design generally – and transport specifically – are excellent	Dolby B/C, twin auto reverse, one records		69
Harman Kardon CD491 £695	Good Good+	Excellent audio engineering and tremendous flexibility make this an audiophile cassette deck 'par excellence'	Real-time counter, auto reverse, track search, Dolby B, C, HX Pro, bias adjust	R	52
JVC TD-R411 £180	Poor Poor	Transport irregularity, especially flutter, and poor set-up lead to a sound that although sharp is lacking in body and detail. However, the quick auto-reverse mechanism is nice to use.	Dolby B/C, auto reverse		69
JVC TD-W444 £190	Average Average	The 444 offers a satisfying blend of cost and facilities, but musically it is lacklustre, lacking detail, dynamics and grip. Fair value though	Dolby B/C, twin deck, unidirectional play deck, auto-reverse record deck		69
JVC TD-V711 £380	Very Good Excellent	This is a complex recorder which is built on the back of some important ideas with audiophile roots. It has a (mostly) superb technical performance and is very capable, if not always strictly accurate	Dolby B, C, HX Pro, 3 Head, variable bias, track search, 3 line inputs	R	63
JVC TD-W222 £150	Below Average Below Average	Well endowed but somewhat user-hostile twin deck. Sound quality is very tape dependent, but offers tolerable stability with considerable loss of resolution and scrappy musical presentation.	Dual deck, auto reverse, Dolby B/C		63
Kenwood KX-440HX £140	Average+ Poor	Uneven, unstable sounding player with limited resolving power, but good control layout and finish	Dolby B, C, HX Pro, intro scan		63
Kenwood KX-660HX £170	Good Good	Well designed control system with useful search aids. Sound quality is positive and detailed	Dolby B, C, HX Pro, track & blank search, intro-scan, bias adjust	R	63
Kenwood KX-5010 £269	Very Good Excellent	This important new middle price deck is a well thought through and thoroughly developed design which eschews gimmicks for the sake of musical excellence	Dolby B/C/HX Pro, auto tape calibration, track/intro search	BB	69
Luxman K-105 £349	Average Average	Rating quite well for an auto reverse deck, and featuring complex track search facilities, it was not sonically competitive on price	Auto reverse, track search, Dolby B & C, remote control		52
Luxman K-112 £349	Average Average	Build quality is not truly consistent with the price. Nor is sound, which veers on the warm, lossy side of neutral	Dolby B, C, HX Pro, bias adjust, 3 Head		57
Marantz SD-35 £150	Good Good+	Rock steady tape transport gives very competitive sound quality for the price, but the slightly bright replay may not appeal to some	Dolby B & C, bias adjust	R	52
Marantz SD-45II £200	Good+ Good+	Well built and dynamic sounding player, working better as a recorder than with musicassettes	Dolby B & C, bias adjust Auto selection	R	52
Marantz CP230 £300	Average Average	This is a competitively priced portable recorder though not suited to replay of musicassettes	Dolby B, bias adjust	R	52
Marantz SD585 £500	Average Average-	Sound quality is a little sat upon, and control ergonomics are somewhat opaque, though the twin auto-reverse/recording capability makes this a powerful machine	Dolby B/C, twin auto-reverse & record, parallel recording etc		69
Marantz SD-55 £349	Good Very Good	Slightly tacky feel and restricted signal/noise performance are the main shortcomings of an excellent sounding piece of kit	Real-time counter, track search, Dolby B/C/HX Pro, bias adjust, 3 Head	R	57
Memorex SCT-84 £200	Average+ Average+	The playback only transport is a little disappointing, but the record one is a quality item and the deck works well. Ergonomics are good, but styling and control feel are decidedly tacky.	Dolby B/C, fine bias, twin with auto-reverse record, unidirectional play	R	69
NAD 6300 £550	Very Good Very Good	Solid and homogeneous sound quality and very good replay compatibility thanks to 'play trim'. Distinctive, musical – and costly	Dolby B, C, HX Pro, 3 Head, bias adjust	R	63
Nakamichi CR-1E £345	Very Good Good	Modestly equipped by any standards, the CR-1E stands or falls by its build quality, which is high, and sound which is highly competent	Dolby B & C		57
Nakamichi CR-2E £395	Very Good Good+	Ordinary to look at, in some respects rather awkward to use (tape switching especially), the CR-2E sounds very slightly better than the CR-1E, and therefore ranks well. But it doesn't come cheap	Dolby B & C, bias adjust, remote control	R	57

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THE DIRECTORY

CASSETTE DECKS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Nakamichi RX-202E £545	Good Very Good+	Fine, clear and articulate sounding player. Excellent with prerecorded material, but idiosyncratic and sometimes obstructive control system	Auto reverse, Dolby B, C, 2 Head	R	63
Nakamichi CR-3E £595	Very Good Very Good	The user interface is a little clumsy, though conceptually straightforward. Sound quality approaches the CR-4E, and is amongst the best at the price.	Dolby B & C, bias adjust, remote control	R	57
Nakamichi CR-4E £745	Very Good+ Very Good+	High class deck with a reasonably full range of features and superb sound at a slightly unlikely price	Dolby B & C, bias adjust, remote control, 3 Head	R	57
Nakamichi CR-5E £995	Excellent Excellent	A slightly simplified version of the all-conquering CR-7, the CR-5 has a very similar standard of audio performance – the best	Dolby B/C, fine bias, 3-head	R	69
Nakamichi CR-7E £1500	Excellent Excellent	Remarkably this deck is not only ergonomically but also sonically superior to the Dragon, particularly on record/replay	Real-time counter, track search, Dolby B & C, tape alignment adjust, bias adjust, remote control, 3 Head	R	60
Nakamichi Dragon £1750	Excellent Excellent	Previous to the birth of the CR-7E, this machine stood head and shoulders above the rest. It is still the ultimate for musiccassette replay	Auto reverse, Dolby B & C, tape alignment adjust, bias adjust, remote		60
Onkyo TA-2120 £130	Average+ Good	Clear, vivid sound with good timing and resolution when using Type II tapes without Dolby. The controls are less inspiring – the meters in particular are plainly inadequate	Dolby B/C, auto tape sensing, block/side repeat	R	63
Dnkyo TA 2130 £160	Average+ Average+	Rating fairly well on both pre-recorded and record/playback, ergonomics were a little poor but overall performance was generally consistent	Track search, Dolby B & C, bias adjust		52
Philips FC566 £179	Average+ Average+	Mostly well equipped, though some tape search facilities fail to exploit the auto-reverse capability. Sounds clean and stable – with prerecorded tapes too	Auto reverse, track search, Dolby B & C		57
Philips FC567 £279	Average Poor	Well equipped but ergonomically substandard; sound quality is messy and lacking in clarity and dynamics	Dual deck, auto reverse, track search, Dolby B & C		57
Pioneer CT-443 £180	Average Good	Structurally sound and subtly musical recorder. Sophisticated, mildly damped sound quality	Dolby B & C, fine bias adjust, track search	R	63
Pioneer CT-737 £300	Average- Average-	Interesting design and a pleasure to use with rather too many rough edges to really work properly	Dolby B, C, HX Pro, 3 Head, bias adjust, memory counter		63
Pioneer CT-939 £450	Excellent Excellent	High grade and easy to use cassette deck featuring a state of the art transport. The audio amplifiers are not quite in the same class, but fail to seriously damp enthusiasm for an excellent package.	Dolby B/C/HX Pro, 3 head, real time counter, variable bias	R	69
Proton AD-200 £140	Poor Poor	Sound quality is essentially on a par with many portables, and has nothing to do with high fidelity. The main problems are an unrelenting hardness and an almost total lack of detail	Dolby B & C		57
Proton AD-300 £200	Average- Poor	High levels of flutter give sound a roughness and coarseness that rules it out for high quality work. The record and replay electronics certainly deserve better	Auto reverse, Dolby B & C		57
Revox B215 £1461	Good Average+	Superb engineering and good sound, but lacking the subjective qualities that characterise the very best hi-fi equipment	Real-time counter, Dolby B & C, tape alignment adjust, remote control		52
SAE C102 £549	Average+ Good	Looking most unlike a cassette deck designed in the States and proving competitive in its price group. Not sonically that outstanding, however	Real-time counter, track search, Dolby B & C		52
Sansui D-X30i £150	Average+ Good	Lively, informative and well equipped basic deck, if rather obscure operationally	Dolby B/C/HX Pro, variable bias, track search	R	69
Sony TC-FX 150 £90	Average+ Average+	Recording and playing back on this deck itself gave acceptable results, whereas prerecorded stuff was a joke. But it's a good £90 worth	Dolby B & C		52
Sony TC-W300 £150	Poor Poor	Deeply unimpressive and messy sounding deck with bloated quality and poor pitch integrity. Dubbing performance substandard	Dual deck, Dolby B & C		63
Sony TC-RX50 £180	Average- Poor	Terminal inability to play at a steady pitch, or (on prerecorded material) in tune spoiled this simple but otherwise attractive design	Auto-reverse, Dolby B/C/HX Pro		63
Sony TC-WR500 £200	Poor Poor	In many ways a curiously old-fashioned package which lives up (down?) to stereotypes about twin cassette decks	Twin Dolby B & C, 1 records, both auto-reverse		69
Sony (WMD6C) ProWalkman £249	Good+ Excellent	"One of the finest sounding cassette decks on the market today. A mandatory Best Buy, which also fits in your pocket"	Dolby B, & C	BB	60
Sony TC-RX60ES £250	Average Average	For once a stable sounding auto-reverse deck but sound quality is rather 'dirty' and compressed, especially with Dolby C	Auto-reverse, Dolby B/C/HX Pro, auto tape recognition		63
Sony TC-RX80ES £350	Average+ Good	Clean, powerful and detailed sound, especially without Dolby C. Stable pitch – but prerecorded cassettes sounded disappointing	Auto reverse, Dolby B/C/HX Pro, bias/level adjust	R	63
Sony TC-K700ES £499	Excellent Excellent	Firmly in the esoteric league, this is easy both to operate and to listen to. Best points: first class imagery, focus and stability	Track search, Dolby B & C, tape alignment adjust	R	60
Teac V-250 £89	Average Average	Ultra-basic design which works quite well. Lack of pitch integrity is the main shortcoming, but it wasn't always noticeable	Dolby B	R	63
Teac V-270C £109	Average- Average-	Not quite cheap enough to compete solely on price, the V-270C is a rather messy and unstable sounding deck	Dolby B & C, bias adjust		63
Teac V-570 £199	Average+ Good	Metal tapes are not exploited well by this deck, and prerecorded tapes sounded very disappointing. But the underlying sound quality sets a very high standard, assisted by clean electronics and an excellent transport	Dolby B/C/HX Pro, fine bias adjust	R	69
Teac V-670 £249	Average Average	This deck is worth considering, but much has been sacrificed for the third head, both musically and in the range and type of features included. Worth considering	Dolby B/C/HX Pro, fine bias, 3 head/off tape monitoring		69
Teac R-515 £299	Average+ Average+	Expensive, this deck is basically a competent but pedestrian performer which will not fully satisfy the critical user	Real-time counter, auto reverse, Dolby B & C, bias adjust		57
Teac W-460C £299	Good Average	Musically this deck is a little lacking, given the price and despite a notably fine transport section. Nevertheless well worth considering if the programming options appeal.	Dolby B/C, twin unidirectional, one records. Programme memory		69
Teac V-870 £399	Good+ Good	Cut-down V-970X for the proletariat. Expensive and carefully engineered with mostly very good but slightly cold sound quality	Dolby B, C, HX Pro, 3 Head, manual tape calibration	R	63
Teac V-970X £499	Very Good Very Good	An excellent sounding deck with useful features (tape calibration etc) that fully justifies the price	Real-time counter, track search, Dolby B/C/dbx & Dolby HX Pro, bias adjust, remote control, 3 Head	R	57
Teac W-990RX £499	Good Good	A mess with dbx, but taut and articulate otherwise. The 990, though expensive, has a powerful range of features, making it one of the few really ambitious decks to successfully straddle both sets of requirements	Dolby B/C & dbx, dual auto-reverse/record, parallel & sequential recording, remote	R	69
Technics RS-T230 £160	Average- Average	Satisfactory with prerecorded material but otherwise unexceptional, the main features of this deck are its excellent user interface and value for money	Dual deck, Dolby B/C		63
Technics RS-B355 £140	Good Good	Good sound let down by inadequate meters and poor prerecorded replay only sound quality	Dolby B, C, microphone inputs, cue and review	R	63
Technics RS-B505 £160	Average+ Average+	Neatly made recorder with Dolby HX Pro that sounds precise and stable, though sometimes a little processed and grainy too	Track search, Dolby B/C/HX Pro		57

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THE DIRECTORY

CASSETTE DECKS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Technics RS-B605 £180	Good Average+	Mixed but generally good sound. Weakest points are dbx and prerecorded sound, best are Type IV (metal) recordings which sound sharp and precise	Track search, Dolby B/C/HX Pro & dbx		57
Technics RS-T330R £200	Average+ Average+	One of the very few dual cassette decks with any real pretensions to audio quality, the RS-T330 is a considerable success musically as well as being a pleasure to use	Dual deck, Dolby B & C	R	63
Technics RS-B705 £250	Average Average-	3 heads for the price of two, but not the sound quality to go with them	Track search, Dolby B, C, HX Pro, bias adjust, 3 Head		52
Technics RS-B905 £350	Good Good	Good, well set up cassette deck with a clean, accurate sound but some compression. dbx circuit sounds poor	Dolby B, C, HX Pro, dbx, bias adjust, 3 Head		57
Technics RS-T80R £400	Poor Poor	Flexible and pleasant to use but poor transports led to poor sound on our latest sample	Dual deck, auto reverse, track search, Dolby B, C, dbx		52
Yamaha KX-200 £120	Good- Good	Cheap, well-equipped and workmanlike with the sound quality less obviously processed than most - the whole is more than the sum of the parts	Track search, Dolby B & C, remote control	R	52
Yamaha KX-300 £150	Average+ Average-	Uncommonly well equipped and adequately made and presented, this model turned out to be a disappointingly uncertain proposition on audition	Track search, Dolby B, C, HX Pro with 'play trim', bias adjust, remote control		57
Yamaha KX-400 £200	Good Good+	A highly commercial package with every widget under the sun. Happily it sounds good too.	Auto reverse, track search, Dolby B, C, HX Pro, remote control	R	52
Yamaha KX-500 £210	Very Good Very Good	An accomplished performer, strongest in the areas of pitch and spatial stability, but slightly rough around the edges	Real-time counter, track search, Dolby B/C/HX Pro with play trim, bias adjust, remote control	R	57
Yamaha KX-800 £330	Good Average	The present Yamaha range seems oddly inconsistent. This sophisticated model sounds fine (almost) but came a clear second best to the KX-500	Real-time counter, track search, Dolby B, C, HX Pro with play trim, bias adjust, 3 Head		57
Yamaha KX-1200 £500	Excellent Average+	A veritable rats' nest of buttons and dials, albeit well laid-out. This is nearly a great recorder, but lacks simplicity of sound	Real-time counter, track search, Dolby B, C, dbx, HX Pro, bias adjust, remote control		52

