SPECIAL EDITION

HI-FI CHOICE

COMPLETE REVIEWS ON SOME OF THE BEST HI-FI IN THE WORLD

The Collection

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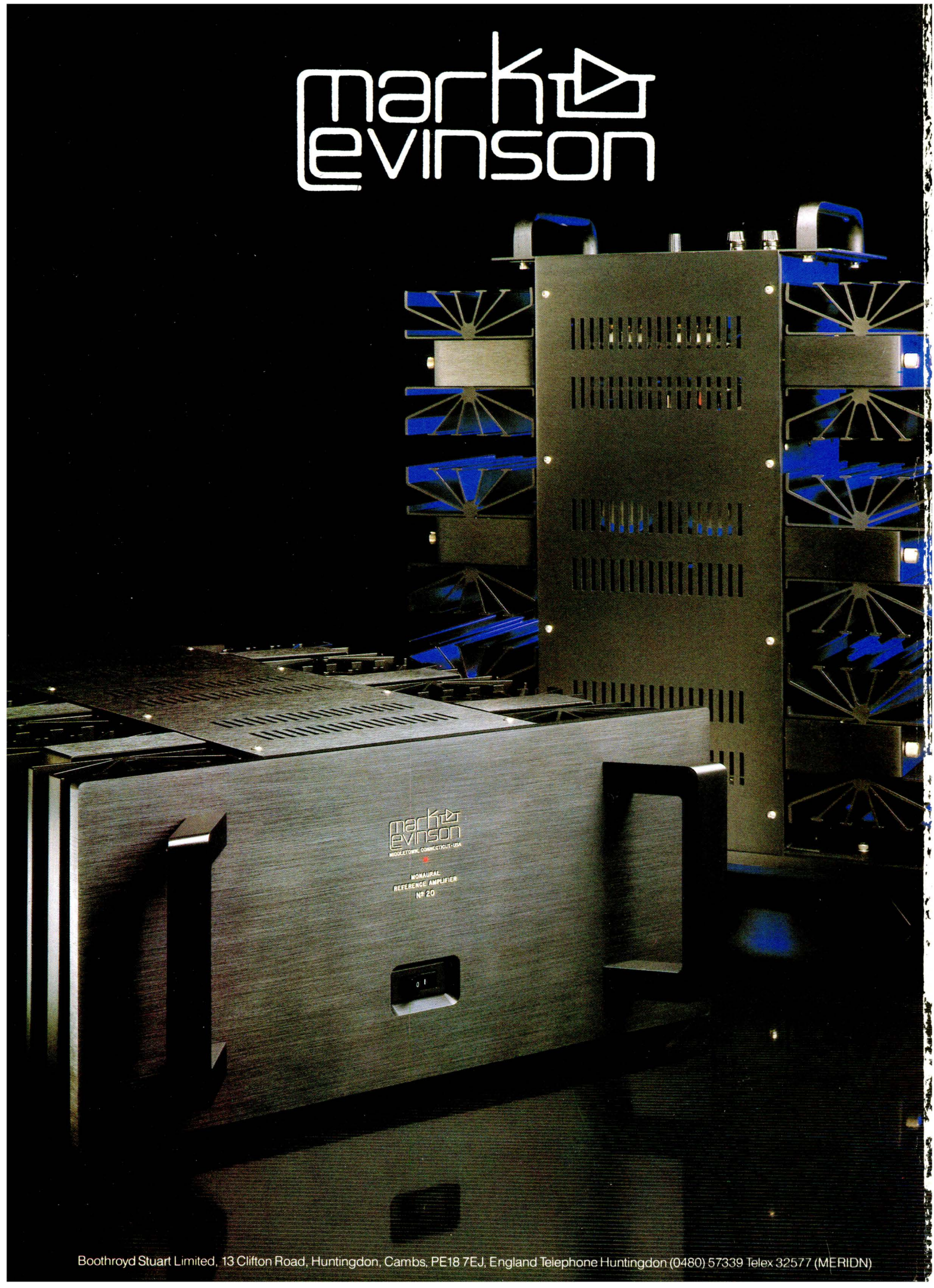

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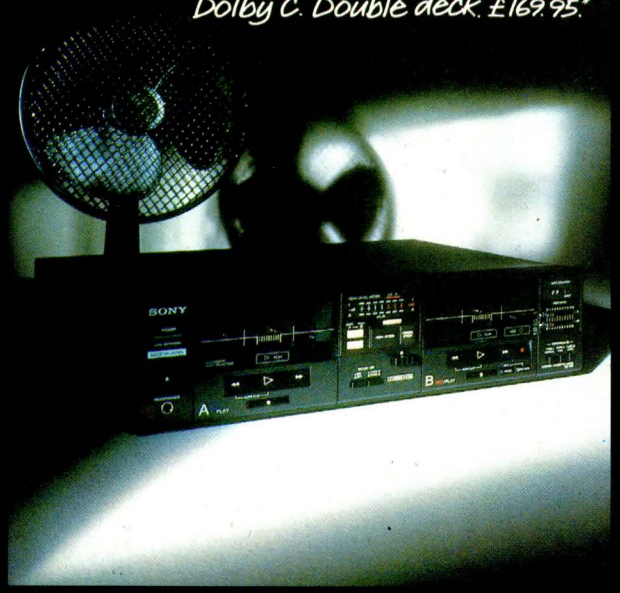
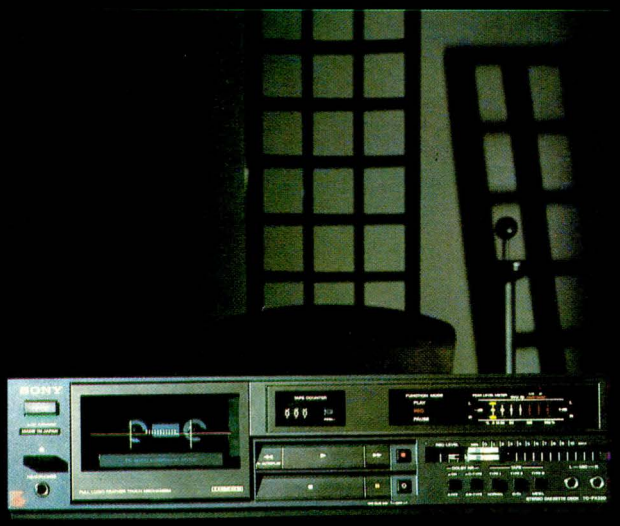
TCW5B Cassette Deck. Dolby B and Dolby C. Double deck. £169.95.*



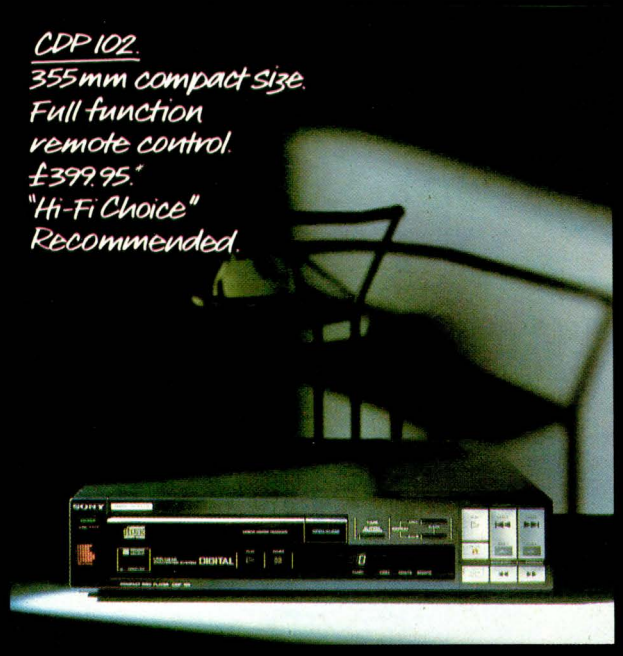
PSLX 320B Turntable. Belt drive fully automatic. Auto size selector. Cartridge supplied. £89.95.*



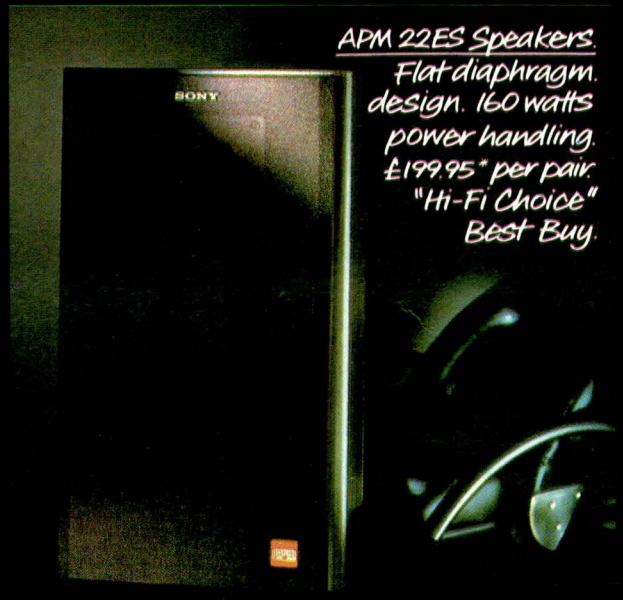
TCFX 320B Cassette Deck. Feather touch controls. Dolby B and Dolby C. £119.95.*

CDP 502ES. High performance digital filter. "Shuffle play." Linear motor. £699.95.* "Hi-Fi Choice" Recommended.

CDP 102. 355mm compact size. Full function remote control. £399.95.* "Hi-Fi Choice" Recommended.



APM 22ES Speakers. Flat diaphragm. design. 160 watts power handling. £199.95* per pair. "Hi-Fi Choice" Best Buy.



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

HI-FI CHOICE

The Collection is a Special Edition from the publishers of *Hi-Fi Choice*. Regular issues each offer the most comprehensive guide to current models in a particular hi-fi product category. They are published bi-monthly and are available from newsagents or by mail order — see page 129 for details and order form.

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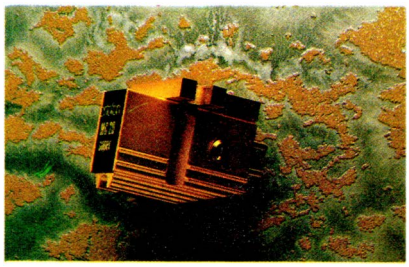

REVIEWS

Test reports cover nearly 140 models, too many to detail here, from approximately £200 upwards (main unit price). For full listing turn to the Index on page 191.

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. . . cover the stunning SME Series V, along with latest Alphasons, famous names such as Syrinx and Zeta, as well as the unique Well Tempered Arm from America. Reviews by **Martin Colloms**.

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. . . from the incredible Scintilla to the high-tech JBL 250Ti, speaker tests cover panels, ribbons and conventional designs. Reviews by **Martin Colloms**.

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The Collection

FEATURES

'State of the art' means the best we can do with today's technology. This *Hi-Fi Choice* Special Edition covers 'high end' equipment which aims at true excellence, and it also reviews the very best that is to be found at (fairly!) reasonable prices. Backed by ten years experience, the full resources of *Hi-Fi Choice* and the expertise of the leading technical reviewers, *The Collection* is the ultimate guide to quality hi-fi components and systems.

Audio Research
they have done for years

SP8 Preamplifier:
". . . . The SP8 now offers first class quality at a comparatively realistic price!"
Hi Fi Choice 1985

"Here we have an extraordinary product . . ."
Hi Fi News February 1983

"There are good preamps. There are very good preamps. And there is the Audio Research SP8."
Class 1b International Audio Review Hotline 12 August 1981 Peter Moncrieff

"I can't recommend the Audio Research SP8 high enough. I wonder how I could have tolerated less."
Practical Hi-Fi June 1982 David Wren

"If you ever considered spending over £2000 on a system you owe it to yourself to hear this preamp"
David Prakel Hi-Fi Answers February 1983

D70 Power Amplifier:
"Tonally it was first rate, and also provided highly transparent as well as revealing of low level detail."
Hi Fi Choice 1985

". . . the Audio Research D-70 is the finest piece of hi-fi equipment – regardless of type – that I've had the privilege to use."
Ken Kessler Hi-Fi News & Record Review February 1984

". . . the D-70 simply surpasses everything solid state and every transformer output tube amp we've heard."
Class 1A International Audio Review "Hotline" 28 December 1983. Peter Moncrieff

". . . the D-70 is the best power amplifier I've ever used."
David Prakel Hi-Fi Answers December 1983

D115 Power Amplifier:
IAR Hotline 32 Class 1a
J Peter Moncrieff

"Despite its cost I believe it to be a 'natural' – one of those rare devices offering a near perfect combination of power, performance, size and sound."
Hi Fi News May 1985

SP10 Preamplifier:
"The Audio Research SP10 is not state of the art. It is a giant leap beyond the state of the art."
IAR Hotline 22 Sept. 1982 © 1982 J. Peter Moncrieff

"I haven't heard as revealing or exciting a piece of electronics in a long time."
A.H. Cordesman Stereophile January 1985

"Pre-amplication was supplied by Johnson's own SP10 preamp which seems frightfully expensive until you've heard it, when all considerations other than its music-making become secondary."
David Prakel Hi-Fi Answers September 1983

". . . . the SP10 allowed me to hear through to the heart of a recording more clearly than any other preamp I have ever tried."
John Atkinson Hi-Fi News & Record Review May 1984

"It makes other pre-amplifiers irrelevant."
David Wren Hi-Fi Today August 1983

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W.A. BRADY & SON, Kingsway Studios, Kingsway North, Warrington. Tel: Padgate 828009

PREVIEW

A New Quad

Quad celebrate their 50th anniversary this year with the launch of a new power amplifier — the 70W per channel 306. The new model uses a highly refined and developed version of the 'Current Dumping' feed-forward error correction circuit used in the 405 power amp. 'Good engineering', say Quad, 'involves attention to all aspects of performance rather than concentration on the one or two areas currently in the focus of hi-fi fashion.'

Features include separate power supplies for each channel, derived from separate secondary windings on the common toroidal transformer and the absence of fuses or relays in the signal path. Full protection circuitry guards against damage through misuse. Price is £229.

Quad's New 306; Seen Here With 34 Pre-Amp And FM4 Tuner

Roksan Arrives

Now in production, the Roksan *Xerxes* turntable, which aroused so much interest at the Penta hi-fi show last year, includes many unusual design features. Roksan have avoided the use of a freely suspended sub-chassis — instead, the *Xerxes* uses a second inner or top plinth, supported on specially-designed spacers. The synchronous motor is mounted on a bearing which allows it to rotate against the pull of a retaining spring, and Roksan say that the spring rate and the compliance of the drive belt have been chosen to eliminate transient oscillations without affecting the correct relationship of the stylus to the groove. The platter is light in weight, machined from solid aluminium alloy. At £450, the deck will clearly come into competition with the Linn *Sondek*.

Roksan also have designs for a tonearm called *Cambyses* and a speaker called *Darius*, but these are as yet still in the development stage.

Dolby 'SR'

Analogue mastering systems can have a dynamic range comparable to that of digital with a new Dolby signal processing system, announced at the recent Audio Engineering Society in Montreux.

Dolby 'Spectral Recording' operates by continuously adapting its own spectral transmission characteristics to those of the signal being recorded on to tape. The circuit can be thought of as a computer, programmed with relevant information about the properties of analogue recording and of human hearing. A fundamental idea in the design is the principle of least signal treatment — processing is always held to the minimum required to obtain an ideal master recording.

Claimed advantages of the system are extremely large dynamic range with exceptional signal purity at all levels, with no hard clipping and no low-level artifacts; a practical, not theoretical performance that produces masters audibly equal or superior to 16 bit PCM, with modulation noise well below audibility; non critical alignment; 'Auto Compare' to give an instant check on recorder alignment; and the simplest possible editing and handling of tapes using existing recording equipment. Dolby SR will be available as retro-fit modules to fit most existing Dolby A noise reduction mainframes, with a single plug-in module per channel.

Dolby SR claims to up-grade existing recording installations to meet the challenge of digital specifications, at a fraction the cost of new digital recording and editing equipment, and hence 'economic rationality' will give it a powerful appeal for studios faced with the need to re-equip.

QA For CD Users

Manufacturing defects in Compact Discs may be responsible for significant differences in sound quality — even though the discs have passed the makers' quality control checks and are not rejected by a typical player.

Aside from crudely assessing metallisation quality holding the disc up to the light and looking for 'pinholes' in the reflective layer, the consumer has no means of determining the quality of new discs. But Cambridge Audio have now announced the CD1-QA 'Quality Assurance' unit, which quantifies the errors in actual use. It comprises three 4-digit event counters, plus an operating mode indicator. In normal configuration, these count the total number of decoded errors subsequently corrected; and the total number of complete dropouts of recorded information. In alternative configuration, it is possible to read out different levels of dropout, from slight surface scratches to areas where there is complete absence of recorded data, for example 'pinholes' in the metallic coating.

Threshold points in this configuration can be varied to suit different requirements, but for the prototype the three counters are set to operate at 70%, 40% and 10% of nominal signal level.

In addition to the counter displays, there is an LED to reveal the use of treble pre-emphasis on recordings. Developed during work on the *CD1* player (reviewed on page 148), the *CD1-QA* is intended to allow the user to assess new discs and reject those of poor manufactured standard, and to monitor the loss of potential and real performance as discs suffer surface contamination and damage. Price to be announced.

A 16 Bit Summer?

Although Philips have successfully launched 'mass-market' CD-based products including the *CD555* portable and the *CM100* midi system, the long-promised 16-bit players are still some months away. Though prototypes were in evidence at the

Philips CD650 Compact Disc Player

end of 1985, the *CD-450* and *CD-650* players will not now be launched until the second half of this year. Philips hope that the 16 bit four times oversampling system, theoretically superior to both 14 bit and non-oversampling 16 bit decoding, will give the players an advantage over Japanese competition at the 'audiophile' end of the Compact Disc player market.

At an expected price of around £399, the *CD-650* will become the flagship of Philips' CD player range. It will carry a Favourite Track Selection (FTS) feature, unique to Philips, in which the player memorises a selection of tracks which can then be automatically replayed whenever that particular disc is inserted. The player also has an additional high-order analogue

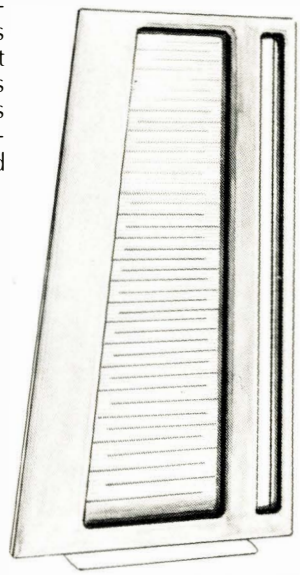
fine playing deserves fine tuning

At Acoustic Arts

every now and then a product appears which can truly be said to advance the 'state of the art'. In the case of loudspeakers one could include the Quad ELS, the Spendor BC1 and more recently the Celestion SL600, all of which set new standards in their time.

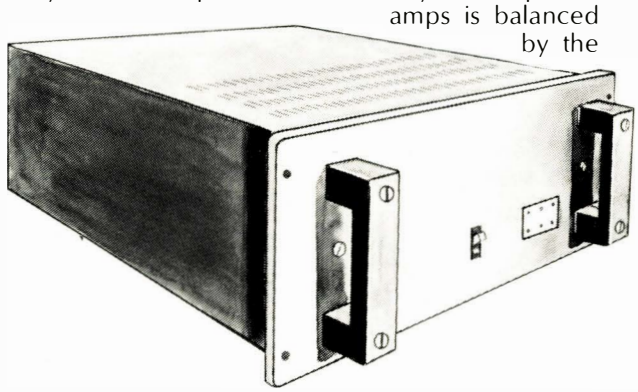
We now have a new standard bearer in the Apogee Scintilla — a truly remarkable new full range ribbon loudspeaker from the USA which is an astonishing technological achievement. A true marriage of art and science combining to produce the finest loudspeaker it has been our privilege to hear.

Apart from the musical delights the Scintilla has now become an important weapon in our armoury. It enables us to compare other products such as turntables, arms, cartridges and pre-amps and learn more about them in a few minutes then we had in hours or even days previously. An invaluable aid in improving our standards to you the customer.



The obvious partner for Apogee is Krell amplification and the superb new MK II power amps are available at Acoustic Arts along with the new PAM 5 pre-amp.

What a wonderful combination they make. The power and authority of the power amps is balanced by the



delicacy and smoothness of the PAM 5 which is a product every pre-amp buyer should investigate as soon as possible. The legendary Krell constructional standards and finish are very evident and one has only to operate the control knobs to know that it is no ordinary product.

Come and hear them here and discover why people travel from all over the country to shop at Acoustic Arts. You will receive a standard of service you thought had long since ceased to exist.

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I am always satisfied with the best".
Oscar Wilde

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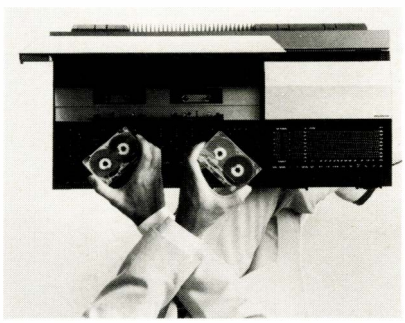
Write or phone for perceptive advice and details of nearest dealer.

PREVIEW

filter, integrated remote control, variable headphone output and digital output. The *CD-450* is a midi-size player with remote control, and is expected to retail at around £279.

B&O Double

'Double' or 'dubbing' cassette decks are usually associated with cheaper audio systems — but B&O's latest casseiver includes this feature in a high-quality package. The B&O *4000* comprises FM/AM radio, amplifier and two cassette decks, to allow dubbing, voice-overs and recordings compiled from several sources. Other features include auto-reverse, continuous play and HX Pro head-room extension for better recordings. Dolby B noise reduction is provided, but not Dolby C. The tuner section has four pre-sets for FM stations and the amplifier output is 20W per channel. The tape decks are independent of the receiver so that tapes can be copied without interrupting radio or disc listening. Retail price is approximately £545.



B&O Beocentre 4000

Discman

Now available in the UK is Sony's *Discman* personal CD player, a 'second generation' portable replacing the pioneering *D50*. With the new *Discman*, Sony can once again claim the world's smallest portable CD, as the new model is fractionally smaller than Technics' recently-launched *SL-XP7* player. Unlike the original *D50*, the *Discman* offers comprehensive play and search features, and is also claimed to concede nothing in sound quality compared with 'full size' players. Price is around £260 (battery pack extra). The *Discman* will be reviewed in *Hi-Fi Choice : Compact Disc Players*, on sale in June.

Mass Modules

B&W Loudspeakers have launched a multi-purpose high-quality loudspeaker system known as MASS — their Modular Automobile Sound System consists of a range of eight associated modules which can be used in various combinations and are intended for use in homes and boats as well as cars. The MASS system was developed following the experience gained with the *LM1* speaker, and is designed to offer fitting flexibility and high efficiency, and makes use of Kevlar speaker cones. MASS is intended to address the five major problems of in-car installations — the acoustical environment, the position of the listener with respect to the source, fitting limitations, temperature and humidity fluctuations, and finally noise and vibration. The eight modules range from a twin bass/mid driver unit to HF units with and without crossovers, separate crossovers and sub-woofers.

Sound And Vision

Electronics giant NEC have announced a multi-function audio-video amplifier, designed to unite TV and hi-fi equipment for 'theatre' sound in the living room.

When used with a five-speaker set-up including front and rear pairs and a sub-woofer, the *AV-300E* can produce full Dolby surround sound from suitable soundtracks. Other options are 'Hall surround', giving normal stereo from the front speakers and reverberation effect from the rear, with adjustable reverb time, and 'Matrix surround', simulating stadium acoustics. Package price is £599 for the *AV-300E* with all five speakers, or £479 for the amplifier and super-woofer only.

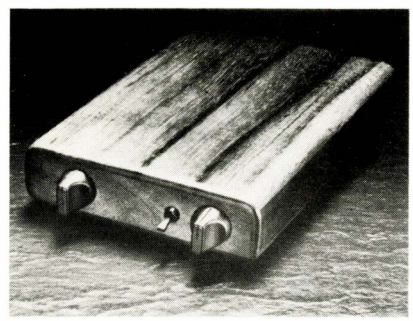
Cheaper Rent

Radio Rentals have cut the price of CD rental from £15.95 to £9.95 a month to new customers, with a further discount for existing customers. Demonstration players are now installed in 400 Radio Rentals outlets. The TV and video rental chain is now offering a range of 'top 30' discs in its major showrooms, with a catalogue of 250 titles available mail order.

More Presence

More exotic new lines are now being distributed by Presence Audio, previously best known for marketing Audiostatic loudspeakers and Decca cartridges. Among the newcomers to this country are the Swiss-made *Ensemble* loudspeaker, an expensive high-quality miniature three-way design including a rear-facing bass unit. At £1000 per pair, they measure 35 × 23 × 23cm and come in rosewood or walnut, with black and white finishes available at extra charge.

Presence are also now importing a French power amp, the 80W per channel *Plenitude*, to match the UK designed, French built *Nuance* pre-amp; the Swiss *PhonoAmp* pre-amp, built in a solid wood case; and the *Interface* record mat and clamp from Holland. More familar ranges now handled by Presence are cartridges from Kiseki (including the *Purpleheart Sapphire* reviewed on page 76) and Glanz, whose current top model is the *GMC-20E* moving-coil at £129. Presence have also released a limited number of the rare Decca *London* loudspeakers, including the Kelly ribbon tweeter, at a close-out price of £195. Phone them (see page 76) for nearest dealer.



Swiss PhonoAmp Pre-Amp

KEF Research Head

Loudspeaker manufacturers KEF, have appointed Dr Richard Small to the newly created post of Head of Research.

Starting out as a practising engineer with Bell & Howell, Dr Small then spent time in Norway and Japan, and since 1964 has lived in Australia, where he is currently a Senior Lecturer at the University of Sydney. During 1985 he spent a six month sabbatical with KEF at Maidstone.

His most important academic contribution was his 1972 PhD thesis on 'Direct Radiator Electrodynamic Loudspeaker Systems', which required four reprintings.

This seminal work, for which he received a Silver Medal from the AES, analysed and codified in great detail the parameters of loudspeaker low frequency behaviour that had first been suggested by fellow Austrialian Neville Thiele of the Austrlian Broadcasting Corporation.

Rotel Ups And Downs

Two price reductions and one increase have been announced by Rotel. Their already cost-conscious *RP-850* turntable and *RD-830* cassette deck now have suggested retail prices of £179.90 and £89.90 respectively.

Despite these reductions on product sourced in the Far East, Rotel have had to announce a price increase on their UK manufactured speaker, the *RL850*, which will now sell at £109.90.

Meanwhile, Rotel's hugely successful budget amplifier, the *RA-820*, has undergone minor surgery and now features a 'tone defeat' in place of the mono switch.

THE AUDIO ELITE

Steve Harris talks to high end specialists about their products, their philosophy and the future

Expensive hi-fi used to be marketed by investing it with the glamour of the recording studio — loudspeakers were always 'monitors', record decks became 'transcription units' and almost anything could be described as 'broadcast standard'. But now, along with a whole new generation of exciting product, we have imported from the US a terminology which accepts that in reality, even (or especially!) the very finest domestic equipment is quite different to that used by professionals. Today, we call the users 'audiophiles' and the equipment, simply, 'high end'.

Of course, high end still means different things to different people. It may refer to some of the most expensive UK products, but much of the time, it applies to imported products.

Not all imported high end equipment comes across the Atlantic though. A handful of European products have gained a foothold, and the Japanese still dominate the business of manufacturing pick-up cartridges. While the Japanese mass-market hi-fi, manufacturers sell product to UK dealers via their own wholly-owned subsidiaries, this course is hardly practicable for the small-scale Japanese companies, who must rely on independent agents to represent their products.

Some distributors are in fact associated with manufacturing too. Max Townshend started this UK hi-fi business with the successful launch of Elite Parabolic cartridges, which were sourced to Japan to the specification of Elite Electronics back in Australia — but eventually he gave up distribution to concenctrate on manufacturing his innovative and startingly effective turntable design, the Elite Townshend Rock. Peter Quartrop's Brighton-based company Audio By Design imports the American Snell loudspeakers and the Audionote cartridge, but is also associated with the manufacture of Audio Innovations valve amplifiers. DW Labs build Gale loudspeakers and import Carver amplifiers from the US and Perreaux from New Zealand. The Grace arm and Supex cartridge were 'discovered' by Linn, who used them to complete their own turntable system — when Linn started selling cartridges under their own name (still built for them by Supex!) the agencies passed to Russ Andrews.

Some retailers have also got involved in small-scale distribution, usually without much success — it is hard to sell a product to other dealers while also selling it through your own retail shop or shops. The exception here is Wilmex, a sister company of the Unilet retail group, who have successfully imported brands such as Fidelity Research, Monster, Stanton and Stax.

RICARDO FRANASSOVICI

So the high end remains largely the preserve of the dedicated importer or distributor. Undisputed leader in this specialist field and doyen of the UK high end scene is Ricardo Franassovici, the ebullient founder of Absolute Sounds.

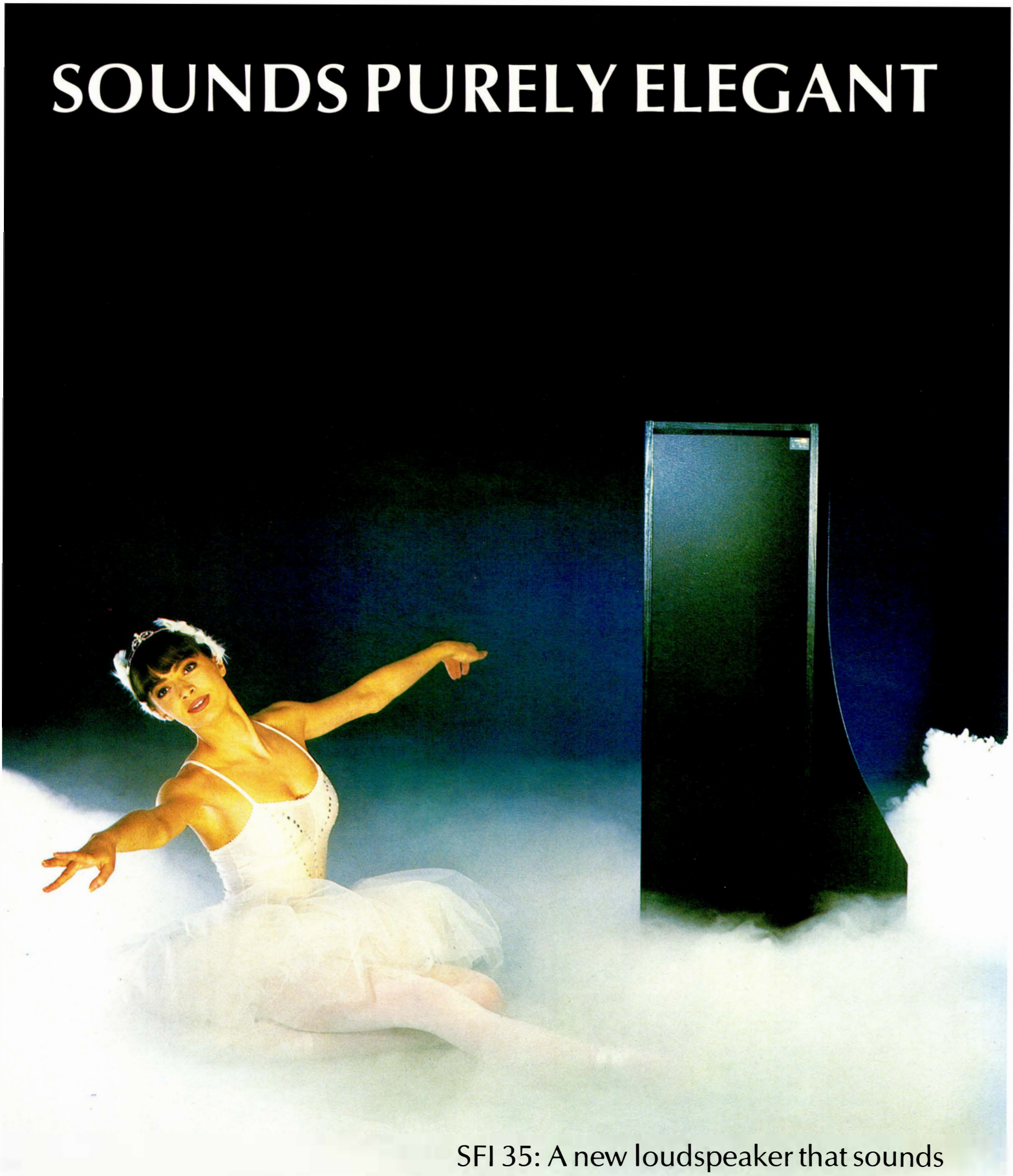
A true cosmopolitan, Ricardo comes of Romanian and French parentage, and was mainly brought up in Portugal. He admits to 40 years but doesn't look it. Always full of enthusiasm and good humour, his command of English is really a sort of benevolent, idiosyncratic dictatorship. He was working in the music business when he arrived in Britain about twelve years ago.

'Well, I started with a lot of spirit, and I think I've still got a lot of spirit, because one thing that I've always enjoyed is music and my entire professional life — apart from a year and a half — has been based around music. I was supposed to come here and work for a major record company. I was appointed director of the International Department, but I found out that the person above me was of a very old school, he was of the pinstripe — in his mid-60s. Instantly, I felt it wouldn't work!'

Ricardo took advantage of a get-out clause in his contract but stayed in the UK.

'To cut a long story short, I worked for a broker, and that was the only time in my life that I didn't work close to music. But it was not for long, because as I was still dabbling with hi-fi equipment, which I'd always been. On a very small scale, I was already bringing through some high end products. One was a ribbon cartridge — it was a moving-coil in the form of a ribbon, so you had only one turn in the coil. It was called the Jeweltone. Then we brought

SOUNDS PURELY ELEGANT



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in some valve pre-amplifiers from a company in California called Precision Fidelity, we brought a lot of secondhand "cult" products like McIntosh and Marantz old valve equipment. Basically I was doing it for friends.'

Ricardo started the business in a more serious way by founding Absolute Sounds in 1979, with the very much-loved but very expensive Koetsu cartridge.

'There was a certain fear in the dealers that they really were not supposed to look at any new venture at that end of the market. The price points were a bit obscure for certain dealers, and at least some of them were completely shocked about it. But a few dealers started looking at the Koetsu as a serious proposition. At that time, *Ittok* didn't exist so you had all the Fidelity Research arms, or you had the Grace, which funnily enough matched the Koetsu sound very well. The Koetsu sort of turbo-charged and polished a Linn *Sondek*, gave it that extra bit of sparkle and energy.'

Even in 1980, the wooden-bodied Koetsu cost £500, an unheard of sum for a cartridge in those days, but was still able to score a recommendation in *Hi-Fi Choice*! Ricardo can with some justice claim that he educated people to spend more on a hi-fi system.

'It was not acceptable to think over £2000. It was socially accepted that you could spend it on a kitchen, on a car, but hi-fi? — no. But there are a lot of people that can afford to buy the best, and that's what I really went out to do, to form a company that would, under one roof, select, really with criteria that had never been used before, the very best that was available.'

Of course, putting a good system together is not just a matter of collecting together the most expensive equipment you can find.

'Let's assume that you've got a very good pre-amplifier, a very good power amplifier, a very good turntable, a very good . . . whatever, in all fairness, you think you should add all those components together and you should get the greatest system available. Well, it's not true. It's absolutely wrong — I can take £20,000 worth of components, and make a system sound worse than a £500 system — it's very easy, it's just a question of interfacing. Obviously this is one thing that Linn and Naim were doing extremely well, they were proposing a complete package that had been calibrated by professional people. Well, I was doing the same except that I was not directed by designers, or by the company, I was doing it the nasty way, which was selecting the good from the bad, but with finished products that existed already in the market.

'I think that a good hi-fi system should be one that one can enjoy over all sorts of conditions — in a bad mood, in a good mood, with friends, with no friends — so you can turn it on and it's giving you that same degree of energetic enjoyment.

'I tend to get a bit away from the sort of concept where you sit between your speakers and you wonder whether something is transparent or something images perfectly, or if the violin is in the proper

LECSON — THE STYLE OF THE SEVENTIES

position. Because obviously, that is a very satisfactory and maybe a very aesthetic way of looking at the sound stage, and my systems by the way, do all these things, I believe, the best — but I go a degree above that and I just say, well OK, the musicians are all there on the stage, but what I want is a good, rich musical tone to burst into the laps of my listeners or my friends. I want my systems to burst with musical energy, and that's what I challenge my systems to do. To bring the music into the room.'

JACOB ZELINGER

A Canadian by birth, Jacob Zelinger has lived in the UK for 15 years, since his university days. He started the Automation Sciences Company in 1983, and now distributes an extremely impressive range of high end American and European products.

'Actually, my initiation started very high up — my first system, in the early 1970s, consisted of a Linn *Sondek* with an old Decca *FFSS* tonearm, a variety of cartridges at the time, moving-coils and magnets — and I was feeding that into Lecson pre- and power amplifiers, which in terms of their sound quality were very fine for the day, and Spendor *BC3*s, which in their day were a wonderful speaker.

'The British equipment of the early 1970s had an inherently musical characteristic which had in my opinion been lost towards the latter part of the decade. Designers seemed to be aiming for sounds which I felt to be unreal, what I call hi-fi sound, which has elements of brashness and harshness; images are artificially projected forward, it's flat and non-dimensional, tone quality tends to lack refinement and timbral discrimination. Of course, I'm not saying that all companies followed this avenue.

'One factor is that most people do not know what the sound of real music is actually like, and the kinds of sounds they were producing were not in my opinion related to the sound of music. And that is because they got too involved with listening to the equipment, and judged equipment on its own terms rather than against an absolute standard — which is, of course, live music.

'Two, and I think this is a more profound reason, the kinds of sounds that people in the 1970s were beginning to think of as musical are not necessarily the ones that I value. If you take a pianist, the kind of sound you hear in a concert hall today is very percussive, great clarity, a lot of control and rather limited tonal colours, but everything is quite clearly defined. Compare that sound to the piano playing of certain pianists in the 1930s, '40s or '50s — I could maybe name Artur Schnabel, for example — you'll find that the kind of sound they produce is not the same. They play more or less the same instrument, and it's not a matter of interpretation, simply. It's a matter of growing up with a tradition of sound which embodies values which one could say are elements of humanity, warmth, depth of feeling.

'When you look back to the Decca late '50s or early '60s recordings, and compare them to what many of the companies are producing today, the sound now is hard, sharply etched, artificial, with very little roundness and I would say very little musical sense or musical realism.'

How close can you say hi-fi can now get to real music?

'On solo instruments, or solo voices, I think you can recreate a remarkable illusion of reality. But on larger scale works it's virtually impossible unless you have the space, and even then I don't think you would manage it, it would be very complex. But the better the system, the less you have to fill in, the less mental or imaginary effort is needed to fill the gaps, and this means of course that you can worry less about that

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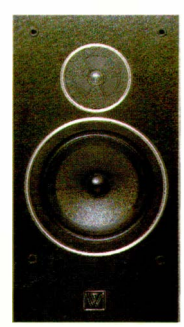

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and it's more enjoyable to listen to. Then people say "That sounds effortless", and the difference between equipment which is *really* high end, and something which is very very good but not completely right up there in the top league is often this quality of effortlessness.

'My first entry was with Burmester and van den Hul, and I believe that their products do represent the best Europe has to offer in particular areas.'

In taking on Conrad Johnson, you must have though that valves had something that solid equipment couldn't give?

'Let's face, valves do do something very special, but the gap between valves and solid state is closing very fast.'

Are you thinking in terms of transparency and dimensionality, those kind of things?

'Yes, the main thing is that one is looking not for cardboard cut-outs but three-dimensional images, with varying degrees of depth — but generally, there are many fine developments in solid state amplifiers. I would think that within a decade, there will not really be any more valve amplifiers being produced, because there will not be any need to.'

What you really have to do must be to assemble systems which work well, and that must be difficult?

'Sure, it's taken us three years to complete an audio chain, and the main reason is that we've been striving to find a loudspeaker which would do justice to the rest of the chain, and we feel we've found that in the Infinity Reference Standard Series.'

Brian Smith

A relative newcomer is Brian Smith, who founded Presence Audio just two years ago and currently distributes more than a dozen product lines from Europe, Japan and the UK. He'd spent 25 years in the motor industry, latterly in Public Relations, but in 1983, after a heart attack, he wanted to find a way of working from home. A series of coincidences led him into the hi-fi business.

'I owned a set of Beard amplifiers, and I asked Bill Beard what speakers he recommended. He said, "well, I think electrostatics are the best speakers you can get, and the best electrostatics I've heard are Audiostatic, made in Holland" — so I said OK, where are they? The importer had been Tresham, and they had just been taken over by Tannoy, who weren't going to bring in speakers to compete with their own. Eventually I tracked a pair down at Jack Lawson's, the Music Room in Glasgow. I went up to hear them and thought they

BRIAN SMITH WITH MONOLITH!

were superb, an absolutely superb loudspeaker. Jack said that it was a great pity that no-one was importing them, because there was a market for that sort of speaker at that sort of price.

'And that set my wheels in motion. I tracked down the manufacturer, and I ended up buying a pair of *Monoliths* and a pair of *Hybies* and bringing them over here to start off.

'I took on Jecklin *Float* headphones in November 84. They became the second of what I call my "resurrection jobs", because I'd had to resurrect Audiostatic from a failure, and now here was Jecklin, having had an unfortunate series of distributors — the dealers were saying are they going to be available or aren't they, and what's the price going to be, and all the problems . . . but by using my PR experience and making models available for review, I began getting editorial coverage, and that produced the enquiries at the dealers and it began to pick up again. Since then, Jacklin has been excellent. The dealers say that if two people come in together, the other person laughs when he sees somebody wearing them, but they only listen for ten seconds and then they're sold on the sound quality. After all, nobody sits in front of a mirror looking at themselves when they're listening to headphones at home!'

Last year Brian became UK distributor for Decca cartridges, which had never gone out of production but had become virtually unobtainable in the UK.

'In about March 1985, I was visiting Kevin Walker at Harrow Audio. He said, "Oh, you might like to try this" and handed me what I subsequently found out to be a Decca *Super Gold*, an early version. It had just been introduced and was being sold then for export, they were doing nothing with it in the UK.

'A distributor should handle everything for the manufacturer. If you could think of Decca, instead of being here in England, as being made in France, then everybody would understand. I buy the products from them and I deal with everything for the UK market. That's the situation that I'm in with them now, although they happen to be in Britain. They don't have any sales and marketing people, no PR, advertising, nothing. They've only got manufacturing people and an accountant. So they need a distributor.

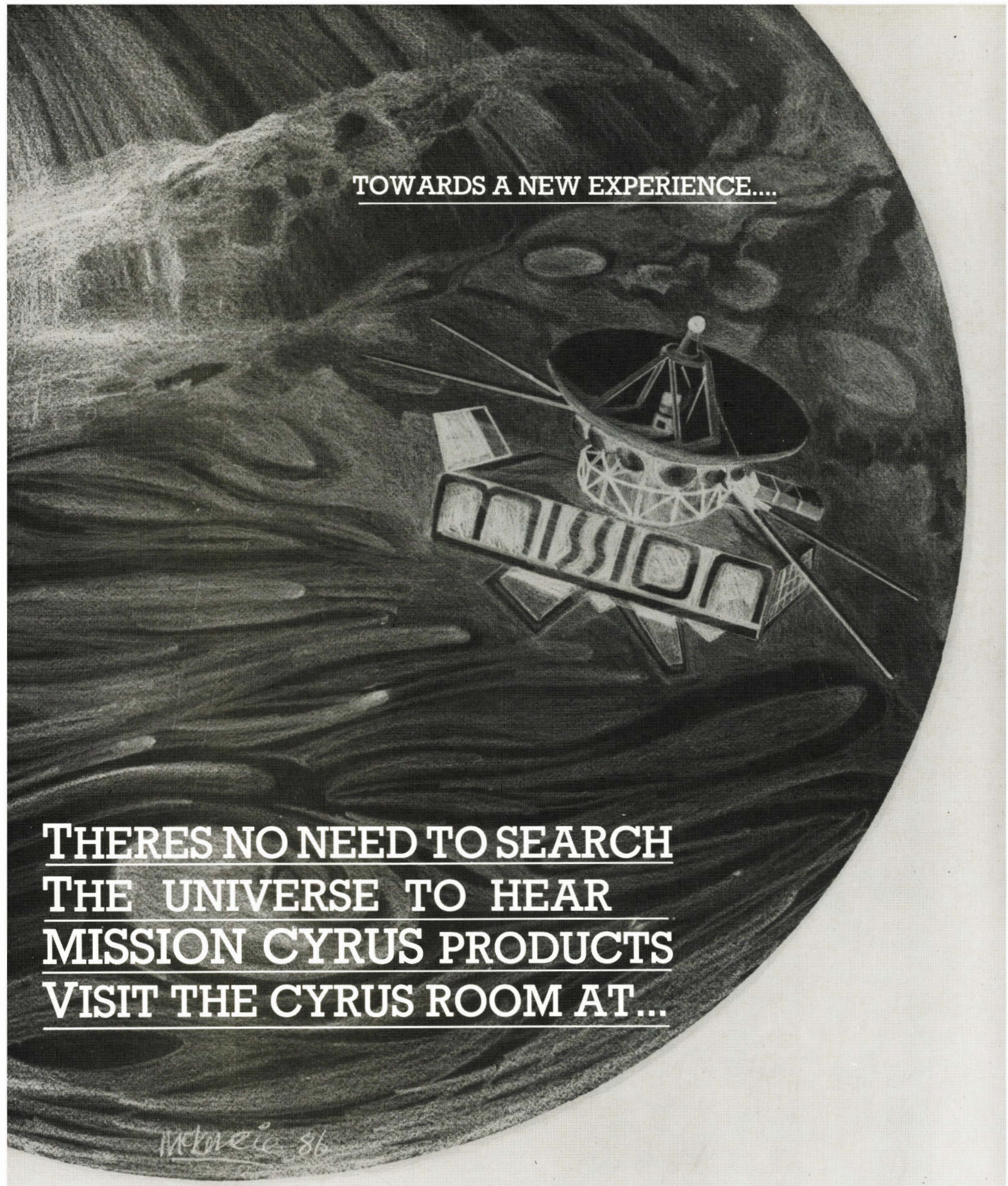
'I'm a newcomer to the business, but it seems to me that there have been two significant things that have happened over the last ten years, that have led Britain into the high end. One was Linn/Naim, taking people up on the first step, which was then considered the high end, if not any longer; then Ricardo, taking them on the next step up. and without those two things, I don't think I'd be here at all, there just wouldn't be the market. The British public had to be educated that there was a better sound than the Thorens and Quad and whatever was the best system then. People like me, who've come along later, have to thank Linn/Naim and Ricardo for setting the pace and opening up the market.'

Future Growth

Distributing high end equipment can be a profitable business, given careful choice of lines and a following wind — though the distributors' margins are not as great as you might think. Ricardo, who now has an extremely strong product line-up, thinks that in spite of a weak pound and the generally disastrous state of the UK economy, there is still room at the top:

'I believe the market will steadily grow for two reasons. One, the systems will sound so good that people will want to own them — and it's always been my philosophy that if the system is really good, you should be able to pull a guy in from the street and say hey, listen to this, and the guy falls instantly in love with hi-fi. And that is to me a good criterion. Secondly, the need for quality — now there is a tendency to own not so many things, but to own something that will last.'

Despite the success of Absolute Sounds, he is not complacent, but like all the high end distributors continues the search for better and better products to improve his systems. As he says — and this a typical Ricardo-ism — 'We must not sit on our laurels'.



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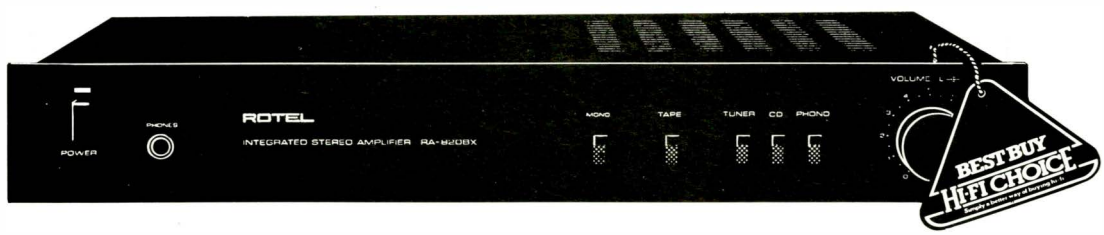

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EXPERTS' CHOICE

Professional hi-fi reviewers might seem to have an enviable time of it. After all, aren't they surrounded by mountains of free equipment, and able to indulge themselves with the most wildly expensive products they can find? Can't they just pick up the phone and get hold of any wonderful piece of technology that takes their fancy?

Well, not really. Manufacturers do not shower reviewers with gifts of free equipment — in the case of true high end items, the manufacturers or importers will think very carefully before loaning equipment in the first place. Once the review is over, they will want thier product back, because no manufacturer can afford to give away expensive items of stock. Although a slightly-used review sample cannot be sold to the public as new, it can still serve as a demonstrator at exhibitions or dealers, or do the rounds of other reviewers. So the equipment that reviewers want to keep, they almost invariably have to buy.

By parting with hard-earned cash, reviewers are putting their money where their mouth is. Their own purchasing decisions must be seen as more telling than even their strongest recommendations in print — which is why we felt it would be interesting to ask our major reviewers to talk about their own equipment.

There is a proviso here, which is that whereas the hi-fi enthusiast or music lover chooses his system purely for enjoyment, the reviewer must use his equipment as a reference for evaluating other products, and this may involve factors other than his own personal taste in sound — but, of course, it only increases his obligation to maintain the best system he possibly can.

It is sometimes surprising but always reassuring to find a strong measure of agreement between reviewers on the most significant products, and this certainly is the case with *Choice* authors — even though, for reasons they will explain, the systems they run are very different.

Hi-fi reviewers spend their time assessing equipment for others — but what do they use themselves?

THE LINN/NAIM TRADITION

Currently *Choice's* cartridge reviewer, **Paul Messenger** now writes extensively on professional studio and broadcasting matters too. In the 1970s, he was one of the first reviewers to adopt a Linn/Naim system and despite extensive experience with other products, he has stuck to it ever since. Even the Linn system's fiercest detractors could hardly deny its significance in the development of the UK specialist market, so Paul's system seemed a good one to start with.

'It's an ongoing development programme' he said with a smile. 'The record deck is a *Sondek, Ittok* and *Karma*, which feed an unspecified Naim pre-amp . . . basically a *12* but with *Series 5* mods that were put on recently'. Among an imposing stack of black Naim boxes are the latest *NAXO* electronic crossover and three old Naim *250*s, which feed Linn *Isobariks*. Paul turned on the radio to demonstrate the Naim *NAT 01* tuner . . . a BBC voice: 'You heard him shuffle his papers?

'The only other speakers that have really stopped me in my tracks and made me wonder were the *Scintillas* — they are still a *bit* expensive to say the least, and I haven't got the sort of room for them anyway.

'As I see it, you've got two main strands of hi-fi philosophy, one of which is to try and recreate the experience of going to a concert, in terms of capturing the entire acoustic, and reproducing that in the home. You can either orient your hi-fi system to doing that, or you can orient it to give you the most out of musical source in terms of musical communication, that is the "information" approach — and this system certainly follows the latter philosophy. Most of the music I listen to is multi-track, with little coherent recorded acoustic, and therefore the live experience doesn't really exist for most of the music that I play. I think if one is into classical music exclusively, there is a case for going the other way, although I do find classical music works better for me on this sort of system, because I don't find it as communicative, inherently, as say rock music. And this sort of system works very nicely on rock in general, where the balances are always hyped-up and strangulated in the recording process.

'The system tends to teeter on the edge of being harsh, but it's still the most communicative thing that I've heard short of having the six Naim mono *'135*s. It's very solid, it has remarkable bass, it has slightly weird stereo. It has an uncanny ability to focus solid images, although it doesn't lay out the classic stereo sound stage in the accepted way. It's exceedingly "fast" and it goes for the integrity of the individual instruments, in preference to the integrity of the ensemble, I would say, so that a single instrument retains very good bandwidth integrity, bass to treble, that is it sounds very solid and very fast and very together, rather than the entire sound stage attempting to do that.

'As a subjective reviewer I can justify the tri-amp system on the grounds that I don't make many mistakes with it. Generally, it's a very reliable indicator. It has its own distortions, but you learn to live with them. I wouldn't claim it's got the least coloured

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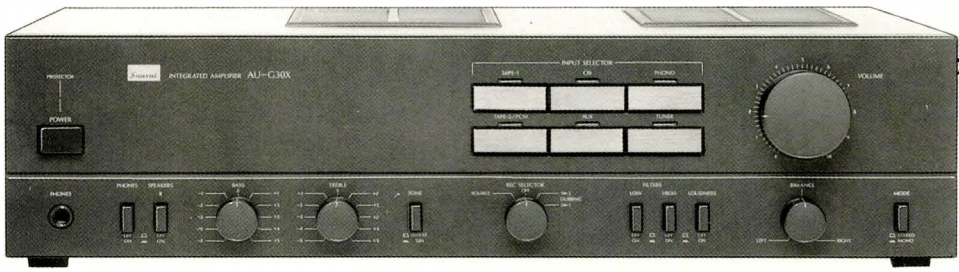

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midband and presence region or the finest stereo on the market! No, it's a very reliable and revealing system. It's too revealing in many respects for the average domestic user, I think. I don't recommend people to purchase it as a rule because it's a little bit too sensitive to the state of tune of the whole system. Today it's not sounding its best, and it may be the stands settling or it may be a question of pulling the cables out and plugging them back in again. It needs a little too much tweaking to keep it *au point*.'

Though for many years the Linn/Naim *PMS* tri-amp has been about the most expensive possible UK systems, current US imports make its asking price of around £5,000 seem quite run-of-the-mill. It could be said that the real high end begins with products above this system price level, which by and large reject the 'communication' dogma expressed by Paul. Instead, they embrace the classic ideal (stated by Quad) of 'the closest approach to the original sound', and aim for new, previously undreamt of levels of 'concert hall' realism.

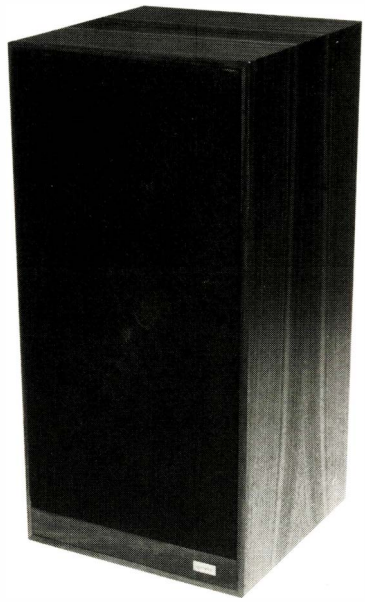
The Real 'High End'

A leading hi-fi designer and consultant, **Martin Colloms** is currently responsible for reviewing amplifiers, loudspeakers, CD players and turntable systems in *Hi-Fi Choice*. Martin is a committed and enthusiastic user of a true 'high end' reference system.

'Components in the reference system are chosen for personal enjoyment, but also to provide a continuing standard against which to judge other equipment. I try to choose the components to be as near to the state of the art as I can afford, and maintain a level of compatibility between those components, such that it allows me to substitute improved components at a later date and still hold its essential balance. So there is an underlying element of reference, of continuity.

'Running a high-end system is very helpful in that it is a continuing reminder of the sound quality of the test programme that you use — it tells you very much what's on those records and what is then missing or altered by less expensive equipment. The components in the system are very much references in their own right.

'The Magneplanar *MGIII* is a large bi-directional open panel speaker of very low coloration, and its key feature is a complete lack of box in its construction, which is immediately audible in its sound, and that is very useful for assessing, if you like, the boxiness and ordinary imperfections of conventional loudspeakers.



'Two other speakers that I use with the high-end system are the Spendor *SP1* and the Celestion *SL600*. The *SL600* is particularly valuable for analysing subtle detail in stereo image. It produces stereo images of remarkable focus and coherent sound, and it's proved very useful for listening tests. I use custom stands for both these, with spiked feet. It's worth spending a fair sum of money on stands for speakers of that quality.

'My current preferred pre-amplifier, which as all of these choices are is partly dictated by cost, is the Conrad Johnson *Premier Three*, and I find it to have the clarity and stereo properties and

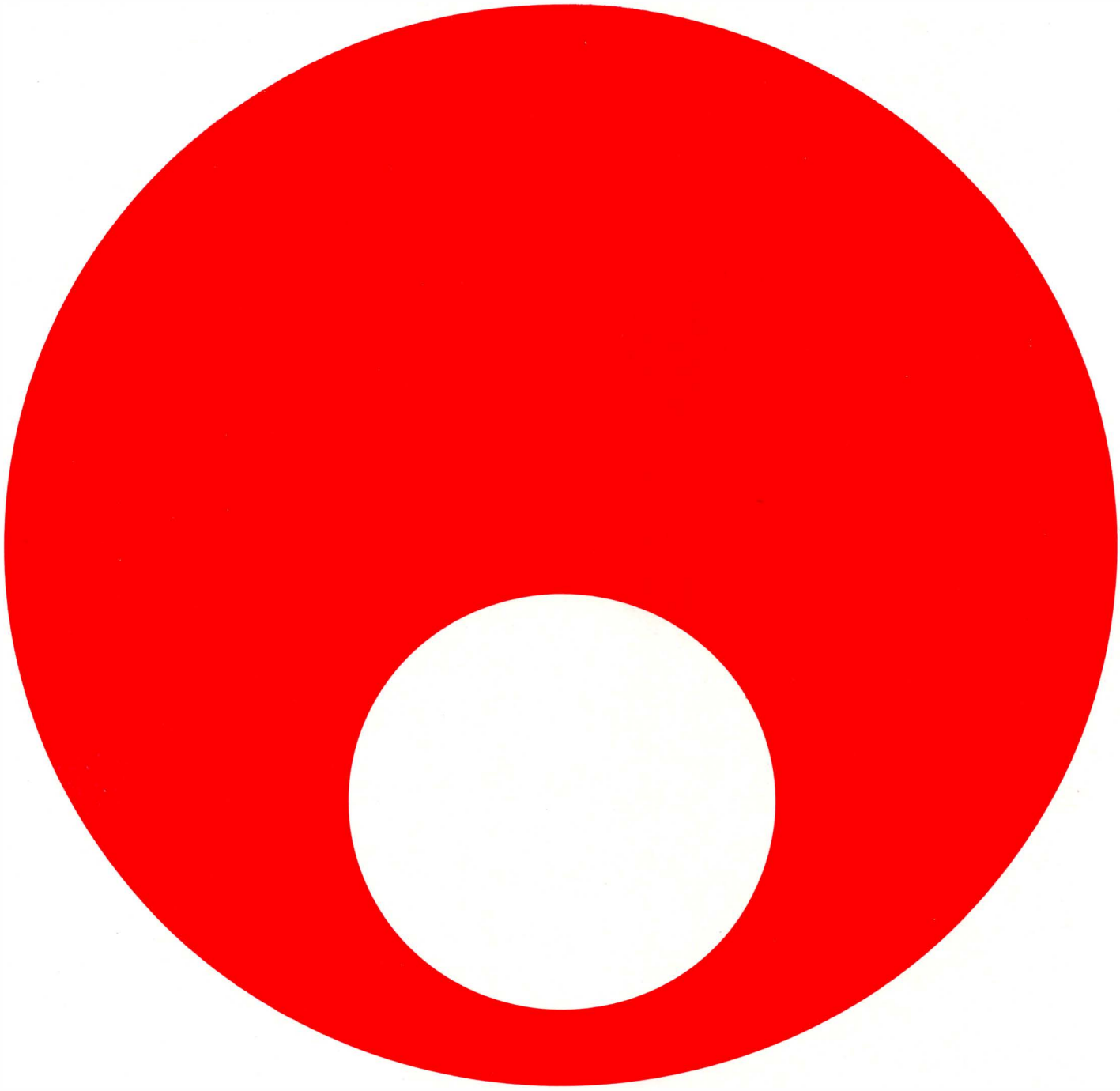
transparency of pre-amplifiers at rather higher prices, and it's one of the best in its price range that it's possible to buy. I feel that it has a distinct advantage in transparency and depth compared with solid-state pre-amplifiers in its price range. It seems to be neutral and consistent; it's quiet, and I just like the way it works. I find the single box a convenience.

'The power amplifier, which has given very good service for some time now is the Audio Research *D115 Mk II*, which has really extraordinary bass performance. For a valve amplifier, that's perhaps a surprise, but it has very firm, tight, extended bass, and it gives excellent stereo. It's a neutral amplifier, it's a good workhorse, and it's been very valuable in making comparisons with other product. It's sufficiently powerful for any conceivable use.

'On the CD side, the Sony *CD-P552/DA-S702* has stood the test of time; it continues to rate as a high quality reference player, and it was the first of the two-unit players with care taken over sound quality as a major directive of design. The *'702* was one of the first to show that CD could have stereo depth. It's also very well equipped in terms of facilities and remote control, which is very useful for test purposes, cycling back, repeating tracks and so on — it's a very consistent sound source. The tuner, which I use less than the other sound sources, is a Sansui *TU-D99X*, which as tuners go has very solid stereo performance, very low distortion and good selectivity.

'On the analogue side, it's a traditional choice of Linn *LP12* turntable in the latest form with the new subchassis, and this continues to set a very high standard in its price category. If you want a better sound than this you have to spend a great deal more for a turntable. Its special virtue is that it has an arm mounting system which is compatible with a number of high performance rigid-tube arms, including the *Ittok* and arms like the Zeta, and especially the new SME *V*, which I now use on the Linn with very good results. In the SME *V*, the van den Hul *MC10*. cartridge is my current favourite, and this has a very good combination of tansparency and stereo depth with good dynamics, and a neutral tonal balance — again, a useful reference cartridge, it doesn't appear to add any of its own character to records that it plays.

'When I moved my system to the speaker end of the room in order to minimise cable lengths, having discovered that the shorter the cables the better the system sound, I found that my hi-fi cabinet suffered from shock and vibration to the extent that the Linn was almost unusable — so I was forced



A75 Power amp C75 Preamp

"A power amp that rates as excellent and a preamp that is merely very good at worst"
ALVIN GOLD, Hi-Fi Answers, Feb 86

"In particular, the preamp was an outstanding performer, delivering an exceptional sound quality for its price, and it couples this with versatile tape facilities.

The power amplifier was notably powerful in its price context, as well as proving highly load tolerant. The lab performance was fine and the sound quality was commensurately good". HiFi News & Record Revue, March 1986

cambridge

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to take a wall shelf seriously. In fact I use a fairly inexpensive one, made by Target. It's attached directly to the wall with just the Linn on it. I found it gave unexpected benefits, and the sound is more stable and is cleaner than anywhere else I've used the Linn. So I'm now a strong fan of wall shelves for turntables.'

The CD Approach

A valued contributor to *Hi-Fi Choice* is **David Prakel**, who reviews the Celestion *SL6S* loudspeakers in this edition. A classical music enthusiast and record reviewer, David's record buying propensities are such that he used to describe himself as 'a vinyl junkie', but his strongest addiction now is to CD.

'For pleasure listening, I do spend more time listening to CD now, because in a way I've got the things I want on LP — I've got the core of the things that are never going to appear on CD, but the new releases, the things that you really get excited about (sometimes!) are on CD.

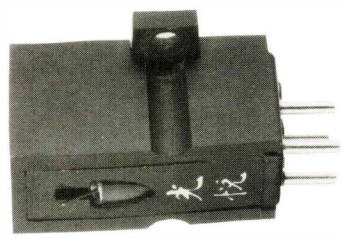
'I think the Meridian *Pro* CD player I'm using at the moment (on loan) is getting the last ounce of performance out of what is actually an interior decoding system. The thing I don't like about the Meridian is its bottom end performance, and the lack of convenience. It sounds crazy but, when I'm doing CD reviews for *Hi-Fi News* they demand to know the timing of the disc, and there's no way that you can find that from the Meridian! Manufacturers have improved the access and given you indexing features, which are actually useful — never thought they would be, but they are. It's more than just convenience, I'd say.

'The turntable is a Linn, with Fidelity Research *FR-64FX* arm, and Koetsu *Black*. The FR arm fulfils both a work and a pleasure requirement. It's good enough to give me satisfaction for listening outside work, and it is also relatively unfussy with the kind of cartridges I end up reviewing, though it's not suitable for high-compliance magnetics. It's relatively neutral, it's got a soft bottom end, it's generally a soft-sounding arm, a bit limited in its dynamic range. The other thing is that I use the very heavy counterweight with the Koetsu — that 250g brass weight that looks like a baked bean can. It changes the effective mass of the arm ideally for the Koetsu. Mine isn't the latest Keotsu *Black K* but I've just got so attached to the sound of that one that I don't want to do anything with it.

'As a student I spent my ill-gotten grant on buying my first Linn, in 1972 I think, and have owned one ever since. I'm just

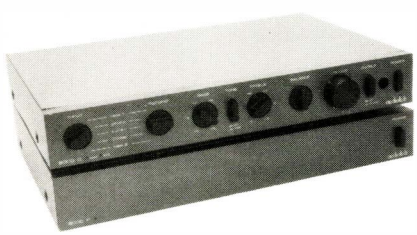
used to the sound of it. I know it's not perfection — having had the Goldmund in here, which was the nearest thing to mastertape I've ever heard. But at about £10,000, you're talking bankruptcy!

'I think this is the Linn number seven. One was nicked, and the others become faulty for various reasons. The problem used to be that any time anyone visited you, they'd say 'Your Linn's not set up



properly — let me have a go at it'. Now, the Linn is an excellent piece of production engineering, but in those days it wasn't — it was a superb bearing with bits around it that happened to work. But now everything about it is great, they have sorted it all out. This one I've owned since about 1980, but it's had all the bits done — it's been Nirvana'd, Valhalla'd and blessed by the Pope! It comes with psychic barbed wire to keep gurus off.

'The rest of the system is the Audiolab *8000C* pre-amp and *8000P* power amp, a



pair of Celestion *SL600s*, and various "visiting" Compact Disc players. I actually own a Marantz *CD63*, which I've partly rebuilt, but with the speed at which CD is changing, it's almost ridiculous for me to invest in a new one at this moment. I've had both the Sony *'552* and the *'502*. I'd happily live with the *'502*, in fact I did do so for six months. A lovely player. The Akai *CD-M88* was getting there, with a clean, powerful sound, but it was just too bright really.'

A busy reviewer, David's choice of equipment has to be practical:

'My equipment is switched on for the news at 8 o'clock when I get up and it gets switched off at 1 o'clock at night, and so every day it has a constant duty cycle. It's got to survive. For example, if I had to buy an arm today, I'd probably buy a Rega, because it's so neutral, so unfussy and so nice and clean. But you're stumped with the Rega for changing cartridges, and I make my living changing cartridges!

'The tuner is a Marantz *ST7* — it's the last of the great analogues. It's been back to Marantz twice for re-alignment and come back sounding so nice I don't want to part with it. There's only one other tuner I've lusted after and wanted to keep, and that's the Hitachi *FT-5500 Mk II*, which is a superb tuner and in my view about the only one that's significantly better than the *ST7*.'

Can you sum up what you look for in a system?

'If the system isn't altering tonal qualities of instruments and isn't altering perspectives in things that I know, then the chances are it's going to get other things right, like the dynamics. The more you can hear, the more right it is as far as I'm concerned.'

Cassettes Count Too

As a dedicated and experienced technical reviewer, **Noel Keywood** has an unrivalled knowledge of cassette decks, which he currently tests for *Hi-Fi Choice*. He listens for pleasure to all three programme sources though.

Noel has recently purchased Quad *ELS63*s:

'In some ways speakers are the most important and the most difficult thing. I've found that all loudspeakers annoy me in some way or other — I've never gone berserk over any, and I usually find conventional loudspeakers a very disappointing experience — which is why I settled with a non-cone non-box design. Cone

loudspeakers are deeply and fundamentally flawed. If I were designing a speaker I wouldn't consider using cones.

'After I reviewed the Quads I felt I just couldn't let them go back out of the door! They have properties that nothing else can touch. What you find, very interestingly, is that every loudspeaker manufacturer has a pair of Quads — and I mean including Japanese speaker engineers.