DAT RECORDERS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Aiwa Excelia XD-001 £1300	Very Good Very Good	Clear and very listenable recorder roughly comparable to but slightly sweeter sounding than the Sony DCT-1000ES - but with an inferior front panel design	Track ID and search, remote	R	63
Grundig Fine Arts DAT-9000 n/a (system component)	Good Good	Conventional DAT recorder offering standard facilities. The deck is well made and equipped, and is engineered to a satisfactory quality standard. It performs to an acceptable standard, though it is not state of the art	2/4 hour recording, mic inputs, digital in/out		69
Luxman KD-117 £1499	Good Good	Slightly soggy, earth-bound sound quality, this model trails the other DAT decks tested so far	Two analogue inputs, remote twin address		63
Pioneer D-1000 n/a	Excellent Excellent	Fine, clear, colourful and consistent sounding deck. The Pioneer is lavishly (uneconomically?) constructed and equipped. It shows what is possible, but will probably never go on sale	Many search and memory facilities	R	63
Sony DTC-M100 £799	Very Good Very Good	Clean, clear sounding 2nd generation model with most of the features and sound of the DTC-1000ES	Midi-width, alpha-numeric display, remote, optical interfaces	R	63
Sony DTC-1000ES £1299	Very Good Very Good	Fine, consistent performer with accomplished tape handling and good build quality	Standard track ID and search, remote	R	63

CD PLAYERS

This all-digital music source is well established, despite still high disc prices and the opposition of many hi-fi enthusiasts. Compact Disc's strengths over conventional vinyl are complete freedom from surface noise with automatic and programmable play, plus track skip and fast music scan - frequently under full remote control. However, many vinyl enthusiasts find CDs sound less involving than

top quality vinyl replay. Introduced five years ago at around £500, CD players now average less than half that price, and for the main offer improved performance besides. Even cheaper players may have the latest decoding chips and the most useful play features; extra money can buy remote control, remote volume control, audio 'tweaks', plus improved build and component

quality control. Compared with many hi-fi components, CD players give impressive lab performance, though there are differences between players nonetheless. Sound quality variations are even more marked, particularly in a good quality system. As it behaves very like a preamp, there are no problems connecting a player to a normal amplifier.

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
ADC CD 2000E £330	Good+ Fair+	One of the slimmest players in the business but nothing special inside. Nice ergonomics but overpriced	Remote, timeshared 16 bit		64
Aiwa DX-M45 £149	Fair Fair	Cutdown Philips technology, but results are quite good for this British made machine	Manual	R	64

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CD PLAYERS

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Aiwa CD-001 £300	Good Good	Pretty close to Recommendation, delivering a respectable sound quality and lab performance from an ergonomically attractive package, but ultimately failed to excel in any particular respect.	Track entry/volume remote, direct recorder connection etc.		58
Aiwa XC-007 £499	Very Good Good	Creditable sound despite inverted output, high tech engineering with very good lab performance. A worthy contender but not cheap.	Remote, keypad, timer, digital output, pseudo 20 bit, dual DAC		64
Akai CD-52 £249	Good Good	A nice surprise from Akai, genuinely good sound from this mid-priced model. Better linearity will help further.	Remote, digital output, headphone socket	BB	64
Akai CD-62 £330	Fair Very Good	Looks, build quality and the technical specification are right up to date. As it stands it sounds very good but if the indifferent lab performance could be improved, it would probably sound even better.	Remote, programme, hdph, comprehensive display etc	BB	70
Akai CD-73 £450	Good Average	A little uneven musically, the Akai tends to smother fine detail, but has first class dynamics and stereo imagery. Worth auditioning.	Track entry keypad remote, menu display (switchable)		62
Akai CD93 £700	Good Very Good	Undoubtedly a CD player of real class in build, presentation, lab performance and sound quality, but also a shade expensive for formal Recommendation – though that's not to dissuade lovers of black lacquer wood finish.	Track entry remote, menu display etc.		58
Arcam Delta Black Box £250	n/a Very Good	This rich, powerful and articulate sounding DAC transforms the majority of medium price CD players.	Needs D-out CD players	R	60
Arcam Delta 70 £500	Good Very Good	This solidly built British player has attractively understated presentation with straightforward, simple ergonomics. The very good sound quality shows a steady improvement over earlier samples.	Simple remote, headphone socket etc.	R	58
Cambridge Audio CD2 £650	Fair Very Good	The finest midrange in digital audio is sufficient grounds for Recommendation, though there remains a tinge of disappointment that the CD2 didn't get closer to big brother elsewhere, notably in the bass.	16x oversampling, remote control	R	58
dbx DX5 £640	Good Poor	Sound quality proved a single disappointment, though it's refreshingly unique in providing semi-pro post-production facilities that some users will undoubtedly relish.	Track entry/volume remote, compression, impact recovery, ambience etc.		58
Denon DCD 610 £200	Good+ Fair+	Lots of Denon player for the money, well equipped with good all round performance.	Remote, versatile programming 2x 0/S	BB	64
Denon DCD 810 £250	Very Good Fair+	A good value allrounder bettered on sheet value by the 610 and 910; power volume could sound better.	Remote, 4x oversampling, programming	R	64
Denon DCD 910 £300	Very Good Fair+	A well equipped deck of impressive appearance and solid sonic and lab performance.	Remote volume, programming, 8x 0/S digital output	BB	64
Denon DCD-1500H £500	Very Good Very Good	The extra build quality over cheaper Denons is justified in terms of sound quality and lab performance, while the feature list is comprehensive and quite nicely presented.	Track entry/volume remote, menu display etc.	R	60
Denon DCD-1520 £500	Very Good Very Good	High tech, high profile, high gadget content, good sounding player at an almost affordable price.	Programme, hdph socket, remote, track entry, optical digital output	R	70
Denon DCD 1700 £650	Good+ Very Good	The overall sound was strong and coherent approaching reference standards. Fine build quality and facilities make this a firm contender.	Remote, skip, scan, headphone socket, programmable	R	58
Denon DCD 3520 £1000	Very Good Good+	Built like a battleship this new model takes its place at the top of the Denon range with a smooth and powerful sound, quite free of graininess.	Composite 20-bit DACs, full-programming features	R	72
Denon DCD-3300 £1200	Good+ + Very Good	Sounding tight and coherent though not significantly better than the cheaper 1700. Very well built and comprehensively equipped.	Remote control, with volume, keypad programme, scan, search, headphone		51
Dual CD 1030 RC £170	Fair Fair	An up and down performance on test but it is hard to deny the overall value for a machine that includes remote control at this price.	Remote, headphone socket, 2x 0/S, timeshared 16 bit	R	64
Ferguson CD007 £130	Good Fair	The cheapest recommendation in the test group; don't expect the earth but the value is good.	Manual, digital output, headphone socket	R	64
Ferguson CD008 £150	Fair Fair	Not as strong as its relatives, sample fault perhaps? Though performance is fair enough overall.	Remote, midi digital output, 2x 0/S, timeshare 16 bit		64
Goodmans GCD300 £129	Average Average	It may be adequately made, but with cheap good sounding players available this particular Goodmans isn't quite good enough.	Programmable, skip, search, repeat		70
Goodmans GCD550 £199	Average+ Fair+	A slow autochanger with a weakish lab performance but the sound is fair enough, the features good and the price is low.	Remote, 6 disc autochanger, 2x 0/S	BB	64
Grundig CD9000 £1000	Good Good	Aimed at a market which puts external styling above sound quality. Although this player is of slightly above average competence in most departments it is expensive.	Remote, programme, hdph socket, calendar display etc		70
JVC XL333 £170	Good Good	This player provides lavish facilities at a budget price (no remote though) and it produces a good sound and performed well in the lab.	Track key entry, 32 track memory, comprehensive display	BB	70
JVC XL-2444 £255	Good Fair+	An average performer, unremarkable though well equipped and fair value for money.	Full feature remote, digital output, headphone socket		64
JVC XL-M400 £300	Good Fair	JVC has produced a competent autochanger which works well. Average sound quality doesn't create any great enthusiasm.	Autochanger, key pad remote, hdph socket, multi disc programming		70
JVC XL5 555 £350	Good Fair	The display is something else, but the rest of the player, although displaying fine build quality is too average everywhere.	Keypad track select, comprehensive display, optical digital output etc		70
Kenwood DP-660SG £180	Below Average Below Average	Build quality and ergonomics are good, and the range of features far exceeds the price norm. However, sound quality is messy with a soft bass, recessed mid and sometimes spiky top.	Remote control, calendar/menu display, keypad, 20 track memory		62
Kenwood DP-880SG £250	Very good+ Fair+	A fine CD transport for the price, fine sound, very good lab results, good for a decoder?	Remote volume, programming, headphone socket	BB	64
Kenwood DP-990SG £400	Very Good Good	Falling just short of the required subjective standard for Recommendation at this price level, this is a doughty player nonetheless, with a build quality and technical performance that arguably justifies its premium price.	Track entry remote, menu display, sprung feet etc.		58
Kenwood DP-8010 £449	Good Fair	Top build quality and novel technological features seem to achieve little success here. While the technical performance is fine, the sound quality doesn't match its competitors.	Track entry remote, memory display, sprung feet, optical digital output etc		70
Kenwood DP-1100SG £450	Very Good Good	Something of a high tech flagship, this model doesn't quite make the grade on sonic grounds but is well built.	Full remote, optical and coax digital outputs, headphones		64
Luxman D-90 £300	Fair Good	Despite technical ingredients that do not seem particularly inspiring, this is a nicely judged package that is ergonomically neater than most, with decent sound quality for the price and distinctive finish and presentation.	Track entry remote, programming etc.	R	58
Marantz CD583 £150	Very Good Good	Devoid of all but the CD essentials it makes up for in sound quality what it lacks elsewhere.	Memory, track skip, search, etc	BB	70
Marantz CD65HSE £300	Very Good Very Good	Scorching sound quality from a competitively priced player, which is the new middle market reference.	Remote, programming, digital output	BB	64

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CD PLAYERS

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Marantz CD75HSE £350	Very Good Very Good	Remote volume version of the 65 SE with an optical digital output as well. A sonic superiority complex in a cheap plastic box	Remote volume, hdph socket, FTS, optical output etc	BB	70
Marantz CD85 £500	Very Good Very Good	This player may just miss a top sonic rating but it's well made and has plenty of features belitting a Marantz heavyweight	FTS, key pad remote, comprehensive display, programming, optical output etc	R	70
Marantz CD94 £800	Good + + Very Good	Clearly the best Marantz CD player, with high build quality and good objective and subjective performance	10 digit keypad, headphone socket, favourite track selection, remote	R	58
Marantz CD94/COA94 £1600	Very Good Excellent	Taking its logical place at the top of the Marantz CD hierarchy, this two-box combination delivers reference standard lab and listening test results, albeit at a price which seems a little steep. Very refined	Favourite track selection, remote, balanced output etc	R	60
Marantz CD12LE £2500	Very Good Very Good	This may be very expensive but it is very well made. Technical performance is very good and the sound is the best from Marantz yet	Two box, digital processor, FTS, optical connection, hdph socket, comprehensive display, balanced output etc	R	70
Meridian CD207 £1050	Very Good Excellent	The 207 matures with age and in its present form it offers one of the best sounds around plus great packaging and versatility through its preamp options	On-board preamp, options, two box, coax digital output, remote	R	72
Micromega CDF1 Classic £1400	n/a Very Good	A very well made and stylish player from France, the CDF1 is a CD player for analogue lovers or as close as we've come across	Basic remote, digital output, suspended chassis	R	72
Micro Seiki CDM100 £3850	Very Good Good	One of the hernia inducing bricks of hi-fi, the Micro is extravagantly styled, finished and built. The good lab performance led to an 'only good' sonic display when the price demanded excellent	Balanced output, remote, display blanking		72
Mission PCM2 £500	Good + Good	A matured design with good features it is the best sounding power volume player available, it even tests well. It accepts the £200 PSX power supply option	Remote volume, display and phase invert	R	64
NAD 5220 £230	Average— Poor	Conforms sonically to a stereotype of the medium that most players have grown out of. Hard, thin and raw sound with poor stereo and resolution.	Time/track display, memory		62
Nakamichi OMS-1E £395	Good Good	This neat enough player doesn't really follow the Nakamichi tradition of providing exceptional sound quality while at the same time perpetuates that of selling at an above average price	Simple remote etc.		58
Nakamichi CDP-2E £495	Very Good Good	It's ergonomically superior and has above average sound, but it isn't cheap. The standard of build quality and finish is first class which isn't quite matched by the sound quality	Programming, hdph, remote track entry, digital output		70
Nakamichi DMS-3E £995	Good Good	Superbly built and presented this expensive machine was a bit of a "stuffed shirt" when it came to sound quality	Remote control, skip and scan, headphone socket		51
Nakamichi OMS-4E £1200	Very Good Very Good	Solidly controlled and comparatively simple this clearly represents one of the major benchmarks for CD sound quality, though the midrange sounded a touch thin	Skip and scan, headphone socket		51
Nakamichi OMS-5EII £1500	Good + Very Good	"... delivers near state of the art performance and build quality in a deliberately starkly functional package, but at a very high price ..."	Skip and scan, simple track programming, manual control		51
Nakamichi OMS-7EII £2000	Good + Good	The only serious criticism here is of the price. And in our not always humble opinion you can get better sound quality for less elsewhere in Nakamichi's range	10 digit track entry keypad programming, headphones		51
Onkyo DX-1500 £170	Average Fair	Ruled out on the grounds of its poor DAC filter, but it's not so bad really given the price	Manual, 2x 0/S, timeshared 16 bit		64
Onkyo DX-3500 £250	Very Good Fair	It offers a lot of facilities and fine build quality for the money. Lab performance is very good but the sound quality doesn't inspire	Key pad remote, memory, hdph socket, comprehensive display etc		70
Onkyo DX-7500 £450	Good Very Good	This comes close to the state of the art performance in many areas. It has lots of facilities and is well made too	Key pad remote, memory, hdph, very comprehensive display, optical digital output etc	R	70
Philips CD582 £200	Very Good Good	Build quality and finish are only adequate but in every other respect it's more than competitive	Simple remote, programming, large display, hdph socket	BB	70
Philips CD473 £229	Good Good	In the forefront as regards sound quality, this is one of the best sounding Philips players yet; we were unable to catch it out on classical through Jazz program	Favourite track selection, remote control with volume, headphones etc	BB	58
Philips CD782 £230	Very Good Good	In the present market this Philips offers an amazing performance in all areas at a most affordable price. The styling is a little bland	Versatile volume remote, FTS, variable headphone socket etc	BB	70
Philips CD880 £500	Very Good Very Good	The '880 is an impressive blend of luxury build quality and features at a far from extravagant price, and also delivers the subjective goods.	Volume remote, FTS, menu display etc.	R	60
Pioneer PD4100 £170	Fair Good	It's not perfect in the lab, the facilities are few, but the sound quality sets it apart	Programmable, skip, search, repeat	BB	70
Pioneer PD5100 £220	Fair Fair	It's well made and has good facilities. The lab performance is generally fine, but it's only average for sound quality	Remote, volume, programming, hdph socket, etc		70
Pioneer PD-6100 £249	Good Good	A budget audiophile player, fine sound even if its lab performance seems a little uneven	Full feature remote, digital output, variable hdph	BB	64
Pioneer PD-M500 £269	Good Good	A high performance autochanger for the money, good value all round and generously featured specification	Full remote, digital output, variable hdph	BB	64
Pioneer PD7100 £300	Good Good	External build quality is fine, the level of facilities are lavish, but the sound it produces only just takes it into the good category	Remote, volume headphone socket, versatile programming, faders etc		70
Pioneer PD-M700 £400	Very Good Fair +	Top class autochanger, surprisingly fast, high specification and a good allrounder	Remote, optical digital output, headphone socket		64
Pioneer PD-91 £800	Excellent Excellent	Close to state of the art in nearly all areas - soundstaging, clarity and simple lack of artificiality. A well made and sophisticated player	Track entry remote, calendar display, index search, etc.	R	64
Revox B126 £649	Very Good Good	Made in Switzerland so the build quality and technical performance is high but then so is the price and the sound quality is only good	Programming, Revox remote system compatible		70
Revox B226 £756	Good + Good	The traditional Revox house style is combined with the fine Philips 16 bit chip set, but this player doesn't really offer sound quality to match the price	Infra-red remote control, full search, scan, programming		51/Coll
Rotel RCD820B £210	Good + Fair +	A budget Philips based player of dependable sound quality and offering very good value. Build is a touch lightweight	Remote, basic facilities	BB	64
Rotel RCD820BX2 £250	Good Very Good	Start with a good base and then make it sound better, the '820BX2 CD player maintains the reputation established by its namesakes, and comfortably deserves Recommendation.	Direct track entry remote etc.	R	58
SAE D102 £700	Good Good	Considering the high price of this player, most of the innards seem fairly prosaic. Sound quality and lab performance are both respectable enough, but hardly justify the price premium involved, though styling is unusual.	Remote (inc volume), skip, scan etc.		58
Sansui CD-XM510M £299	Average Fair	Not designed to appeal to the audiophile, but with its 12 disc facility it's ideal for background music or as a second player for the kids	12 Disc, 2 magazine autochanger, comprehensive remote, programming etc		70
Sansui CD-X501i £300	Fair Fair	Weak dynamic range for an upmarket player which shows in both lab and listening tests	Remote, programmable, digital output, headphones		64
Sansui CD X70 1i £449	Good Good	A stylish attractive player which sets itself apart from mainstream mediocrity by means of its external appearance. It works well too, has plenty of facilities and good sound quality.	Remote, key pad track access, digital output, variable headphone socket etc	R	70