'First, they are totally coherent from top to bottom, free of discontinuity — you don't feel individual drive units. They are free of peaks, they don't have a 'character' in that sense. They don't have any sort of bass boom or enhancement. They start and stop absolutely perfectly, stopping particularly — the lack of overhang is quite phenomenally different from dynamic loudspeakers, and it gives you a genuine form of clarity rather than an artificial or contrived effect. There is no distortion and little coloration. They give you an incredible insight into the musical programme, which is why they are true monitors, but they achieve it without artificial emphases such as a raised treble or upper midrange. They are completely smooth — the treble is if anything slightly reticent. Imaging is unmatched.

'Bass is a drawback. The bass is dependent on the size of the room and the amount of cancellation. Small rooms cancel bass quite heavily because the return energy is so strong. I find them adequate in my lounge but if they aren't away from the wall, up off the floor and in a good room, driven by a good amp, they can sound rather poor. But this is a relaxation system, I don't do much assessment of other equipment through it — that would be contentious, but no more so than assessing bass through any small box speaker, as some people try to do, and believe they have true bass, which they don't!

'There's always been some difficulty with amps for the Quads, but I have found the Myst *Tma 3* to be a nearly perfect match in numerous ways. It is very slightly bright and perhaps there isn't a lot of weight in the lower bass. But it is a very nice sound and it is entirely satisfactory. I don't have to query it. It works in an almost symbiotic way with the Quads.

'You have to realign your expectations. They are getting things off records that other speakers truly have no chance of achieving (by this I mean because of the mass of the cone, distortion and other problems). You do get the feeling all other loudspeakers really are incorrect. Others tend to be a representation of the music, not the music itself.

'The disc front end is the Lux *PD-300* vacuum platter deck, Rega *RB300* arm and a variety of cartridges — usually an Audio-Technica *AT31E*. I could go on for reams about top-end cartridges.'

For evaluation purposes, Noel uses the Lux or Linn or other turntables on a 2cwt sandfilled shelf in his lab. But what about the problem of dust pressed into the other side of the disc by the *PD-300*'s vacuum effect?

'You just have to keep the platter *very* clean, in fact clean it before each playing — I keep it spotless. But then LP players should be kept spotless and absolutely free from dust anyway.

'I've got this belief that disc is completely coloured, and rather artificial — you can find an infinite number of combinations that are interesting and very satisfactory to listen to — every manufacturer has what they consider to be best and correct, but only best or correct in their particular terms.

'The CD player I'm using now is the Akai *CD-M88*, which is extremely good but is now being overtaken by events. CD is developing so rapidly. It looks as if I'll have to go in the direction of Philips-type 16 bit oversampling machine when it's available. I heard the Marantz prototype and was impressed.'

What are the good and bad points of CD?

'Well, depth and dimension . . . the bad ones sound rather flat. And treble quality — the bad ones sound gritty. Philips players have their own unique sound, which I find rather reticent but still very nice. As a generalisation, though, I still prefer to listen to LP. I do believe that CD has much more potential, though to realise it the technology has to be improved, and the original recordings have to be improved too.

'I use all three media, and I buy cassettes LPs and CDs. I often buy one album on all three, for my own education — I believe that a professional reviewer has an obligation to do this. Also I consider it very important to be very aware of disc cutting and pressing technology, of CD mastering techniques and of cassette duplicating technology, I visit cutting rooms, duplicating houses and pressing plants to stay in touch with developments. Some of the most rapid development and change is taking place in the cassette industry — it is sad that the hi-fi business in general can be sufficiently myopic to ignore this fact. Plenty of people only listen to LP, and to them CD is a curse and LP is a joke. I'm not saying that LP is inferior — I prefer it to cassette, and generally, to Compact

Disc. But I can quite easily get a level of sound quality from cassette that is very acceptable and far about what most people would consider typical.

'Ultimately, though, if the music is good, the limitations of the medium tend to recede!'

Limited Budget?

All our reviewers spend a lot of time reviewing and recommending less expensive equipment, so we asked them if they could suggest the best system combinations at middle to low prices.

Paul's suggestions remained firmly tied to the Linn scheme of things, and he mentioned the Rega turntables, Naim *NAIT* amplifier and Linn *Kan* speakers, admitting though, that the last named do not suit all rooms or music tastes!

Martin does run a second, realistically-priced system, to establish a fairer reference when reviewing products in the middle market. It is currently based on the Mission *Cyrus Two* amplifier.

'The *Cyrus Two* is load-tolerant and gives a very clear, dynamic sound quality, a very revealing sound — and that fits very neatly with the Spendor *SP2*, Spendor's middle-sized monitor, which consistently sails through blind listening tests. It's a very well balanced combination.

'The analogue source is the long-established Heybrook *TT2* fitted with the Rega *RB300* tonearm, which was a knockout when first released and remains a very very good performer. Fitted to that is the latest Ortofon *MC20* moving-coil, a very lively cartridge at a reasonable price.

Martin also assembles a budget system for review reference purposes, this consisting of B&W *DM100* loudspeakers, driven by a Rotel *RA-820BX* or Mission *Cyrus One* amplifier; and a good but inexpensive subchassis turntable, the Systemdek *IIX*, probably with the Linn *LV Plus* arm including the *Basik* cartridge.

'These all work well together and give a lively, nicely balanced sound, lots of detail, and reasonable depth, considering the price territory. Philips' *CD150* CD player seems just as good as the more expensive Philips players, which have got consistently good ratings for sound quality.

At an even lower overall system price, David Prakel's budget system choice would be based on the Marantz *PM151* amplifier — he demonstrated this by substituting it for the Audiolabs in his own system, and aside from a certain constriction or 'pinched' quality and lightweight bottom end, it stood up to the comparison remarkably well for an under £100 model. Turntable would be the Dual *505 II*, preferably the *Deluxe*, as supplied complete with cartridge, and speakers would be Wharfedale *Diamond* or preferably, Wharfedale *504* speakers.

With a slightly different emphasis, and at a slightly higher overall price level, Noel's recommendation would be for the NAD *3120* or *3130* amplifier — with the latter, he feels that NAD have really maintained their grip on the budget amplifier market — Rega *Planar* 2 turntable and Tannoy *Mercury* loudspeakers.

All reviewers would agree that you can now get a fairly satisfying sound at quite modest cost. But a true high end system will still offer some very special benefits, as Martin sums up:

'Compared with the high end system, the best middle-rank systems sacrifice some degree of stereo depth and transparency; it isn't quite so easy to hear into the far stage and into the recorded acoustic present on good recordings. With the high-end system, you get a feeling that you are almost in the environment of the recording, the listening space where the orchestra performs and you can hear the character of the back wall and the rear spaces behind instruments. With lower-price systems, the sound stage becomes contracted, it reduces in scale and size and the back walls come nearer and begin to sound more obscured. Also the dynamics of the performance are often reduced somewhat — it's not as exciting or involving.

'A high end system can produce a feeling of almost electric excitement — those feelings of change and contrast, soft and loud, will be reduced with a less expensive system. Apart from that most of the instrumental detail will be preserved in the middle-priced system.

'You can argue that an "up-front stereo" system superimposes a sameness on all recordings, which makes them more consistent. The "far space stereo" view tends to be more revealing of the differences in space between recordings — on the other hand, it allows you to appreciate the different interpretations of the recording producers concerned. If an engineer wants to make an intimate, enclosed, up-front sound, the far-space stereo system will reproduce it accurately. But if there is character, if there is natural acoustic on recordings, the far-space stereo system will reveal it and add more enjoyment to the performance. It enhances the feeling of "being there".'

And that, surely, must still be what it's all about.

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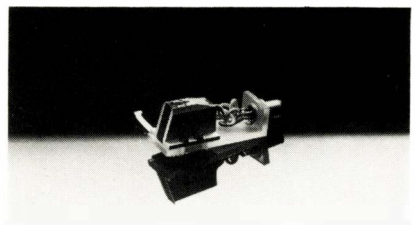
THE ANALOGUE ANSWER

Digital audio is clearly here to stay, but 'high end' users so far remain obstinately committed to conventional analogue LPs. Paul Messenger explains why.



Hi-fi for the enthusiast is about playing black vinyl discs. Despite the subsequent appearance of various alternatives over the years, modern hi-fi was a direct consequence of the modern stereo LP, and the two remain inextricably linked.

The microgroove vinyl disc, in both 33rpm and 45rpm versions, first appeared about 35 years ago. The first hi-fi boom really began soon after stereo discs were introduced in 1958. Of course, microgrooves quickly supplanted the brittle and fragile 78s, though the latter are still affectionately retained and played by many collectors. And of course many classic performances, cut originally on 78rpm, have been transcribed and preserved for posterity.

Radio as a hi-fi medium received a shot in the arm in the late 1950s, when FM broadcasting was introduced. Again this higher-quality source was originally mono, but a compatible stereo version followed a few years later.

The BBC's policy of extensive live and serious music meant that radio became a major source for the minority of classical music listeners. Rock and pop listeners (some 80% of the total audience) have been better served by the more *laissez faire* US attitude to needletime and station licensing.

When the source is live or from studio recorded tapes, FM radio is a worthy alternative to LP as a source of high quality home music. It is, however, a qualitatively different medium, replacing the choice of the listener with the choice of the broadcaster. It has its place, but it is no substitute.

TAPE FLEXIBILITY

The mid-'60s saw vinyl's first real rival appear in the form of the Compact Cassette. Being tape-based, it was much better suited to portable/car use, and had the inestimable advantage of having a recording capability in addition to the replay of pre-recorded material.

Cassette was invented by Philips, whose cleverest move was to license other manufacturers without royalties. This, more than any other factor led quickly to the successful establishment of the system as a world standard. After 20 years, cassettes have now overtaken vinyl LPs for sales of recorded material, with additional enormous sales of blank unrecorded tapes.

Where vinyl has remained almost exclusively a music storage medium, with its development closely linked to the music industry, the cassette has spread its tentacles into all manner of different fields since its inception. These have all served to increase research and improve economies of scale in the manufacture of mechanisms and the tape itself.

The cassette tape medium has also received a series of distinct major stimuli. Some five years after those early portable Philips players and their Japanese competitors, Ray Dolby invented his remarkably clever noise reduction system, and Du Pont introduced chromium dioxide tapes. An American company built a high quality stereo machine around a rugged industrial transport mechanism, and so, at the end of the '60s, the hi-fi cassette recorder was born.

By the mid '70s, hi-fi cassette deck production was in full flow, while in-car units were also starting to appear in real numbers. The company car with generous fitted extras has probably had as great an influence as any other factor upon the growth of the market for pre-recorded cassettes.

In the '80s, Sony's *Walkman* created a whole new market for 'personal' players, battery portables auditioned through headphones, the very best of which could be regarded as 'hi-fi'. 'Super-trannies' with fitted cassette decks now enliven homes and shopping arcades. And at the same time cheap personal computers came on the scene, and the volume low-price examples invariably used adapted cassettes for storage of programs.

The cassette has had some success as a hi-fi medium, particularly for creative enthusiasts and in countries where the radio transmits original material. Historically, the pre-recorded cassette, has never really succeeded in coming up to the expectations of the enthusiast, though quality has at last started to improve. The avoidance of disc surface noise has won some converts, but those with good quality turntables and cassette decks invariably find they can get better results at home.

The reasons behind this are covered in detail by Noel Keywood elsewhere in this volume. To summarise, commercial tape duplication uses more transfer stages than disc pressing, and the horrendous 'loop bin master', operating at 64 times normal speed, makes compromises which may well be acceptable enough for the general consumer, but which do limit the potential attainable compared with vinyl.

THE CD EFFECT

Where cassette may still be seen as complementary to vinyl, the newest development in hi-fi is clearly intended as a straight replacement. Compact Disc, developed jointly by Philips and Sony, has been around for three years now. It was conceived as a 'high-tech' replacement for the LP, offering the claimed superiority of digital sound quality, an absence of surface noise and freedom from scratch damage, plus the potential for in-car and personal applications.

Record companies were attracted to this new replay-only medium. Their hostility towards the copyright piracy capability of cassettes has never been fully assuaged by the profits that they make from musicassettes. And they foresaw that compact discs would sell at a premium price, margins on vinyl having slipped significantly over the years.

Compact Disc may have started to take its toll of confidence among the bigger

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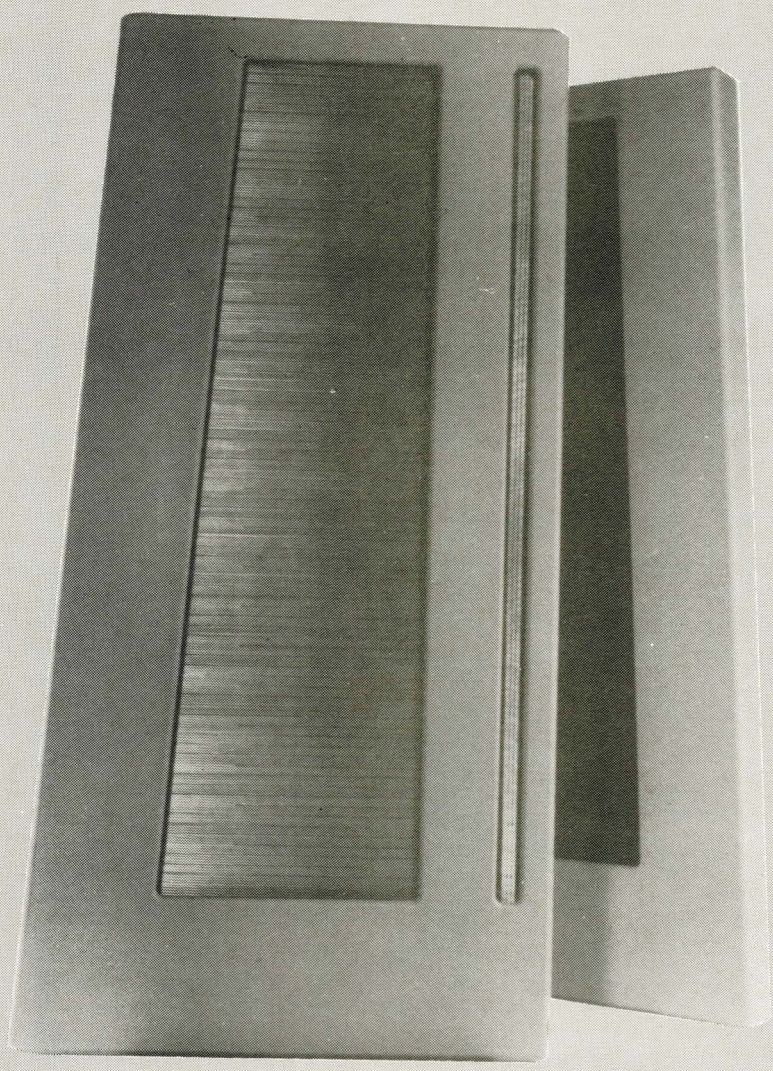

My 'Scintilla' speakers have been in use now for almost eighteen months having been the first UK dealer to immediately recognise their uniqueness. During this period I have built up a wealth of experience in obtaining the best performance by the use of appropriate ancillary equipment. They are on permanent demonstration in my home and always sound at their best. As such auditions are as private and comfortable as a product of this standard should demand. Wherever you may live I will personally install and set up your own new pair of Apogee's and give whatever guidance that may be necessary to obtain results as good as my own.

The new 'Duetta' from Apogee will be shown for the first time at the Stanneylands Hotel, Wilmslow on Thursday 1st May at 8.30 pm. Please telephone if you would like to join us for what promises to be a most excellent and enjoyable musical evening.

Derek Aston-Darker

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cartridge and turntable manufacturers, but any adverse influence so far seems to have been offset by the stimulus CD has given to the whole hi-fi scene — providing a touch of extra interest and glamour around the time that the gilt plating of personal computing has become a little tarnished.

The CD format has an undoubted appeal for its convenience, consistency, and a sound quality that many regard as more than adequate. But even its most ardent supporter will acknowledge that the need to build a new collection of music from scratch is tiresome and expensive. Though CD is winning its share of supporters, other customers have had interest in their LP collections re-awakened, and are upgrading record playing systems instead.

Compact Disc is still very much the 'third format' in terms of availability of material, and will remain so for the medium term future, until such time as the world population of CD machines represents more than a drop in the ocean of record and cassette decks.

From the consumer perspective, CD lacks the capability of making recordings, which did so much to establish the Compact Cassette as an alternative to the LP. CD looks most unlikely to provide cost-effective erasable music storage for many years to come, though its future as a high density computer storage medium is much rosier. It is now possible to buy systems to record an optical disk, the machinery costs thousands, the disks hundreds, and it is a write-once-only operation used for computer archiving. Record/erase systems do exist, but only in research laboratories at present.

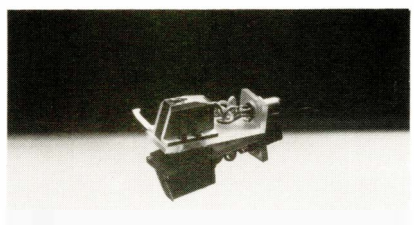
Comparisons

Perhaps most significant of all in the context of this book, there is no doubt that the 'CD sound' has little appeal to a significant number of hi-fi and music enthusiasts. Whereas one body of opinion is enthusiastically welcoming CD as an end to pops and clicks as we known them, an equally vociferous set is making it quite clear that they would much rather listen to analogue for its musical qualities, notwithstanding the odd pop or click.

Recent experiences of the listening panel during cartridge comparisons, provided with a CD item as a neutral reference to tonal balance admittedly in a system optimised for analogue, is a relevant case in point. (Special thanks, by the way, to John Farlowe of Exposure electronics for the use of his listening room and equipment.) Repeated plays brought steadily increasing hostility towards the new medium, even in comparison with cheap cartridges used in a high quality turntable and tonearm.

While the absence of surface noise was welcome, and the bass in particular was clear and clean, the treble was distinctly aggressive, becoming fatiguing as the day wore on. What initially was an attractive 'sparkle' became an irritating 'glare' which seemed almost to be fighting rather than following the music as a whole.

Though quoting a specific instance, this particular experience seems to reflect a line of criticism that has been voiced by many others besides. Though this is only speculation, it could be that CD suffers from an effect analagous to that which the 'loop bin master' has on musicassettes, in that most discs until very recently have been mastered via the Sony *PCM-1610*, a £15,000 professional machine. This has now been upgraded to a *1630* version with improved high frequency phase performance due to new oversampling filters, so we will have to wait and see whether this improves the rather disappointing results from the medium so far.



This writer, who has a substantial LP collection, would freely admit that his sympathies lie with the analogue LP. The reader, particularly one who may be only just starting to collect recorded music, should take the trouble to make up his or her own mind, by making the effort to hear the alternatives demonstrated, and by taking into account considerations such as repertoire and price.

Today, £200 might be considered a minimum for an LP player of reasonable hi-fi standards, whereas CD players now start at around this figure, and indeed we may see the entry-level CD price drop to £150 by the end of 1986.

The top turntable systems cost anything from £1000 upwards, with the sky providing little limitation on some of the excesses produced beyond these shores *(enough hyperbole — Ed)*. One or two 'superior' CD systems are starting to appear, notably the Sony system reviewed elsewhere in this volume, but the majority of models cost under £500, with varying sophistication of control functions.

The success of CD in the market is evidence enough of its undoubted strengths. But to 'go CD' is still taking a plunge, necessitating a financial commitment, for a player and 25 discs, of maybe £500. In the meantime, turntable, arm, and cartridge manufacturers will happily go on selling devices which can improve the sound of an existing collection at a stroke, as well as being easier on the pocket.

The Vinyl Imperative

Despite the protestations of the apostles of CD, there's not the slightest chance that vinyl will ever go away, and certainly not quietly. It is far too deeply entrenched, with billions of examples covering a repertoire that must be in excess of a million. In my town alone there are now as many secondhand as new record shops.

The irony is that CD was originally conceived more than a decade ago. The standard it achieves is probably more or less comparable to that which vinyl was capable of at that time. But ten years of enthusiastic development by hi-fi specialists has meant that the very best analogue LP systems make CD sound embarrassingly bad.

Agreed, the players and disc mastering systems of the new format are in their infancy, but the digital reproduction system is essentially a 'closed' one, fitting the music to an exact mathematical formula. The joy of vinyl is that each successive incremental improvement in the replay system brings the realisation that there is much more information on all the discs in one's collection — old and new — than one was aware existed at the previous stage. The entire collection awaits rediscovery.

And the bottom line question, which will only be answered once CD players have properly penetrated the market in real numbers, is whether the consumer, who has shown he is happy enough to accept the standard of the musicassette for its convenience over the LP, will really be willing to pay a substantial premium for the silver disc over either of the alternatives.

The present arrangement whereby the customer can spend £50 or £5,000 for the means to replay nice cheap software, getting results more or less appropriate to his investment, is far too reasonable, logical, and defensible to be jettisoned lightly in favour of a 'convenient' new system with such limited ultimate horizons. Having said that, it must be admitted that the latest 'high end' players may be expanding those horizons somewhat, and for those who are *still* not content with the best that analogue has to offer, these are also reviewed elsewhere in this book.

AUDIO LABOR KONSTANT

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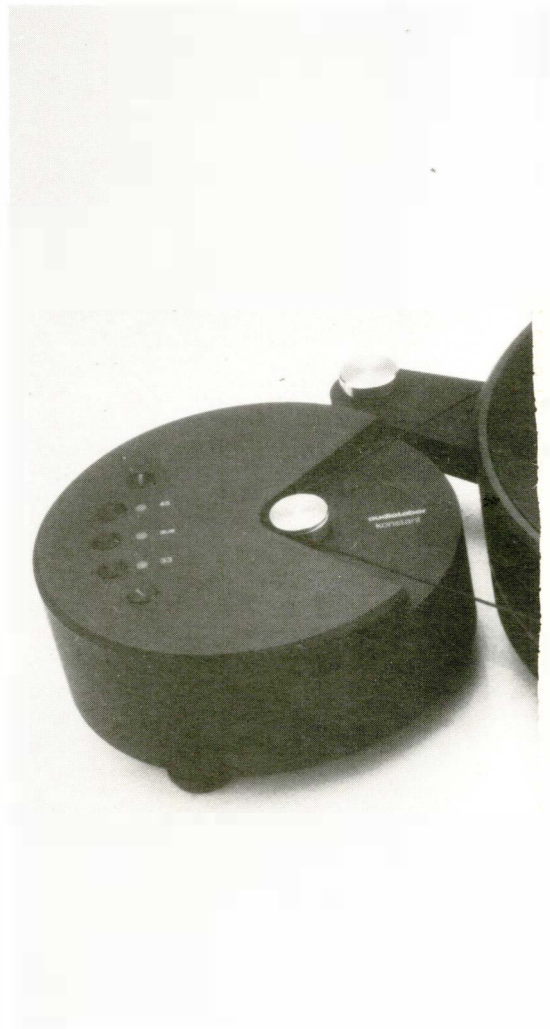

Designed and manufactured in West Germany, the Audio Labor turntable is a remarkable product whose price is so high that it has attracted little press attention so far. It costs a basic £2,360, and only the Goldmund designs are more expensive. How can one justify the money? Obviously one cannot do so on a direct value basis, but a wealthy enthusiast may have a good reason for acquiring one. In any case, a very good sound quality is mandatory, and fortunately, when properly installed, this is just what the *Konstant* delivers. Moreover its design allows it to do so without the need for undue alignment and the results are consistent over very long periods.

Thoroughly engineered, this turntable is founded on a massive tripod frame built in solid alloy, to which massive horizontal beams can be attached via highly secure clamps. Substantial arm mounting blocks can be fitted to these stainless steel beams in the manner of a slide on rails, and before tightening such a mechanism allows for the fine adjustment of the stylus overhang position to be made.

As a result of its symmetric construction and its separately positioned motor unit, up to four tonearms can be installed. Two had been fitted for the review — a SME *V* and a *Well Tempered Arm*, both equipped with matched van den Hul *MC10* moving-coil cartridges. As has been noted, the motor is built in a separated cylindrical housing which is placed on a shelf adjacent to the turntable. Special isolating feet are fitted to the housing, while the dc brushless motor is itself supported on damped anti-vibration mounts and operates very silently. For optimum performance the whole assembly is best run on a marble slab, the latter resting on a rigid wall-mounted shelf. A suitable slab was provided by the agent for review purposes.

Special power supplies are fitted to the motor to smooth and isolate supply line fluctuations. Smooth acting logic type buttons select 33⅓ rpm, 45rpm and off; a red LED changes to green when the correct speed has been attained. Coupling between the motor and the platter is effected by a resilient synthetic rubber cord.

Built on monolithic lines, the heavy 7kg platter is milled out of a large alloy billet of excellent tolerances, and is mounted on a massive 16mm main bearing of superb engineering quality. The platter is highly inert by virtue of its engineered form, and a polished glass mat is used to support the record. Good contact with the disc is assured by means of a weighted centre clamp; it goes almost without saying that records must be kept scrupulously clean to avoid damage to disc undersides, due to impressed grit or dust when clamped down on to the glass surface.

A key feature of the design is the use of a damped spring suspension to isolate the deck from higher frequency shock and vibration, and this proved to be most effective, aided by the high suspended mass and its non-resonant properties. As a disc support system it proved singularly inert, and thus free from coloration or resonance.

No standard plinth cover is available, due to the skeletal design, but custom cases can be made to order in clear or tinted acrylic. Its size does however mean that it needs a substantial shelf!

The high rigidity and high mass of the arm mounts raises an interesting question concerning the interface between arm and motor unit. Fortunately the two arms fitted for test were able to illustrate this point nicely and provide us with information as to optimum use. Ultra-rigid tonearms such as the SME *V* and related models from other manufacturers such as Zeta or from Linn in the form of their long established *Ittok* all appear to benefit from some degree of damped resilience or 'give' in the arm mounting. This can provide a lossy termination for vibrational energy from the cartridge travelling down the arm tube, and minimising reflected waves at the arm foundation. If the mounting is heavy and rigid it may act as a boundary, reflecting the energy back into the arm. Such reflections are then audible in the cartridge output as a loss of clarity and tonal balance, or even as an increase in coloration.

On test we felt that this was occuring to a small degree when we used the Audio Labor with the SME *V*, this determined by reference to samples of the same tonearm when mounted on the Oracle *Delphi* and a current Linn *Sondek LP12*.

Conversely, the excellent *WTA* seemed to perform at its very best on this rock steady platform — no doubt due to its inherent self-damping and terminating properties; the design of the silicone well and the resilient foam plastic pad securing the well cup. According to our experiments with tonearms, the *WTA* results suggested that the Audio Labor was an ideal match.

SOUND QUALITY

Once the preliminaries had been completed, serious listening could commence. The following comments are in fact based on a fair knowledge of the ancillary components used, especially the cartridge and the two tonearms.

A particular Audio Labor hallmark turned out to be its quality of absolute stability, as if it were founded on a rock, which must be due in part to the wall-

mounted marble slab. The bass was singularly 'open' and extended, free from emphasis, and in this respect nearer to mastertape than any I have heard. No trace of boom or lumpiness was evident. The feeling of neutrality extends throughout the midrange which lacked the usual vinyl thickening or 'rounded' type of coloration and allowed, for example, voices to soar through the frequency range with a finely controlled proportion and perspective.

In the treble, it was notably clean and again both depth and perspective were preserved in the large scale stereo image. Dynamics were reproduced with authority, aided by the strong pitch stability inherent in the massive platter and the powerful drive.

Taken overall it sounded confident, neutral and relaxed. This was particularly true with the *WTA* tonearm whose own virtues included a relaxed stability, apparently less disturbed than usual by the oft-encountered mechanical disc imperfections. It is possible that improved results could be obtained with the SME *V* following experimentation with some sort of softer composite interface between the tonearm and the Labor mounting surface.

Lab Report

As indeed it should, the *Konstant* produced fine results during the lab testing. This was complicated to some degree by its extreme weight, including the mass of the marble bedplate supplied. Absolute speed was highly accurate while the DIN peak weighted wow and flutter was superb at 0.035%, and virtually at the test limit. Individual contributions of wow and flutter were both very low, and nicely balanced. Drift was also very low but the slowing under load was a little higher than I should have liked at 0.35%, a mild weakness in a product at this price. However, the adverse effects were mitigated by the very high platter mass, together with the zero rotational overshoot defined by the internal fluid damping paddles. Ultimately the pitch stability was to a high order, while start-up was fairly rapid at 4 seconds, in view of the high 7kg platter mass. Rumble levels were very low though some mild motor-related periodicity was evident. Apparently based on multiples of 25Hz, this minor effect was considered inconsequential in practice.

The high overall mass and fine platter damping assured us of very good results for acoustic breakthrough despite a high damping rate on the suspension springs. Good vibration isolation was also seen though it was not as impressive as for the 'free' chassis types. The standard *Choice* impulse disc test gave an excellent result, free from any frequency-dependent emphasis.

Conclusion

If you have the money and the shelf facilities, and require a very neutral state-of-the-art turntable, with superb engineering and facilities for up to four tonearms, then the Audio Labor *Konstant* should be given serious consideration. The *Well Tempered Arm* was found to work very well with this deck, and if several cartridges are favoured, it could easily be equipped with more than one *WTA*. The price is sky-high but the engineering content, versatility and performance all go a long way towards justifying it.

Test Results

	Motor unit
Type	belt-drive, subchassis
Platter mass/damping	7kg/average+
Finish and engineering	excellent/excellent
Type of mains connecting leads	3 core
Speed options	33/45rpm variable
Wow and flutter (DIN peak wtd sigma 2)	0.35%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)	0.055%/0.045%
Absolute speed error	0.07%
Speed drift, 1 hour/load variation	<0.05%/−0.35%
Rumble, DIN B wtd, L/R average	−79/−81dB
Size (w×d×h)/clearance for lid rear	58×43×16cm/none
Ease of use	good
Typical acoustic breakthrough and resonances	excellent
Subjective sound quality of complete system	very good
Hum level/acoustic feedback	very good/very good
Vibration sensitivity/shock resistance	very good/very good
Estimated typical purchase price	£2360

HEYBROOK TT2

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

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

The *TT2* is superficially reminiscent of the Linn *Sondek*, but closer examination will reveal that Heybrook have used a rather different set of solutions which do not appear to derive from any attempt to compromise engineering quality or finish. At the same time, the *TT2* is quite competitively priced if compared with certain of the more expensive brand leaders in the specialist field.

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

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

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

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

Lab Report

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

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

Sound Quality

On audition the latest *TT2* was felt to offer an improvement over the earlier version, notably in terms of better exposition of the dynamic contrasts in the music.

Pitch stability, rhythm and timing were all to a very good standard, while the bass was a strong point, with a welcome firmness coupled with good extension to the lower-bass frequencies.

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

Conclusion

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

Strong points included very low wow (approaching the Linn in this area) as well as its fine bass. It was easy to set up, remaining stably aligned, and attains a firm recommendation.

Test Results

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

First reviewed: original mode, 1983; current model 1984, reassessed 1985. Rating: Recommended.

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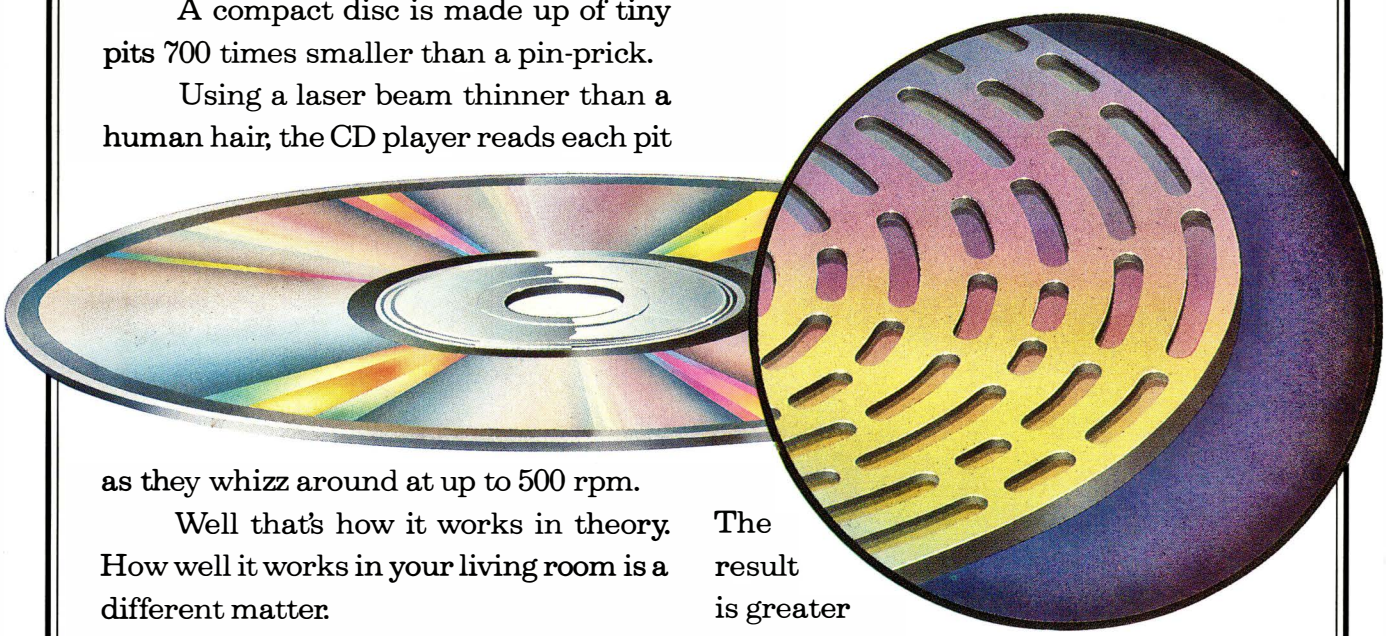

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LATEST LP12, SEEN HERE WITH LINN ITTOK LVII ARM

Now well into a second decade of production, the Linn has become something of an institution. The design was originally quite closely based on the classic Thorens *TD150*, but Linn's policy of continuous development means that the capabilities of current *Sondek* is a product far removed from the earliest examples, even though the appearance has been pretty well unchanged over the years. While Linn have continued to make detail revisions, it is now some three years since the last major modification, known as 'Valhalla'.

Previously, the slow-speed synchronous motors generally fitted to subchassis belt-drive turntables had always been at the mercy of the mains supply. The latter's frequent distortion, noise level, transient fluctuations and voltage all affect the motor's output and also the level of vibration emitted from the motor frame.

Ideally such motors should be run from a two phase supply, but the second phase-shifted line has generally been optimised in a less-than-ideal fashion by using a phase shifting capacitor. When a turntable is intended for UK and for US markets, a pulley change is also required.