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CD PLAYERS

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Sharp DX150 £129	Fair Fair	This is a none oversampled player which is rather outclassed for technical and sonic merit by the vast majority of the competition. Pretty enough but would you want to put discs in it?	Programmable, skip, search, repeat		70
Sharp DX750 £179	Fair Fair	It has a remote control but it's too like the 150 which is rather outclassed for technical and sonic merit by the vast majority of the competition	Remote, programmable, skip, search, repeat		70
Sharp DX-620 £200	Good Good	A surprising achievement but it shows what can be done. Another high value budget package	Remote, headphone output, 2x 0/S, timeshare 16 bit	BB	64
Sharp DX-R700H £225	Average— Poor	A workmanlike player that does not offer exemplary lab or sound quality but which is well-built with good facilities and should perform well in use	Remote control, track selection keypad, skip, scan repeat programming		53
Shure Ultra D6000 £495	Average+ Fair	Ergonomically well thought out with full function remote control, but not really scoring sonically considering its price	Remote control (full function inc volume)		51
Sonographe SD1 (by CJ) £799	Good Very Good	Distinctive with oak end-cheeks, using Philips based 14 bit x 4 oversampling, Conrad Johnson electronics make this a musically rewarding player	Full search programme and timing	R	51/Coll
Sony CDP-M35 £170	Fair Fair	There is no disguising the lightweight plastic construction of this player, but the technical performance, sound quality, aesthetics and ergonomics all deliver more than one has the right to expect for £170.	Skip, scan, programming etc.	R	58
Sony CDP-350 £180	Fair Fair	A fairly basic machine. The lab test showed up some faults and it didn't do particularly well sonically	Programming, skip, search, repeat, hdph socket		70
Sony CDP-M55 £190	Fair Fair	£20 buys a remote control handset to operate your M35. Sony call it an M55 (see CDP-M35 review).	Simple remote, skip, scan, programming etc.	R	58
Sony CDP-550 £200	Good+ Fair+	Another dependable Sony, it doesn't have a digital output but at the price who's complaining? Fit and forget	Full remote headphone output, 4x 0/S	BB	64
Sony CDP-M75 £230	Good Good	This midi version of the '750 saves £20 on the price (see CDP-750 review).	Track entry remote, menu display ect.	BB	58
Sony CDP-750 £250	Good Good	A seductive blend of fine presentation and solid performance, all at a very realistic price that should ensure its success.	Track entry remote, menu display ect.	BB	58
Sony CDP-C50M £250	Fair Fair	The Sony concept of an autochanger is interesting and executed with characteristic thoroughness. The lab and sound test results reveal it to be of only average quality	Carousel autochanger, remote, multi disc programming, variable hdph socket		70
Sony CDP-M95 £280	Very Good Fair+	Very well equipped mid sized player fine build and finish, incorporating Sony's custom file disc labelling	Remote, programmable, variable hdph output	R	64
Sony CDP227ESD £400	Good Good	The cheapest of the ESD range offers plenty of ergonomically arranged facilities. It performed well in both the lab and on the listening tests, and its reasonable price makes it hard to miss	Remote, keypad track access, volume, hdph, comprehensive display, FTS, custom index, etc	R	70
Sony CDP-337ESD £550	Good Very Good+	Well built, high grade player with excellent if undemonstrative sound. Excellent resolution, dynamics and bass weight, though arguably not control	Random access remote, calendar display, FTS, memory	R	61
Sony 557ESD £1000	Excellent Good+	Superbly built flagship model that produced excellent lab results and very good sound. Many luxury features though not that good value	Full remote, disc directory, digital output, power volume, 8x 0/S, 18 bit		64
Sony CDP-R1/DAS-R1 £5000	Very Good Very Good	Sony has aimed high with the R1 and in some ways has created the reference player. Build quality is amazing and it offers a high level of facilities. One or two faults were revealed in both the lab and the listening, but it's generally excellent	Two box, dual optical connection, digital processor, FTS, remote		72
Stax Quattro £2995	Very Good Very Good	Now in mkII guise this substantial player recreated exceptionally strong and convincing bass lines together with a beguilingly musical midband	18-bit DACs, 20-track memory, full IR remote, variable o/p	R	72
Teac PD135 £180	Fair Fair	Particularly easy to use, this lags a little behind the pack when it comes to sound quality, but it still represents a valid alternative for those who find the presentation attractive.	Skip, scan, programming, repeat.		58
Teac PD470 £250	Fair Good	Pleasant sounding though unexciting, ergonomically functional though predominantly plastic. It doesn't achieve the sonic status required in a hotly contested market segment	Remote, track key pad, autospace, comprehensive display, hdph socket		70
Teac ZD880 £450	Good Fair	Decent enough in most respects with a very good build and finish. Its sound isn't competitive enough to inspire any real enthusiasm	Remote, track key access, auto space, comprehensive display, hdph socket etc		70
Technics SL-P350 £250	Very Good+ Good	Nicely built, good features and fine sound, what more do you want for £250?	Remote, digital output, variable hdph output	BB	64
Technics SL-P770 £350	Excellent Good	Sophisticated, high resolution player, but inconsistent with level with some coarseness and compression during loud passages	Remote, 18 bit, rotary cue wheel, comprehensive display	R	61
Technics SL-P990 £450	Excellent Good	An obvious technical tour de force, with ample engineering and build quality to justify the price, but some subjective reservations nonetheless.	Track entry remote, menu display, search dial etc.		58
Technics SL-P1200 £800	Good+ + Good	Looking more like a desk workstation than a stackable component, this will appeal to the creative recordist and semi pro user. Sounded pretty good	Headphones, remote control, search dial cueing, etc		51
Toshiba XR-9318 £150	Good Fair+	A basic Philips based player perhaps but just look at the price/performance equation	Remote via system, manual, non oversampled, 16 bit	BB	64
Toshiba XR-9128 £190	Very Good Good	A well equipped Philips clone with a very good performance for the price	Remote, programmable, digital output, hdph	BB	64

CD MIDI SYSTEMS

So you want a hi-fi, but you don't want to make a fuss about it. A pre-packaged system with everything matching up and no aggravation may not rank with carefully chosen separates on **sound quality**, but there's no denying the attractiveness or popularity of this approach – the market for pre-packaged component hi-fi systems is at least as big as that for separate items, even ignoring the vast numbers of low-cost single unit stacker systems.

The arrival of compact disc led to a new fashion for shelf-standing compact systems, or 'midis' as

they are known in the trade, as a replacement for earlier floor-standing rack systems (themselves the upmarket development from music centres). Only some 330mm wide, midis can more or less match full-size (430mm) rack components for performance, and are certainly cheaper to make, ship, sell and buy.

Whereas specialist hi-fi is moving steadily towards ultra-simple 'no frills' components, midi systems tend to be sold on a feature count at a price point, usually with little opportunity for

demonstration and comparison. Our test programme includes extensive auditioning and lab testing, while making allowance for the different aspirations of designers and expectations of users. Key features valued highly by customers include system remote control, automatic switching, double 'dubbing' cassette decks, and elaborate equaliser tone controls. And the top end of the market is developing with surround sound audio/video-ready packages.

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Aiwa X-55 £380	Average Average—	The turntable was slightly better than usual, the cassette deck highly limited, but the dreadful loudspeakers are the clincher	Combined cassette tuner-timer/amp, dedicated T/T speakers, & optional CD		65
Aiwa X-78 £550	Average+ Good	Good. The loudspeakers are disappointing and the turntable is excessively microphonic, but the rest of the system works well.	Auto reverse cassette/tuner/amp & timer, T/T and CD	R	65
Akai M.50CD £550	Poor Poor	Cassette lacks Type II compatibility, general sonics mediocre or less	Devolved from M.80 but simplified, part remote		65

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CD MIDI SYSTEMS

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Akai M.80CD £800	Good Good	Good all rounder with minor ergonomic shortcomings but generally practical layout	Separates based, twin auto-reverse cassette	R	65
Goodmans 5300CDM £400	Average— Average+	Crisply styled system with gutsy amplifier and sophisticated speakers. CD player works well, other sources are variously mediocre	Combined cassette/tuner/amp, plus T/T and CD with remote	R	65
Goodmans Maxim-Midi System £520	Average Average+	De-luxe version of 5200 system – very good value for money and readily upgradeable. Sonics rough but OK and speakers good; CD crude	All separates with twin cassette	R	54
JVC Midi-W900CD £1000	Good Good+	A competent allrounder, with important convenience related features, and powerful linked recording facilities. Less strident speakers would be appreciated	Separates system, equaliser, auto-reverse cassette	R	65
Marantz MX583 £750	Below Average Poor	The system has potential in an A/V context, but is patently lacking in a purely audio one. Only the CD excels	Component system with A/V amp, no speakers		65
Marantz MX673CD System £900	Average+ Average	Tremendously flexible audio/visual system. Sound quality is satisfactory at best and ergonomics a mess	Various A/V inputs, remote, speakers optional		54
Philips F777 £850	Good Good	Excellent CD player, tuner and amplifier, offset partly by poor cassette deck and turntable	Separates system, optional remote, no speakers		65
Pioneer System 300 £1000	Very Good Very Good	Sharp, articulate and powerful system that works. The turntable is a weakness as usual, but the only real weakness in an uncommonly sophisticated package.	Remote separates system, optional multi-disc CD	R	65
Proton AI-3000 £550	Good Good	There are a host of minor problems, including no LW, but the unit is attractively packaged and can be made to sound very good despite a woolly sounding amplifier	One piece CD, cassette, tuner and amp, remote	R	65
Sanyo System 22 £350	Average Average+	Some careful detail design has given this system sound quality out of keeping with ordinary appearance. More than the sum of its parts	Single piece, plus speakers	BB	65
Sanyo W40CD £380	Average Average	Low cost, no options package with attractive displays, cassette had high wow and flutter, but the rest worked OK	Semi auto T/T, auto record start, twin cassette	R	54
Sanyo System 33 £400	Average Average+	Similar to the 22, and better when extended, but the price (and value) advantage is dissipated.	As 22, separate T/T, remote	R	65
Sharp SA-CD800H £700	Average Average—	A superficially high grade, high spec system, the SA-CD800H actually sounds clean but a little 'synthetic'	One-piece, 6-disc CD, no T/T		54
Sony Compact 350CD £480	Average— Average—	Visually stunning appearance hides very basic audio attributes, the turntable and cassette deck suffering severe pitch related shortcomings. CD is too expensive in this company.	Integrated one piece, (ex CD), 5 disc non-cartridge player		65
Sony Compact 500CD £550	Average+ Average+	Impressive visuals are matched to electronics which in audio terms lack inspiration. The speakers are particularly poor	Combined amp/cassette, 36 preset tuner, T/T component CD		65
Sony Compact 700CD £700	Average+ Good	Loudspeakers and (to a lesser extent) turntable spoil a fine-sounding and stylish – if rather costly – package	Separates system, auto reverse cassette, 36 preset tuner		65
Sony Series 1000CD £1500	Very Good Excellent	Very sharp, articulate sounding system from CD and FM. Cassette deck good and flexible, turntable as usual is not in keeping	Separates system, twin auto-reverse cassette, amp with DAC	R	65
Technics X900CD £470	Average Average—	Good build and mostly good sound is offset by mediocre amplifier and loudspeaker and some operational oddities	Main cassette/tuner/amp, separate T/T and CD		65
Technics X950 System £850	Good Good	Fine sound from CD, FM and AM radio and cassette. The record deck is a little better than normal too, but the loudspeakers are disappointing	Component based, CD, twin auto-reverse cassette, tuner, auto T/T, amp and speakers	R	65
Technics X990D System £1250	Good Very Good	Powerful, flexible and well built system – loudspeakers apart. Even the turntable is on the rough side and the loudspeakers should be changed if possible. The rest of the system is AI	Twin deck, programmable T/T, amp, CD, speakers	R	65
Toshiba V17CD £370	Average Average+	Loudspeakers are the weak link, with cassette and turntable also indifferent. Tuner and CD worked well though, so reasonable value for money	Twin cassette, semi-auto T/T	R	54
Toshiba V18CD £400	Poor Poor	Neat and simple to use basic system with good CD but poor elsewhere and abysmal loudspeakers	Integrated amp/cassette deck, other components separate but dedicated		65

TUNERS

The radio medium operates at a much lower profile than TV, but in areas outside pop music the BBC service is the envy of the world. Live Prom concerts can rival all other sources from a hi-fi perspective. Only the FM (VHF) bands give stereo hi-fi sound, though AM (MW & LW) are useful for receiving certain transmissions in the UK.