'Valhalla' solves these problems by effectively isolating the motor electronically from the mains supply. Mains power is rectified and smoothed to feed a bi-phase 100V low distortion power amplifier acting as the motor source. The exact 50Hz frequency is synthesised from a quartz oscillator. When fed clear, stable 50Hz, the motor generates less vibration and mains harmonic components, attaining a near perfect pulley speed stability over both the long and the short term. Power into the belt is more stable, with (in theory at least) a lower rumble and reduced subchassis vibration resulting from the power feed.

General alignment has also been improved, with further refinements including a bonded rather than a welded subchassis, plinth reinforcements, better springs, loaded main bearing oil and suspension lock nuts. Earlier Linns were subject to suspension settling with use, and thus required occasional realignment; the current low-fatigue springs should solve this problem.

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

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

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

The well-damped platter weighs some 4.1kg. Our assessment of disc damping showed that while the initial transient was certainly poorly damped by the felt mat, the impulse died away quickly thereafter, this a good result. Earlier measurements comparing the frequency transform of the felt mat versus an absorbent one showed that while the 'composition' mat produced greater attenuation, its frequency response was uneven, while that of the felt was more uniform, suggesting lower overall coloration.

'Valhalla' has made its mark on the motor results with excellent wow and flutter, plus significantly lower linear wow.

Absolute speed and accuracy was satisfactory, while loss under load was very good at 0.13%, another important result. DIN weighted rumble improved to a superb −80dB. In fact the spectograms for residual measuring system noise and for the *Sondek* were very similar and to check this result the two were submitted to subtraction — no mains related rumble components remained! It is worth noting here that Naim Audio Ltd have privately modified a few Linns in accordance with their own ideas, replacing the 'Valhalla' electronics with a massive outboard power supply (in the shape of one of their own preamplifiers) and have called this unofficial variant the 'Armageddon'.

As regards vibration isolation or acoustic breakthrough, the *LP12* was not the very best we have tested, but measurements did confirm a high standard for these parameters nonetheless. Shock resistance was also quite good, with both acoustic feedback and hum very good.

Sound Quality

A few years ago it was considered heresy to suggest that turntables could make a 'sound' at all, but meanwhile the *Sondek* has been a leading exponent in demonstrating just how different the subjective performances can actually be. It scored an excellent rating on audition, notwithstanding some mild spectral imbalance and coloration; a consumer who feels that absolute tonal neutrality is paramount is entitled to reject the *LP12* but should be made aware of the importance of certain other factors. For example the *LP12* has long generated a feeling of 'involvement' with the music for reasons that are only partly becoming understood.

After careful and prolonged listening the *LP12* was found to excel in its ability to retain the timing, tempo, rhythm and pitch of complex percussive sections, failure here producing some loss of interest on the part of the listener. Additional qualities included rapid post-transient decay producing 'transparent silences' between successive notes and these were all too often obscured by hangover in other models. The felt mat also provided a level of tonal integration of bass and treble now considered optimum for the deck. The recent improvements have noticeably controlled the mild upper bass excess, this particularly true when the deck is used with a current *Ittok*. The *Ittok* arm still produces a spectacularly good sound with the *Sondek*; the Alphason arm also matched it well.

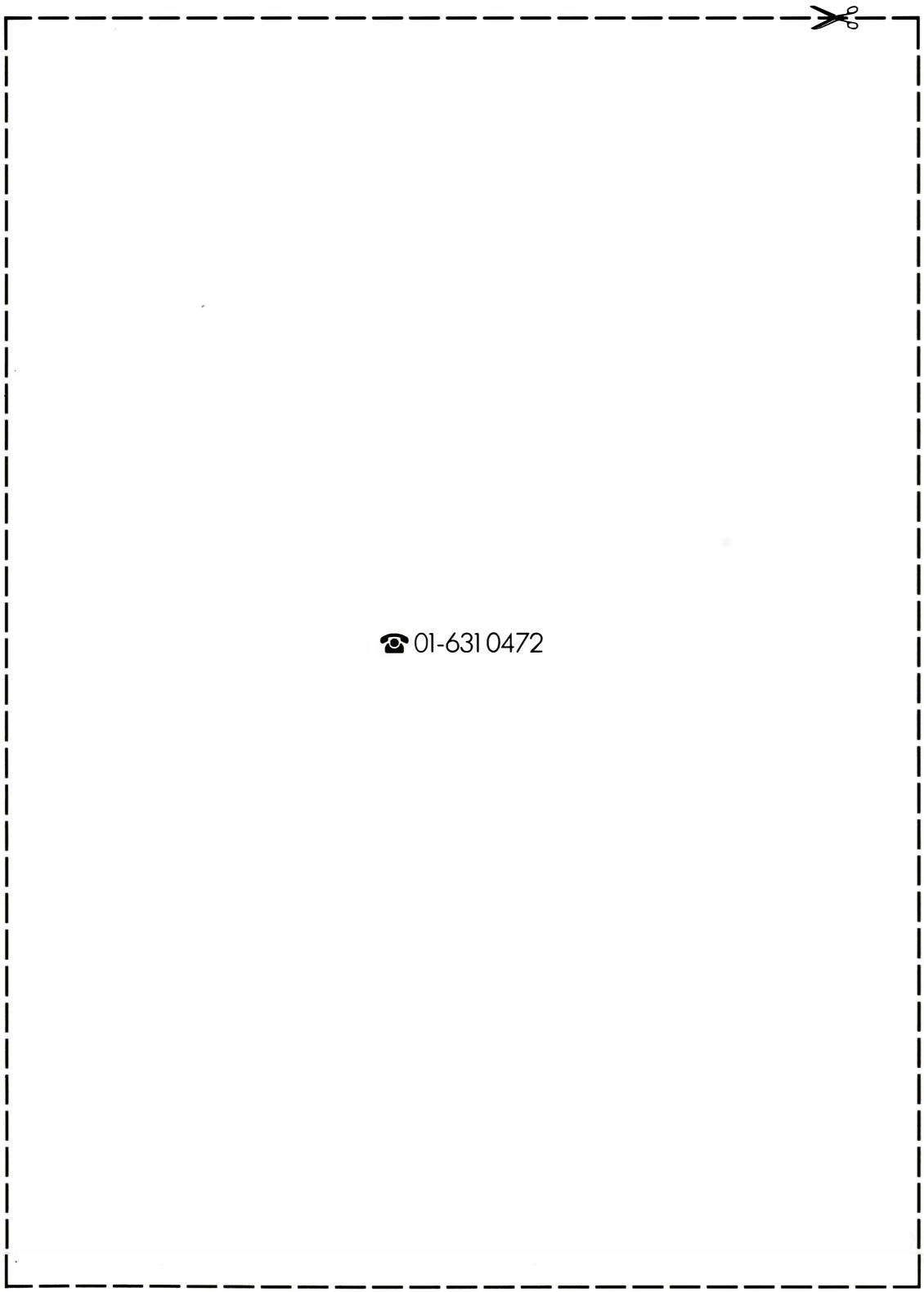
Conclusion

While many other analogue turntable companies appear to be treading water, Linn have continued to advance the standard of their *LP12*. This year it offered better focus, intertransient silences, stability and solidity. Pitch and rhythm remain excellent though this does depend on precise dressing of the arm cable. Alternatively, very stiff or very compliant arm cables may affect the subchassis dynamics but a good dealer can sort this out. A strong recommendation is maintained for this fine turntable.

Test Results

	Motor unit
Type	manual, belt-drive, synchronous motor, subchassis
Platter mass/damping	4.1kg/good
Finish and engineering	excellent/excellent
Type of mains connecting leads	2 core
Speed options	33rpm
Wow and flutter (DIN peak wtd sigma 2)	0.06%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)	0.09%/0.05%
Absolute speed error	−0.2%
Speed drift, 1 hour/load variation	quart-locked/−0.13%
Start-up time to audible stabilisation	6 secs
Rumble, DIN B wtd, L/R average	−80dB
Size (w×d×h)/clearance for lid rear	44.5×36×15cm/5.5cm
Ease of use	good
Typical acoustic breakthrough and resonances	very good
Subjective sound quality of complete system	excellent
Hum level/acoustic feedback	very good/very good
Vibration sensitivity/shock resistance	very good/good
Estimated typical purchase price	afromosia, £450
(other finishes: walnut, £462; black, £474; rosewood, £495)	

First reviewed: 1978, last retested 1985. Rating: Recommended.



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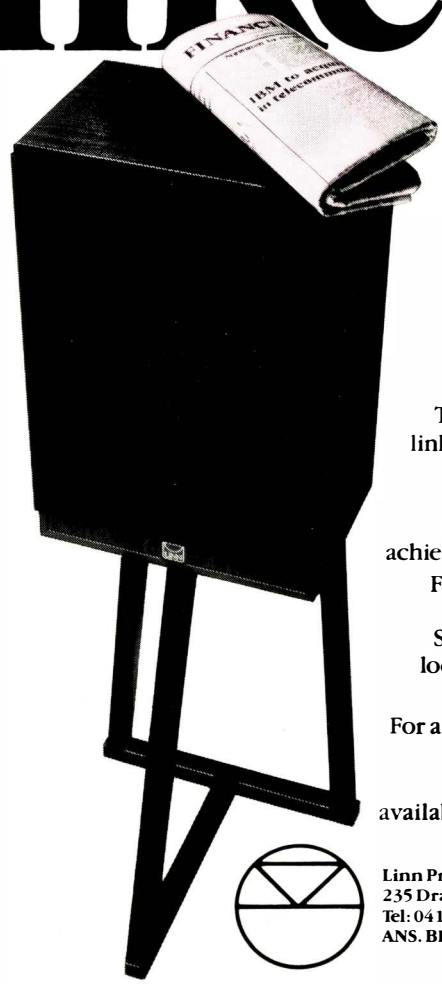

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MICHELL GYRODEC

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STRIKING LOOKS MATCH FINE ENGINEERING IN THE *GYRODEC*

Impressive in appearance and massive in construction, the *GyroDec* represents Michell's concept of a top-quality no-compromise turntable. A large design fitted with a costly hand fabricated glass-clear acrylic case and lid, it has provision for the symmetrical attachment of one or two arms as required. Carrying a five-year guarantee, the *GyroDec* has been well thought out with regard to setting-up and all parts are accessible without the need for the removal of baseplates and so on.

Unlike earlier Michell designs, the *GyroDec* employs a fully suspended sub-chassis, this taking the form of the massive spoked 'wheel' casting preloaded with lead weights which largely counterbalance the arm masses. The whole is suspended in compliant coil springs resiliently mounted within the three suspension towers adjacent to the platter, and the system is readily adjusted from above upon removal of the spring covers. Special mounting plates of thick alloy are provided for individual arms, these of different mass to give a constant state of balance without recourse to changing springs.

The alloy platter is loaded by an array of heavily gold plated weights on the underside, these helping to distribute resonances as well as augmenting the platter mass. The platter itself is driven at its grooved periphery by a pair of thin rubber cords powered via a large hysteresis synchronous motor made by Papst. This is a low voltage type, fed via a small transformer in the mains supply lead. Two speeds are provided via the motor pulley, with the appropriate selection easily selected by hand, since the drive is entirely exposed in this model.

A key feature is the incorporation of a full clamp absorption system for record damping. A polymer mat is used, in conjuction with a record label clamp, this bearing over a central washer and thus tensioning out all but the most stubborn of warps. In this respect the *GyroDec* bears a great similarity to the *Oracle*.

LAB REPORT

The platter weighed some 4.5kg and proved to be well damped with respect to the disc impulse response. The initial transient was well trapped, but a low frequency aftershock was present at about 40Hz — probably platter rock on the main bearing total compliance. Wow, flutter and integrated wow and flutter were all very low particularly for belt drive. On our earlier review sample, with only a single drive cord, absolute speed was about 0.2% slow while a further 0.3% slowing (slightly high) occurred on standard loading, and start-up time to audible pitch stabilisation took a very long 9.5 seconds, mainly due to oscillation of the platter inertia against the belt compliance. Poorly damped, this could be an influence on subjective pitch stability on transient programme. However, these aspects have all been improved by the adoption of the double cord drive system.

Rumble was very good at −77dB, showing just the slightest incidence of motor rotational components, and its resistance to acoustic and vibration breakthrough was so extraordinary that the scales had to be magnified by 10dB to bring the residual coupling into sight. Hum levels were fine and acoustic feedback excellent, while shock resistance was also very good.

SOUND QUALITY

Just failing to make the top grade the *GyroDec* scored a very high mark on audition. It sounded very neutral and transparent, producing stable and spacious stereo images with impressive depth. Bass was substantially even with weight, power

SYNCHRO IS CONSTRUCTED ON A GREEN-TINTED ACRYLIC BASE

and attack. Earlier reservations concerned something which may in practice prove less important to other listeners, namely dynamic wow. On rock programme with heavy transients a trace of pitch instability was evident, believed due to this effect.

Overcoming earlier criticisms, the current *GyroDec* has improved start-up time as well as having reduced short-term pitch variations. Subsequent auditioning revealed a more stable sound with much better pitch and timing.

MICHELL SYNCHRO

Resembling a scaled-down version of the *GyroDec*, Michell's *Synchro* is also a true subchassis design. In common with other Michell models it has a striking, 'engineered' appearance, with all the working parts exposed and fully finished.

A cast ring subchassis is used, rather smaller than that of the *GyroDec*, with a strong outrigger platform for arm mounting and a three point coil spring suspension. The assembly is mounted on a pale green tinted, clear acrylic base and the matching, round cornered lid, as well as the thick plate glass patter are all similarly tinted. A thin felt mat is provided in a darker shade of green. The synchronous motor feeds power via a rubber cord to the periphery of the platter. Speed change is effected manually by changeover on the two pulley diameters. The feet are screw-in, with a choice of rubber-faced or hard alloy pointed types, the latter proving popular at present.

On audition, the player provided a very good standard of sound reproduction, with firm bass and an articulate detailed stereo, presentation with good stage width and depth. Coloration was low while pitch and timing were of a high order. Feedback effects were negligible.

CONCLUSION

For the price, the *Synchro* offered an appealing combination of finish, engineered style, and a good lab performance, plus a fine sound quality. It was versatile with respect to arm fitting, and complemented the Rega *RB300* well, our test arm choice. As such, the *Synchro* comfortably achieved recommendation.

In view of the fine overall engineering and generally good performance, the *GyroDec* carries a recommendation in the current issue despite its elevated price. As many have commented, the appearance goes some way to justifying the cost.

TEST RESULTS

MICHELL GYRODEC Motor unit

Type ____manual, belt-drive, synchronous motor, subchassis
Platter mass/damping _____4.5kg/very good
Finish and engineering _____very good/excellent
Type of mains connecting leads ____2 core, line transormer
Speed options _____33/45rpm
Wow and flutter (DIN peak wtd sigma 2) __less than 0.04%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz) less than 0.06%/0.04%
Absolute speed error _____−0.2%
Speed drift, 1 hour/load variation ____synchronous/−0.3%
Rumble, DIN B wtd, L/R average _____−77dB
Size (w×d×h)/clearance for lid rear _____53×42×19/4cm
Ease of use _____good
Typical acoustic breakthrough and resonances ____excellent
Subjective sound quality of complete system ____very good
Hum level/acoustic feedback _____very good/excellent
Vibration sensitivity/shock resistance __excellent/very good
Estimated typical purchase price _____*£595

**includes dealer set-up, arm fittings, clamp mat system*

First reviewed: GyroDec, 1983 (retested 1984, 1985); Synchro, (1985) (for full technical report see issue 43). Rating: Recommended.

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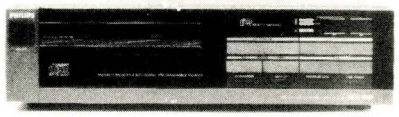

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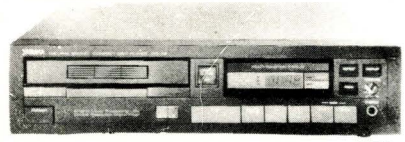

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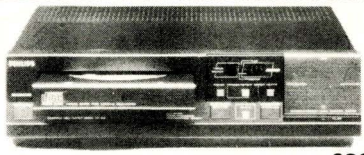

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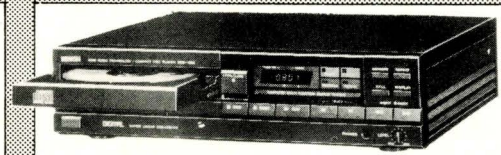

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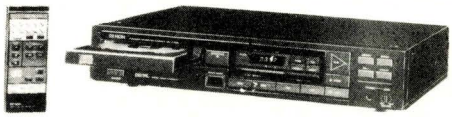

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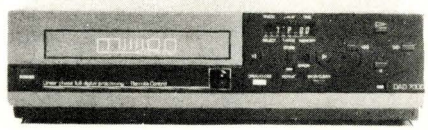

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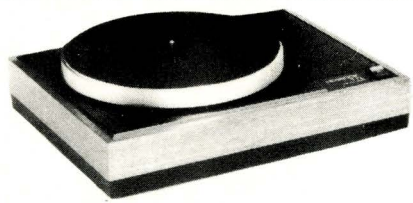

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ORACLE DELPHI

ABSOLUTE SOUNDS, 42 PARKSIDE, LONDON SW19. TEL: 01-947 5047

A beautifully-built open chassis turntable from Canada, the *Delphi* has been with us for some years now. It always has been expensive, aiming to offer superb finish and performance with good facilities. Early samples were prey to various teething troubles such as wow and torque problems, due to the belt and motor design, plus some suspension anomalies. More recently the company went through a financial reorganisation which disrupted supplies for a period.

Thankfully this is now all behind the company, and the current review *Delphi* now appears in its strongest ever form. Many evolutionary changes have in fact occurred since the original production, these born of strong dedication on the part of the designer, and have resulted in an even better sound and performance.

Each of the three chassis towers contains a complex tuned suspension system. The deck uses a striking planar chassis composed of aluminium alloy sheets laminated with a special adhesive interlayer to control resonances. The whole chassis may be easily lifted off the suspension towers to aid adjustment when tuning the suspension, which is carried out using an improved range of up to seven colour-coded springs.

The chassis is tuned to an almost ideal frequency range of 3-3.5Hz, the springs chosen according to the tonearm mass. The earlier offset balance weight, located below the platter, is no longer required. Suspension problems have also been solved by the adoption of new seatings and differently shaped springs, working in conjunction with specially formed felt dampers. The well-controlled free movement which is essential for vibration isolation has been achieved together with a reduction in harmonic breakthrough.

Belt driven, the deck is powered by the Papst Hall-effect brushless motor, now equipped with a high-inertia bell-shaped flywheel to smooth the rotation. Two speeds, 33⅓ and 45rpm, are available, these electronically selected by push buttons on the front control panel.

As regards the motor, two lines of attack have been adopted to provide the most stable power. A heavy duty line cord power supply and regulator is followed by a so-called 'electronic flywheel', a bank of capacitors following the regulator to provide additional smoothing and regulation. While it is very hard to measure the effects of such precautions, extensive listening tests have confirmed their value.

Originally, the *Delphi* bearing ran dry, using special PTFE liners. Lower friction and greater reliability have since been achieved by adding an oil film to the bearing. Using an accurately machined hardened steel shaft, the spindle is tipped with an ultra hard tungsten carbide ball, bearing on a thrust plate. Tolerances are very good with negligible bearing play in evidence.

In contrast to some other skeletal decks, the Oracle is founded on a thick acrylic bedplate or plinth to which a smoked acrylic cover is attached, correctly isolated from the suspended chassis.

For the purposes of the review, a new SME *V* tonearm was installed using the supplied acrylic arm mounting plate, and tests were undertaken with the latest version of the excellent Koetsu *Red* cartridge. We obtained fine results using a turntable 'table' as well as a wall shelf, as the deck was fortunately not too critical of position.

The *Oracle* still keeps one of its original features, namely the 'tacky' synthetic platter mat which when fitted with the usual under washer, assumes a slightly domed form. Used in conjunction with the screw-down clamp the record centre is stressed in such a way that the grooved music area of the disc is brought into intimate contact with the mat. The latter has considerable damping properties. The disc and mat, working in conjuction with the ideally shaped platter with its peripheral wave trap, results in an inert whole.

SOUND QUALITY

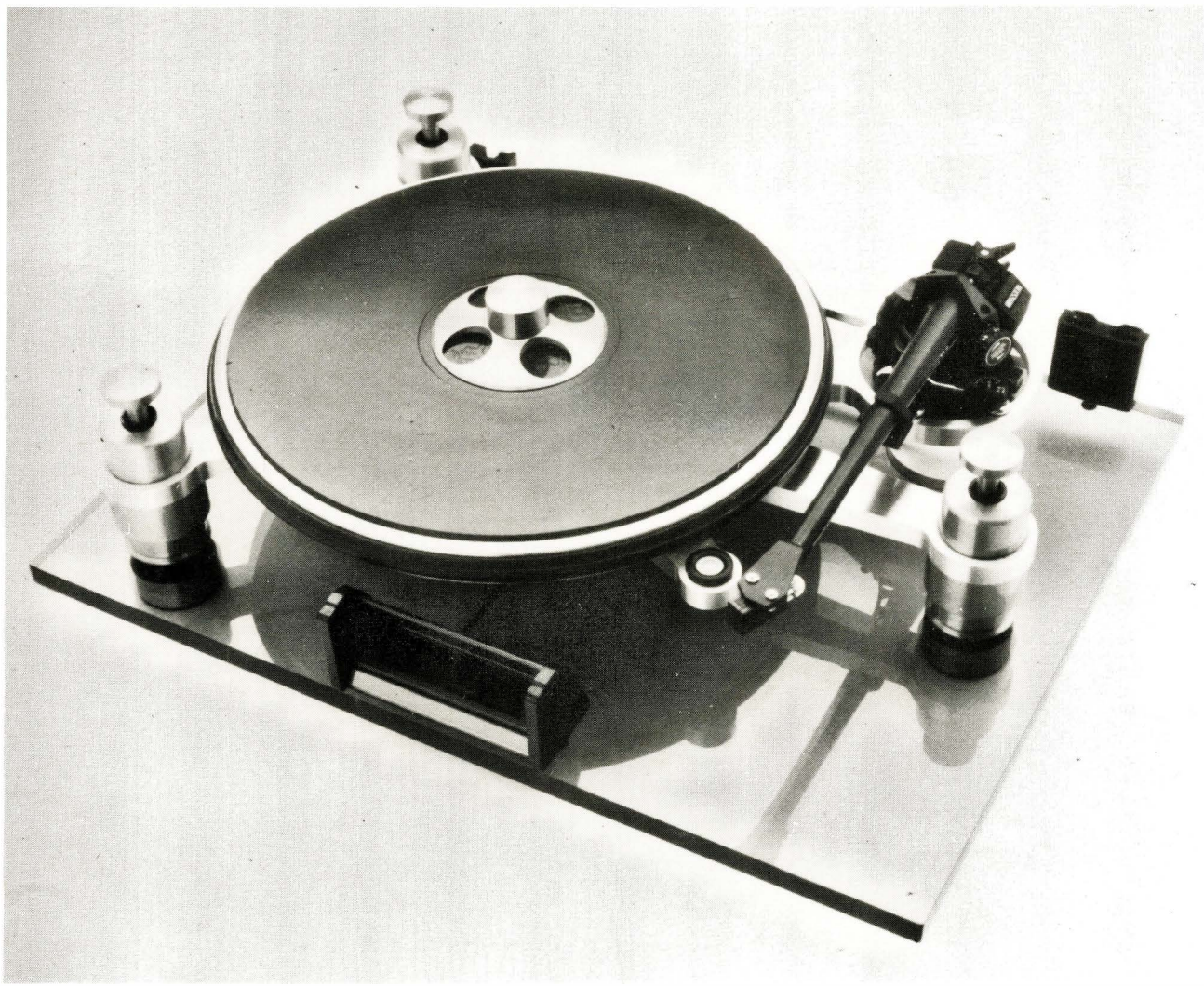
A *Delphi* trademark is the absence of the 'vinyl disc sound', which is normally audible when a felt mat platter is in use. This mid-dominant effect is suppressed in the Oracle by the very good disc-mat contact. Subjectively the consequence is a comparatively 'laid-back' midrange with a very good space and depth, the typical 'up front' disc sound being replaced by a more naturally balanced sound, one in which the bass and treble are presented in better proportion.

Treble sounds are also finely controlled and would perhaps be considered 'rich' in the absence of its superior midband performance. The player has a notable ability to focus treble sounds in depth, this high quality focus was also maintained throughout the mid which demonstrated excellent definition and a strong discrimination of fine detail.

It showed good extension in the bass with a nicely judged performance here. The forceful percussive attack was coupled with good rhythm and timing. Pitch stability was rated highly, rather better than was experienced with earlier versions tried several years ago. Dynamics were well represented, and the sound using the Koetsu and SME *V* was both involving and exciting. These three components seemed to work very well together, providing a lively and yet well-balanced effect. In particular the cartridge appeared to be almost holographic in its portrayal of perceptibly solid central images — for example, of solo vocalists. This has to be rated as a very well-matched system.

LAB REPORT

In the lab the *Delphi* returned an excellent set of results, commensurate with the



subjective performance. Wow and flutter readings were close to instrument thresholds, with the final reading an excellent 0.04% DIN peak weighted. Wow was much lower than before, while a good speed accuracy was shown. A notable improvement was seen in the variation of speed with loading, now fine at −0.15%, compared with the old result of 0.45%, a figure at the suspect level. Start-up was fairly slow at 7.5 seconds, but was achieved without overshoot. Rumble was excellently low and the DIN B weighted figures showed these at around −78dB on average. No motor related components could be found in the rumble analysis while very good results were obtained for acoustic and vibration breakthrough.

The first disc impulse response was so good that the signature was almost invisible, and a second graph was taken using higher magnification to see just how well ordered the impulse response was. Essentially the cartridge picked up an attenuated version of the original impulse, almost without distortion. No platter rock or similar disturbance was visible.

The hum levels were very low, while moderate impact shock was rejected well owing to the efficient suspension. In terms of matching it seemed to suit the SME V well and the two made an attractive combination, both visually and sonically.

Conclusion

While some may consider it a bit late, the Oracle *Delphi* has undoubtedly come right at last. The designer has competently dealt with all the original points of weakness, with the result that its inner strengths are now fully revealed.

This deck offered a neutral yet dynamic disc platform, which suited some of the world's finest tonearms very well. Pitch stability was now exemplary endowing the deck with precise timing and involving rhythm. In the midrange and treble it also provided particularly good stereo depth. If the enthusiast is looking for a beautifully made and finished subchassis turntable in the upper price category, he need look no further than the *Delphi*.

Test Results

	Motor unit
Type	belt-drive, subchassis
Platter mass/damping	2.8kg/excellent
Finish and engineering	excellent
Type of mains connecting leads	2 core
Speed options	33/45rpm variable
Wow and flutter (DIN peak wtd sigma 2)	0.04%
Wow and flutter (lin peak wtd 0.2-6/6-300Hz)	0.007%/0.055%
Absolute speed error	+0.1%
Speed drift, 1 hour/load variation	<0.5%/−0.1%
Rumble, DIN B wtd, L/R average	−81/−76dB
Size (w×d×h)/clearance for lid rear	48×36×16/8cm
Ease of use	satisfactory
Typical acoustic breakthrough and resonances	excellent
Subjective sound quality of complete system	first rate
Hum level/acoustic feedback	low/exceptional
Vibration sensitivity/shock resistance	very good/very good
Estimated typical purchase price	£1,550

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PINK TRIANGLE

PINK TRIANGLE PROJECTS LTD, 44 BRUNSWICK VILLAS, LONDON SE5 7RR. TEL: 01-703 5496

Over the past five years, the Pink Triangle turntable has become well established in a part of the UK market largely dominated by the Linn *Sondek*. The product of a small but dedicated company, the Triangle has undergone many detailed refinements during its long life, and the report given here reflects work carried out on a series of samples over the years. In fact, the manufacturers, now known as Pink Triangle Projects Ltd, feel that they have gone as far as possible in refining the existing model, and have announced that in the course of 1986 it will be replaced by a substantially revised version to be known as the *PT TOO*. A retrofit kit, to upgrade existing turntables to *PT TOO* standard, will be made available through franchised dealers.

Designed along classic lines, using a sprung subchassis and belt-drive, the Pink Triangle player nonetheless incorporates many unique features; for example, the platter is solid matt finish acrylic, supplying the record support and termination itself. Fine speed control adjustment is available by the use of a screwdriver inserted in the small holes in the deck plate adjacent to the speed change switch, the drive being electronic via a small DC motor. (For the *PT TOO*, the motor will be the commonly-used 24-pole AC synchronous motor, using an electronically controlled power supply. The position of the motor will also be changed.)

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

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

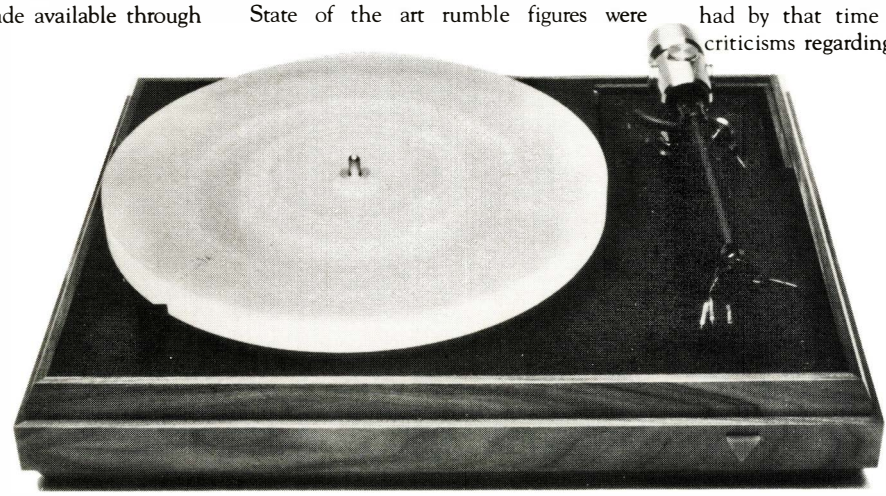
Arm mounting is by means of a 'U' shaped section alloy extrusion, which is firmly bolted to four studs set in the sub-chassis. Adequate provision for lead has been made, and the unit came fitted with an *Ittok*, which suited it well.

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

LAB REPORT

State of the art rumble figures were achieved, the spectrum analysis revealing nothing of significance. The drive was remarkably stable with very low wow, very good flutter and fine weighted wow and flutter. On our last sample, slowing under load was kept to a satisfactory 0.22%. With a moderate 1.7kg platter mass, the flywheel effect was lower than in some competing models.

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



SOLID ACRYLIC PLATTER DISTINGUISHES THE PINK TRIANGLE DESIGN

SOUND QUALITY

For previous issues the Triangle was tried with both the Linn *Ittok* and Helius *Orion* tonearms and qualities of low coloration and tonal neutrality as well as a pleasing musical balance were immediately apparent. The bass register was well above average showing an open and articulate quality — tuneful and with good weight and solidity. The sound was alive yet somehow unforced. Disc/platter contact seemed particulary good, with a well focused treble, the whole delivering stable, clear stereo images.

CONCLUSION

Our last tests on the Triangle were carried out some time ago, but internal changes had by that time answered our earlier criticisms regarding slowing under load. Assuming that current production models continue to meet the standard set by our review sample, dynamic wow has been virtually banished from current production, so removing our only significant reservation concerning this fine-sounding player, and a full recommendation is thus appropriate.

TEST RESULTS

Type	belt-drive
Platter mass/damping	1.7kg/very good
Finish and engineering	very good/very good
Type of mains connecting leads	3 core
Speed options	33/45rpm internally variable
Wow and flutter (DIN peak wtd sigma 2)	0.06%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)	<0.06%/0.07%
Absolute speed error	adjustable, +1%
Speed drift, 1 hour/load variation	+0.2%/−0.5%
Start-up time to audible stabilisation	3 secs
Rumble, DIN B wtd, L/R average	77/78dB
Size (w×d×h)/clearance for lid rear	45.5×38.5×15.2cm/6cm
Ease of use	good
Typical acoustic breakthrough and resonances	excellent
Subjective sound quality of complete system	very good+
Hum level/acoustic feedback	very good/excellent
Vibration sensitivity/shock resistance	excellent/ good
Estimated typical purchase price	£442

First reviewed: 1982 (retested 1984). Rating: Recommended.

THE SOURCE

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THE SOURCE – SEEN HERE WITH ODYSSEY ARM

Superbly finished, the *Source* is a substantially built belt-drive design, with a sprung subchassis. Its massive platter and chassis weight means that it is relatively impervious to alignment 'tweaking' and is happy with a range of tonearms, proving easy to set up. An electronic power supply feeds the substantial motor and provides for two speed operation, changing at a flick of the front mounted switch. The transformer section is well isolated in a remote power-lead box.

The subchassis is a thick steel plate, asymmetrically shaped and supported in a surprisingly complex manner by five carefully located coil springs. Vertical subchassis motion is excellent at 3-4Hz, but the system is rather stiff in the rotational mode. The main bearing is superb, and supports an amazing two part bronze platter weighing 7.5kg. A soft felt mat provides record support.

LAB REPORT

Absolute speed was a touch slow at −1.1% (belt properly crowned). Wow and flutter at 0.13% was satisfactory, but could have been better, while the unweighted wow result of 0.23% suggested a possible belt imprecision. Drift was negligible, while slowing under load was a satisfactory −0.3%. Start-up was slow at 7.5 seconds, and the rumble results were fine, with dB figures in the mid seventies for an average of the two channels.

The disc impulse response was typical for a felt mat type, but we noted clean decay with negligible delayed resonances. Acoustic and vibration breakthrough were both very low, though some mild spring resonance effects could be seen in the 300Hz region.

Analysed for rumble, the main bearing was clearly excellent, but interestingly a motor vibration component was evident at 25Hz, though this was not at a serious level.

SOUND QUALITY

This turntable gave a sound reminiscent of the US-built SOTA *Sapphire* model in respect of its ability to give a solid, weighty foundation to the reproduction. Bass was open and extended while the whole effect was one of an easy relaxed neutrality. In this respect it is probably unrivalled, though it was not felt to be so strong in areas of 'foot-tapping' timing and rhythm; the pitch stability also suffered slightly if the player was subjected to the effects of footfalls or other similar subsonic disturbances.