Something of a hi-fi afterthought, tuners are often selected merely to match a chosen amplifier

cosmetically. However, the task they carry out is far from simple (or cheap), combining the skills of RF (reception) and audio (signal processing) engineering. The importance of the former will depend on local reception conditions, but money invested in a high quality outside aerial system is well spent.

Tuners come in two basic types. Analogue models tune gradually (and usually manually) across

the bands, and can have analogue or digital displays; they are often preferred for sound quality, and are certainly best for AM bands. Digital tuners offer convenient automatic tune facilities and hold many station positions in pre-set memories

(The Lab and Sound results for models tested in issue No. 65 refer to FM only. For AM results see under Comments.)

NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Akai AT-52L £150	Very Good Very Good	Holds its own on FM against many much more expensive tuners, but AM is very poor	All bands	BB	65
Akai AT-93L £250	Good+ Good+	By AM standards presentable (good) while FM delivers the goods	All bands, aerial switch	R	65
A&R Arcam Alpha £149	Good Average++	Attractively classic British analogue tuner with sound quality comfortably better than most	FM/AM Analogue	BB*	50
A&R Arcam Delta £270	Very Good Very Good	Hi-fi sound on FM, good on AM, a dependable British all-rounder	6AM, 6FM presets. FM/MW LW display manual tune	BB	55
Denon TU 450L £130	Average+ Average+	Poor AM sound quality may be a deterrent but the FM performance fully merits recommendation	FM/AM Digital MW/LW	R	50
Harman Kardon TU920 £299	Good Average	Rather weak sound quality for the price despite good lab test results	16 presets, AM/FM, digital auto scan, active tracking		55
Harman Kardon Citation 23 £559	Good Very Good	Fine performance, interesting features and ease of use are this tuner's forte, and the sound quality is top notch	FM/AM seek/manual adjustment mulling 16 presets remote control	R	60
Hitachi FT-MD 5500 £200	Excellent Good++	A powerful, good sounding tuner with versatile facilities	16 presets, FM, AM, MW auto scan digital, signal meter	BB	55
Kenwood KT-66DL £130	Fairly Good Fairly Good	You get your money's worth of gadgets and the radio's basically sound although programming is complicated. AM – fairly good	Timer, clock, all bands	R	65
Kenwood KT-1100D £300	Good+ Good+	Behind a gaudy and rather useless display the radio is much better than you might first think. AM – good	Firework display FM/MW bands only	R	65
Linx Theta £400	Good Very Good	A Magnum Dynalab on the cheap with the hallmark styling of this small British newcomer. Some of the best midrange from any tuner	Manual analogue tuning, no presets, signal strength meter	R	72

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NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Magnum Dynalab FT101 £599	Good Very Good	Although expensive for its fairly minimum set of facilities its excellent sound makes up for what it lacks elsewhere	Analogue manual tuning, no presets, signal strength meter	R	72
Marantz ST35L £125	Good+ Average-	It works well enough but the sound could be better for the money	16 presets, AM/FM, digital auto scan, active tracking		55
Meridian 204 £525	Good+ Good	Pleasant sounding with a fine finish but does not make the grade at this price	FM only, auto scan, digital, remote, clock timer		55
Musical Fidelity TI £300	Good+ Very Good	Top class FM stereo sound on good signal strengths from this audiophile model. Watch out for local CB!	FM only, analogue box dial, manual tune, signal meter	R	55
NAD 4020B £139	Good Average+	Not the quietest or most sensitive tuner tested, it still provided good sound for the money, being "musical and ambient"	Analogue FM/AM	BB	50
Naim NAT 01 £1098	Very Good Very Good	There may be better sounding tuners in the world, but we have yet to hear one	No presets. Two box, flywheel tuning FM only. Analogue	R	50
Nakamichi ST-7E £750	Good++ Good+	Exceptionally good for weak-signal areas, and good all round	16 AM/FM presets, Schotz enhanced sensitivity, auto time digital		55
Onkyo T909 £590	Very Good Very Good	It has most of the facilities you could possibly want and more beside. Lab performance and sound quality are both good enough to ensure recommendation even at this price	FM only, digital, 20 presets, auto scan etc.	R	72
Pioneer F551L £100	Good+ Good+	High value budget tuner, very little to argue about (includes long wave)	12 FM, 12 AM presets, auto scan, digital and signal strength meter	BB	55
Pioneer FT 443L £130	Poor Poor	The pretentious 'computer controlled' features don't amount to much. AM - very poor	All bands		65
Pioneer F-737 £230	Good+ Good+	Terrific separation and selectivity on FM, but AM still lacking. AM - fair	FM/MW only	R	65
Pioneer F91 £350	Excellent Good++	Easy to use, this model has excellent RF performance and scored very high ratings on the listening tests	FM/AM 24 presets	R	60
Proton AT-300 £199	Good Good	The AT-300 is pretty on the outside, orthodox on the inside and rather dear. AM - poor	FM/MW only	R	65
Quad FM4 £289	Very Good Good+	Fine sound, excellent ease of use, good build and finish and a more than satisfactory technical performance	7 presets. Digital	R	50
Revox B260 £918	Excellent Very Good	Sophisticated and expensive, the B260 is ideally suited to the rest of the Revox range and should also work well in other systems	FM - virtually everything	R	60
Rotel RT-830AL £110	Good+ Good	Fine sounding budget audiophile material, no frills, no fuss	Manual dial analogue, FM, MW, LW	BB	55
Rotel RT-850AL £160	Good+ Good+	Scoring well on listening tests and one of the best sounding tuners at its price level, it was a bit let down on AM but RF performance was good	FM/AM, digital	BB	50
SAE T-102 £449	Good+ Good+	Expensive for all the radio you get, but sounds interesting. AM - Poor	FM/MW only	R	65
Sansui TU-D99XL £249	Very Good Good+	This slimline compact model gave good FM sound quality and strong RF performance. But the AM sounded unpleasant	FM/AM, 16 presets	R	50
Sony ST-S300L/ ST-S100L £140/£100	Good Good	A reasonable entry point, not for difficult areas. AM - Poor	All bands	R	65
Sony ST 500ES £200	Good++ Average-	Disappointing sound quality but good lab performance. (Includes long wave)	10 AM/FM presets, auto scan digital		55
Sony ST-S 700ES £299	Very Good Very Good	First class in every respect including FM sound quality. Even AM was well above average	FM/AM, 10 presets, digital scan	BB	60
Yamaha TX-L400 £130	Good++ Good+	Good FM sound, let down by poor AM but otherwise good value	16 presets, auto scan, digital, FM, MW, LW	BB	55
Yamaha TX-500 £150	Average+ Average	Under a gaudy coat, this sensitive tuner gave reasonable stereo results. However, the AM had again been thrown down a well	20 presets (10 buttons) digital		50

HEADPHONES

There are a variety of different approaches to headphone design, and examples of each turn up in this group. Amongst the more expensive esoteric models, electrostatic drivers are used in square open-backed phones such as the Jecklin and Stax models. The majority of these come with some form of transformer which takes the signal initially from the speaker terminals on the amplifier. The actual speaker cables then travel from this unit *via* a

bypass switch to the loudspeakers.

The more down to earth models feature dynamic drivers in circular open-backed designs. The advantage of open backs seems to be a correspondingly open sound and a less claustrophobic feel to the music. One can also of course hear external noises and irritate people on public transport.

The third category are closed-back designs,

which are useful in situations where it is necessary to block out background noise.

Another means of distinguishing different types is the way they sit on your head or ears. There are three styles: circumaural models enclose the ear and rest on the side of the head; supra-aural designs press on the outer ear (pinna); and intra-aural types rest inside the ear and are popular amongst users of personal stereos.

NAME PRICE	SOUND COMFORT	COMMENTS	TYPE	VALUE	BACK ISSUE FULL REVIEW
Aiwa HP-X8 £49	Good Very Good	Very slick Walkman oriented phones which are tonally well balanced and go loud without becoming painful	Supra-aural, closed-back, dynamic	R	63
Aiwa HPEX-200 £90	Good Good	Modern looking and well finished the Excelias, as they are dubbed, had meaty bass and sounded reasonably open for the type	Circumaural, closed-back, dynamic		63
AKG K135 £35	Fair Poor	Despite a very appealing design the K135s don't live up to the usual AKG standards, though they do have the ability to reproduce rhythm well	Supra-aural, semi-open, dynamic		63
AKG K240 Monitor £60	Good Very Good	Something of a classic these AKGs are very user friendly in all respects; sonically on the warm side of neutral	Circumaural, semi-open, dynamic	R	63
AKG K280 Parabolic £110	Very Good Good	A very revealing and unusual twin driver design that uses the same principle as a satellite dish to beam sound into the ear	Circumaural, open-backed, dynamic	R	63
Audio Technica ATH 909 £55	Average Average	Quite impressive in the treble though a bit bass shy, the 909s worked well at highish levels	Circumaural, semi-open, dynamic		55
Audio Technica ATH 910 £65	Good Average	The closed-back 910s are an improvement on the 909s with a nice rhythmic quality rarely found with headphones	Circumaural, closed-back, dynamic	R	55
Audio Technica ATH-911 £75	Very Good Very Good	Nicely finished dynamic headphones with all the trimmings, plus a very clean and subtle sound	Circumaural, open-backed, dynamic	R	63
Beyer DT 325 £30	Fair Very Good	Lightweight in more ways than one, the 325s may be a little bright for some systems and tastes but will suit duller sources	Supra-aural, open-back, dynamic	R	63

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NAME PRICE	SOUND COMFORT	COMMENTS	TYPE	VALUE	BACK ISSUE FULL REVIEW
Beyer DT330 Mk II £45	Poor Good	Not the most revealing 'phones encountered, the 330s were nevertheless enjoyable and rarely offended	Circumaural, semi-open, dynamic		55
Beyer DT550 £69	Good Good	On their own the 550s sound articulate with a slightly 'gritty' treble and 'keen' midrange, not suitable for headbangers!	Circumaural, semi-open, dynamic		55
Beyer DT880 £90	Good Good	Well made cans with a warmish sound but fairly solid midrange, though they're not that informative for the price	Circumaural, semi-open, dynamic		63
Beyer DT990 £119	Very Good Very Good	The 990s are definitely a significant pair of dynamic headphones; they have a smooth and yet revealing, neutral sound that is hard to criticise.	Circumaural, open-back, dynamic	R	55
Jecklin Float Model One £79	Very Good Good	Whilst very unusual in appearance the Floats give remarkable sound quality and openness at a reasonable price	Circumaural-ish, open-back, dynamic	BB	55
Jecklin Float Model Two £99	Very Good Good	Helmet shaped and pretty unflattering but open sounding and comfortable in the long term. Note lack of adjustment means you should try before you buy	Circumaural-ish, open-backed, dynamic	R	63
Jecklin Float Electrostatic £399	Excellent Good	One version of the state-of-the-art, these electrostatics have an openness of sound rarely found in the breed, with good dynamic range to boot	Circumaural-ish, open-back, electrostatic	R	55
Koss K/6X Plus £30	Poor Fair	'Sixties-style' 'phones from the good ole US of A, their sonic style is unique and can make a system sound quite different	Supra-aural, closed-backed, dynamic		63
Quart Phone 30 £40	Fair Good	Whilst not as seductive as their PMB25 predecessor the 30s are reasonably neutral and do improve on some of the competition - though not stunning	Circumaural, semi-open, dynamic		63
Quart PMB 25II £40	Good Good	Despite a somewhat unconventional suspension system the 25s put in a convincing and enjoyable performance with warm yet lively balance	Circumaural, open-back, dynamic	BB	55
Quart Phone 70 £70	Good Good	Competent performers that were hard to criticise but lacked the life and sparkle of which some of the competition are capable	Circumaural, closed-back, dynamic		63
Quart PMB 65 £70	Good Good	Quite revealing and neutral albeit with the usual closed back sound, this competes well with more established models	Circumaural, closed-back, dynamic	R	55
Quart PMB 85 £90	Very Good Fair	These more expensive Quarts bear a striking resemblance to the Jecklin Float models and use two drivers per ear. Sound is a bit bass heavy but not bad overall	Circumaural, open-backed, dynamic		63
Ross RE-2760 £35	Fair Poor	Stylish white cans from the only British firm in the business. Unfortunately sound quality is not up to par in this price range	Supra-aural, closed-back, dynamic		63
Sennheiser HD30 £13.50	Poor Good	Built specifically for the personal stereo market these small and light Sennheisers have a slightly synthetic sound, but are an upgrade on the average Walkphones	Supra-aural, semi-open back, dynamic		55
Sennheiser HD450 £27	Fair Good	Modern, simple and lightweight phones that are remarkably robust and which turned in a relaxed if weighty performance that was at worst pleasant	Supra-aural, semi-open, dynamic	R	63
Sennheiser HD480 £37	Fair Good	Using the same shell as the 450s, the 480s were a little softened and unrevealing by comparison with their competitors	Supra-aural, semi-open, dynamic		63
Sennheiser HD420SL £47	Good Good	The 420s gave a full and tangible quality to instruments and voices, whilst not the most revealing headphones around they would suit slightly brash sources	Supra-aural, open-back, dynamic		55
Sennheiser HD540 Ref Gold £160	Very Good Good	The 540 Golds prove that dynamic headphones can be subtle, informative and capable of creating a remarkable sense of space	Circumaural, open-back, dynamic	R	55
Sony MDR V3 £30	Good Fair	Portable stereo oriented phones that are very nicely made and combine clarity with a pleasant lack of distortion	Supra-aural, closed-back, dynamic	BB	63
Sony MDR V7 £70	Very Good Very Good	Classy sounding cans that are very slick and work well with all types of music, setting the standard in their price range	Circumaural, closed-back, dynamic	R	63
Sony MDR-R10 £2500	Very Good + Excellent	Costly state of the art sealed moving coil design built to the highest standards using the finest materials. Sound quality reflects this care, being big, clear, sweet and refined	Circumaural, closed-back, dynamic	R	72
Stax SR34 £140	Very Good Fair	The least expensive Stax headphones around, the SR34s are lively and rhythmic with good tight bass and a sweet midrange	Supra-aural, open-back, electret		55
Stax SR84 £210	Very Good Very Good	The stepping stone between dynamics and full electrostatics, these electret phones are revealing, open and highly enjoyable	Supra-aural, open-backed, electret	R	63
Stax Gamma pro/SRD-X pro £296/£230	Excellent Very Good	The Gamma pros are like a stethoscope for your hi-fi, revealing subtleties that many loudspeakers fail to resolve	Circumaural, open-backed, electrostatic	R	63
Stax SR Gamma £299 (inc. SRD-6 Adaptor at £100)	Very Good Very Good	The next model down the Stax range from the Lambda, the Gamma is an excellent headphone with little to criticise but the price.	Circumaural, open-back, electrostatic	R	55
Stax SR Lambda Pro £545 (inc. SRD-7SB Mk 2 Adaptor at £185)	Excellent Very Good	A bit of an industry reference the Pros are frighteningly revealing, bringing across more information than loudspeakers costing twice as much	Circumaural, open-back, electrostatic	R	55
Stax Lambda Signature/SRM-T1 £470/£895	Excellent Very Good	The Signature when combined with the SRM-T1 valve driver must be the most transparent headphone available	Circumaural, open-backed, electrostatic	R	72