CONCLUSION

Finely engineered, this heavyweight turntable did well on test, offering an alternative foundation for many tonearms and providing a distinctive standard with respect to bass extension and power. It did, however, prefer a firm support to maximise its speed stability. A further strength of this larger design was its ability to accept several tonearms which do not fit well on the smaller subchassis models such as the Linn.

TEST RESULTS

	Motor unit
Type	belt-drive, subchassis
Platter mass/damping	7.5kg/average
Finish and engineering	excellent/excellent
Type of mains connecting leads	remote transformer
Speed options	33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.13%
Wow and flutter (lin peak wtd 0.2-6Hz/6-300Hz)	0.23%/0.12%
Absolute speed error	−1.1%
Speed drift, 1 hour/load variation	0.01%/0.3%
Start-up time to audible stabilisation	7.5 secs
Rumble, DIN B wtd, L/R average	−77/−74dB
Size (w×d×h)/clearance for lid rear	50×40×15cm/4cm
Ease of use	very good
Typical acoustic breakthrough and resonances	excellent
Subjective sound quality of complete system	very good+
Hum level/acoustic feedback	negligible/low
Vibration sensitivity/shock resistance	very good/fair
Estimated typical purchase price	£800

First reviewed: 1985. Rating: Recommended.

SYSTEMDEK IV

SYSTEMDEK LTD, UNIT 34, KYLE ROAD, IRVINE INDUSTRIAL ESTATE, IRVINE, SCOTLAND KA12 8LD. TEL: (0294) 71251

Though some distinctive engineering features are unchanged, this new design in fact bears little resemblance to the earlier classic Systemdek *III*. It comprises a well-suspended belt-drive subchassis, using a set of hanging coil springs, like those of the budget *IIX* but uprated to cope with the higher platter mass. The concave platter surface of the *III* has been retained, together with an improved metal clamp, though the platter itself is now a composite type with the upper surface finished in a hard grade of vinyl to match the disc in contact with it. Two speeds are available, with electronic switching between them. The original spiral-groove oil-feed main bearing has been retained.

Platter mass is high at 4kg, and the construction affords very good disc damping, which promises a low-coloration sound. Arm fixing and lead dressing is straightforward and suspension is designed so that the deck can be easily levelled from above.

LAB REPORT

The product of an experienced manufacturer, this deck returned a highly respectable lab performance. Wow and flutter were very low, and well below audibility, this performance being complemented by fine torque with negligible slowing under load. Absolute speed was commendably accurate with imperceptible drift. Rumble was excellently low, dB figures ranging in the upper seventies, DIN B weighted.

The disc impulse was also excellently damped, though with a hint of a low-frequency subchassis/platter oscillation mode. The new record clamp and platter system was most effective, and both acoustic and mechanical vibration breakthrough were very well controlled.

SOUND QUALITY

This model sounded lively and dynamic, with an excellent transient quality in the mid and treble registers. In tonal balance, the midrange was 'lean' and open while both mid and treble were crisp and clear, with fine detail and stereo focus. The bass exhibited good extension, but with a slight softening of impact and rhythm. On a firm support it proved nicely stable, but was less happy on floor tables where some low frequency shock or vibration might be present in the building.

CONCLUSION

This is a well-engineered upmarket turntable, with good facilities and performance for the money. The clarity and definition in the midrange and treble were outstanding, and it showed little weakness in other directions. True, the rotational chassis mode could have been set to a lower frequency to improve the shock performance, but under most conditions, this will prove fairly unimportant. The Systemdek *IV Electronic* can be recommended.

TEST RESULTS

Motor unit	
Type	belt-drive, electronic
Platter mass/damping	4.0kg/good
Finish and engineering	very good/very good
Type of mains connecting leads	3 core
Speed options	33/45rpm
Wow and flutter (DIN peak wtd sigma 2)	0.08%
Wow and flutter (LIN peak wtd 0.2-6Hz/6-300Hz)	0.10%/0.10%
Absolute speed error	0.03%
Speed drift, 1 hour/load variation	negligible/−0.1%
Start-up time to audible stabilisation	4.5 secs
Rumble, DIN B wtd, L/R average	−78/−75dB
Size (w×d×h)/clearance for lid rear	48×39×15.5cm/4cm
Ease of use	very good
Typical acoustic breakthrough and resonances	excellent
Subjective sound quality of complete system	very good
Hum level/acoustic feedback	low/very good
Vibration sensitivity/shock resistance	very good/fair
Estimated typical purchase price	£449

First reviewed: 1985. Rating: Recommended.

THORENS TD320 SERIES

CAMBRASOUND LTD, BRITANNIA ROAD, WALTHAM CROSS, HERTS EN8 7EF. TEL: (0992) 716666

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

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

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

LAB REPORT

The clutch provided a judder-free start up at a slow 8.7 seconds. Rumble was very low at −76dB with no supply harmonics visible on the spectogram. The new flat mat offered quite good platter damping with a good termination of disc impulse energy.

The suspension offered very good levels of vibration isolation while acoustic energy was also well rejected. No particular emphases were detected in the frequency range.

Wow and flutter was very low at 0.06% DIN peak, sigma 2 weighted. The discrete figures for wow and flutter were well balanced, while speed accuracy was good, and slowing under load was mild at 0.25%. This player also provided quite good resistance to shock though the chassis proved to be a trifle 'whippy' in the rotational mode.

SOUND QUALITY

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

TD316

THORENS TD316

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

Features include an electronic motor control with convenient two speed switching on the plinth plus the comparative luxury of a plinth-mounted cue control which allows jiggle-free operation despite the suspended subchassis.

The arm has been improved by replacing the old headshell with a new cast metal design, offering a sensible cartridge fitting and a firm locking collar. Bias compensation is by the thread and weight system with down-force set by a calibrated dial and rotating counterweight.

SOUND QUALITY

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

CONCLUSION

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

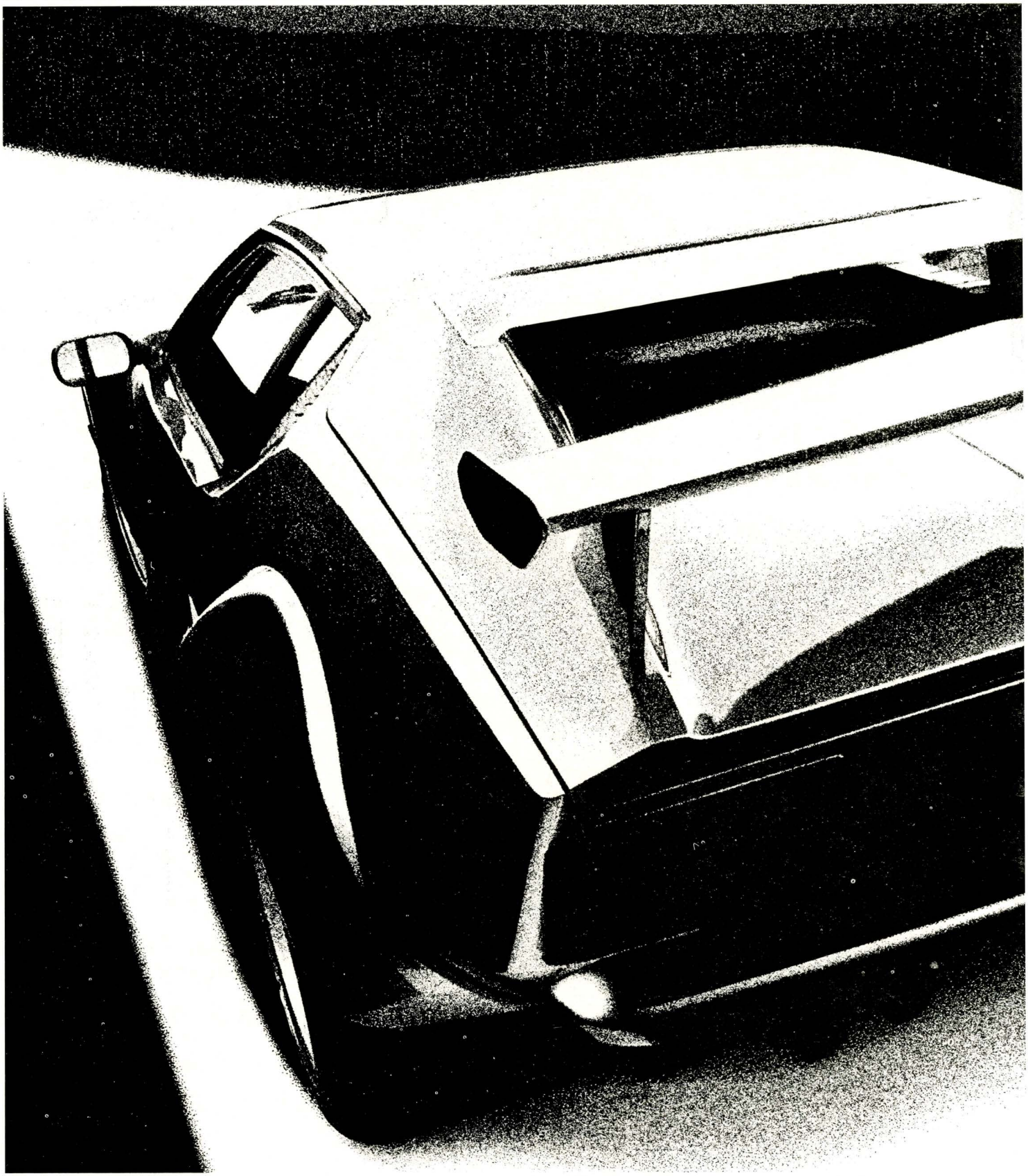
In a slightly higher price bracket, the *320* series improve on the traditional strengths of the *TD160* and offers a welcome advance in engineering, performance and finish. Fully competitive in their price category, this range of models is firmly recommended.

TEST RESULTS

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

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

First reviewed: 1985; for full lab report on TD316, see issue 43.



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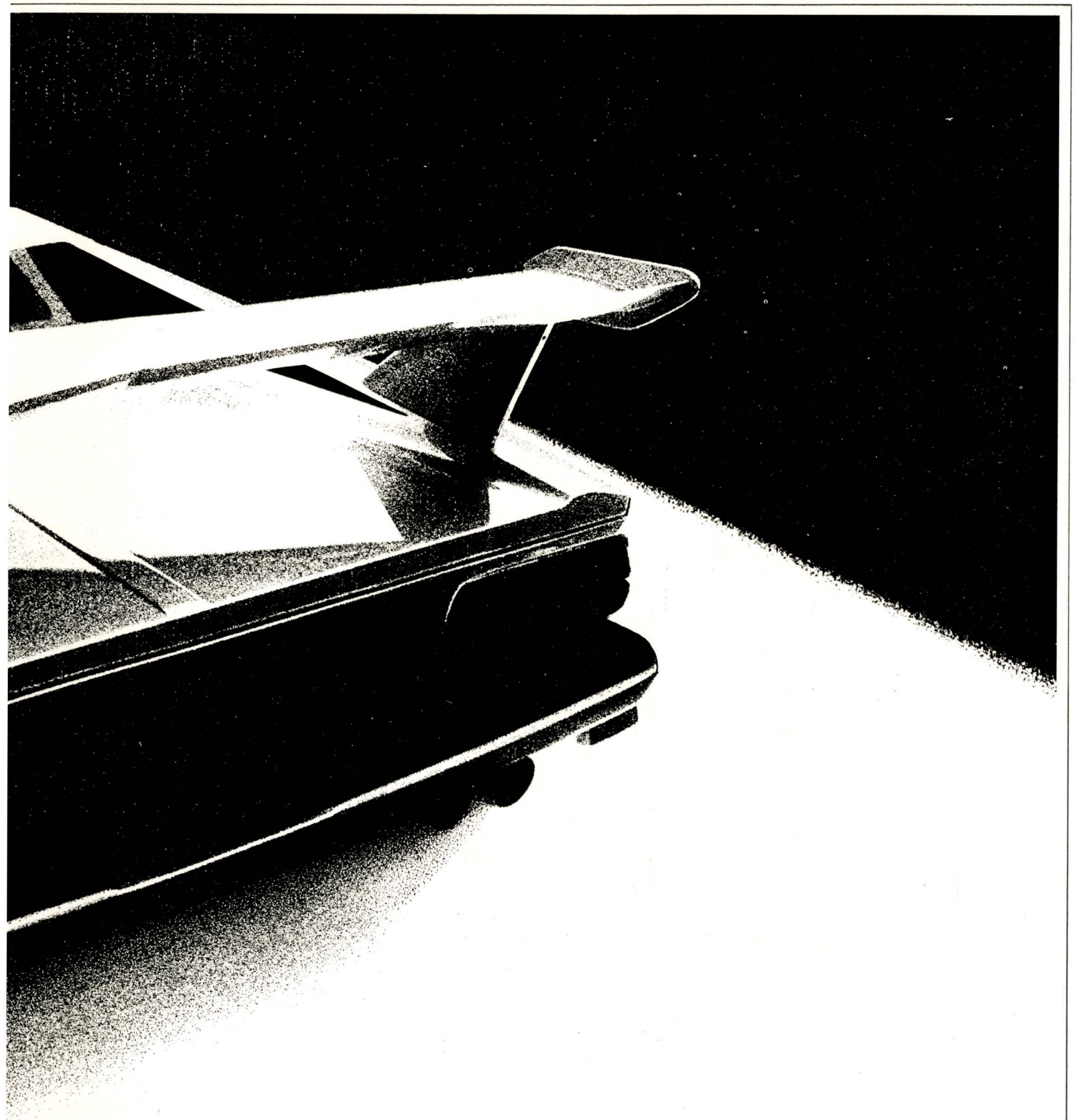

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ALPHASON HR100S

ALPHASON, 190-192 WIGAN ROAD, EUXTON, NEAR CHORLEY, LANCS PR7 6JW. TEL: (02572) 76626

ALPHASON XENON: OPAL HAS A STRAIGHT ARM TUBE

Alphason have now extended their range to include less expensive *Xenon, Delta* and *Opal* models, while their first model, the *HR100S*, is available optionally with van den Hul 'monocrystal' wiring throughout, as the *HR100S MCS*.

A medium mass arm possessing high rigidity, the *HR100's* main feature is the use of a substantial titanium beam tube with classic 'S' shape geometry. This has allowed a straight join to the headshell, itself ingeniously formed from the front end of the tube; a transition accomplished with minimal impairment to good interfacing of cartridge and arm. A considerable proportion of the beam upper surface continues down to the 'shell' or cartridge mounting platform.

The concentric gimbal bearings are built of hardened tool steel for maximum strength and the pivots have bearing surfaces using ultra-hard carbon inserts, offering high rigidity with reduced friction levels.

Considerable care has been taken to maximise rigidity as well as to minimise resonances in the design by suitable choices of materials and structure, the resulting performance reflecting the mechanical engineering expertise of the designer. Appearance and finish are to a very good standard, and the arm is supplied with a Linn *Ittok/Basik*-compatible mounting.

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

LAB REPORT

Effective mass was in the low to medium range at 10g inclusive of steel fixing bolts, and the structure was highly 'dead' as well as most rigid, with zero bearing play. The geometry was excellent, with very good finish and fine engineering. With the larger bias weight on the centre notch the compensation was fine for a 2g downforce as well as being in the right ratio, while friction was very low. The cue worked well though the arm lock was rather stiff — I would prefer a separate pillar rest. Resonant behaviour was very good, indicating a low-coloration design.

SOUND QUALITY

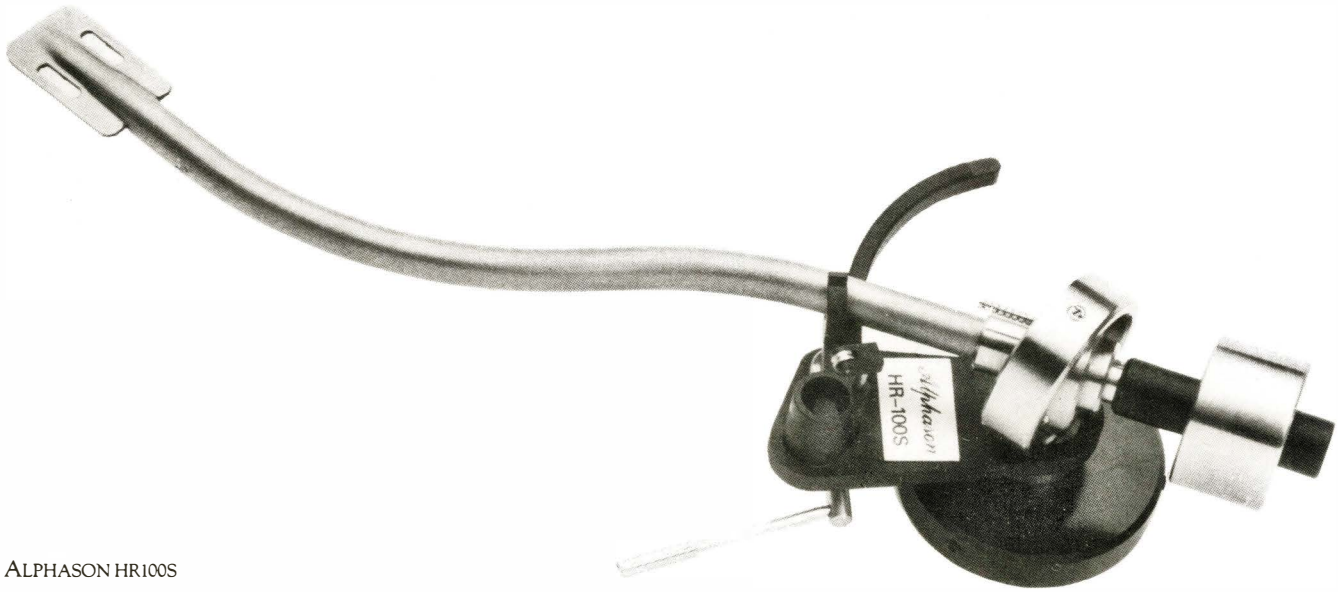
The *HR100S* impressed us strongly by its neutral and tonally balanced performance. Treble was detailed and precisely located and yet free of 'edge' or 'grain'. The mid-range gave excellent rendition of vocal lines while bass was firm, extended and detailed. Stereo was exceptional with precise positioning and fine depth and ambience, and despite an apparent 'smoothness', transients were nevertheless reproduced with fine 'attack'.

ALPHASON XENON

Selling at just under £200 this is the most expensive of Alphason's new tonearms and fills a gap in the market between the budget examples and the higher class £300 group such as the *HR100S* and the Linn *Ittok*.

The *Xenon* owes much to the well established *HR100S* and indeed uses the same good-sounding 'S' shaped one-piece arm/shell unit.

Some savings have been made as regards details of the cue mechanism and bias compensator, as well as the exterior finish of the bearing assembly, but these have not significantly prejudiced the performance.



ALPHASON HR100S

The more expensive model's concentric bearing gimbal design is retained and is well aligned, offering negligible play plus very low levels of friction and stiction.

On audition, it proved hard at first to separate this model from the well-rated *HR100S*. The *Xenon* showed a solid overall control with a firm sense of image focus over a wide frequency range. The treble was clear and finely detailed, the mid of undoubtedly low coloration, with minimal 'clang' or hardness. Bass was free from boom or emphasis. Open and clean sounding, stereo depth was also respectably portrayed.

ALPHASON OPAL

Comfortably under £100, the *Opal* nonetheless manages to maintain Alphason's high standards for solid engineering and low friction, with bearings free from play or looseness. it may be fitted via a single hole in an arm board, but compatibility with the popular *Ittok* mounting is provided via a special base, which is again clamped by a single large nut.

This is a straight fixed head arm, whose strong main beam is fitted with a properly clamped counterweight and supported on a concentric gimbal bearing. Thread and weight bias correction is provided. Appropriate calibrations are given for bias and downforce, and the arm falls into the medium-mass category; when typically balanced with appropriate mounting hardware an effective mass figure of 10g was recorded.

The *Opal* gave a good account of itself on audition, happily meeting rated £100 tonearms in their own territory. In tonal balance it appeared lightweight and 'airy' with some 'zinginess' in the high treble — less well suited to moving-coils in this respect.

The bass was dry and firm, while mid focus and stereo depth were both pretty good. A particular attribute was the smooth uncoloured midrange, this an Alphason hallmark.

CONCLUSION

With Alphason's high standard of engineering, a basically good finish and a fine lab and sonic performance, the *Xenon* comes strongly recommended. The price was very fair for this arm, an essentially well balanced model in all respects. The *Opal* has proved to be a well designed and constructed British tonearm, which at the price certainly deserves a 'Best Buy' rating.

Since our first review some time ago, the *HR100S* has been improved in respect of finish and tube damping. Re-auditioned for 1985-6, the standard arm showed improvements in high frequency control, while the MCS version gave worthwhile gains in clarity and definition throughout the range. Both versions can be recommended.

TEST RESULTS

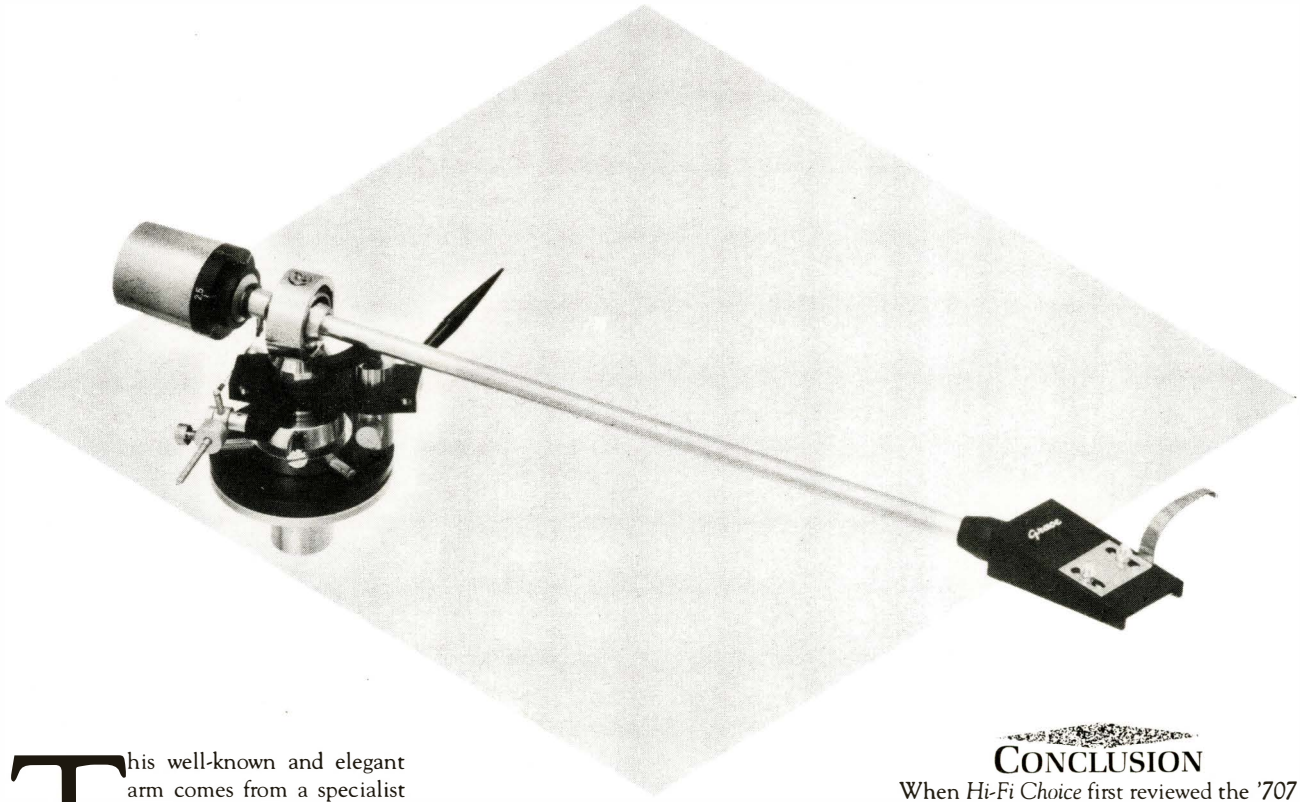
ALPHASON HR100S

	Tonearm
Approximate effective mass, inc screws, excl cartridge	10g
Type/mass of headshell	non-detachable
Geometric accuracy	excellent
Adjustments provided	overhang/offset/height
Finish and engineering	good/excellent
Ease of assembly/setting-up/use	verygood/good/good
Friction, typical lateral/vertical	10mg/20mg
Bias compensation method	thread, pulley and weight
Bias force, rim/centre (set to 1.5g elliptical)	180mg/150mg
Downforce calibration error, 1g/2g	—0.1g/—0.1g
Cue drift, 8mm ascent/descent	negligible, 0.5 sec/1.0 sec
Arm resonances	very good
Subjective sound quality	very good
Lead capacitance/damping method	95pF/none
Estimated typical purchase price	HR100S, £335; HR100S MCS, £385

First reviewed: *HR100S*, 1983 (retested, 1984, 1985); *Opal* and *Xenon*, 1985. Rating: Recommended. For full lab reports on *Opal* and *Xenon*, see issue 43.

GRACE G707

RUSS ANDREWS TURNTABLE ACCESSORIES, EDGE BANK HOUSE, SKELSMERGH, KENDAL, CUMBRIA LA8 9AS. TEL: (053 983) 247



This well-known and elegant arm comes from a specialist Japanese company. It is a rigid yet low mass design with a fixed plastic headshell (adjustable for tilt) and employs a straight chromed alloy tube with secure gimbal bearings free of play. Essentially little decoupling is provided on the rotating counter-weight assembly, while a pivoted weighted lever applies bias compensation via a thread.

The instructions supplied were rather poor, with minimal guidance on alignment, and we felt that only a relatively experienced user could be expected to set up the arm correctly using the information supplied. However, the distributor, who also handles the Supex cartridges, will be well qualified to help here.

LAB REPORT

Low friction values were recorded but the supplied bias system set to 1.5g gave values virtually double that required for normal elliptical styli (the arm was originally intended for discrete quadraphonic use, with Shibata styli! — Ed). However the ratio of rim-to-centre values was correct. Set up with a protractor, the geometrical accuracy was very good, with tilt, height and overhang provided. Cue operation was satisfactory and downforce calibration accurate. Effective mass was low at 6g and suitable for medium to high compliance cartridges, and extra weights may be necessary for low mass, low compliance models (otherwise moderate bass lift in the 20-40Hz region may occur.) A better than average characteristic was apparent from the arm resonance graph despite the anomalies in the 280-500Hz range and the related harmonic spike at 850Hz. Above this range the characteristic was commendably even with fair control and maintained energy to the 20kHz limit. A minor resonance appeared at 80Hz — too low for a bending mode and possibly due to the stiff counterweight elastic 'liner'.

SOUND QUALITY

In assessment for previous issues a 'very good' rating was established using either a *LP12* or an ATR deck. The bass register was considered tight, extended and powerful, with accurate placement while stereo was detailed with good depth and precision. The arm presented an interesting contrast to the *SME III*, which we felt to be on the rich side of neutrality, the *G707* conversely sounding slightly on the bright and coarse side of this balance.

CONCLUSION

When *Hi-Fi Choice* first reviewed the *'707* nearly a decade ago, it was supplied by Linn Products (at around £70!) and usually fitted to the *Sondek*. Now something of a classic, the *G707* remains worth considering. But more recent introductions have really made certain aspects of the design, such as the plastic headshell and slim arm tube, seem rather old fashioned. Improved designs from a number of other makers have reduced its competitiveness.

TEST RESULTS

Approximate effective mass, inc screws, excl cartridge	7g
Type of headshell	Fixed
Geometric accuracy	very good
Finish and engineering	very good
Ease of assembly/setting-up/use	very good/very good
Friction, typical lateral/vertical	20mg/15mg
Bias comp: type/force rim/centre (1.5g ell set)	weighted lever & thread 240mg/290mg
Cueing: drift/8mm ascent/8mm descent	satisfactory/2secs/2.5secs
Downforce calibration error, 1g/2g	−0.025g/−0.05g
Arm resonances	above average
Subjective sound quality	very good
Motor recommended	TD160, LP12 etc.
Amount of damping	none
Estimated typical purchase price	£221

First reviewed: 1977 (retested and reassessed in subsequent editions). Rating: Worth Considering.

HELIUS ORION 2

HELIUS DESIGNS, THE WHITE HOUSE, ALDINGTON, EVESHAM, WORCS WR11 5UB. TEL: (0386) 830083

Since the introduction of their first arm, Helius have continued development of their advanced Orion model, taking some of their concepts to a further level of refinement. The result is the now well established *Orion 2*.

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

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

The main arm beam, in alloy tube, has an extended larger diameter first section to distribute vibrational modes. At the front the standard Helius right-angled alloy cartridge platform is fitted.

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

LAB REPORT

Effective mass was estimated at 11g, and the arm is therefore classed as medium. Helius stress the concept of differential masses, giving an effective mass of 8g in the vertical plane and 12g laterally. They state that the arm will accept cartridges from 5-40cu compliance: in other words almost any modern design.

Geometric accuracy was excellent, the slotted headshell providing ready adjustment of offset angle and overhang. Although no slack whatsoever was detectable in the bearings, the friction levels in both planes were exemplary.

Set to 'minimum' the bias was found to be appropriate for a 1.5g downforce, and little extra will be required for the usual 1.8-2.0g downforce moving-coil cartridge.

Resonant behaviour was well ordered, showing a highly-favourable energy trend. It did however demonstrate some resonances, with that at 200Hz probably a bearing/counter counterweight mode, and that at 800Hz the main tube — a worthwhile high value. Low in capacitance, the leads were usefully flexible and carried good quality plugs.

SOUND QUALITY

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

CONCLUSION

With the current series the fine sound quality is maintained. The arm is excellently engineered with rigid bearings, free from slack. It remains very expensive but its performance wins it recommendation.

TEST RESULTS

Approximate effective mass, inc screws, excl cartridge	12g
Type/mass of headshell	non-detachable
Geometric accuracy	excellent
Adjustments provided	height/overhang/offset
Finish and engineering	excellent/excellent
Ease of assembly/setting-up/use	very good/good/average
Friction, typical lateral/vertical	<20mg/<20mg
Bias compensation method	uncalibrated thread and lever
Bias force, rim/centre (set to 1.5g elliptical)	175mg/225mg
Downforce calibration error, 1g/2g	uncalibrated
Cue drift, 8mm ascent/descent	0.75secs/10secs
Arm resonances	good
Subjective sound quality	very good
Arm damping	none
Estimated typical purchase price	£435

First reviewed: 1983 (retested 1984). Rating: Recommended.

LINN ITTOK LVII

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

When first released, the *LVII* immediately established an enviable reputation for excellent engineering, sound quality and technical performance. The current version still resembles the original arm, despite some minor constructional changes which have helped maintain a competitive state of 'tune'.

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

At close on a 14g effective mass including hardware, the design fits the upper end of the medium-mass group and is best suited to cartridges in the 8-16cu compliance range. Providing a strong foundation for cartridge mounting, the cast magnesium headshell carries a very well designed and non-resonant finger lift.

This arm proved convenient to use, the effective cueing system controlled by a lengthened finger lever fitted with a roller at the top. This aids cueing on floppy subchassis turntables and reduces unwanted spurious shock effects post cueing. In marked contrast to the majority of upmarket audiophile designs, the *Ittok* comes fitted with a well calibrated and respectably accurate dials for both downforce and bias, the latter adjustable during play. A precision low-torque flat coil spring is used for downforce, with a linear coil spring for bias correction.

LAB REPORT

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

As has been noted previously, the close nature of the coupling between arm and mounting board meant that the latter becomes influential as regards final sound quality.

SOUND QUALITY

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

CONCLUSION

A top-quality universal tonearm, recent minor improvements in fixings, counterweight tightness and form, plus a revised cable with superior fittings have all helped it to maintain a highly competitive position. Suitable for many turntables, it performs at its best on the current *LP12*, where the performance of the combination exceeds the sum of the parts.

This superbly engineered and finished arm remains strongly recommended. Experiments with alternative cables may prove rewarding but beware of upsetting the suspension dynamics of the *LP12*.

TEST RESULTS

Tonearm	
Approximate effective mass, inc screws, excl cartridge	est. 13.5g
Type/mass of headshell	non-detachable
Geometric accuracy	excellent
Adjustments provided	height/overhang/lateral angle
Finish and engineering	excellent/excellent
Ease of assembly/setting-up/use	very good/v.good/v.good
Friction, typical lateral/vertical	less than 10mg/less than 10mg
Bias compensation method	internal spring
Bias force, rim/centre (set to 1.5g elliptical)	175mg/195mg
Downforce calibration error, 1g/2g	less than 0.03g/0.038g
Cue drift, 8mm ascent/descent	negligible, 0.8 secs/1.8 secs
Arm resonances	very good
Subjective sound quality	very good
Lead capacitance/damping method	100 pF/none
Estimated typical purchase price	silver, £348; black £399

First reviewed: 1980 (retested for all subsequent editions). Rating: Recommended.

REGA RB300

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

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

The design is based on a very rigid one-piece arm beam/headshell, which unusually is constructed from a hollow aluminium casting. No joins are present between cartridge platform and pivot. The bearings themselves are highly pre-loaded and yet mounted to such a high tolerance that friction is negligible while play is physically undetectable.

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

The bearing gimbal is itself a substantial casting and Roy has abandoned the usual adjustable vertical pillar design, regarding this a structural weakness. His alternative is a threaded stem and large locknut; vertical height adjustment is only possible using various washers, this assuming that the arm/cartridge combination will in any case fit the chosen turntable. For example the arm was a mite too high for an EMT (ven den Hul) cartridge, though fine for an *Asak*, when mounted on a Linn deck; on the Lux *300*, the height was right for the EMT.

LAB REPORT

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

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

SOUND QUALITY

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

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

CONCLUSION

The *RB300* is an excellent product, of which Roy Gandy can be justly proud. Despite its modest price it sets new standards in performance. Its benefits were clearly apparent in the *Planar 3*, but it is suitable for a number of high quality turntables. A 'Best Buy' rating is clearly appropriate.