PERSONAL STEREOS

Whilst not exactly hi-fi components, personal stereos probably play more music to more ears than all manner of domestic systems and as such demand some attention. Now that personal CD players have joined the ubiquitous Walkman in the market, the variety and standard of sound quality is huge, with obscurely named cassette players practically falling out of your cornflakes packet and Discmen going for £300.

Despite their diminutive size personals attempt to incorporate as many gimmicks and features as

possible, cassette players often incorporating tuners, graphic equalisers and Dolby noise reduction. CD players are still relatively expensive and don't tend to vary that much on the features front, rather the amount and quality of accessories differs. Most models come with a mains adaptor and some include remote control.

Sound quality on the cassette front seems to have a proportional relationship to price and integrity of construction - wow and flutter being quite obvious on the cheaper models. CD players

become less noisy as they get dearer and also reduce in size, one drawback of the latter seems to be that immunity to shock suffers as a consequence. Cassette players do, on the whole, seem better suited to the outdoor life than their digital counterparts, as does the software. Bear in mind that the sound and lab ratings given below cannot realistically be compared to those in other categories or between cassette and CD personals.

PERSONAL CASSETTES

MODEL NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Aiwa HS-G35 MKII £30	Poor Fair	A reasonable player for the price but not well suited to classical material and let down by the headphones	Autoreverse, graphic EQ, types I & II		56
Aiwa HS-J36 £89	Good - Average	Comprehensive facilities and reasonable sound are no mean feat for the price.	Dolby, autoreverse, types I, II & IV, AM/FM, recorder	R	56

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PERSONAL CASSETTES

MODEL NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Aiwa HS-PX101 £149	Average— Good	A very slick little number with soft touch controls and remote control headphones	Dolby B, C, autoreverse, types I, II & IV R		56
Philips D6658 £30	Very Poor Poor	The low price limits sound quality, and this is not a spectacular machine, but it does a reasonable job nonetheless	Graphic EQ, AM/FM		56
Saisho PS90R £40	Poor Poor	A bit of a jumble of features and gadgets, the PS90R has on-board speakers, an extending aerial and even records, but sound quality is dubious	Graphic EQ, types I, II & IV, AM/FM, recorder		56
Sony MGR-77 £35	Very Poor Very Poor	Rather a basic machine with a raw edgy sound, not helped by poor speed stability	Graphic EQ, AM/FM		56
Sony MGR-87 £50	Very Poor Fair	The 87 came up with a slightly fast but rhythmic sound. Although lacking in finesse, it worked OK with pop material	Autoreverse, graphic EQ, AM/FM		56
Sony MGP 600D £50	Average+ Average—	With styling aimed at the fairer sex the 600D sounded a little better than the similarly priced MGR-87. Lacking in clarity, it was still quite durable	Dolby, autoreverse, graphic EQ, types I, II & IV		56
Sony JJ-P4 £100	Poor Good	Claimed by its makers to be the world's smallest personal stereo the JJ-P4 is a tasty looking object that's capable of good sounds to boot	Dolby, autoreverse, tape types I, II & IV, rechargeable		56
Sony Walkman Pro £249-£289	Good+ Excellent	One of the finest sounding cassette decks on the market today. A mandatory Best Buy, it takes other personals to the cleaners (except on weight and power consumption)	Dolby B, C, types I, II & IV, record, line BB in/out, varispeed		52/56

PERSONAL CDS

MODEL NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Goodmans GCD-10 £120	Average— Poor	Cheap, flashy and not short on accessories the GCD-10 is a rather noisy player that left a lot to be desired on the sound quality front	13.5 x 3.7 x 18cm, 478g, mains adaptor		66
Kenwood DPC-77 £270	Good+ Very Good	Very chunky and well made, the DPC-77 is the only player to include a digital output and sounds very good through its analogue output — a suitable domestic alternative	12.8 x 3.5 x 14.5cm, 750g, digital output, mains & in-car adaptors	R	66
Philips D6800 £130	Average Average—	A competitively priced and reasonably attractive looking player whose sonic performance is somewhat marred by a rather grainy top end	13 x 4 x 17.5cm, 516g, 3" ready, twin hdph sockets		66
Sony CP-12 £260	Fair Good+	Sonically amongst the more enjoyable personal CD players and capable of revealing the musical aspects of a disc in an interesting and entertaining fashion	12.5 x 2 x 12.7cm, 380g, wired remote, mains adaptor	R	66
Sony D-20 £150	Average+ Fair	Not bad for a machine at this price, it's nicely designed and reasonably robust, with reasonable sound quality	13.8 x 3.8 x 15cm, 450g, mains adaptor	R	66
Sony D-88 £300	Average— Fair+	A stylish and 'cultish' object, the D-88 is very small and has an adjustable disc drive for three and five inch discs. Sound quality doesn't quite match appearance	9.4 x 3 x 9.8cm, 300g, 3" ready, mains adaptor, no line out		66
Sony D-150 £300	Fair+ Very Good	One of the most enjoyable machines encountered, sounding informative and sweet and looking very tasty to boot. Comes complete with a tough carrying case	12.6 x 2.1 x 13.5cm, 420g, 3" ready, mains adaptor	R	66
Xenon CDP-03 £180	Average— Fair+	A well made and competitively priced machine that is ergonomically spoilt by flat slightly unresponsive buttons. Sound quality ain't too bad but a trifle boring	12.6 x 2.7 x 12.6cm, 560g, high frequency filter, key lock		66

CD PORTABLES

CD Portables or Yuppie Blasters as we classified them are basically portable stereos gone digital, ie a compact disc player is included alongside the usual AM/FM radio and single or double cassette deck. Compact disc is a novelty that seems to add a fairly hefty premium onto the price of the standard ghetto blaster, but the improved sound quality over standard cassettes may justify this for some.

In virtually every case a CD output socket is

filled which means that it's possible to play silver discs through a domestic amplifier and loudspeakers, thus they are some sort of substitute for standalone mains machines (as are the personal CD players). One drawback with having a CD player on board is that batteries are gobbled up even quicker than usual, up to ten batteries being required in some cases. Neither are the units particularly light, the heaviest weighing eight kilos!

However they do all run off the mains too, and come with an appropriate lead for this purpose. Other useful features common to most are spare input sockets to record from an external line source such as a preamplified vinyl disc signal, and microphone sockets for recording live events (although the usual lack of record level adjustment is a nuisance).

MODEL PRICE	SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Aiwa CSD-XL25 £150	Poor	It's cheap, cheerful and not too low on features but sound quality from disc is frankly uninspiring	Twin headphone sockets		73
Bose Acoustic Wave £750	Very Good	No exactly a CD portable as it doesn't play discs, but a highly versatile and stylish radio cassette player that has bass	Input sockets, Dolby NR, PA capable etc	R	73
Grundig RR9000C0 £300	Average	Relatively slick machine with full CD function and volume remote control, low on features for price and unspectacular sounding	Remote, motorised volume pot, condenser mic		73
JVC-X510 £200	Average+	A chunky but not too enormous machine which makes reasonable sounds for the price and has something pertaining to low frequencies	Twin decks, graphic eq.	R	73
JVC PC-X300 £350	Average+	Very large machine with removable speakers and radio presets. Goes quite loud but not with a great deal of finesse, guaranteed to impress your mates	Twin decks, aerial connections, graphic eq., etc		73
Philips AZ8394 £200	Average—	Stylish in a wasp like fashion, unfortunately the disc playing lets it down somewhat but otherwise it's OK	Twin decks, graphic eq., bass boost, condenser mic		73
Sharp QT-CD43 £280	Average	Quite a beefy box that comes complete with remote control for volume and CD functions. It even has a surround sound option which enhances imaging	Clock, speaker outputs, powered volume pot		73
Sony CFD-D73 £280	Good	The model we received was intended for the Japanese market and thus may not be entirely representative but it made reasonable sounds and has novel features	UHF bandwidth, input sockets, graphic eq., Megabass	R	73
Sony CFD-DW83 £300	Average	A macho looking beast capable of highish levels, but unimpressive sound for the price. Nice styling and good for scratching	Clock, timer, balance, input sockets, graphic eq.		73
Toshiba RT-8089 £200	Poor+	Square and long but rather drab on the sound quality front, as well equipped as most but rather tinny in many respects	Clock, twin decks		73
Toshiba XR-9458 £250	Average+	Accompanied by a plethora of accessories including a meaty plinth and infra red remote the Toshiba didn't quite make it on the sound quality front but is worth considering	420g, 2 remotes, mains adaptor, 3" ready etc.		73

THE WORLD'S NO 1 GUIDE
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THE DIRECTORY

STANDS AND SUPPORTS

It's becoming more and more apparent that all the components in a hi-fi system benefit from being placed on the right kind of support. It is already acknowledged that performance of electro-mechanical transducers, such as turntables and loudspeakers, can be greatly improved by using highly rigid supports. This notion has been expanded to include electronics such as amplifiers and compact disc players, and inevitably a broad range of stands and supports have been produced to cater for this requirement.

With loudspeaker stands there seems to be two

broad schools of design. The most common is the open frame type which uses square section steel tubing (usually less than an inch square) made up to form a tripod or quadropod stand usually fitted with spikes top and bottom to ensure good coupling to both floor and cabinet. However, for reasons of domestic harmony this latter option is often not pursued as eagerly as perhaps it should be. The alternative approach is to use mass. Larger section (approximately 3 inch x 2 inch) tubing is welded between square top and bottom plates and filled with sand and/or lead shot. Again, this type uses

spikes at the base but Blu-tack or the like for coupling with the speaker cabinet.

Equipment supports generally place isolation quite high on the list of priorities and usually use a lightweight steel frame to support an MDF platform. Once again spikes are used to minimise contact with the platform and ensure good coupling to the floor. Minimising weight without compromising rigidity seems to be the aim with turntable supports but those designed for electronics often employ some form of damping to kill vibration, sometimes in the form of mass.

LOUDSPEAKER STANDS

MODEL PRICE	TYPE FINISH	COMMENTS	TOP PLATE SIZE HEIGHT	VALUE	BACK ISSUE FULL REVIEW
Appolo A820 £40	4 leg Fair	A light open-framed budget design slightly lacking in rigidity and subjectively superceded by other stands costing £10 more.	19 x 19cm 53cm		58
Appolo A10 £47.25	4 leg Fair	A robust and lightweight model, it would make an ideal upgrade for those still happy with the big boxes of old.	19 x 19cm 44cm	R	58
Foundation Fred £65	2 leg Average	With sand filling the Freds made speakers sound tight and coherent with a more even balance.	19 x 19cm 36/43/59cm		58
Foundation Maggi £159	Pair Very Good	Made for Magneplanar and other similar panel speakers they seem to have a healthy effect on the sound quality thereof.	50 x 2cm 2cm	R	58
Foundation Pi £250	2 leg Very Good	Overpriced in material terms the Pi nevertheless has a very positive effect on the low frequency performance of conventional speakers.	20 x 20cm 25/38/46/53cm	R	58
Heybrook Point 5 £50	3 leg Very Good	An unusual triangulated open frame stand that can help certain speakers sound more transparent and fluent - a good value stand.	23 x 21.5cm 47cm	BB	58
Heybrook HBS1 £75	4 leg Very Good	With its new aluminium base frame the HBS1 fared very well in the listening tests. It allowed much of the speakers own 'sound' to remain intact.	23 x 21cm 47cm	R	58
Linn Kan II £79	4 leg Very Good	Built to support Linn's Kan speaker this stand is well suited to the task, but is less successful with other loudspeakers.	19 x 16cm 59cm		58
Linn Sara £85	4 leg Very Good	The Sara exhibits some odd properties so its use other than with the Sara loudspeaker should be viewed with caution.	25 x 21cm 53cm		58
Monotrak Engineering M1 £58	1 leg Good	The M1 gave the mid and treble a commendably smooth and detailed presentation but bass sounded rather lacklustre and muddy.	19 x 18.5cm 48cm		58
Monotrak Engineering M4 £58	4 leg Very Good	Begging comparison with Heybrook's HBS1 the M4 maintained much of the openness and forthright detail of that model.	23 x 21.5cm 53cm	R	58
Monotrak Engineering M4S £58	4 leg Very Good	Its stature and stability would seem to mark it out as most suitable for smaller, lighter cabinets. The M4S possessed an open midband and clear treble.	20 x 17.5cm 53cm		58
Mordaunt-Short IS1 II £45	3 leg Good	Suited to low mass speakers, preferably using spikes to effect coupling, they sounded slightly 'jazzed up' but the overall sound was quite unclouded.	18 x 15cm 56cm	R	58
Origen Live £117	3 leg Good	An unusual tripod stand devoid of top plate and taking up more floor space than normal, subjective and technical performance was exemplary.	(support area) 22 x 17.5cm 52cm	R	58
Partington PP4 £50	1 leg Good	The PP4 offers a rather mixed performance, though when damped with sand infill it was less ready to embellish the overall sound and low frequencies became tauter and quicker.	18 x 16.5cm 48cm		58
Partington Dreadnought II £120 (filled)	1 leg Very Good	Ideal for systems on the light/bright side of neutral, the Dreadnought IIs nevertheless still need some careful re-examination by Partington.	17.5 x 16.5cm 63cm		58
QED TS22 Tristand £50	3 leg Very Good	Most tracks sounded uplifted or buoyant, never thick nor coloured. It worked well with most of the speakers tried and encouraged a fluid and revealing midband.	19 x 17cm 45/50/58cm	BB	58
RATA Torlyte £190	2 panel Excellent	Suited to low mass speakers, these unusual stands are hardly discreet but offer transparent and clean sound - much like the Torlyte table!	25 x 21cm 48cm	R	58
Target HS20 £53	1 leg Excellent	This monopod stand can be used either filled or unfilled and encourages different characteristics in the sound accordingly.	19 x 16.5cm 53cm		58
Target HJ15/3 £83	3 leg Very Good	Sound quality was basically very good though without the sand infill some loudspeakers may sound a little unbalanced as both bass and treble regions are subjectively exaggerated.	28 x 28cm 40cm	R	58

EQUIPMENT SUPPORTS

MODEL PRICE	TYPE FINISH	COMMENTS	SIZE (H x W x D)	VALUE	BACK ISSUE FULL REVIEW
Audioquest Sorbothane Feet £10 each	Feet Good	These large gundrops are very useful for damping vibrations in amplifiers and especially CD players.	6.5 x 2.5cm (circular)	R	57
Cornflake TCS5 £50	Table Very Good	A little too close to the ground for comfort, perhaps, but this novel and stylish little table is certainly worth seeking out.	29 x 43 x 33cm	R	57
Cornflake TCS6 £50	Shelf Good	A squat and rigid frame supports a Medite top board with four adjustable spikes, better suited to suspended sub-chassis turntables.	43 x 23 x 33cm		57
Deltec Isolation Base £135	Platform Good	Designed for all CD players, amplifiers and separates, but not suspended sub-chassis turntables, the isolation is second to none.	50.5 x 40cm	R	57
RATA Model A £125	Table Very Good	A three-legged Torlyte turntable support that has become something of an industry reference.	46 x 46.5 x 38.5cm	R	57
RATA Amplat £40.25	Platform Very Good	A lightweight and rigid Torlyte slat with spikes for floor or shelf mounting, it works well in conjunction with the Target TT2.	4 x 44.5 x 35cm		57
Sound Organisation Table £55	Table Very Good	A deceptively simple structure that just happens to be engineered in a thoughtful, and ultimately successful manner.	37 x 45 x 35cm	BB	57
Sound Organisation Wall Stand £40	Shelf Very Good	The first of its ilk and still amongst the best, this simple framework represents a vast improvement over standard furniture shelves.	27.5 x 43 x 35cm	BB	57
Target TT1 £46.50	Shelf Excellent	This rigidly braced shelf offers both good sound quality and material value for money.	26 x 46.5 x 35.5cm	BB	57
Target TT2 £47.50	Table Very Good	Standing up to the best in most areas, the TT2's only real foible concerns a slight loss of bass 'slam'.	52 x 46.5 x 35.5cm	BB	57
Townshend Suspension Base £145	Platform Fair	Designed to complement the Rock turntable, this platform will bring subjective improvement to a wide range of electronics.	43 x 36cm	R	57

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THE DIRECTORY

CABLES AND CONNECTIONS

Although cables and connections are sometimes thought to be the least important items in an audio system there has been a growing awareness in recent years that they have a significant effect on sound quality. To this end there is now a vast array of exotic cables and interconnects available to those interested in experimentation. The key observation on cables is that they are much more than mere accessories. Carrying the audio signal, just as any amplifier does, it's really not too surprising that they can influence the quality of that

signal.

The characteristics of any cable are determined by the materials and topologies utilised in its construction. The purity of the conductor, nature of the insulator dielectric, mechanical construction, physical geometry, RF characteristics, efficiency of screening and finally the connectors themselves, all play vital roles in the sonic character. These factors tend to vary more with interconnect cables which are used to carry the signal between active components like pre and power amplifiers. The

interconnects summarised here were tested in 1m terminated lengths and therefore the results and prices relate to that length – some cables may well perform differently when used in longer lengths.

The features column contains information on the material make-up of the different cables with the following abbreviations: OFC – oxygen free copper, OFHC – oxygen free high conductivity (Audionote define the HC as high crystal), PC-OCC – pure copper by ohno continuous casting, LC-OFC – linear crystal oxygen free copper.

INTERCONNECT CABLES

MODEL PRICE (per metre)	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Apature LSD N/A in UK	Poor Fair	Faint resonant boom was audible at very low frequencies, but otherwise this cable sounded remarkably neutral.	Silver plated copper, PTFE dielectric		59
Audioquest Reference 2 £29	Good Fair	Ultimately Reference 2 simply damped much of the atmosphere and emotional charge of a musical performance.	OF copper		59
Audioquest Livewire Topaz £29	Good Fair	Sounding 'bigger' and faintly richer than Reference 2, Topaz was also slightly grainy at the top end.	Gold-plated plugs, OFHC copper		59
Audioquest Livewire Ruby £45	Fair Good	Smother sounding than the Topaz, the extended crystal Ruby is less grainy and coarse, better able to resolve complex passages.	FCL copper twin axial	R	59
Audioquest Livewire Quartz £65	Good Good	Quartz has an ideal, neutral balance that embodies sparkling clarity without the drawbacks of harshness or compression.	3 piece plugs, PTFE dielectric	R	59
Audio Technica AT6115 £50	Very Good Fair	This cable sounds somewhat 'quieter' than the original LC-OFC interconnect, but is also less transparent and three dimensional.	PC-OCC copper coaxial		59
Audionote Copper ANC £35	Fair Good	ANC sounded punchy with a faintly lean but tightly-focused bass character. This crystalline precision waned slightly at higher frequencies.	OFHC copper twin-axial	R	59
Audionote Flexible Silver ANS £85	Fair Good	ANS scored a hit with its transparent midband and revealing but quite unforced treble quality. Bass transients were slightly softened.	Silver signal & Copper screen	R	59
Audionote Silver ANV £140	Poor Fair	Fair weightier-sounding than the flexible ANS, ANV interconnect also possesses a fair degree of treble clarity and sparkle.	21 strand silver Litz		59
Aural Symphonics N/A in UK	Poor Good	This cable enjoyed an open and transparent midband and sounded remarkably neutral and faithful to the source.	OF copper PTFE dielectric	R	59
Budget Patch Cords see text	Fair Poor	As thrown in gratis with cassette decks and the like – frequency extremes were restricted and performances were veiled.	Thin coaxial		59
Budget OFC circa £7	Fair Fair	Subjectively, this cable did lift much of the aural fog experienced with scrawny standard hook-up leads.	OFC		59
Deltec Slink £32	Good Very Good	Ideally used in lengths of under 4 metres, it errs on the lean side of neutral but has an uncommon transparency in the midrange.	4 silver plated OFC strands PTFE dielectric	BB	59
Deltec Black Slink £152	Excellent Excellent	Inherently neutral the cable faithfully reproduced broad and deep stereo soundstages with precise focus and a sense of tactility.	8 silver plated OFC strands PTFE dielectric	R	59
Denon LC-OFC N/A separately	Very Good Fair	Supplied with Denon's dearer CD players this cable introduced a peculiar 'twangy' coloration at high frequencies, and a slightly soft bass.	LC-OFC, non-magnetic gold plated plugs		59
DNM Solid-core £15-£25	Fair Good	Transparent in the midband and full of sparkling detail in the treble, low bass was slightly curtailed (unterminated price £2.30 per m.)	Single strand nickel-plated copper. Unshielded	R	59
Kimber Kable PSB £32	Very Good Very Good	An exceedingly transparent midband but slightly 'clanky' treble. It always managed to sound remarkably uncluttered and open.	OFC, PTFE dielectric	BB	59
Kimber Kable KC-1 £47	Very Good Fair	Tonally faintly leaner and brighter than the more open-weave PSB, KC-1's treble detail was just too sharp and grainy.	Multi-gauge PTFE dielectric		59
Kimber Kable KC-AG £375	Good Very Good	Treble detail resolution was perceived in a slightly abrupt if wholly controlled fashion. Depth re-creation and lateral separation were excellent.	Multi-gauge silver, PTFE dielectric	R	59
MDM Interconnect £14.95	Good Fair	The subjective performance of MDM did appear a little imprecise at the frequency extremes, but a worthwhile upgrade on budget interconnect.	Coaxial, solid core, gold plated plugs		59
MIT PC-Squared £75	Fair Good	This multi-gauge cable produced a very open and buoyant midband but sounded slightly 'peculiar' at frequency extremes.	OFC, multi-gauge	R	59
MIT Spectral MI330 £193	Poor Fair	MI330 displays a marvellously open and enticing midband quality, bass is warm and rich but this character has a tendency to dominate.	Multi-gauge balanced bandwidth		59
Monitor PC 0100381 £17	Good Fair	There is more than a hint of instrumental muddling and bass is slightly soft, however, the slightly 'shut-in' sound is par for the course at the price.	OFC, coaxial	R	59
Monster Interlink 400 £30	Good Good	Bass is solid and punchy, counterpointed by a slightly overblown midband which tends to make vocalists sound larger-than-life.	Multi-gauge	R	59
Monster Interlink CD £44	Fair Fair	Low frequency is commendably weighty, but the top-end sounds vague and lacking in image focus. Suited to some systems better than others.	Multi-gauge		59
Monster Interlink Reference £88	Good Fair	Protracted listening indicated a lack of dynamic speed – a subjective sluggishness. It may prove well suited to up-front systems.	Multi-gauge Balanced bandwidth Gold plated plugs		59
Myst Tm £15.60	Fair Good	Fairly neutral with a pleasantly open and transparent midband. Some deep bass detail is lost but treble is sharply focused.	Solid-silver PTFE dielectric	BB	59
Origin Live Soli-Core Super £60	Good Fair	Improves over previous Soli-core samples in stereo depth and bass weight, but a 'loud' treble presentation remains.	Solid-core gold-plated AT plugs		59
QED Incon P1-Gold £14.95	Good Good	A lively open presentation that just borders on the lean side of neutral, the quick and lucid delivery affording considerable musical insight.	OFHC, gold plated Deltron plugs	BB	59
QED Incon Graphite GP1 Gold £18.95	Fair Fair	A shielded version of Incon P1, it sounded thicker at the frequency extremes, the top end being coarser and more out of focus. Good for long runs though.	OFHC Graphite shielding	R	59
Sony RK-C310ES £40	Excellent Good	Possessing deep firm bass and a sparkling top end it offers a balanced perspective with negligible coloration.	Coaxial LC-OFC	R	59
Sterling £250	Fair Good	Possessing a neutral if faintly rich overall balance it supplies a pleasantly open and transparent perspective. (Reviewed in pre-production form.)	2 silver strands per conductor		59
Thorens SAC 100 £50	Good Fair	Performance is undermined by a slightly coarse and splashy treble, not necessarily bright, simply rather confused – and fine detail lacks resolution.	Silver-plated OFC, coaxial		59
Van den Hul MC-D300II £59	Poor Good	It tended to highlight some upper mid detail, but a generally open and spacious acoustic proved its saving grace. Slightly soft at LF.	Silver plated single strand VdH plugs	R	59
Van den Hul MC-1021II £69	Good Good	Possessing the same endearing qualities as the D300 it presented open and transparent soundstages and improved timbral resolution.	Twin axial silver plated copper	R	59

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INTERCONNECT CABLES

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Van den Hul MC-D502 £77	Fair Fair	The tonal balance was 'tilted' by a strong and authoritative bass line, which had the knock-on effect of muting treble detail. A bit dear.	Twinn axial silver plated copper, teflon dielectric		59
Van den Hul Thunderline £147	Good Fair	Thunderline essentially parallels the sonic performance of the cheaper D102. HF is occasionally tainted by a 'tizzy' coarseness, bass is tight and dry.	Silver plated 'matched copper'		59
Van den Hul MC-Gold £247	Fair Good	It possesses a rich and beguiling treble balance that matches a weighty, slightly warm bass character. Seductive balance may prove worthwhile in some circumstances.	Silver & gold plated copper		59
Van den Hul MC-Silver £747	Good Good	Although remarkably transparent for an asymmetric design this costly cable was not considered to be of 'state-of-the-art' standard, and is bettered by cheaper models.	19 silver plated copper strands		59
Vecteur 8045 £49	Very Good Good	Sounding solid and forthright it might seem slightly cold in some systems but the treble 'edge' is mercifully clean. Very low frequencies were a little lacking in 'slam'.	LC-OFC signal & screen	R	59