TEST RESULTS

Approximate effective mass, inc screws, excl cartridge	10-11g
Type/mass of headshell	non-detachable/—
Geometric accuracy	very good
Adjustments provided	overhang/offset
Finish and engineering	very good/excellent
Ease of assembly/setting-up/use	very good/excellent/very good
Friction, typical lateral/vertical	15mg/15mg
Bias compensation method	magnetic
Bias force, rim/centre (set to 1.5g elliptical)	340mg/330mg
Downforce calibration error, 1g/2g	−+0.05g/+0.03g
Cue drift, 8mm ascent/descent	negligible, 0.5 secs/3 secs
Arm resonances	good
Subjective sound quality	very good
Arm damping	none
Estimated typical purchase price	£90

First reviewed: 1984. Rating: Best Buy.

SME SERIES V

SME LTD, STEYNING, SUSSEX BN4 3GY. TEL: (0903) 814321

After several fallow years, SME have come up with a radically new state-of-the-art tonearm. During 1985, we were able to review the only example then in existence, a pre-production prototype, and it is on these tests that the following report is based. Subsequent experience has confirmed that this prototype was indeed representative of production models.

It should be noted that the prototype had already travelled to exhibitions all over the world, but despite this it arrived in fine condition bar the lateral bearing friction which was on the high side; in production, figures of less than 40mg are anticipated for this parameter. Fortunately the friction level was not so high as to disturb the tracking of the test cartridge at 1.7-2g downforce.

At the phenomenal price of £1138, this arm's design technology, engineering finish and sound quality are all directed towards justifying that cost. Previous SME designs employed a gravity loaded knife edge for the vertical plane bearing, but the 'V uses firmly preloaded, high force stainless steel ball race bearings of the highest quality, offering zero detectable play or slack when properly assembled.

The main beam or tube, in thinwall cast magnesium, is a complex one-piece structure including the shell/cartridge platform, the massive beam, the yoke bearing assembly and the rear section slide for the counterweight. The beam is heavily tapered both externally and in terms of its wall thickness. No joins are present from end to end though it must be said that the low-effective mass, high density tungsten counterweight block is joined via a cam lock system. Fine control of zero balance is via a thumbscrew, while downforce and bias correction is set by calibrated dials *a la* Linn *Ittok*.

While the mounting hardware is compatible with existing SME arms — the familiar oval hole with the four point fixing — the 'V has a highly rigid vice-like clamp system which nevertheless includes the familiar rack for easy adjustment of overhang and offset geometry. Height adjustment is facilitated by a detachable control, which may be temporarily operated during play for fine tuning. Vertical tilt cannot be adjusted except perhaps by special wedge shims at the headshell.

The cable is a special van den Hul type, connected via a Japanese style 5 pin plug while the arm socket is a right angle type, with a viscous-damped free rotation, allowing the cable to take up a natural 'set' for alignment in subchassis turntables; in the current Linn player, the plinth reinforcement comes dangerously close to fouling this socketry, and will probably need cautious shaving away. SME's internal arm wiring is specially selected for optimum sound quality. Construction and finish was quite excellent — it felt and operated like a Leica.

Concerning cartridge compatbility, the arm has a moderate effective mass and is suited to medium compliance cartridges in the 8-30cu range; the top limit is higher than expected because of the arm's damping feature. A calibrated damper engages in a horizontally acting silicone fluid trough. A wide range of damping is possible, with the suggestion that it be used with extreme moderation. As such it can pacify the arm cartridge resonance, particularly with the higher compliance examples, and so stabilise tracking.

In the interests of low resonance, no finger lift is provided on the headshell, which has a milled undersurface for a good cartridge fit.

LAB REPORT

On test this arm was found to be well calibrated with satisfactorily accurate downforce, as well as sensible levels of bias correction, the latter achieved without friction.

Effective mass depends to some degree on the mass of cartridge counter-balanced as well as the selected hardware, typically

measuring 12g including fixings. With various fluid choices available from SME, any required damping can be achieved.

Analysis of the arm resonance behaviour was complicated by the necessary use of a new test cartridge. Impulse analysis showed a well damped main arm mode to lie at a high 1.6kHz, but the combination of rigidity and damping made it hard to identify on a conventional graph. In comparative terms, this suggests a notably clean behaviour with this cartridge.

Sound Quality

Perhaps in confirmation of its aspiration to set a new reference standard, this arm has the ability, once heard, to show just how coloured and tonally unbalanced many other arms are.

The arm appears to have very little of its own false emphasis and, subjectively, it unleashes the black disc in a surprising manner. Several aspects caught our attention — for example, stage width is notably increased, yet central focusing is more precise over a wide frequency range. Tonally even, it allows previously 'difficult' musical passages such as certain female vocal tracks, to soar through the frequency range without any hindrance or any suspicion of a 'forced' quality. Stage depth is remarkably good, with harmonic perspectives convincingly maintained in free space. Fine detail was excellently resolved, indeed certain detail was heard for the first time on many records. The bass was agreeably firm and extended, lacking any particular emphasis, while the treble was sweet and airy, slightly rich tonally compared with other arms.

Conclusion

Clearly, the *Series V* is an excellent tonearm in terms of design, engineering, build, and sound quality. While the high price constrains considerations of value, it can be argued that this arm does just what it set out to do, namely establish a new reference standard regardless of price. In our view the 'V has a good chance of re-establishing the old SME slogan, 'The Best Pickup Arm in the World' and must be recommended.

Test Results

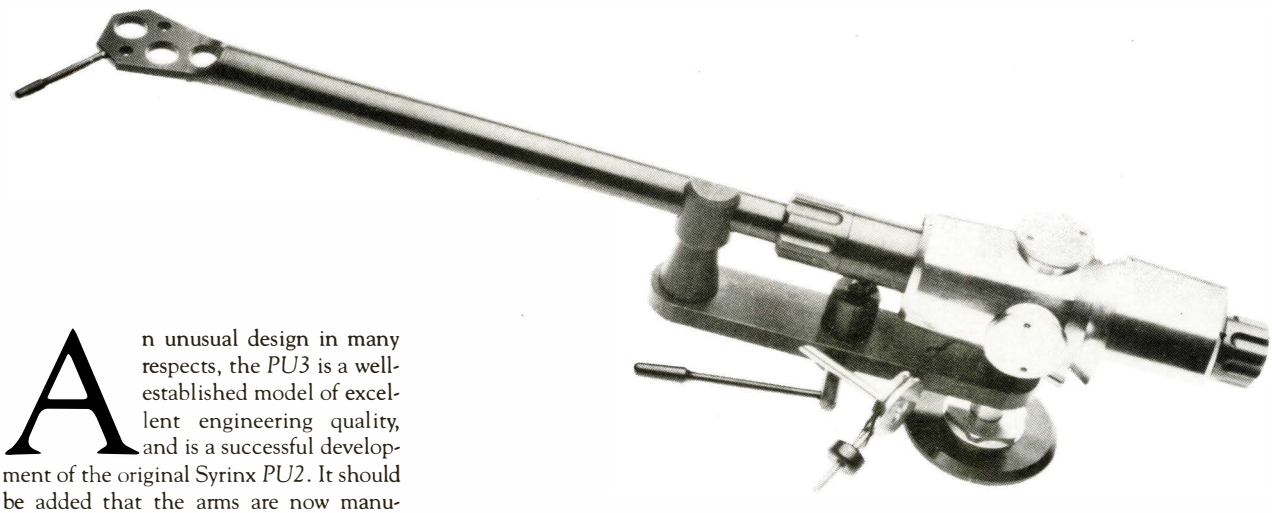
Tonearm	
Approximate effective mass, inc screws, excl cartridge	10.5g
Type/mass of headshell	fixed
Geometric accuracy	excellent
Adjustments provided	height/overhang/offset/damping
Finish and engineering	excellent/excellent
Ease of assembly/setting-up/use	very good/good/very good
Friction, typical lateral/vertical	100mg*/30mg
Bias compensation method	internal spring
Bias force, rim/centre (set to 1.5g elliptical)	150mg/210mg
Downforce calibration error, 1g/2g	+0.02g/−0.07g
Cue drift, 8mm ascent/descent	negligible, 1.5secs/3secs
Arm resonances	very good
Subjective sound quality	excellent
Arm damping	special structure; adjustable viscous damping
Estimated typical purchase price	£1138

**Over-torqued assembly on prototype; correct setting gives typically 30mg.*

First reviewed: 1985. Rating: Recommended.

SYRINX PU3

SYRINX AUDIO LTD, ROYSTON HOUSE, CAROLINE PARK, GRANTON, ENDINBURGH EH5 1QJ. TEL: 031-551 2404



An unusual design in many respects, the *PU3* is a well-established model of excellent engineering quality, and is a successful development of the original Syrinx *PU2*. It should be added that the arms are now manufactured under new management, so our review samples do not strictly represent current production.

The *PU3*'s massive main beam may be rotated on a threaded fixing of very fine pitch. As the designer has explained, the finer the pitch the greater the locking forces which may be obtained via the centre rotating sleeve. After adjustment, the *PU3* can certainly be set very firmly. A sensible cartridge platform is fitted, well reinforced and firmly bonded to the tube.

A massive gimbal bearing assembly is employed, with large precision ball races designed to accept a substantial pre-load. The pre-load assures a freedom from play with effective coupling from cartridge to mounting base. Best described as cigar shaped, the main beam is profiled to provide a defined resonance pattern chosen for optimum sound.

The polished counterweight moves on the threaded rear stem, and is locked in position by a contra-rotated inner sleeve.

A relatively large alloy plate forms the gantry for the arm rest and cue mechanism, but this was suspected of introducing a minor resonance in the 1kHz region. However, experiment showed that a small wood wedge between the extreme end of the gantry and the arm mounting board (where this is possible) could minimise this resonance effect.

Arm height is adjustable by means of a locknut on the threaded pillar, not as convenient as the side locking methods used by most arms. Neither downforce nor bias levels were calibrated.

LAB REPORT

Effective mass was found to be around 11g, including fixing hardware, this suited to a broad range of high quality modern cartridges from the Linn to the Koestsus. The geometric accuracy was high, and all the related adjustments were correct. The bearings were devoid of play at the expense of some friction, typically 70mg in both planes for our recent sample, and considered to be satisfactory.

Charted with an Osawa *60L* moving-coil cartridge, the structural arm resonance graph presented an interesting picture. Minor counterweight modes were present from 200-400Hz, with the main resonance appearing at a high 1kHz, indicating fine main beam rigidity. The break in energy trend was fairly strong at 1kHz, but above this range the arm was notably well behaved. The main 1kHz resonance could however prove interesting in the context of the listening tests.

SOUND QUALITY

On audition, the sound was characterised by a light-textured, delicately open quality with a sweet detailed treble capable of bringing out the best from the line-contact type cartridges. The mid was slightly 'nasal', but no more so than several competitors, though in our view this area did not benefit from the Pink Triangle and its alloy plate tonearm mounting. Perhaps a wooden board would provide a superior termination! Tracking stability was notably superior, if marginally behind that of the Zeta for example.

CONCLUSION

Syrinx have maintained a fully competitive standard with their *PU3 Ipsissima*. In the right turntable — the *Sondek* is one example — the *PU3* can provide a first-rate sound quality, with the finish and most technical aspects of commensurate quality. Taken overall, the *PU3* qualifies for recommendation.

TEST RESULTS

Approximate effective mass, inc screws, excl cartridge	11.0g
Type/mass of headshell	non-detachable/—
Geometric accuracy	excellent
Adjustments provided	tilt/height/overhang/offset
Finish and engineering	excellent
Ease of assembly/setting-up/use	good/good/average
Friction, typical lateral/vertical	70mg/70mg
Bias compensation method	thread and lever
Bias force, rim/centre (set to 1.5g elliptical)	uncalibrated
Downforce calibration error, 1g/2g	uncalibrated
Cue drift, 8mm ascent/descent	very good, 0.5secs/2.0secs
Arm resonances	average
Subjective sound quality	very good
Arm damping	none
Estimated typical purchase price	£290

First reviewed: 1984. Rating: Recommended.

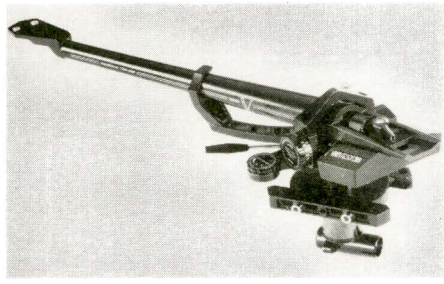
SYCHRO DEK, YAMAHA, MISSION, NAKAMICHI, SOURCE, ZETA, KOETSU, BRIAR, LYNX, MEDUSA, JECKLIN

AUDIOLAB, A+R CAMBRIDGE, AUDIO RESEARCH, BEARD, DENON, DECCA, CONRAD JOHNSON, INFINITY, SUGDEN ROGERS, J.B.L., TEAC, DUAL, ARISTON,

FOAT, HARMON KARDON, MERIDIAN, CYRUS, QUAD, MAGNUM, PROAC, TANNOY, KRELL, MACPAN, QED, ALPHASON, QLN, GRODEK, THATS TAPE,

CONCORDANT, VAN DEN HULL, WHARFEDALE, AUDIO TECHNICA, P.S. AUDIO, SME, NUANCE, MONITOR AUDIO.

The Music Room



Well, here we are once more, with lots of news that we feel to be of great interest to the discerning Audiophile, whether North or South of the border!

We have recently been appointed agents for the incredible Elite rock turntable, which we feel must represent the finest value for money analogue front end available. The Rock is priced at £299 without arm, and can be bought from around £390 inclusive of arm and cartridge.

On the amplification front we have recently re-discovered a very fine range of Yorkshire bred electronics from Sugden. They have a superb little amp in the A25 which must be heard to be believed. An audition is mandatory against any other amp in the sub £200 league. This company also produce a magnificent Pre and Power combination in the C128, P128, which offers 160 watts per channel into 8 ohms, with superb sound quality, it costs, a mere £930 inc. vat.

The Music Room, Manchester are now proud to be Harman Kardon centre. This range of amplifiers, tuners and cassette decks offer most of the facilities anyone would normally need or use. Should you happen to be looking for JBL loudspeakers then you will be relieved to know that we also have the entire Ti range from the 18Ti, to the magnificent 250Ti. So you want a cracking system that is affordable?

Recent visitors to the shop have been stunned by one of our 'Reference' systems, which comprises of Michel Gyrodec, Zeta tonearm and Decca gold cartridge, linked to the AudioLab 8000 C & P (pre & power combo). Air was being moved by the Infinity RSIVB. This is the one system that must be heard by all, in search of true Hi-Fi at just under £3000.

Other new additions to the Music Room range of products come from the superlative Lynx Audio and ethereal sounding Goldbug cartridges. This could be the basis for the illusive system you have been searching for.

Of course, not everyone can afford or, even wants to afford a system like this, so we at the Music Room also cater for all serious Audio-philes who are on a budget.

An excellent starter system comes in the form of the RD 50 from Ariston (a turntable to be reckoned with), the Sugden A28 class A integrated amp coupled with the rogers LS2 or Monitor Audio R252 which we feel both offer excellent value for money. Both these speakers use real wood veneer and are exquisitely finished at around £150 per pair. This system complete with stands comes to around £570, with our free 2 year guarantee.

Almost drawing this newsletter to a close, The Music Room Manchester are proud indeed, to present one of the ultimate music reproduction systems available. It comes in the form of the Audiolabor turntable with SME series V tonearm or the Well Tempered Arm coupled to cartridges from the A.J. Van den Hul. Amplification is from exquisite valve technologists Conrad Johnson driving the amazing Infinity RSIIB's. This is one system, at around £35,000. It may be expensive but we would like every audiophile in the land to hear just what can come from the grooves in a piece of vinyl!

Finally we'd like to mention to all enthusiasts in search of a Digital system that we stock C.D. players from Yamaha, Denon, Philips, Mission and Meridian.

Look forward to seeing you at our Manchester or Glasgow shops.

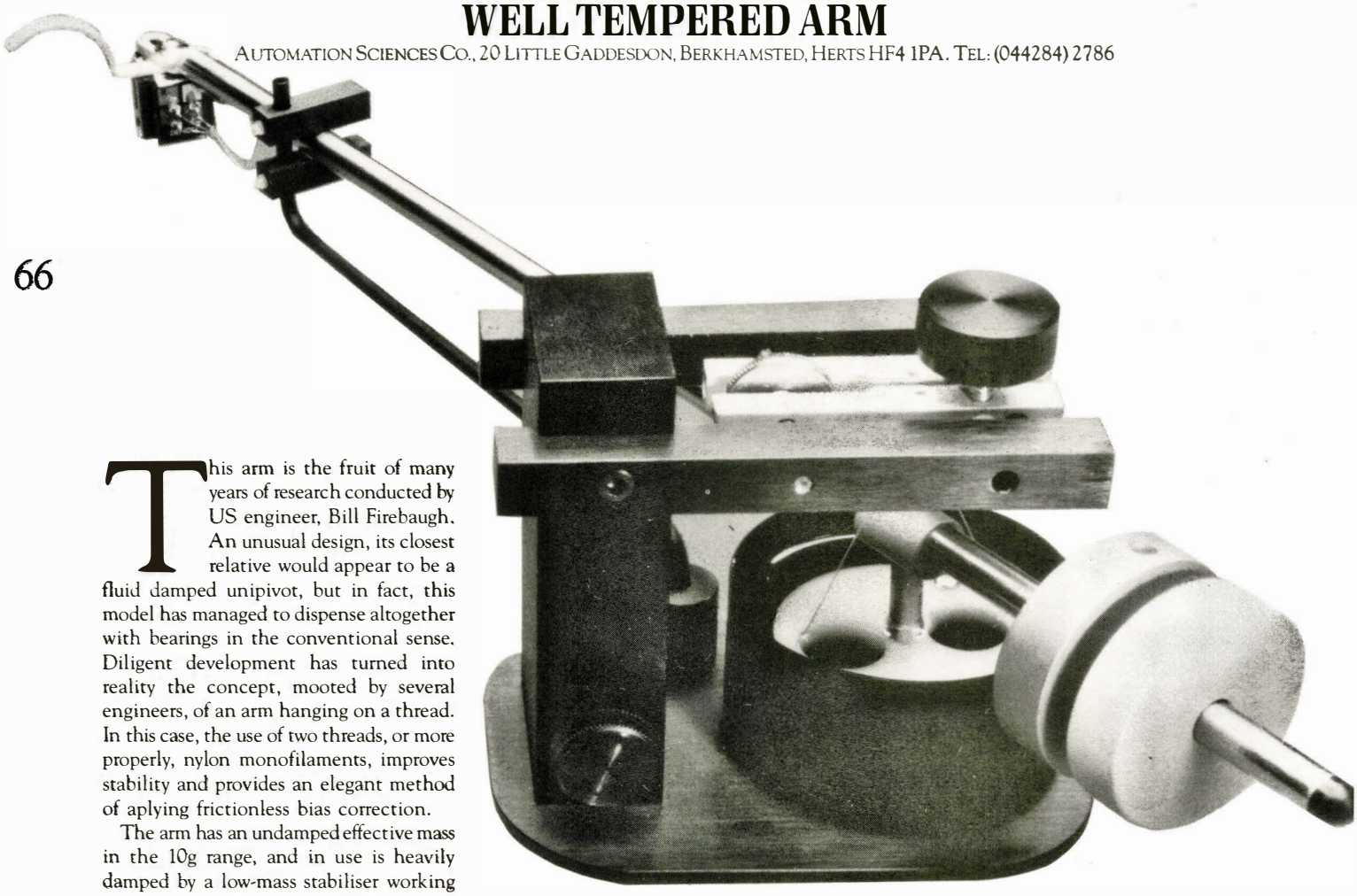
The Music Room
50 Bridge Street
Manchester M3
061-835 1366
Tues-Sat 10am-6pm
Evenings by appointment

The Music Room
221 St Vincent Street
Glasgow G2
041-248 7221
Mon-Sat 10am-6pm
Thursdays 'til 8pm

BADA MEMBER ACCESS, VISA, AMERICAN EXPRESS INSTANT CREDIT

WELL TEMPERED ARM

AUTOMATION SCIENCES CO., 20 LITTLE GADDESDON, BERKHAMSTED, HERTS HF4 1PA. TEL: (044284) 2786



This arm is the fruit of many years of research conducted by US engineer, Bill Firebaugh. An unusual design, its closest relative would appear to be a fluid damped unipivot, but in fact, this model has managed to dispense altogether with bearings in the conventional sense. Diligent development has turned into reality the concept, mooted by several engineers, of an arm hanging on a thread. In this case, the use of two threads, or more properly, nylon monofilaments, improves stability and provides an elegant method of aplying frictionless bias correction.

The arm has an undamped effective mass in the 10g range, and in use is heavily damped by a low-mass stabiliser working in a well of viscous silicone fluid, which, in a real sense, is the foundation for the arm. The subsonic arm/cartridge resonance is heavily damped, as are structural resonances in the arm taken as a whole, with the end result that the arm is singularly non-resonant.

It should be noted that the assembly is rather high and will not fit with most turntables with their lids in position; but for some models, modified lids may be available from the importer.

LAB REPORT

Arm resonances were well controlled, free from sharp breakups. In energy terms, some mid dominance was apparent but this was broad and thus of little consequence.

Bias correction is applied by moving the relative positions of the two suspension threads to impart a slight twisting force to the arm. Adjustment is by a small thumb-wheel, and when set at minimum, the measured bias correction value was appropriate for a typical cartridge of 1.5g tracking force. Rotated by one turn, 'anti-skating' of some 500mg or so was provided, appropriate to downforce in the 2.5 to 3.0g range. Checks confirmed the negligible stiction in the suspension and the damper assembly, so in practice friction values can be regarded as very low for small, slow arm movements.

SOUND QUALITY

Properly set up, this arm gave a highly neutral, low-coloration sound — one which was balanced throughout the audio range. Compared with most arms, it sounded 'quieter' in a subtle way — restrained yet finely detailed and extremely well focused through bass mid and treble registers. Images were unusually stable without the oft-heard stylus 'fluttering' and uncertainty.

CONCLUSION

The high standard of sound quality shown here demands recommendation. Stable and relaxed, its overall performance 'grows' on the listener with prolonged use. Its average effective mass and high damping suits it to a wide variety of cartridges, ranging from the robust low compliance versions, to the more delicate moving-coils, and while its looks may be off putting and there are admittedly some mounting complications, the end results certainly justify the extra effort required.

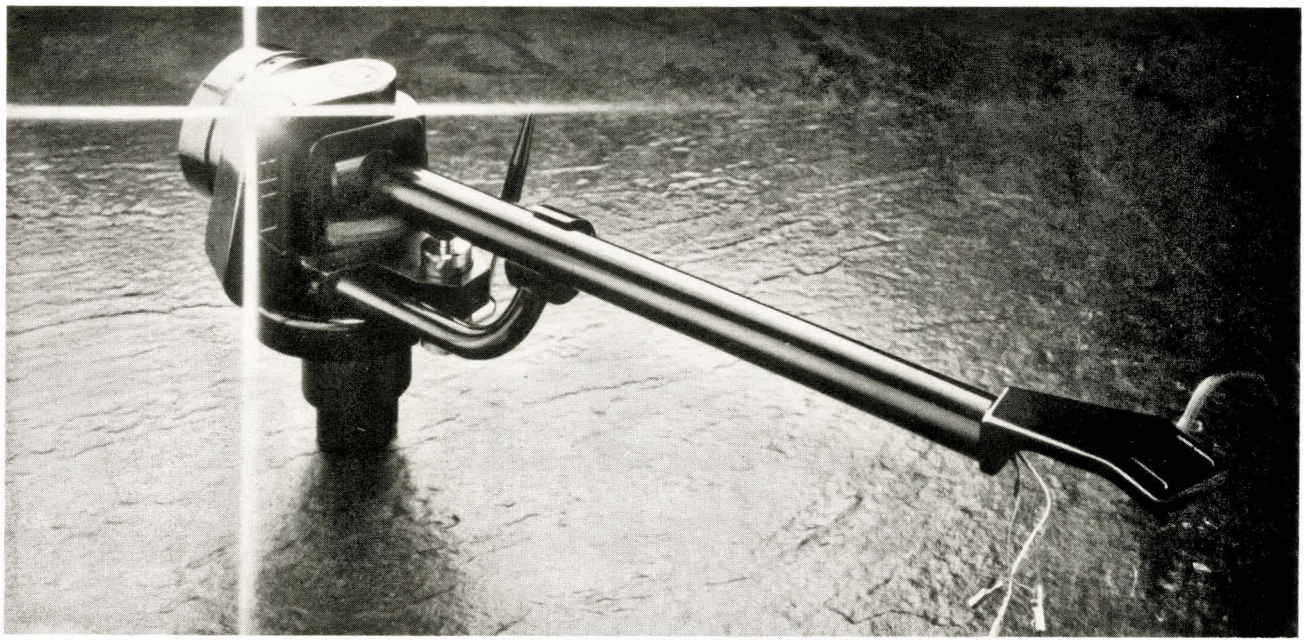
TEST RESULTS

Approximate effective mass, inc screws, excl cartridge	6.8g
Type/mass of headshell	fixed
Geometric accuracy	excellent
Adjustments provided	tilt, overhang, lateral
Finish and engineering	very good/very good
Ease of assembly/setting-up/use	difficult/average/average
Friction, typical lateral/vertical	none
Bias compensation method	twisted thread
Bias force, rim/centre (set to 1.5g elliptical)	225mg/500mg
Downforce calibration error, 1g/2g	uncalibrated
Cue drift, 8mm ascent/descent	no cueing device, poor drift/0.5secs (inherent damping)
Arm resonances	excellent
Subjective sound quality	very good
Arm damping	very heavy damping
Estimated typical purchase price	£515

First reviewed: 1985. Rating: Recommended.

ZETA

MOTH MARKETING, 47 ARMSTRONG CLOSE, WILSTEAD, BEDFORD. TEL: (0234) 7451152



Firmly in the 'super-fi' class, the Zeta arm is a UK-designed and manufactured product with a very business-like construction and exterior. A fixed headshell design, rigidity is its byword, with the massive construction clearly amplifying this concept. The entire pillar/base and gimbal support is machined from a solid block and likewise the oversize beam tube is a continous structure, running right through the bearing assembly. The headshell is free of perforations aside from the cartridge fixing slots, representing an excellent mounting platform. Those few parts which are joined are thermally bonded, thus avoiding the variability of the adhesives normally used.

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

Geometrically, the offset is at 23.75 deg in order to bring the stylus tip into alignment with the arm beam centre line and to reduce torsional excitation. Heavily gold-plated professional connectors are used for the arm cable which has fine phono plugs at the other extremity, these also gold plated. The cable was judged to be reasonably compliant and offered a low 100pF lead capacitance.

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

SOUND QUALITY

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

LAB REPORT

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

Charted for resonances, the low frequency range was distinguished by a uniquely even energy trend. A few minor resonances were present, but did not significantly disturb the result. Our samples showed some bearing quality variation but we are informed that recent production will not suffer from this.

CONCLUSION

Here is another UK-built, front-rank audiophile product. Its construction quality, finish and sound were all first rate and would satisfy the most discerning of all purchasers, and while a high price must be paid for this, for many the results will justify the outlay. Van den Hul cable is available as an option, offering improved clarity and depth, plus a still sweeter treble.

TEST RESULTS

Approximate effective mass, inc screws, excl cartridge	16g
Type/mass of headshell	non-detachable
Geometric accuracy	excellent
Adjustments provided	height/overhang/offset
Finish and engineering	excellent/very good
Ease of assembly/setting-up/use	good/good/good
Friction, typical lateral/vertical	25mg/25mg
Bias compensation method	internal spring
Bias force, rim/centre (click-stop)	200mg/200mg
Downforce calibration error, 1g/2g	uncalibrated
Cue drift, 8mm ascent/descent	slight, 0.7 secs/1.9 secs
Arm resonances	very good
Subjective sound quality	very good
Lead capacitance/damping method	100pF/none
Estimated typical purchase price	£459, vdH cable £549

First reviewed: 1983 (retested 1985). Rating: Recommended.

PRESENCE AUDIO NEWS

PRESENCE-ANNIVERSARY On Thursday 6th February, Presence Audio celebrated 2 years in business, and is now the UK distributor for no fewer than 16 manufacturers. Latest product news follows.

PRESENCE-AUDIOSTATIC The latest versions of the Audiostatic ES200 model have a slightly simplified design with no base plinth and the transformers mounted on the back of the panel. Price remains the same at £1,395. Tel: 044485 333.

PRESENCE-DECCA Decca cartridges have been in short supply due to component problems, which Decca hopes are now resolved. Decca's Diplomat carbon fibre brush is selling well on both looks and efficiency. *BARGAIN OF THE YEAR?* Presence has a limited number of the rare Decca London loudspeakers with ribbon tweeter (list price £460) available at the incredible price of £195 per pair, and at this price there is probably nothing to compare. Available in Rosewood veneer or white. For nearest dealer phone 044485 333.

PRESENCE-ENSEMBLE The Ensemble PA1 speakers are remarkable. Measuring only 35×23×23cms (14×9×9ins) they produce a real big-speaker sound with plenty of bass and have to be heard to be believed. Made in Switzerland, they come in Brazilian Rosewood or walnut as standard, and at £1,000 a pair they are one of the world's most expensive small loudspeakers. Tel: 044485 333.

PRESENCE-GLANZ Presence Audio is now the UK distributor for Glanz. Prices of these highly regarded models (3 moving coil and 3 moving flux) remain unchanged and replacement styli are avaialble for all models. Tel: 044485 333.

PRESENCE-INTERFACE Produced in Holland, the Record Interface Mat (£24.95) is made out of a similar material to records (Polymethylmethacrylate!). The Record Interface Clamp (£29.90) has the same bottom surface as the mat plus a lead/barium coating and an aluminium magnesium housing. CD Interface Mats (£2.99 for 10) are made of a translucent plastic and are permanently attached to the label side of each CD. Tel: 044485 333.

PRESENCE-JECKLIN Latest versions of the highly acclaimed Jecklin Float Electrostatic headphones sound even better with four transformers in the energiser box and improved signal cable. Price remains £299. Tel: 044485 333.

PRESENCE-KISEKI Presence is now the UK distributor for these world famous cartridges which rank among the best available and at lower prices too! The improved range consists of the Blue Silverspot at £295, the Purpleheart £395, the Purpleheart Sapphire £495, Agate Ruby £595, and the incredible hand-built, hand-tuned Lapis Lazuli as the world's most expensive cartridge at £2,000. Also available is the Kiseki range of moving coil transformers to suit its own and other cartridges. Tel: 044485 333.

PRESENCE-MDM The Jecklin-originated MDM cables with their solid-core co-axial cable in a startling red or blue plus unique phono plugs are winning friends for sound quality as well as looks. Available in 0.6m, 1.0m and 1.5m lengths at £7.95, £8.95 and £9.95 respectively. Tel: 044485 333.

PRESENCE-MILLTEK The superbly made Milltek Aurora is a high output (2mV) moving coil cartridge which bears more than a passing resemblence to Kiseki. Sound quality is very good for the price (£195). Tel: 044485 333.

PRESENCE-NUANCE The Nuance Mk II transistor pre-amp is setting new standards (see Ken Kessler review in March Hi-Fi News). This first model has the phono stage optimised for moviong coil, but a moving magnet version is coming. Available in champagne or black the Nuance costs £695. Tel: 044485 333.

PRESENCE-ODYSSEY Beauty and the Best? The £798 Odyssey RP1-XG MkII arm is one of the world's best and certainly the most beautiful — but watch for Odyssey designer John Gordon's new arm at half that price. Odyssey Perfect Lock Banana Plugs at £39 a set are a unique design and an excellent gift. Tel: 044485 333.

PRESENCE-OMEGA POINT Developed from the Dais, the Omega Point turntable and unique unipivot arm are British designer Tom Fletcher's finest products to date. New thinking has produced top flight products and at reasonable prices too. Turntable is £895 and the arm £298. Tel: 044485 333.

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AUDIONOTE IO2vdH

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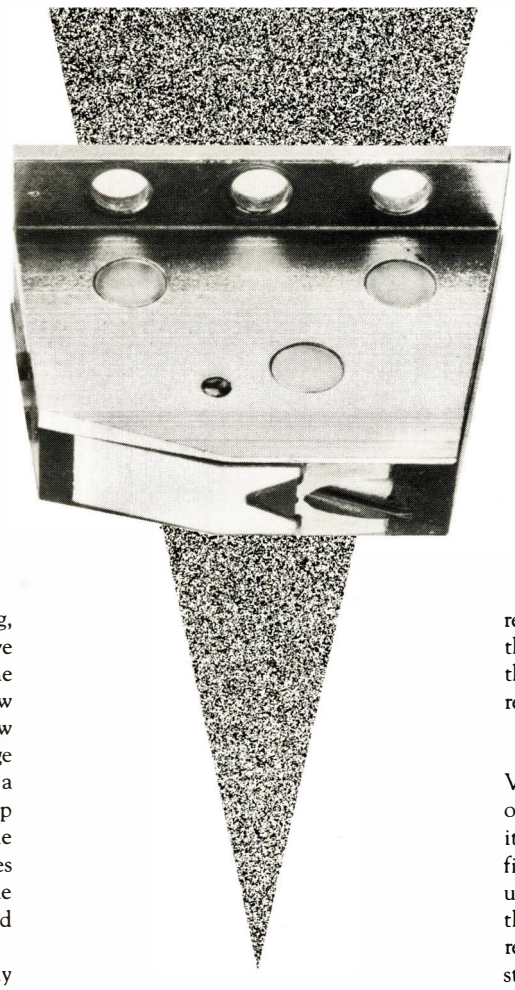


Possibly the most fascinating, certainly the most expensive cartridge we have tested, the van den Hul-tipped *IO2* is now available in the UK via a new distributor, Audio By Design. The cartridge itself is now priced at £695, while a package including a suitable step-up transformer now costs about £975. The *IO2* has internal silver wiring and comes with flying leads for attachment to the arm, the intention being that this should also ideally be silver-wired.

The *IO2* is also twice the weight of any of the oppositon, 18g no less, and built to give a new meaning to the term rigidity, with four head-shell screws to boot. However, compliance is very low, so it suits a wide range of medium and high mass arms. Some asymmetry was apparent in the compliance, with notably heavy damping in the vertical plane.

LAB REPORT

Output is very low (−28dB), so the matching (low impedance) transformer will often be needed, though we found Naim moving-coil boards just about usable directly. Experimenting with different loadings showed that reducing the impedance or adding a transformer seemed to cut down detail, but also reduced the slightly obtrusive treble.