LOUDSPEAKER CABLES

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Absolute Wire Force 4 £4.50 per metre	Good Fair+	By current standards there was a loss of fine, sharp detail at the frequency extremes, but it has a big and friendly sound	744 OFC strands, PVC dielectric		64
Audionote OR-200 £16 per metre	Fair+ Fair+	Open and detailed throughout the midband but a grainy coloration tended to corrupt subtle timbral information at very high frequencies	200 LC strands, polyurethane and cotton dielectric		64
Audionote AN-SP £100 per metre	Average— Good	A clean and open sounding cable that offered a deep and pleasantly detailed perspective. Bass was slightly restricted, but seemed tight and coherent nonetheless	15 silver strands, polyethylene dielectric		64
Audioquest BC-4 £2 per metre	Average+ Good+	There was a slowing of fast transient edges to contend with but in general BC-4 offered a delightful clarity and sparkle throughout the highest octaves	4 OFHC strands, PVC dielectric	BB	64
Audioquest Livewire Black £15 per metre	Good Good	It proved clear and punchy but with some grain across the treble. Nevertheless Black remains an interesting concept and proved better than Livewire Green	OFHC, surface only — foam core construction	R	64
Audioquest Livewire Green £30 per metre	Good Fair+	Green proved more overtly dynamic and forward than BC-4 with simple music, but complex passages tended towards a mushy and ill-defined perspective. FCL — functionally crystal less	FCL, surface only — foam core construction		64
Audio Technica AT6120 £95 — 10m	Fair+ Fair	Compared to earlier LC-OFC cables this PC-OCC derivative sounded smoother and less aggressive	PC-OCC, PVC dielectric		64
Bellwire 12p per metre	Poor Average—	Broadly speaking it delivered a bright and tizzy sounding treble with a fairly open and detailed mid with little or no bass resolution	0.5mm single strand, PVC dielectric		64
Deltec 8S £144 — 5m pair	Good Good+	The unerring transparency and detail resolution of 8S throughout the midband makes it a far cleaner and more spacious sounding cable than others at the price	4 silver plated OF copper strands, PTFE	R	64
Deltec Black Sixteen £456 — 4.5m pair	Very Good Excellent	Bass was deep and rhythmically secure, the mid tonally pure and free of additional sibilance while the treble was both relaxed, sweet and highly detailed	16 silver plated OF copper strands, PTFE dielectric	R	64
DNM Solid core £2.30 per metre	Average Fair	DNM cable seems too unbalanced for general consumption but excellent results have been obtained in sympathetic systems	0.65mm single strand, webbed PVC dielectric	R	64
Exposure £2 per metre	Good Good	It could sound a trifle matter of fact but this emotive flattening was also somewhat dependent on the music program. It is also highly suited to long runs	56 OFC strands, webbed PVC dielectric	R	64
Kimber Kable 4PR £49.45 — 5m pair	Fair Fair+	This directionally marked cable benefitted from an open and airy treble quality but seemed notably leaner than 4TC. Bass was well round and satisfyingly taut	4 x 7 copper strands per conductor, PVC dielectric		64
Kimber Kable 4TC £16 per metre	Good Good+	4TC made a great impression in the listening tests with an open midband, a smooth and unfatiguing treble with slightly rich but suitably weighty bass	OF copper, PTFE dielectric	R	64
Linn K20 £2.20 per metre	Good Fair	Subjectively it erred on the forward and bright side of neutral but enjoyed an essentially clear and punchy delivery	56 OFC strands, webbed PVC dielectric		64
Marantz ML-55S £24.90 — 10m	Fair Fair	Subjectively this cable offered a loose and splashy treble which, though not overtly bright, did compromise both tonal and timbral accuracy	30 OFC strands, 3 conductors PVC dielectric		64
Mission Cyrus £2.50 per metre	Average+ Good	Because of its impedance characteristic this cable will deliver a smooth and unfatiguing treble balance with loudspeakers offering an easy load	0.8mm single strand, PVC dielectric	BB	64
Monitor PC Silverline PC4 £5.75 per metre	Good Average	Sonically it laboured under a heavy and claustrophobic balance, lacking the see through transparency and lucidity of the better solid core cables	2072 x 0.07mm silver plated copper strands		64
Monster Superflex £2.50 per metre	Fair+ Fair+	Treble detail was both reserved and confused though there was little in the way of harshness and grain. Deep bass notes were also found to be lacking	OFC, multistrand, Duraflex dielectric		64
Monster Original £4 per metre	Good Fair+	Original sounded relatively congested and murky at higher frequencies but possessed weight and conviction in the bass	Multistrand		64
Monster Powerline 2 £12 per metre	Good Good—	Powerline stamped its own hallmark on the sound with a strong taut bass and an essentially clear midband giving tactile stereo images	Multistrand, helical construction		64
Musical Fidelity Lifeline £11.50 per metre	Fair Good—	Lifeline did demonstrate a strong directional inclination, affording a laid back but fairly neutral balance when correctly oriented	4 x 0.8mm PC-OCC strands	R	64
Naim NAC-A4 £2.25 per metre	Good Fair+	Tinged with brightness while the deep bass response seemed both over heavy and poorly integrated compared to the immediate competition	Multistrand, webbed PVC dielectric		64
NVA £6 per metre	Average+ Good	A light and breezy sounding cable best suited to short lengths, NVA benefitted from a clear and transparent outlook	7 x 0.25mm silver alloy strands, PTFE	R	64
Origin Live Soli-Core Ordinary £1.80 per metre	Good Fair+	Subjectively it bettered the performance of the costlier Super version, affording a pleasantly detailed and spacious soundstage with firm bass but slightly coarse treble	1.8mm and 0.5mm single strands	R	64
QED 79-Strand 90p per metre	Good Fair	For much of the last decade QED 79-Strand has been the first port of call for enthusiasts on the upgrading ladder, a tradition that should still hold true today	79 strand, PVC dielectric	R	64
QED Incon Graphite £1.75 per metre	Fair+ Fair+	This graphite version of Incon sounded cruder and generally more heavy handed than the cheaper unshielded type. Overall presentation was mildly restricted and cloaked in a faint aural fog	OFHC, polymeric screen		64
QED Flat 200 £1.95 per metre	Good Good	I detected a degree of confusion at low frequencies but this did not stifle the acoustic atmosphere which remained open and positive	200 strands, flat webbed PVC dielectric	R	64
Rotel Supra 4 £2.49 per metre	Good+ Good	Ideal for both long and short runs, it furnishes a big sound that benefits further from a smooth, unatiguing treble	1,036 OFC strands, webbed PVC dielectric	R	64
Rotel Supra 10 £6.49 per metre	Good+ Good+	Supra 10 provided a very free and open sound that was unhindered by any excess at low frequencies. Worth its weight in scrap copper!	2,562 OFC strands, webbed PVC dielectric	R	64
Sony RK-S5ES £59.95 — 5m	Fair+ Fair+	The sound of this cable was also somewhat controlled and over damped. The treble was relatively free and airy but lower octaves, including the midband, were constrained	350 x 0.08mm OFC strands, heat shrink dielectric		64
Solid core mains cable 35p per metre	Fair+ Good	It enjoys much of the smooth treble and articulate midrange usually associated with the better solid core derivatives. Lean but taut and rhythmically coherent	1.5mm square, 3 cores, PVC dielectric	BB	64

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LOUDSPEAKER CABLES

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Sterling £499 - 5m pair	Fair Fair	This pre-production sample possessed a strangely muddled and reserved sound quality. It suffered from a progressive instrument modulation that totally confused more complex orchestral passages	Pure Silver, PTFE dielectric		64
Townshend Isolda £400 - 5m pair	Fair+ Good	Isolda possessed a truly dark background out of which rose a very solid and extended bass together with an excellent sense of transparency through the upper octaves	8 coax cables per conductor - very thick	R	64
van den Hul CS-122 £5.50 per metre	Fair+ Good-	Characterised by a driving and powerful bass, CS-122 proved to be a heavy sounding cable. Mid treble detail was refreshingly clear but there was a slightly muted air about the extreme treble	19 x 0.45mm silver plated strands, webbed rubberised dielectric	R	64
van den Hul CS-352 £12.95 per metre	Good Fair+	Subjectively it sounded like CS-122 only more so, the deep rumbling bass tending to overwhelm subtle musical details. It also appeared a trifle peaky in the treble	7 x 0.76mm + 168 x 0.125mm silver plated strands, rubberised dielectric		64
van den Hul SCS-12 £29.95 per linear metre	Good+ Good+	SCS-12 set a high standard with a tight and well focused soundstage populated with tactile stereo images. Bass wasn't as extended or resolved as some other cables	19 silver plated strands of 12 different gauges, PTFE dielectric	R	64
van den Hul SCS-2 £99.95 per linear metre	Good+ Good+	Overall it was commendably neutral and transparent but nothing less would be acceptable bearing in mind the tremendous cost of a stereo pair	665 silver plated matched crystal copper strands, PTFE dielectric	R	64
Vecteur R-CV30 £4.99 per metre	Fair Good	Subjectively the better of Vecteur's three-strong cable line-up offering a neutral overall perspective but with a slight loss of detail resolution at both frequency extremes	4 x 0.8mm LC-OFC PTFE insulated strands	BB	64
Vecteur S-CV90 £199 - 5m pair	Fair+ Fair+	It seemed both less transparent and integrated throughout the midband than R-CV30, though both frequency extremes were spruced up with a tighter sharper delivery	6 x 0.7mm LC-OFC strands		64

IN-CAR ENTERTAINMENT

In-car entertainment is an area not usually associated with the esoteric world of domestic hi-fi. However, it represents a source of musical entertainment that many of us are exposed to every day. The majority of new cars are fitted with some form of radio before they leave the showroom and in many cases this usually very basic player is taken for granted and accepted as representative of in-car audio standards.

For the price of a budget amplifier or more, there is a wide variety of in-car machines to choose from,

including cassette, CD and even DAT players. The majority of sub £300 players are integrated units featuring a cassette player, AM/FM tuner and amplifier, all in one remarkably compact standard sized box. At this price level the cassette players tend to be fairly basic affairs, although autoreverse and noise reduction systems are both fairly common. Tuners are usually of the digital variety with varying degrees of sophistication in signal tuning and presetting, with some machines featuring as many as 18 FM presets. The emphasis is on the frequency

modulated band and AM often suffers as a consequence, but fortunately for radio enthusiasts there are some exceptions.

The amplifier is usually designed to drive two pairs of speakers mounted fore and aft of the vehicle, and a fader is fitted to adjust the balance between the two. The dearer machines feature separate bass and treble controls which can be quite handy given the unusual acoustic of the car environment and the variety in balance and presentation to be had from car speakers.

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Alpine 7282L £250	Good Very Good	A very attractive and seductive sounding player. The matt surfaced transparent preset keys are especially sexy	Bass/treble controls, 12 FM 6 AM presets, chrome eq., clock, 8W	R	61
Alpine 7905M/3539 £650/£350	Excellent Excellent	An easy to use and attractive CD/tuner, partnered with a powerful and flexible amplifier to give an effortless source of in-car entertainment	Bass/treble controls, 12 FM, 12 AM presets, slide-out, 150W	R	68
Aiwa CT-Z3500YL £199	Fair Fair	A nicely designed machine with a flip up lid for disguise purposes. Sound quality from cassette is a bit poor but the radio is exemplary especially on AM	Bass/treble controls, 6 FM, 12 AM presets, Dolby, chrome eq., 8.4W	R	62
Blaupunkt Paris SQM 48 £253	Average Average	A powerful and sensibly designed player but let down by a very dull sounding cassette. The radio is a bit better	Bass/treble controls, 5 FM, 10 AM presets, uni-directional, 11.5W		62
Blaupunkt Windsor SQR 38 £275	Good Average	Not very enthralling sonically, the Windsor is rather low powered but does have a reasonably stable tape transport	5 FM, 10 AM presets, 3.1W		62
Clarion 916HP £160	Good Average	With its rubbery buttons and touches of white this is a modest looking player let down by a weak cassette	Bass/treble controls, 5 FM, 5 AM presets, 9W		61
Clarion 946HP £250	Very Good Very Good	A good FM side let down slightly by AM performance. This Clarion is particularly nice to use with its nifty SAM tuning system	Bass/treble controls, 12 FM/6 AM presets, slot-in, 15.1W	R	61
Clarion CDC7000/10028HA £650/£250	Very Good Excellent	Despite a slightly off-beat cartridge system the Clarion combo put in a performance that had the sonic edge over other CD/tuners in its test group	Bass/treble controls, 12 FM, 12 AM presets, security code, 80W	R	68
Goodmans GCE229 £150	Fair Average	If knobs, switches and legends are your bag then the GCE229 is the one for you - a lot of gizmos for the price and it even sounds OK	Bass/treble controls, 6 FM/6 AM presets, Chrome eq., clock, MSS, 10.1W	BB	61
Hitachi CSK-402E £250	Good Good	An attractively designed little player that for once doesn't disappoint when it comes to playing music, and it even has a security system	Bass/treble controls, 6 FM, 12 AM presets, Dolby, chrome eq., music search, 7.4W	R	62
JVC RX-318 £200	Average Average	This JVC sounded quite enjoyable and turned in an impressive performance on FM. It even looks quite nice	Bass/treble controls, 5 FM, 10 AM presets, slot-in, 8.8W	R	62
JVC RX-418 £250	Average Fair	An attractively designed machine with a fair selection of features - even an aux socket for a portable CD player	Bass/treble controls, 10 FM, 10 AM presets, Dolby, chrome eq., slot-in, aux socket, 7.7W		62
JVC XL-C30E/KS-A102 £499/£130	Very Good Very Good	Not sonically as impressive as the other CD cartridge players in its group, the C30/A102 combo is, however, a versatile and fast sounding player	Bass/treble controls, 10 FM, 10 AM presets, direct track access, 30W		68
JVC KS-D1 £1000	n/a Excellent	The only in-car DAT player we've tested proved musically quite impressive and if software ever becomes prolific it will be able to offer CD a run for its money	Bass/treble controls, no tuner, direct track access	R	68
Nakamichi TD-400E/PA-300 II £450/£275	Very Good Excellent	If you want your in-car entertainment to compete on sound quality grounds with your domestic system, this combo offers a very strong challenge	Bass/treble controls, 5 FM, 10 AM presets, uni-directional, chrome eq., Dolby B, C, 75W	R	62
Nakamichi TD-700E/PA-300II £795/£299	Very Good Excellent	For those who appreciate the wonders of analogue there are few in-car players to really compete with this superb cassette/radio. You can even adjust azimuth	Bass/treble controls, 6 FM, 6 AM presets, music search, Dolby, 75W	R	68
Panasonic CQ-497 £117	Fair Poor	The CQ-497 has a traditional style analogue tuning system making it easy to use. AM reception was good but the other sources are less encouraging	Bass/treble controls, chrome, NR, 7W		62
Philips 553 £120	Average Average	Not the most ergonomic player on test but sound quality was quite refined for the price. Presets are a bit gauche	4 FM, 4 AM presets uni-direction cassette 3.1W		61
Philips DC680 £180	Average Good	A colourful and musically competent player that despite a gammy volume knob is well worth checking out	8 FM, 4 AM presets 3.5W	R	61
Pioneer KE-303D £150	Poor Fair	A tasty looking, if sonically bass heavy, little box well suited to blasting out rock or dub	18 FM, 6 AM presets 4.2W		61
Pioneer KEH-5080B £230	Fair Good	A chunky and neatly styled player with healthy power output and an easy relaxed sound. Just the thing for pumping up the volume	Bass/treble controls, 18 FM, 6 AM presets, anti-theft device, slot-in, 9W	R	61