Frequency response was pretty impressive, albeit with a 3dB downtilt across the band through the midrange, and mild recovery above 6kHz. Channel balance was very good, though with minor departures at the frequency extremes. The trace was smooth through the midband, but uneven below 50Hz on one channel.

Separation was disappointingly asymmetric, but at the same time highly impressive in some respects, especially at low and mid frequencies. Tracking abilities seemed reasonable, particularly in view of the compliance, though there is not much in reserve for difficult discs.

SOUND QUALITY

Going some way towards justifying its extravagant price, the *IO2 vdH* was obviously one of the very best, and was particularly liked for an extraordinarily relaxing midrange clarity, giving plenty of 'space' around instruments.

Notably clean in the upper bass, it reacted extremely well to panel speakers, and sounded thoroughly romantic via its transformer. Used directly into dynamic speakers the low bass was a bit 'rich' and the extreme top a trifle obvious — detailed, but exaggerating surface noise a little. It was a trifle prone to dust clogging, so records need to be kept clean. Not quite the 'fastest' cartridge, it was always one of the most listenable, though it certainly requires careful system and arm matching.

CONCLUSION

Very much the sort of product with which one enters into an emotional relationship, it is not for the fainthearted who prefer to fit and forget. Nevertheless it has some unique strengths which may well charm the dedicated enthusiast, and definitely represents one variation on the current state of the art.

TEST RESULTS

Type, mass	low output moving coil, 18g
Stylus type	van den Hul
Stylus inspection result	confirmed, superb mounting
Output Level (1kHz, 5cm/s)	0.03mV*
Relative output (0dB=1mV/cm/s)	−29dB
Channel balance	
Channel separation (L,R)	
Tracking ability (L,R)	
Frequency response limits 100Hz-5kHz	+1.5, −1.5dB
Frequency response limits 30Hz-20kHz	+2, −1.5dB
Separation L on R 100Hz, 3kHz, 10kHz	50+, 26, 20dB
Separation R on L 100Hz, 3kHz, 10kHz	30, 20, 15dB
Channel diff. 100Hz, 1kHz, 10kHz	0, 0, 0dB
Response limits ref computer mean, 1kHz-15kHz	—
Response limits ref computer mean, 1kHz-20kHz	—
Test tracking weight, loading	2b, n.a.
LF resonance frequency, 12.5g arm (vert, lat)	12, 10Hz
Estimated compliance (vert, lat)	6, 14cu
Recommended arm effective mass	8-18g
LF resonance rise, 12.5g arm (vert, lat)	8, 13db
Typical selling price	£695

First reviewed: 1984. Rating: Worth considering.

BANG & OLUFSEN MMC1

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

With the top of the range MMC1, B&O throw all their advanced technology into a miniature cartridge with jewelled cantilever and tiny diamond tip with exquisite line-contact profile (but with a sensible shank long enough to avoid too much dust collection). Regrettably again we have the plug-in adaptor, though the overall mass is still low, and downforce a superlight 1g.

Compliance is pretty sensible, considering it has to accommodate B&O's own ultra-low-mass arms, though 13g arm effective mass represents the top limit for safety.

LAB REPORT

Output is a little on the low side, but should be sufficient for the great majority of amplifier moving-magnet inputs. Though specified and measured as sensitive to capacitance loading changes, in fact we found low capacitance inputs superior subjectively.

Response and channel balance were exemplary, save a single 900Hz 'glitch' we attribute to the mounting adaptor. That apart the trace was pretty smooth, gently falling 4-5dB across the band with exemplary high frequency control.

Stereo separation was likewise reference-standard stuff, with outstanding figures throughout the band, and no compromise at high frequencies. Groove stability was decent and tracking ability fine, despite the low downforce, though the cartridge as a whole was rather microphonic.

SOUND QUALITY

The extraordinary clarity and detail at high frequencies are almost sufficient to rate this amongst the very top cartridges, and will be sufficient and convincing reason for many purchasers. But one does notice the treble, inasmuch as it somehow draws attention to itself, while the bass plods along a bit, almost as an afterthought. Focus, midrange dynamics, and stereo imaging were of the highest order. There is a close family resemblance throughout the B&O range, which extends through the '2, '3 and '4 down to the cheapest MMC5 model. All are handicapped by slight softening and blurring at low frequencies, which gives a relaxed rather than 'punchy' presentation, with fine control. In our own tests, the MMC4 was picked out for its particular solidity and overall balance, which appeared remarkably 'seamless' for the price (just under £40). Midrange clarity, dynamics and focus are excellent, giving fine stereo imaging. The treble is well balanced and controlled for the price, though a touch unrefined. Stability was impressive and surface noise was well under control.

CONCLUSION

Probably deserving recommendation for its strengths, the MMC1 also deserves a better adaptor, since the one supplied lacks rigidity. Even as it stands it is a very satisfying cartridge, possibly with greater appeal to the classical than rock listener.

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

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

TEST RESULTS

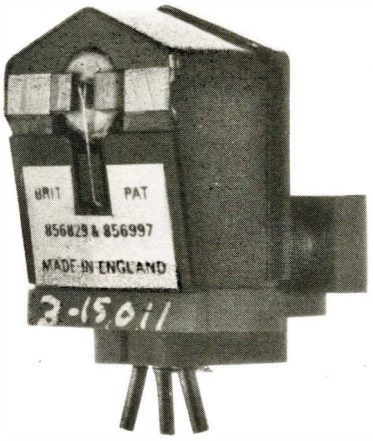
B&O MMC1

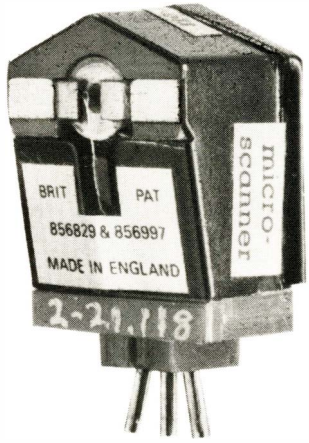
Type, mass	moving magnet, 3.3g
Stylus type	small nude 'line'
Stylus inspection result	fine, tiny, long 'pegged' line contact
Output Level (1kHz, 5cm/s)	2.75mV
Relative output (0dB=1mV/cm/s)	−2dB
Channel balance	0.4dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5kHz	+1, −1.5dB
Frequency response limits 30Hz-20kHz	+1, −4dB
Separation L on R 100Hz, 3kHz, 10kHz	29, 38, 32dB
Separation R on L 100Hz, 3kHz, 10kHz	33, 48, 34dB
Channel diff. 100Hz, 1kHz, 10kHz	0.5, 0.5, 0dB
Response limits ref computer mean, 1kHz-15kHz	+0, −3dB
Response limits ref computer mean, 1kHz-20kHz	+2, −3dB
Test tracking weight, loading	1g, 200pF
LF resonance frequency, 12.5g arm (vert, lat)	9, 8Hz
Estimated compliance (vert, lat)	24, 21cu
Recommended arm effective mass	5-13g
LF resonance rise, 12.5g arm (vert, lat)	13, 12dB
Typical selling price	£95

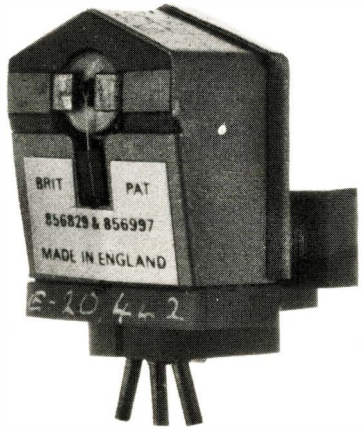
First reviewed: 1984. Rating: MMC1 Recommended, MMC4 Best Buy.

DECCA LONDON

PRESENCE AUDIO, EASTLAND HOUSE, PLUMMERS PLAIN, HORSHAM, WEST SUSSEX RRH13 6NY. TEL: (044 485) 333







Defying comparison with other cartridges, the Decca is a throwback to the days when record companies carried out much of the technical development. Some regard it merely as a curious British anachronism that can't possibly work. But Decca enthusiasts will contend that it can spit contemptuously on any rivals.

The 'moving-iron' generator with no conventional cantilever, is completely undamped and has wildly differing vertical and horizontal compliances which would suggest there isn't an arm on the market which is really suitable; in practice the more substantial tonearms seem to work best, and some form of damping can be a boon. The *London Blue, London Gold* and *Super Gold* models differ primarily in stylus type. At £248, the recently launched *Super Gold*, with a high-quality van den Hul stylus, is less expensive than the unofficial Australian-modified Garrott Decca with its 'microscanner' tip.

SOUND QUALITY

The Decca's unique strength is the sheer 'speed' and dynamics of the midrange, which makes even its most exotic rivals sound comparatively ponderous and 'smeared'. This tremendous 'attack', and the equally impressive notable lack of 'overhang', further spotlighted by the 8kHz resonance, does however tend to leave low bass and high treble sounding like something of an afterthought.

Criticism was made of the mild tracking uncertainty, some midrange coloration and flattening of stereo perspectives, and some exaggeration of surface noise.

LAB REPORT

All Deccas possess steep low frequency rise due to the high-Q vertical resonance at around 20Hz; this can add some excess 'weight'. Response from the mid bass up to the lower treble (5kHz) is then remarkably flat, if marred by the mounting bracket decoupling effect at around 350Hz. The main treble resonance around 8kHz is surely the most dominant subjective factor. There was some tracking uncertainty, particularly on heavy bass transients and sometimes at high frequencies. Following the same response pattern, our *Super Gold* sample was even flatter in the vital midband from 100Hz to 5kHz.

SUPER GOLD

Sounding decidedly 'bright' in balance, more perhaps than might be suspected from the measurements, the *Super Gold* could sound a little 'fierce' and tended to emphasise record surface faults and tape hiss. However, treble detail was exceptionally fine where the cheaper models could sound a little coarse.

Traditional virtues of dramatic 'speed' and lack of 'overhang' were fully — even exaggeratedly — on display, while some coloration was evident and stereo imaging seemed precise but somewhat 'up-front', with reduced depth.

CONCLUSION

Deccas seem to sound better year by year. It is likely that their undamped *modus operandum* reaps benefits with the steady improvement in turntables and tonearms. Despite reservations regarding consistency, fragility and the possibility of record wear due to the stiff vertical compliance, the Deccas' main strength demands recognition. The *Blue* offers exotic performance at a down-to-earth price, and so deserves recommendation.

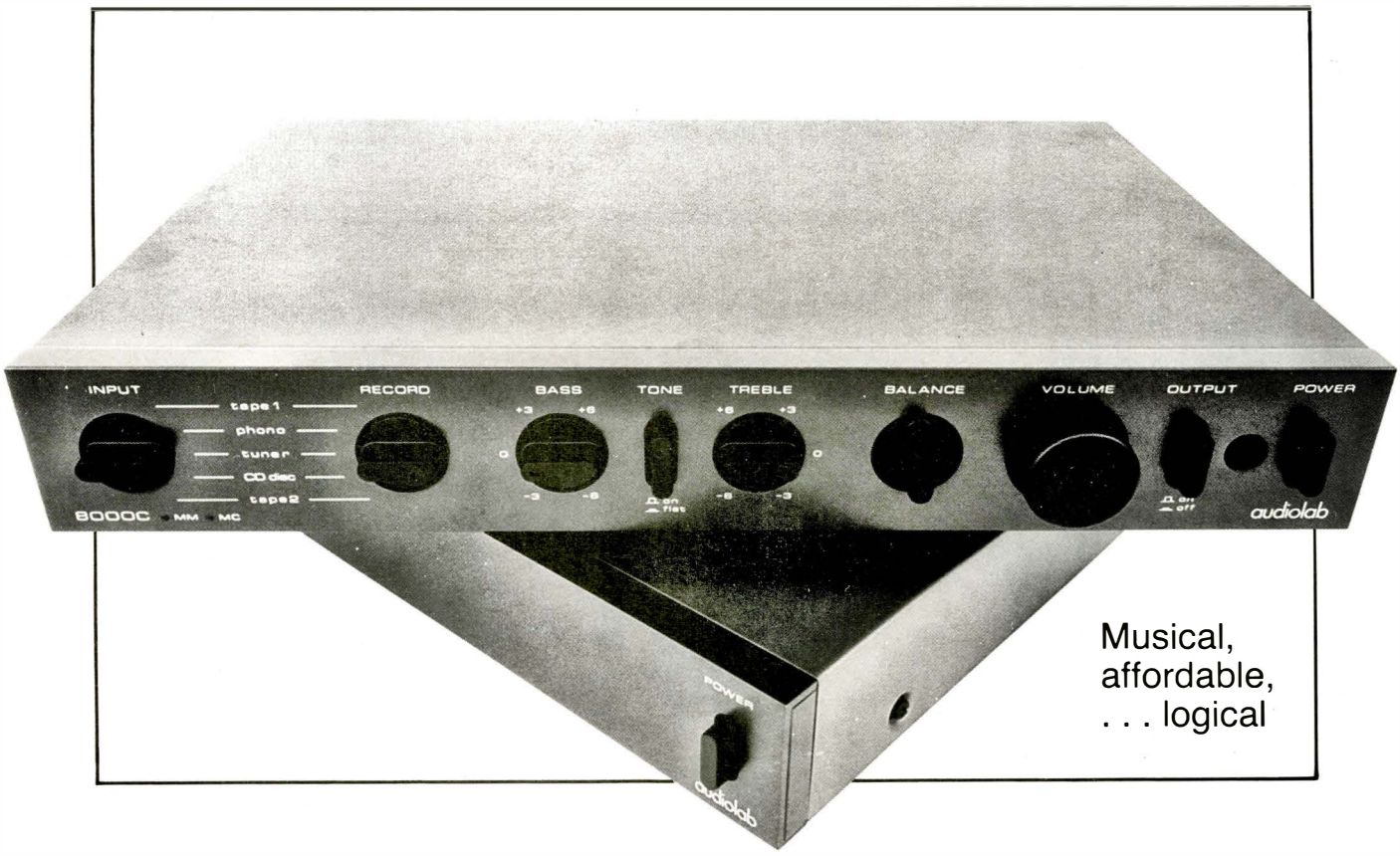
There is probably no cartridge more capable of revealing the excitement and tension of musical performance than the *Super Gold*, though it is kind neither to recording defects nor to record surfaces. Capable of inducing the fiercest and most loyal love/hate relationships in audio, the top Decca is not for the faintheearted. or those who take the trouble to persevere in optimising a system, possibly involving some modification of mounting and body damping, the rewards can be considerable.

TEST RESULTS

DECCA LONDON BLUE

Type, mass	moving iron (eff. magnet) 6.7g
Stylus type	spherical
Output Level (1kHz, 5cm/s)	5.5mV
Relative output (0dB=1mV/cm/s)	+3dB
Channel balance	1.2dB
Channel separation (L,R)	17, 24dB
Tracking ability (L,R)	80, 80μm
Frequency response from graph, 100Hz-5kHz	+0.5, −0.5dB
Frequency response from graph, 30Hz-20kHz	+5, −3dB
Stereo separation R on L 80Hz, 3kHz, 10kHz	30, 35, 17dB
Test tracking weight, loading	2g, n.a.
LF resonance frequency, 13.5g arm (vert, lat)	18, 11Hz
Estimated compliance (vert, lat)	3.5, 10cu
Recommended arm effective mass	see text 8-20g
LF resonance rise, 13.5g arm (vert, lat)	25dB
Typical selling price	£80 (Gold £138)

First reviewed: 1985 (Garrott Decca, 1984). Rating: Recommended. For full lab report on Super Gold, see issue 43.



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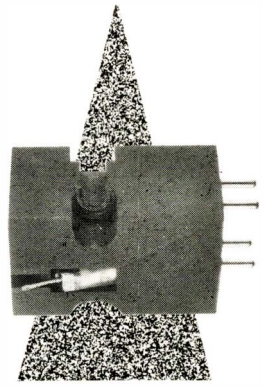
DENON DL103

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

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

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



LAB REPORT

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

Frequency response showed a fairly modest 2dB downtilt through the midrange, and a slight flattening out at 7-8kHz. In fact a straight line could be drawn through the response trace from 20-20kHz with deviations of less than 0.5dB, which is very impressive at this (or any) price level. However, the response was 2dB 'brighter' if taken at the outer grooves, a function of the limited scanning radius of the spherical tip. Channel balance was pretty good, and the response was smooth, with just a tiny 900Hz 'glitch' and some bass unevenness.

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

SOUND QUALITY

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

DENON DL103D

Again a low-output (0.33mV) moving-coil, the *'D* has a tapered cantilever and special elliptical stylus. More compliant (17cu) than the spherical-tipped *103*, it offers improved tracking ability with lower tracking weight of 1.5g. A smooth but rising treble response was confirmed by subjective descriptions of brightness and 'splash'. This marred the sound quality a little, as it lacked the detail and transparency of some more exotic 'bright' designs. Clearly demanding a good quality tonearm the *103D* was quite competitive but not significantly preferred to the cheaper *103* on balance.

DENON DL110

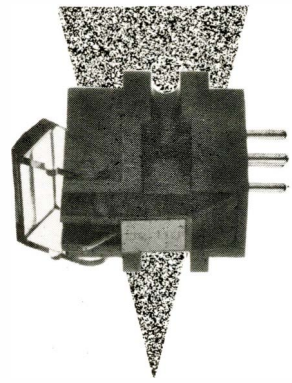
In addition to the *103* series, Denon now offer two very competitively priced high(ish) output models. While finding the *DL160* a competent all-rounder, we preferred the cheaper *DL110* at £50. Finished in an attractive maroon tortoiseshell effect, this has a neat rigid four-square body with substantial though only semicircular mounting lugs and a reasonable area of headshell contact. A high quality advanced elliptical tip stylus of low mass was fitted.

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

In blind listening tests, panel members were generally enthusiastic, praising the clarity and dynamics, a generally neutral balance, and fine midrange projection. Minor concern was raised at the quality of the bass, which some felt sounded mildly disassociated and detached.

CONCLUSION

Spherical styli may be unfashionable, but they have always worked exceedingly well in the *103*. Once again this stalwart shines out from the pack, and furthermore offers fine value for money. The *110* sailed through our subjective and objective test programme with consummate ease. It deserves firm recommendation as a fine all-rounder which is very likely to perform to a consistently high standard under nearly all circumstances. Provided the lowish output is no problem, our only minor reservation is that other less well-damped models can sound rather more lively.



TEST RESULTS

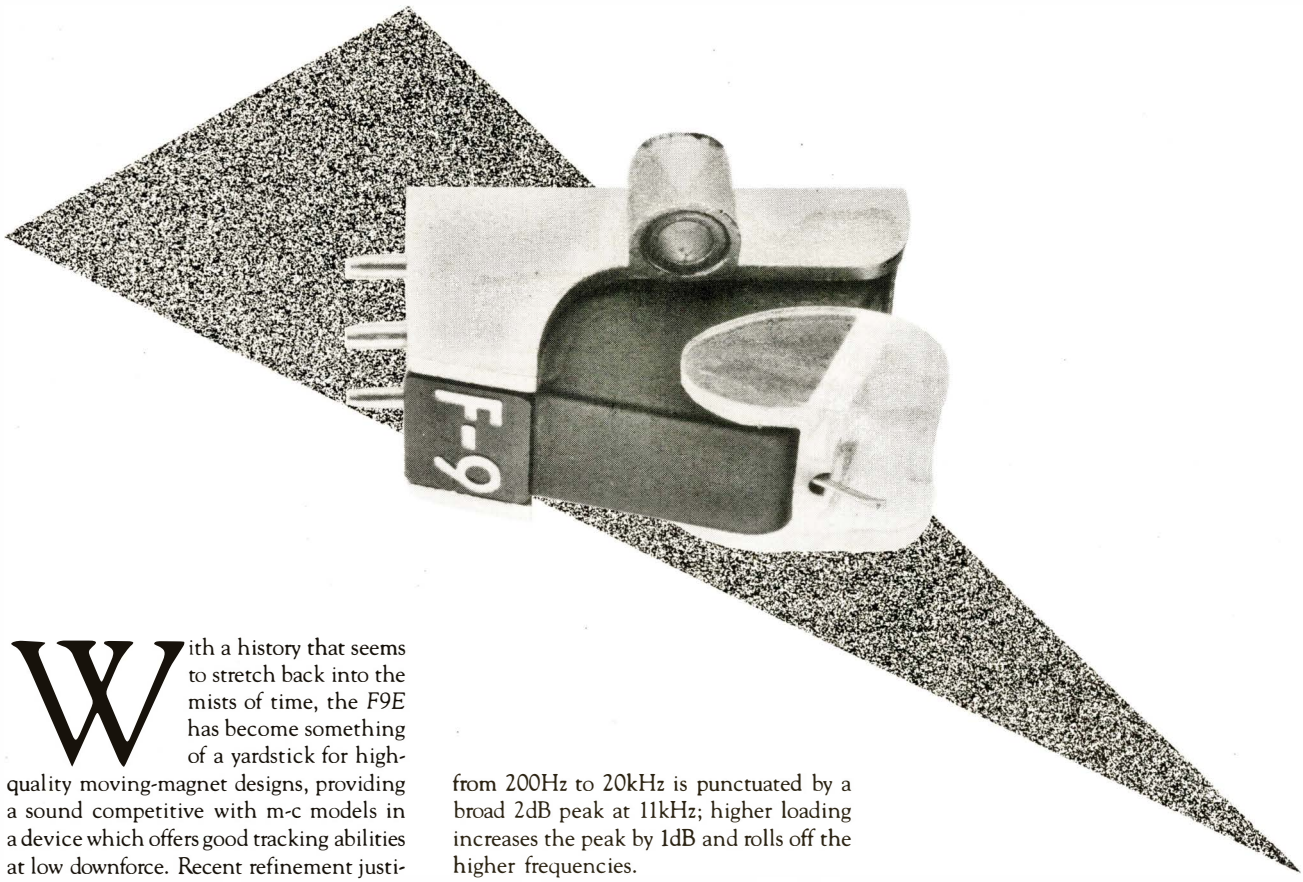
DENON DL103

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

First reviewed: DL103, 1984; DL110, 1985. Ratings: DL103, Recommended; DL110, Best Buy. For full lab report on DL110, DL160, see issue 43.

GRACE F9E II

RUSS ANDREWS TURNTABLE ACCESSORIES, EDGE BANK HOUSE, SKELSMERGH, KENDAL, CUMBRIA LA8 9AS. TEL: (053 983) 247



With a history that seems to stretch back into the mists of time, the *F9E* has become something of a yardstick for high-quality moving-magnet designs, providing a sound competitive with m-c models in a device which offers good tracking abilities at low downforce. Recent refinement justifies the *II* suffix, with visible change to the fluorescent stylus assembly moulding.

The manufacturer's family ties with the Supex people can be seen in a similar concern for good mechanical body rigidity with substantial fixing lugs. The new stylus assembly makes a fairly good fit, but was not exceptional in this respect.

Compliance is specified at a sensible 20cu; we have now ascertained that the higher figure recorded in our 1985 test (in *HFC* issue 43) was a sample anomaly, caused by the effect of removing and replacing the stylus during the tests, and should not be encountered on other samples. Assisted by fairly strong internal damping, the *F9E II* once again tracked well at a fairly low downforce of 1.2g.

Electrical output is ample, and channel balance fair. The fine small advanced elliptical tip had a slightly asymmetric shank.

LAB REPORT

Changing the load capacitance altered the treble response by a fairly substantial 3dB, so attention should be paid to this in a system context. With low capacitance, an almost ruler-flat response downtilted 4dB from 200Hz to 20kHz is punctuated by a broad 2dB peak at 11kHz; higher loading increases the peak by 1dB and rolls off the higher frequencies.

Separation was excellent, particularly through the lower midrange with dB values consistently in the '40s, and with well-suppressed ultrasonics.

SOUND QUALITY

Curiously, during 'hands-on' listening, the sound was actually preferred with the additional capacitance. The traditional highly regarded virtures of the *'9E* were again in evidence, combining a slightly 'weighty' balance with an impressively 'lively' presentation.

The majority of comments positively described this as an interesting solid-sounding cartridge. But there were a couple of dissenters, and a general criticism of some 'fizz'.

CONCLUSION

While the latest version of the *F9E* can be said to deliver the sonic goods satisfactorily, the excessive compliance of our solitary sample could well have been the reason why the *II* was not regarded as any significant improvement over its predecessor; but purchasers should find the *II*'s compliance unchanged at a sensible 20 or so cu. It still remains a significantly fine example of moving-magnet technology to retain a recommendation.

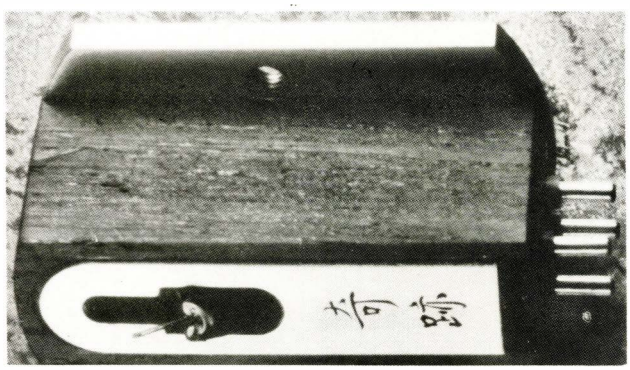
TEST RESULTS

Type, mass	moving magnet, 6g
Stylus type	advanced elliptical
Stylus inspection result	tiny, slightly asymmetric advanced elliptical
Output Level (1kHz, 5cm/s)	4mV
Relative output (0dB=1mV/cm/s)	+1dB
Channel balance	0.6dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 100Hz-5kHz	+1, −1.5dB
Frequency response limits 30Hz-20kHz	+1, −3dB
Separation L on R 80Hz, 3kHz, 10kHz	31, 39, 27dB
Separation R on L 80Hz, 3kHz, 10kHz	36, 39, 28dB
Response limits ref computer mean, 1kHz-15kHz	+1, −0dB
Response limits ref computer mean, 1kHz-20kHz	+1, −0.5dB
Test tracking weight, loading	1.2g, 200pF
LF resonance frequency, 13.5g arm (vert, lat)	5, 5Hz
Estimated compliance (vert, lat)	see text
Recommended arm effective mass	5-10g
LF resonance rise, 13.5g arm (vert, lat)	11, 13dB
Typical selling price	£176

First reviewed: 1985. Rating: Recommended. (F9L first reviewed 1978, F9E 1984.)

KISEKI PURPLEHEART SAPPHIRE

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



Kiseki are a small Japanese manufacturer of exotic moving-coil cartridges. They have been around for a number of years, but distribution in the UK has been intermittent. Some years ago the *Blue* model achieved a certain recognition, but the then distributor got heavily involved in a manufacturing project. Now Presence Audio have added Kiseki to their extensive roster of rare overseas brands, and the extraordinarily named £500 *Purpleheart Sapphire* is one of the more expensive models they are importing.

The *Sapphire* is quite exquisite in appearance and finish, fully living up to its extravagant pricetag in this respect. The wooden 'heart' is firmly bonded into a gilt-finish metal frame which ensures a decent surface area for headshell contact. This metal backplate carries threaded screw holes, so that the cartridge needs only screws to secure it to the headshell. This is an arrangement which usefully saves a little mass at the headshell, even though past experience with Dynavector *Karat* models makes one a trifle apprehensive of overtightening and stripping the thread. However, such an event would not be the catastrophe with the Kiseki that it was with the *Karats*, as a nut and bolt could be substituted without difficulty.

The delicate sapphire cantilever, with small line contact stylus, is evidence of the fine materials used, though there was some debate on visual inspection whether the generator components were exactly aligned in the body. The combination of samarium cobalt magnets and comparatively long coil windings (420ohms impedance) ensures that output is generous by low-output moving-coil standards — sufficiently so to suggest that the *Purpleheart Sapphire* could have a role to play with some of the valve amplifiers where the pre-amp circuitry has to struggle a little to provide enough gain for normal low output devices.

LAB REPORT

An admittedly fairly brief measurement programme nevertheless highlighted a number of characteristics. On balance the cartridge acquitted itself quite well, but the tests did reveal certain inherent characteristics which experience suggests are likely to be reflected in the audible performance.

Output is indeed generous, but the channel imbalance of 0.6dB was thought rather disappointing in such an expensive design, and outside the quoted specification of 0.25dB. Channel separation is very good, but the measured tracking abilities were a little disappointing considering that a high 2.25g downforce was used. However, the tracking abilities seemed less related to the downforce than to the operating temperature, and provided the cartridge was kept reasonably warm there seemed to be no practical difficulties (exceptionally cold weather was a factor during the period of the tests!). Frequency response was commendably smooth, even and well extended — in fact, a textbook result.

Heavier than average at 7.5g, this model is also quite compliant, so the 13.5g arm used for the tests is about the maximum that can be used with confidence — in theory at any rate. In practice, the generator is much more heavily damped than most moving-coil models, so the importance of optimum arm matching is reduced.

SOUND QUALITY

On audition, the sound was well liked overall, with its own distinctive character. It was both lively and spacious, was well balanced, with solid focusing in the mid-range. The bass conveyed plenty of power and extension, but also seemed a trifle 'slower' and less well defined than with certain less heavily-damped cartridges, and was also described as a little 'fat'. Treble detailing was good, though the extreme top end seemed to go slightly 'out of focus'. Dynamic range was generally good, and the sound as a whole was relaxing, 'sweet', and very easy to listen to.

CONCLUSION

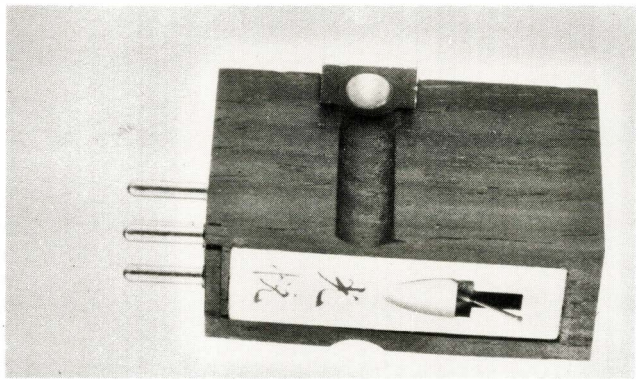
There can be no doubt that this is a very nice cartridge, though it does have a very high pricetag. Subjectively, it stacks up amongst the top models available, with a fine combination of spaciousness and liveliness which some might regard as bridging the gap between Linn and Koetsu sounds. However, the heavy internal damping is in our view a definite handicap in getting the maximum performance from a carefully-optimised system — the fact is that it helps the cartridge to work better under less than ideal conditions by corollary limits the ultimate that can be achieved when everything is working well together. Under such a proviso, the *Purpleheart Sapphire* may be cautiously commended; it is beautiful to look at and very nice to listen to, and as such delivers the goods.

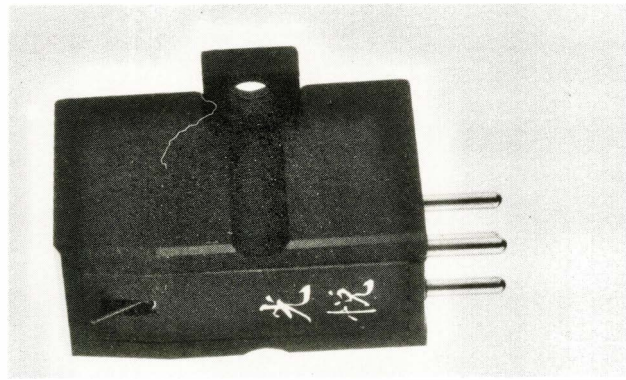
TEST RESULTS

Type, mass	low output moving coil, 7.5g
Output Level (1kHz, 5cm/s)	0.34V
Channel balance	0.6dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	62, 54μm
Frequency response limits 1kHz-15kHz	+1, −2db
Frequency response limits 1kHz-20kHz	+2.5, −2db
Test tracking weight, loading	2.25g, n.a.pF
LF resonance frequency, 13.5g arm (vert, lat)	8, 8Hz
Estimated compliance (vert, lat)	18, 18cu
Recommended arm effective mass	5-14g
LF resonance rise, 12.5g arm (vert, lat)	8, 9db
Typical selling price	£495

KOETSU BLACK K

ABSOLUTE SOUNDS, 42 PARKSIDE, LONDON SW19. TEL: 01-947 5047





A refinement of the well-established Koetsu *Black*, this latest *K* version features a number of detail changes, including the addition of some tasteful gilt to the otherwise featureless body.

Mechanically it appears to be very similar, with a lightly-damped compliance suited to medium and high mass arms. Some additional tonearm damping might be to advantage if available.

Electrical output needs normal moving-coil boost but no more. Though an inherently good quality stylus was fitted, polish was a little lacking and glue rather too much in evidence. Tracking margins were not generous despite the sensible 1.8g tracking weight, and this model should be approached with caution by lovers of grand opera and choral music.

LAB REPORT

An inherently flat and smooth response downtilted a modest 2dB across the band, and held between fine overall ±1dB limits. However there were occasional 'glitches' and a mild lack of control at high frequencies was also indicated.

Separation was truly outstanding, maintaining a symmetrical 45dB-plus, right from 250Hz to 5kHz, albeit with slight spurious ultrasonic output.

SOUND QUALITY

In our initial 'hands on' work, it was obvious that the *Black K* was a significant sonic improvement over its predecessor, retaining the Koetsu character but with a 'lighter', 'faster' sound overall.

However, in the 'blind' presentation the panel were somewhat less convinced. While praising the impressive 'scale' and dynamics, there was criticism of some bass muddling and excess, and some high treble 'tizz'. Though scoring well enough, it was not quite as highly rated as might have been expected. Overall it has a romantic and spacious presentation which has undoubted appeal.

KOETSU RED

Considerably more expensive than the *Black*, the *Red* Koetsu is by far the prettier model, looking like an expensive Mah Jong tile in its beautifully finished rosewood sleeve. The stator and generator assemblies are built on a solid metal foundation, which can be bolted closely to the headshell.

Stylus type is unspecified, but consisted of an inherently fine small long-shank tip with mildly anomalous super-ellipse/line profile. Compliance is low, quite lightly damped, and mildly asymmetric,. suited to a wide range of medium-high effective mass arms. Like the *Black*, despite near 2g downforce, margins of tracking ability are not generous, and may be further compromised if not used with the best tonearms.

Frequency response was a further refinement on the *Black* in straightness: a line drawn between 30Hz and 20kHz would drop 2dB, but show no deviation greater than 0.5dB. Such trends as exist corroborate subjective observation of slight richness and brightness, but the high frequency region is remarkably flat and well controlled.