THE DIRECTORY

IN-CAR ENTERTAINMENT

MODEL PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Pioneer DEX-M300/CDX-M100/ GM-3000 £300/£450/£280	n/a Very Good	Separate control unit and boot mounted multi play autochanger make this a bit of a hefty installation but it uses the same magazines as their domestic players and sounds fine	Bass/treble controls, 18 FM, 6 AM presets, 80W, removable fascia		68
Proton 214CD/D275 £300/£175	Very Good Very Good	This Proton cassette/tuner offers good power and a level of fidelity appropriate to its price. Musically it has a Decca-like charm that is very appealing, plus a sensitive radio	Bass/treble controls, 8 FM, 8 AM presets, Dolby B/C NR, chrome eq., 85W	R	68
Sansui RX-3100L £180	Poor Fair	Quite flash looking with a reasonable feature count but FM sound and cassette replay quality could be a bit stronger at the price	Bass/treble controls, 12 FM, 12 AM presets, chrome eq., 8W		61
Sansui RX-5100L £250	Good Very Good	One of the cleaner machines around the 5100 has an excellent AM section and a reasonable cassette player	Bass/treble controls, 12 FM, 6 AM presets, chrome eq., slot-in, 12.5W	R	61
Sharp RG-F816E £200	Poor Average	Nothing if not novel the 816, with its unusual anti-theft system is custom built for the furry dice brigade, but is sonically a bit lacklustre	Four band graphic, 8 FM, 16 AM presets, ASP, Dolby, MSS, 10.9W		62
Sharp RG-F882E £220	Average Average	Again a glitzy full feature machine with a flip out control panel and plenty of lights. However, sound quality is a bit disappointing	Seven band graphic, 5 FM, 10 AM presets, ASP, chrome eq., Dolby, 8.5W		62

RECEIVERS

Purists will look down their noses at the very idea of combining two functions into one box, and indeed they always have done. But unless we're talking about the exotic elite, the creme de la creme of amplifier and tunerdom, intrinsic technical shortcomings simply aren't an issue.

One obvious reason why you should buy a receiver if you were otherwise considering an amplifier and a tuner is that there are savings, ie of

size. Generally you end up with one box in place of two similarly sized boxes, which has got to be a good idea. Receivers are also simpler to operate, in principle anyway. At the very least you save on one power switch, and typically you are presented with an integrated control system that is bound to oil the wheels of ergonomics.

But there is one important point to watch. Because receivers don't sell in vast quantities in

this country, and because this is one of the very few countries to use Long Wave for public service broadcasting, many - no, most - receivers on sale in this country cover FM and MW only. Remember that LW is the home of Radio 4, where it can be heard on the all too frequent occasions it is not on FM.

MODEL NAME PRICE	LAB SOUND	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Harman Kardon HK330Vi £259	Average Average-	No LW, and FM section best suited to strong, local transmissions. The amplifier is quite powerful but favours the treble. Bass is tuneful but lacks weight	5 inputs (inc 2 tape), FM/MW tuner		70
Harman Kardon HK440Vxi £329	Good Good	Clear, dynamic, slightly bright sounding design, a little grainy in extremis. Mono switching and LW missing from tuner, which otherwise performs well	5 inputs (including 2 tape) with FM/MW tuner	R	70
JVC RX-777VL £500	Good Good	Sharp, lively but euphonious sound quality from line and phono source is matched to a high grade tuner. However, many half-baked facilities blunt value for money	A/V capable with 6 inputs, equaliser, digital ambience, FM, MW/LW		70
JVC RX-1001V £770	Average Poor	Power output is well below spec, and sound quality is cluttered and messy on all inputs	Digital ambience processing, Dolby Surround, 2/4 speaker, 40 FM/MW presets		70
Revox B285 £1782	Average Average-	Sophisticated and capable tuner is married to a muddled, compressed sounding amplifier, which also has low sensitivity preventing the amplifier being driven fully in many situations	70 watts/ch, 4 inputs (inc 2 tape), 29 FM/MW/LW presets		70
Rotel RX-850AL £230	Good Good	Well built and sensibly equipped receiver with outstanding sound quality for the price via the tuner, phono and line sources alike. It majors on subtlety however, and may not impress the heavy metal brigade	4 inputs (inc 1 tape), FM/MW/LW tuner BB		70
SAE R102 £599	Average- Average	This is an uneven but mostly good performer. It sounds constrained but musical, but the tuner is weak on both wavebands.	4 inputs (inc 2 tape), FM/MW tuner		70

VIDEO RECORDERS

For some time there's been a move to improve both the video and the audio quality of video recorders and TV sets alike as a necessary prelude to a proper integration between the two. Hi-fi video is obviously an important element in the story, and so is Dolby Stereo, the ambient 'surround sound'

system. The weak link of course is on the broadcast side. Although TV sound is well up to normal hi-fi standards, it has always been in mono and unjustly or otherwise has rarely attracted much audiophile interest. But TV sound is - or shortly will be - freed of the shackles of mono by the introduction of NICAM

stereo. NICAM - an acronym for Near Instantaneous Companding and Modulating - is the missing link that will help facilitate the much feted integration of video with audio. And then we have S-VHS, a system which does for picture quality what the other developments promise to do for the sound...

NAME PRICE	LAB SOUND & PICTURE	COMMENTS	FEATURES	VALUE	BACK ISSUE FULL REVIEW
Akai VS-75EK £550	Average Good	Excellent performance and a slick set of controls make this recorder a pleasure to use. Good price is a bonus	Hi-fi, NICAM, programmable remote	BB	71
Akai VS-77EK £700	Average Good	Another fine and carefully designed model from the impressive Akai video stable. The Dolby installation, whilst flawed, is certain to increase interest in the system	Hi-fi, NICAM, Dolby Surround decoder & stereo amp	R	71
Ferguson FV33H £500	Very Good Below Average	Beer budget NICAM has excellent tape search facilities and an intelligent remote control. Neither picture nor sound quality however are state of the art, and ergonomics are poor	Hi-fi, NICAM, transmitter LCD remote control		71
JVC HR-D750EK £500	Good Average+	Well sorted and relatively affordable NICAM recorder with LP sound only. It is pleasing to use and helpfully equipped, especially when trying to find individual recordings buried in long tapes. Performance is good in relation to price	Hi-fi, NICAM, transmitter LCD remote control	BB	71
JVC HR-S5000EK £1000	Good Very Good	This is the first domestic S-VHS recorder on the market, and it's an unusually well designed one with a wide range of well sorted features and controls. Sound and picture quality are close to state of the art, and miles ahead of any non-S-VHS recorder	S-VHS, Hi-fi, NICAM, LCD remote	R	71
Mitsubishi HS-B70 £1000	Very Good Very Good+	Superb model, and true state of the art picture quality, though you'll need a high grade S-VHS compatible monitor to reap full advantage. The facilities are also wide ranging and generally helpful	S-VHS, Hi-fi, NICAM, LP & SP, programmable remote	R	71
Nordmende V4405K £799	Good Good	Fine basic sound and picture quality, but the RF convertor introduced significant losses. An excellent model, but configured for German home market. VPS compatibility is of no practical use here, and the recorder lacks NICAM	Hi-fi, transmitter handset, digital FX		71
Panasonic NV-FS1 £1000	Poor Good	The control system is poorly organised, with cramped legends and some strange machine logic. Bar code programming is hardly a great achievement either. Picture and sound quality are good, but not state of the art	S-VHS, Hi-fi, NICAM, bar code programming		71
Sanyo VHR-D4710E £900	Very Good Good	Fine colour and moderate detail make for a basically good video section to match a fine sound section. Some of the facilities are a little disappointing however and the deck looks expensive	Hi-fi, NICAM, infra-red headphone remote, digital FX		71

THE WORLD'S NO 1 GUIDE TO BUYING HI-FI



PERSONAL MESSAGES

Is the phase response of a loudspeaker more important than the amplitude frequency response? Paul Messenger offers food for thought . . .

Round about the time I should have been getting on with writing up this month's loudspeaker reviews, I took time out to play around with the test gear and investigate some old favourites, while getting to grips with the room measurement technique used in the reviews.

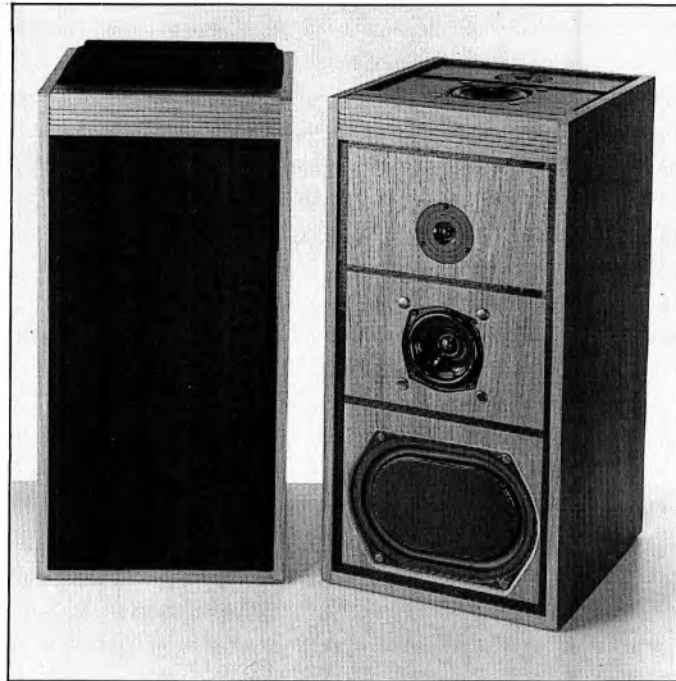
The results were most interesting, clearly confirming the minor weaknesses and idiosyncracies alongside the strengths of such classics as the Spendor *BC1* and (original) Quad *Electrostatic* – both of which showed a smoothness and seamlessness unapproached by all others.

Somewhat more perplexing were the findings with my active (Naim-driven) Linn *Isobariks*. The averaged trace (excluding the 30Hz main room mode) held within ± 5 dB of the 'target', which isn't too bad, although the 'three-humped' character that is typical of many three-way designs is evident, along with the midrange 'bump' (600Hz-1.2kHz) that accounts for this design's characteristically 'cuppy' midband coloration.

But this playing around also managed to throw up a real paradox, acting as a salutary lesson that a flat frequency response is only one of the factors that defines a good loudspeaker. It's important for sure, but can also lead one astray, as the following tale illustrates.

Because the *bariks* are actively driven, access is available to the individual drivers in isolation, without any impediment from on-board passive crossover network circuitry, and this in turn allows close examination of the acoustic integration of the drivers through the crossover regions. The electronic crossover also allows the relative outputs of the drivers to be adjusted.

The problems encountered when 'crossing over' from one driver to another are manifold – sufficient alone to form the basis for an extensive article. Ignoring for now such matters as distribution (dispersion) discontinuities, the fundamental difficulty is that at some specific frequency two separate sources are trying to reproduce precisely equal halves of the signal, so that these add together to produce a



smooth transition. It sounds simple enough to ensure that each driver produces half the required output, but in practice a nasty thing called phase comes along and upsets everything.

Phase is almost as difficult to explain as it is to measure. To create a simple sinewave, a loudspeaker cone, dome diaphragm or whatever vibrates like a piston at the required frequency. Take two identical drivers and put the same signal through both, and the sound output should be double that of one alone (give or take the odd interference pattern).

However, if you get one of the drivers round the wrong way, by connecting the red amplifier terminal to the black speaker terminal and vice versa, the net output will actually be less than from one alone. That's because instead of both pushing and pulling together (ie in phase), when one is pushing the other is pulling, and they tend to cancel each other out.

To get back to the point, you not only need to match the output of the two drivers at the crossover region, you also need to take into account whether they're in phase with each other (unlikely), and figure out how to cope with that one. In the case of the *Isobariks*, there were obvious response dips around the crossover region, and because of

the active drive it is simple to reverse the relative phase of the drivers to see what happens.

At the junction between bass and midrange, reverse phasing actually made matters worse. However, the mid-to-treble crossover notch (3.5-4kHz) was at least partly filled in to the tune of some 3dB, by reversing the tweeter phase.

I was feeling pretty smug about managing to improve the response by a small but worthwhile amount, so I disconnected the test gear and sat back to enjoy some music. The relative lack of said music soon wiped the smile off my face. All the speed, precision and drama of a system that I've known and respected for a decade seemed to have evaporated. As soon as I put them back in phase the music returned.

Which leaves the conundrum that better sound was created with the poorer measured response. Cue for a glib theory. The reason why the 'notch' was deeper with the system in phase is simple enough. Any cone driver is like a piston at low frequencies, with the whole cone area moving together in phase with itself and the voice coil. As you get to the top end of the working range, the mechanical integrity starts to break down, the movements demanded by the

voice coil take a finite time to reach the cone, and the cone itself starts to flex, so a steady phase lag develops as one moves higher up the frequency range.

By the time the tweeter's ready to help out, the midrange output is getting close to being out of phase with the lower end of its working range, and hence out of phase with the tweeter at crossover frequency. Reversing the tweeter phase therefore helped output through the transition zone.

But it also spoiled the music, and that has more to do with understanding the nature of music. We're all so used to dealing with frequency response graphs and referring to bass, midrange, treble and so forth that we are inclined to miss the point. Musical events, such as the plucking of a string or striking of a drum occur at a single instant, yet their reproduction usually requires contributions from all drivers. If there's any real hope of defining the 'leading edge' of a note, it must involve these different contributions occurring simultaneously, and as far as possible in phase.

And in this particular three-way system, at least all the drivers start off in coherent phase, even though they're bound to wander off the straight and narrow a little along the way. Which is a glib but not inconceivable explanation that accounts for the acknowledged strengths of this system, and offers some explanation for this odd out-of-phase paradox.

But it also poses the decidedly uncomfortable open question that perhaps the phase (frequency) response of a speaker system is as – or maybe even more – important than the more conventional amplitude frequency response. Probably both are equally important for different reasons, since both are aberrations from the ideal. Indeed, an investigation comparing and contrasting could easily fill in those awkward gaps where a good sounding speaker measures awfully, and vice versa. History has thrown up too many such instances to believe that conventional amplitude frequency response measurements give more than a part of the truth.

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