On audition, the *Red's* magnificently 'laid back' balance seemed particularly well suited to classical music, and the sound showed a significant improvement in smoothness, control and refinement over the *Black*, further enhancing the stereo sound-stage. Suiting panel speakers and valve amplification even better than the *Black*, it was a little less 'fiery' and exciting on dynamics, and sounded a touch 'slower' at low frequencies.

CONCLUSION

The *Black K* has certainly done enough technically and subjectively to retain recommendation, enhancing the reputation of its illustrious and successful predecessor. However, it is not a sound to everyone's taste, and the panel showed sufficient misgivings to warn that it should be auditioned before purchase. A good turntable and arm are mandatory.

Turning to the *Red*, this beautiful cartridge is clearly a worthwhile graduation for those already seduced by the charms of the *Black*, with improved detail and control throughout the mid and treble. It is a little less forgiving of arm quality than the *Black*, and, inevitably, requires even more careful selection of ancillaries to make the most of its strengths.

TEST RESULTS

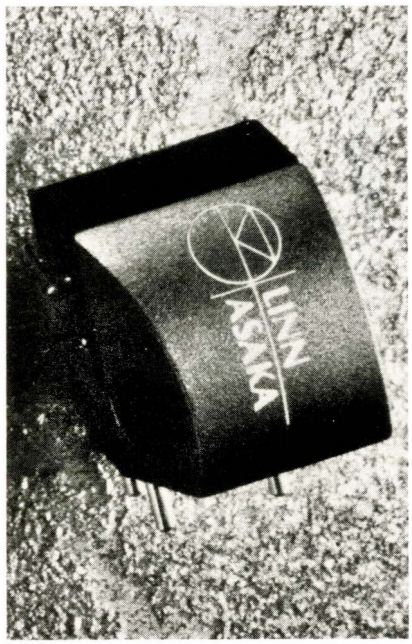
KOETSU BLACK K

Type, mass	low output moving coil, 9.5g
Stylus type	not specified
Stylus inspection result	super elliptical, indifferent polish
Output Level (1kHz, 5cm/s)	0.36mV
Relative output (0dB=1mV/cm/s)	−21dB
Channel balance	0.2dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	62, 65μm
Frequency response limits 100Hz-5kHz	+1, −05dB
Frequency response limits 30Hz-20kHz	+1 −1dB
Separation L on R 80Hz, 3kHz, 10kHz	34, 44, 37dB
Separation R on L 80Hz, 3kHz, 10kHz	37, 45, 38dB
Response limits ref computer mean, 1kHz-15kHz	+2, −0dB
Response limits ref computer mean, 1kHz-20kHz	+5.5, −0dB
Test tracking weight, loading	1.8g, n.a.
LF resonance frequency, 13.5g arm (vert, lat)	10, 10Hz
Estimated compliance (vert, lat)	13, 13cu
Recommended arm effective mass	6-18g
LF resonance rise, 13.5g arm (vert, lat)	15, 17dB
Typical selling price	£499

First reviewed: Black K, 1985 (Black reviewed 1982, 1984); Red, 1985. Rating: Recommended.

LINN KARMA

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



Though still manufactured for the Scottish company by Supex of Japan, Linn's cartridge models have increasingly taken their own path. *Karma* is clearly much more of a Linn cartridge than its predecessors.

The body is a small strong alloy casting. The (short) aluminium alloy cantilever carries a swept elliptical (Vital) tip, which was a tiny well-aligned rectangular section nude stone.

Compliance is low, symmetrical and with very little damping, so medium-to-high mass arms are the rational choice, with the *Ittok* making an admirable match. Downforce is 1.7g, which gave adequate tracking abilities but left little in hand.

SOUND QUALITY

With the best will in the world, the author is going to find it impossible to remain entirely dispassionate about the model he has purchased and been using over a long period.

The *Karma* sound is essentially very weighty, powerful and extended in the bass, and slightly bright and brittle in the mid treble. Integration and control are major strengths, yet there is none of the congestion that often accompanies more heavily damped models — Karma is very 'fast' in the manner of the Decca (though not to the same degree), yet extends this subjective speed over a much wider bandwidth. Focus, dynamics and projection in the midband are exceptional, but the sound is a little 'clinical' lacking the warmth, romance and depth of smoother sounding high-end models. Yet because of the fine integration, what seems to be less apparent detail translates into more coherent information.

LAB REPORT

Undoubtedly a low output model, the *Karma* still has sufficient output for any decent m-c input, with an easily-met amplifier input impedance recommendation of 470ohms.

Frequency response was smooth but with a fairly large 3dB downtilt, running from 100Hz to 5kHz, then a small, controlled 1dB peak at 10kHz, and a small 'glitch' at 14kHz. Channel balance was very close with fine control at high frequencies. At high writing speed, there was a solitary 'glitch' at 1.2kHz. Separation figures were amongst the best.

LINN ASAKA

Replacing Linn's longstanding and successful *Asak*, this £230 model incorporates the rigid metal bodywork from the more expensive *Karma* without any real price increase over its predecessor. *Asaka's* silver finish contrasts with *Karma's* jet black, but there are few other apparent differences.

Basic measurements were impressively consistent, with fine separation, tracking ability that was adequate (improving with higher room temperatures), and a slightly 'bright' response, particularly at 15kHz on one channel.

A crucial question for Linn cartridge fanciers must be whether *Asaka* offers *Karma* performance on the cheap — but this it does not. It is an *Asak* at heart, and lacks the remarkable low frequency 'speed' and integration of the *Karma*.

Nevertheless, it is a fine-sounding cartridge, capable of great dynamic contrast, bounce and 'life', if erring a little on the aggressive side. In the right system it may be confidently recommended, but cannot help falling within the no man's land between the 'good but cheap' models and top performers like its big brother.

CONCLUSION

Capable of superb results in the right system context, *Karma* sets high standards for bandwidth integration, and is uncoloured and fast to boot. But by coupling such a bandwidth of high mechanical energy to the tonearm, it also sets new standards for interface problems. While it may be strongly recommended for use in Linn-based systems, there must be a similarly strong note of caution against more general applications, where results will be less predictable.

TEST RESULTS

LINN KARMA

Type, mass	low output moving coil, 6.2g
Stylus type	Vital superelliptical
Stylus inspection result	confirmed, fine small stone, accurately set
Output Level (1kHz, 5cm/s)	0.2mV
Relative output (0dB=1mV/cm/s)	−26dB
Channel balance	0.25dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 76μm
Frequency response limits 100Hz-5Hz	+2, −1dB
Frequency response limits 30Hz-20kHz	+2, −2dB
Stereo Separation L on R 100Hz, 3kHz, 10kHz	30, 33, 35dB
Stereo Separation R on L 100Hz, 3kHz, 10kHz	32, 37, 33dB
Channel diff. from graph, 100Hz, 1kHz, 10kHz	0, 0, 0.5dB
Response limits ref computer mean, 1kHz-15kHz	+1, −0dB
Response limits ref computer mean, 1kHz-20kHz	+2.5, −0dB
Test tracking weight, loading	1.7g, n.a.
LF resonance frequency, 12.5g arm (vert, lat)	11.5, 11.5Hz
Estimated compliance (vert, lat)	12, 12cu
Recommended arm effective mass	9-18g
LF resonance rise, 12.5g arm (vert, lat)	15.5, 14.5dB
Typical selling price	£380

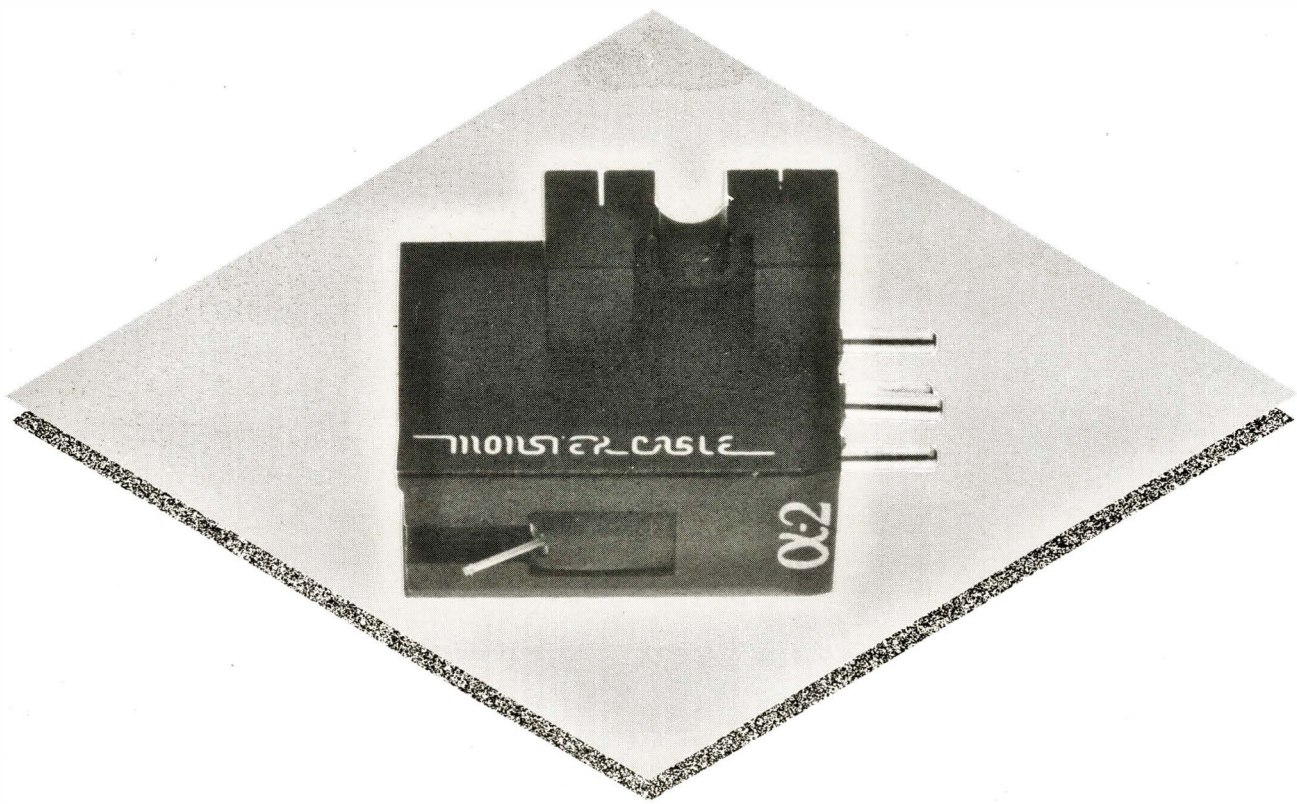
First reviewed: Karma, 1985; Asaka, 1986; (Asak 1980, retested 1982, 1984). Rating: Recommended.

LINN ASAKA

Type, mass	low output moving coil, 6.2g
Output Level (1kHz, 5cm/s)	0.17mV
Channel balance	0dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	66, 58μm
Frequency response limits 1kHz-15kHz	+1.5, −2.5dB
Frequency response limits 1kHz-20kHz	+2.5, −2.5dB
est tracking weight, loading	1.6g, n.a.
LF resonance frequency, 13.5g arm (vert, lat)	11, 11Hz
Estimated compliance (vert, lat)	12, 12cu
Recommended arm effective mass	9-18g
LF resonance rise, 13.5g arm (vert, lat)	16, 16.5dB
Typical selling price	£230

MONSTER ALPHA 2

WILMEX LTD, COMPTON HOUSE, NEW MALDEN, SURREY KT3 4DE. TEL: 01-949 2545



Still something of a rarity in the UK, the Alpha moving-coils have been a hit at home for the American cable and accessory specialist Monster.

Sourced in Japan, the *Alpha 2* is an expensive low-output model. The good quality of the 'ridged' stylus profile was confirmed under examination, and the body construction looks eminently capable of rigid headshell fixing, despite its semi-circular lugs. Though the souce of the *Alpha 2* was not revealed, it resembled the *Highphonic* a little in construction, being compact with a substantial (6.5g) alloy body.

Horizontal compliance was theoretically a little high for our medium mass test arm, so low mass arms are generally to be preferred, though the substantial internal damping should permit almost any tonearm to be used without undue difficulty.

Output level is ample for normal moving-coil (low-ouput) amplifier inputs.

LAB REPORT

Response was generally smooth, with just a couple of 'glitches', downtilting quite gently a couple of dB between 200Hz and 4kHz, recovering around 10kHz, whereupon the channels diverged by 4dB — a reasonable but not exceptional result.

Separation was outstanding, maintaining 40dB or better from lowest frequencies until well into the treble, a still impressive 28dB at 20kHz, and no evidence of ultrasonic spuriae.

SOUND QUALITY

The Monster received a slightly mixed reception during the listening tests, faring well enough to establish its inherently fine quality, if not perhaps to justify its exceptionally high price. The general impression was of good neutrality in relationship to Compact Disc. The sound was open and spacious, though a trifle obtrusive in the treble. Bouncy and lively, the bass was a little 'soft'. Overall the Monster came over as a fine all-rounder in terms of sound, without particularly excelling in any single respect.

CONCLUSION

This is a first rate cartridge in many respects, offering fine sound quality and better tracking ability than many top moving-coil models. However, compliance is a little high for many of the best tonearms, and the damping a little high for the sort of turntables such an exotic ought to partner. In the final analysis this fine all-rounder is insufficiently exceptional in any specific respect to justify fully the high UK price, but is most certainly worth considering.

TEST RESULTS

Type, mass	low output moving coil, 6.5g
Stylus type	'micro-ridge'
Stylus inspection result	fine quality small nude stone
Output Level (1kHz, 5cm/s)	0.31mV
Relative output (0dB=1mV/cm/s)	−22dB
Channel balance	0dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 74μm
Frequency response limits 100Hz-5kHz	+1.5, −0.5dB
Frequency response limits 30Hz-20kHz	+2, −2.5dB
Separation L on R 80Hz, 3kHz, 10kHz	39, 48, 32dB
Separation R on L 80Hz, 3kHz, 10kHz	41, 42, 31dB
Response limits ref computer mean, 1kHz-15kHz+2.5, −0dB	
Response limits ref computer mean, 1kHz-20kHz +5, −0dB	
Test tracking weight, loading	1.75g, n.a.
LF resonance frequency, 13.5g arm (vert, lat)	9, 7Hz
Estimated compliance (vert, lat)	17, 27cu
Recommended arm effective mass	6-14g
LF resonance rise, 13.5g arm (vert, lat)	10, 11dB
Typical selling price	£479

First reviewed: 1985. Rating: Worth Considering.

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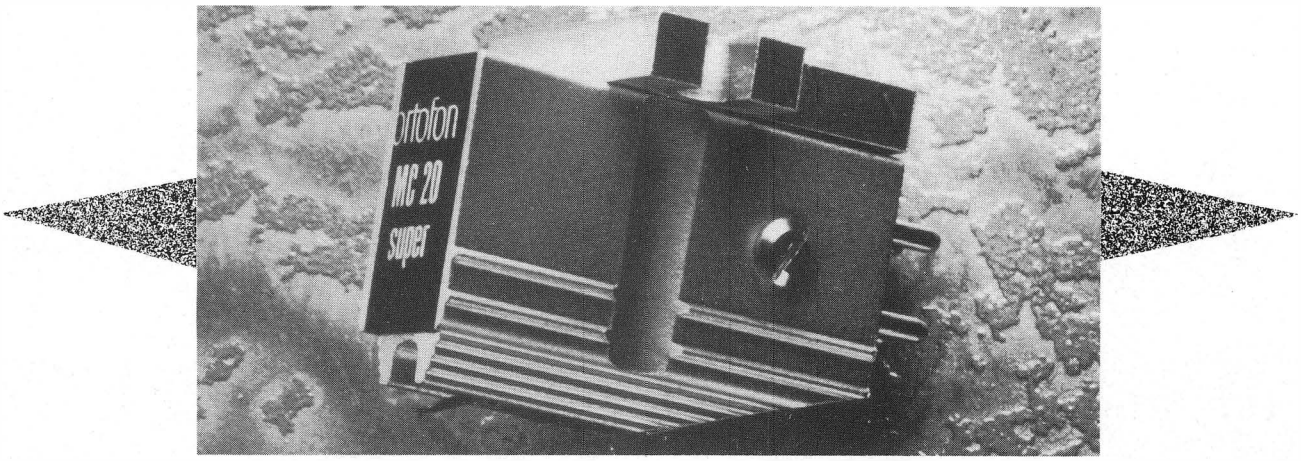


Ortofon are quite rightly still known as *the* name in moving-oil cartridges, having persevered throughout the '60s with this then-unfashionable method of converting the groove 'wiggles' into electrical signals, despite the more difficult micro-engineering involved. Breaking with long-standing tradition, they first launched their highly successful moving-magnet models in the late '60s, but their heart has always been with the moving-coil principle which has come into its own in the past decade.

Around 18 months ago Ortofon launched the blue plastic bodied *Super* version of the *MC10* model, and this was an immediate success, receiving Best Buy status in *Choice* for a fine balanced performance at a realistic price. Now the *Super* treatment has been applied to the more expensive *MC20* model, and in this case the re-design appears to have been even more extensive.

At its current UK price, the *'20 Super* is neither cheap enough to be purchased easily along with a turntable nor expensive enough to be classed as a pukka 'exotic'. Ortofon, with some justification, regard the gold-finished *'20 Super* as a bargain-priced exotic, and certainly the rigid all-metal body construction is normally associated with higher priced models. Solid integral circular fixing lugs and a good headshell contact area should ensure rigid mounting in high quality tonearms.

Until recently, Ortofon moving-coil models have shown a significantly lower output voltage than most of the competition. Though not a bad thing in itself, this placed a burden upon the amplifier designer to keep noise figures low, and thus proved a mild commercial disadvantage. Recent technical developments have led to more powerful small magnets, so first the *MC10* and now the *MC20S* have more normal moving-coil output levels, while still retaining a low source impedance.

Designing for rigidity and respectable output has had the one undesirable side-effect of a highish mass of 9g, this similar in fact to the Shure and Kiseki also reviewed in these pages, though substantially heavier than the Linn *Karma* or *Asaka*. This makes the task of balancing tracking ability against the low frequency resonance a little more difficult.

Stylus is specified as a van den Hul II, which is a fine quality tip well suited to the highish 1.8g downforce. Despite the generous tracking weight, the tracking ability is adequate rather than impressive. Measurement showed that channel balance and separation were likewise good rather than spectacular, while the response was impressively smooth, flat and extended. The output level is adequate for all normal moving-coil amplifier inputs.

The generator mechanism is impressively symmetrical in vertical and horizontal compliance and in terms of the lightish damping. A lower effective mass than the 13.5g test arm would probably provide the best match; ideally under 10g is to be preferred, though up to 15g effective mass may be used without the resonant frequency dropping down into the warp danger zone. Happily, Ortofon's carefully chosen combination of mass, compliance and damping result in a well-balanced design.

SOUND QUALITY

Sound quality was very inviting, tending towards politeness rather than excitement. Attractive clear and open sounding, the balance tended towards the 'dry' and 'thin'. Treble was very detailed, if perhaps a little obvious, and while the bass sounded well extended and firm, it was a little lacking in 'slam' and 'punch'. Stereo imaging was delightful, spacious and 'airy' with good soundfield integration. The cartridge showed very tidy control of unwanted resonances, but was felt to lack a little energy in the bass and lower mid regions, and did not sound as 'quick' as some designs.

CONCLUSION

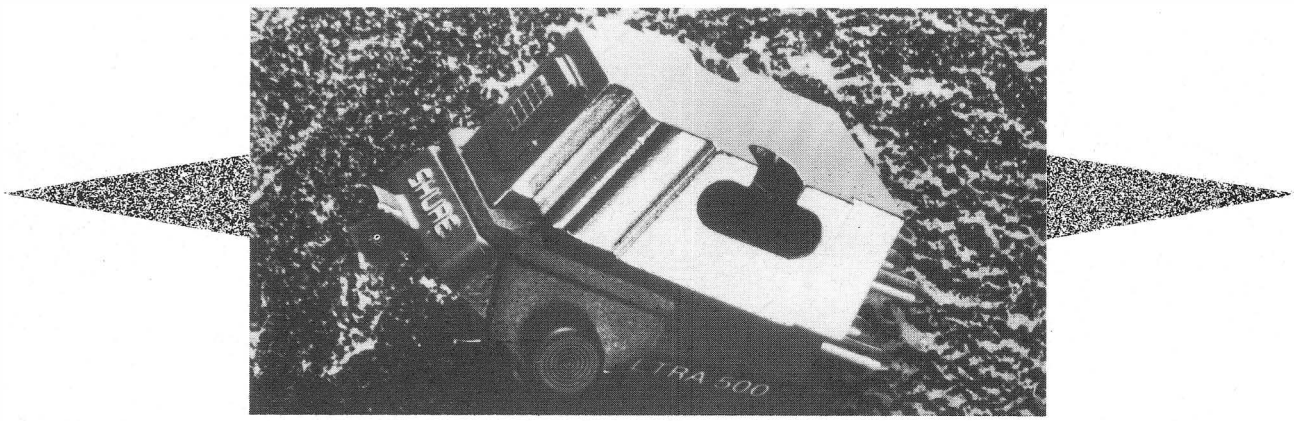
Overall, this new Ortofon is a very competitive and well balanced package which certainly merits recommendation on the basis of fine sound quality and wide compatibility at a reasonable price. In many ways its performance can approach the much more expensive exotic models, though the total package does fall a little short of the best. The strength of the *MC20 Super* is that it should give a realistic and high standard of performance in a wide range of 'real' hi-fi systems. It is demonstrably better than the *'10*, yet at a price which shouldn't impose excessive financial hardship.

TEST RESULTS

Type, mass	low output moving coil, 9g
Output Level (1kHz, 5cm/s)	0.2mV
Channel balance	-0.5dB
Channel separation (L, R)	30, 28.6dB
Tracking ability (L,R)	68, 63μm
Frequency response limits 1kHz-15kHz	+0.5, −1.5db
Test tracking weight, loading	1.8g, n.a.pF
LF resonance frequency, 13.5g arm (vert, lat)	9, 9Hz
Estimated compliance (vert, lat)	16, 16cu
Recommended arm effective mass	6-15g
LF resonance rise, 13.5g arm (vert, lat)	15, 15dB
Typical selling price	£125

SHURE ULTRA 500

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



Four hundred odd pounds seems on the surface a lot of money to pay for any cartridge, especially one of the moving-magnet variety — though there are precedents in the exotic hand-tweaked Grado *Signature* series, this is the first time for many years that Shure have ventured into the real high end.

Shure have been one of the great pioneers of cartridge technology, taking an almost self-consciously engineering-led approach invariably headed by their most expensive model. The *Ultra 500* bristles with specific engineering features, including the telescopic beryllium tube cantilever, the 'ridged' stylus profile, advanced laminated magnetic generator structure, and a Dynamic Stabiliser.

One major departure with the '500 is its use of a comparatively heavy metal body which is engineered to give a firm headshell fit. Improved body/mounting rigidity was one reason why many critics, myself included, preferred the *V15-V* to the *IV*, and in this respect the *Ultra 500* is the next logical step.

While it is good to see this strong rigid body, the lugs might have finished the job by completing the circle rather than being cut away at the edges. And there is inherent flexibility in any detachable stylus assembly, despite careful engineering.

Shure have retained their commitment to extending the boundaries of tracking ability, so this model has a highish compliance as well as highish mass. This is a combination that under normal circumstances could be unwise, due to the risk of record warps exciting the fundamental resonance of the arm/cartridge combination. The notable effect of Shure's Dynamic Stabiliser is that it effectively removes the troublesome vertical resonance, so the problem is sidestepped.

SOUND QUALITY

Unlike the other similarly-priced models tested, this is a moving-magnet cartridge, so the assessment, using different amplifier circuitry, cannot be truly competitive. Furthermore, a modern UK audiophile system, such as the one used for auditioning on this occasion, does tend to be moving-coil oriented, giving its best with these low output, low source impedance devices.

Admitting therefore that the *Ultra 500* probably started at a slight disadvantage, it acquitted itself very respectably, and the tracking security gave audible benefits. The stereo image seemed a little narrower than that provided by the expensive moving-coil models, the soundstage more closely confined to the loudspeaker enclosures, though again the stability and freedom from 'nasties' was appreciated.

Overall balance was attractively 'lively', a little forward perhaps, but well-focused in the presence and vocal regions. Treble showed fine control, with no 'splash' and very little 'smear', if not perhaps as 'fast' as some m-c models; changing pre-amp loading capacitance yielded only marginal subjective differences here, which were not considered very significant. Low frequencies were uncoloured and quite well extended, though there did seem some lack of 'weight' and a reduced sense of scale in the total presentation.

LAB REPORT

Only a basic technical examination was carried out on this occasion. Results were generally good, and impressively consistent whether or not the stabiliser was used. However, despite careful installation alignment, separation only just bettered 25dB on one channel (1kHz), though it exceeded 30dB on the other; this is not a bad result per se, but is nevertheless a little disappointing considering the price.

Tracking ability comfortably exceeded our measurement limit, though the horizontal compliance is a little on the high side for medium mass arms. The inherent internal mechanical damping appears to be lighter than many previous Shures, while the stabiliser removes the vertical LF resonance almost completely, and reduces the horizontal component by 3dB. The response seemed impressively flat.

CONCLUSION

There is no doubting the accomplishments of what could well be the finest moving-magnet cartridge around. Whether they are sufficient to justify the high asking price is harder to judge. In the context of the system used for auditioning, more is possible elsewhere, but usually to some degree with the disadvantage of a little more 'temperament'. For those with whom tracking ability and control are major priorities, the *Ultra 500* delivers the goods, and will do so across a broad range of turntable and arm systems with great equanimity.

TEST RESULTS

Type, mass	moving magnet, 9.3g
Output Level (1kHz, 5cm/s)	3mV
Channel balance	0dB
Channel separation (L,R)	25.6, 30dB
Tracking ability (L,R)	80, 80μm
Frequency response limits 1kHz-15kHz	+1, −1.5db
Frequency response limits 1kHz-20kHz	+1, −1.5db
Test tracking weight, loading	1.7g (total), 250pF
LF resonance frequency, 12.5g arm (vert, lat)	9*, 7Hz
Estimated compliance (vert, lat)	20, 27cu
Recommended arm effective mass	6-14g
LF resonance rise, 12.5g arm (vert, lat)	15*, 16db
Typical selling price	£452

**This resonance removed when stabiliser is used.*

SUPEX SDX2000

RUSS ANDREWS TURNTABLE ACCESSORIES, EDGE BANK HOUSE, SKELSMERGH, KENDAL, CUMBRIA LA8 9AS. TEL: (053 983) 247

Latest moving-coils from Supex are the high-and low-output *SDX2000* models, the latter distinguished by its maroon body and marginally less expensive at just under £480.

Fine mechanical construction with solid lugs and a good contact area ensure this model may be securely mounted, necessary in a good quality arm because substantial energy may be coupled. Stylus is the usual high quality Vital, again rather over-glued in this instance.

Compliance is quite low, but so is the mass, so a fairly wide range of arms may be used, with preference for strong rigid types. Tracking is a little marginal for some tastes in music, and considering the sensible 1.8g downforce. Damping was a little higher than the Supex norm.

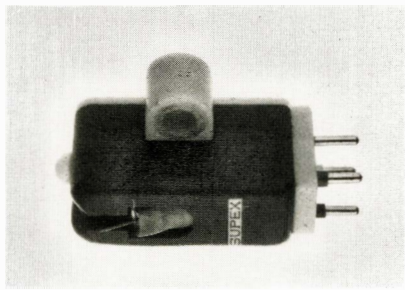
LAB REPORT

The low-output *2000's* frequency response is very flat and quite smooth, showing a less exaggerated downtilt and recovery, with very good control and channel balance up to ultrasonic frequencies. The high-output *2000's* response was almost identical to the low-output model, but with each of the latter's flaws slightly exaggerated. In addition there were a number of response 'glitches', perhaps due to the greater number of internal wire turns. Though inevitably not quite up to the low-output's standard, it is a fine result nonetheless. Separation was fine.

SOUND QUALITY

Reception to the *2000* was rather mixed, though generally positive. The sound was described as rather on the bright side, notably 'quick' at mid and high frequencies, yet with a heavy slightly 'sluggish' bass, which somehow seemed to lack the expected tension and power. The soundstage was big and open, with good detail and without exaggeration of surface noise. In all it sounded lively, but not entirely integrated across the spectrum.

For some reason the reaction of the listening panel to the high-output *2000* was the more positive. Treble balance was quite neutral in relation to CD (though sonically substantially preferred). Which means it is a touch on the bright side, but with additional weight and richness at the bottom end. The treble sounded sweet and fast, the midrange coherent and detailed, surface noise was controlled, but bass definition was thought not quite right.



SUPEX SD900 IV AND SD901 IV

Very much an old favourite, the Supex *900*, in early wooden and latter plastic-body forms, pioneered the UK moving-coil revival a decade or so ago. It has now been upgraded to Mk IV status, with further improvements to the excellent external finish via a new bottom plate. This low-output moving-coil model needs the full step up of an m-c pre-amp. It is fitted with a fine advanced Vital elliptical tip, on a small rectangular shank.

The silver-bodied *901* is the high-output moving-coil sister of the *900*, and is also now in Mk IV form. Past experience has shown that output of the *901* is still lower than a normal moving-magnet cartridge, and it is worthwhile checking that a particular pre-amplifier has enough sensitivity.

LAB REPORT

The *900's* frequency response kept within fairly close limits, though a 2.5dB downtilt starts at around 200Hz and bottoms out at 5kHz. A mild 1dB recovery is centred upon 10kHz, with a slightly uneven but well balanced continuation beyond. The *901* was very similar though a little brighter and with a more pronounced peak in the treble region. The downtilt was held to around 2dB, and the recovery at 9kHz made up the same amount. Channel balance was outstanding throughout, even above the treble peak.

SOUND QUALITY

Earlier *900* versions have sailed through listening panel tests often enough and we were surprised that the new *900 IV* was not better received. Criticisms on this occasion were of a tendency to dullness and slowness, with some bass softening. On the other hand, the *901* received plaudits like 'exudes authenticity'. A degree of 'boom 'n' tizz' was criticised, but there was praise for mid and treble detail, for space and ambience, and the ability to maintain resolution well down into the mix. Not everyone was completely convinced, and there was felt to be some room for improvement in the bass, which showed mild tracking problems and was a little 'sluggish', but on balance the *901* gave a fine overall performance.

CONCLUSION

The Supex *900* is an inherently fine cartridge, but despite the recent update it does seem to be beginning to show its age. The *901* delivered sufficient objective and subjective performance to justify its price tag, and the (fairly) high output allows it to provide high quality moving-coil performance for systems without m-c gain where a separate step-up would be an intrusion.

Distinguished from the 'low' version by the uniqueness of a high-output option within the context of a top up-to-date moving-coil design, the *2000* 'high' merits recommendation. It doesn't match the best of the low-output designs sonically, and there may be some conventional inputs which need a little more urge than it can provide. But it is a pukka modern m-c, 'faster' than the *901*, and therefore has its own unique niche.

TEST RESULTS

SUPEX SDX2000 HIGH OUTPUT

Type, mass	high output moving coil, 4.8g
Stylus type	vital line contact
Stylus inspection result	fair quality vital, rather gluey
Output Level (1kHz, 5cm/s)	1.1mV
Relative output (0dB=1mV/cm/s)	−10dB
Channel balance	0.4dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	79, 66μm
Frequency response limits 100Hz-5kHz	+1, −0.5db
Frequency response limits 30Hz-20kHz	+1, −0.5db
Stereo Separation L on R 80Hz, 3kHz, 10kHz	34, 52, 33dB
Stereo Separation R on L 80Hz, 3kHz, 10kHz	36, 48, 33dB
Response limits ref computer mean, 1kHz-15kHz	+2, −0dB
Response limits ref computer mean, 1kHz-20kHz	+5, −0dB
Test tracking weight, loading	1.8g, n.a.
LF resonance frequency, 13.5g arm (vert, lat)	10, 9Hz
Estimated compliance (vert, lat)	14, 18cu
Recommended arm effective mass	6-16g
LF resonance rise, 13.5g arm (vert, lat)	13, 14dB
Typical selling price	£529

First reviewed: 1985. Rating: Recommended (high output verstion). For full lab reports on SDX2000 low output, SD900 IV and SD901 IV, see issue 43.

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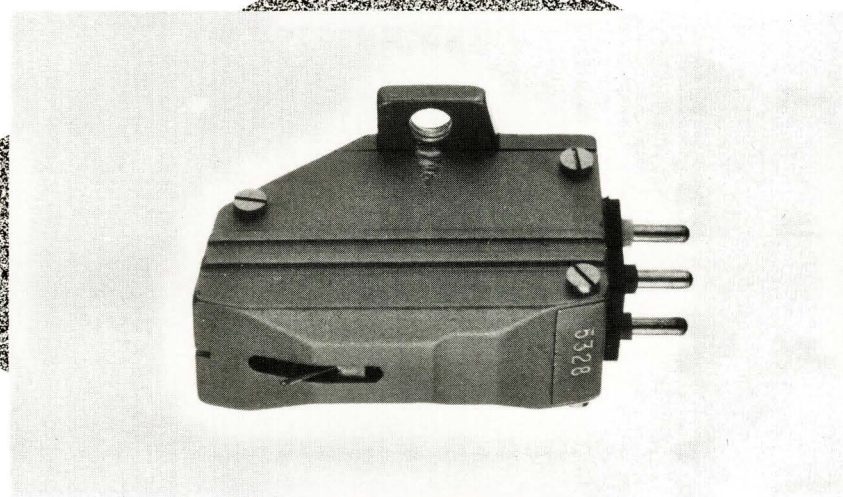


Dutchman A.J. van den Hul has become a powerful influence in cartridge design, both through the adoption of his stylus profile by several manufacturers, and his design consultancy work for other manufacturers, notably Empire. His own name has become a brand through the modifications he has performed on existing designs such as EMTs and Deccas; the *MC10* represents his handmade version of the Empire *MC1000*, which he designed.

This expensive low-output moving-coil cartridge reportedly uses the latest type of 'mono-crystal' wire internally, and was supplied with a set of special silver headshell leads. Though not a complete solid casting, the screwed alloy body looks quite rigid, and rather small tapped lugs take the fixing screws directly.

While the arrangement helps save mass at the headshell, it risks the problem, which we in fact encountered, of the thread stripping, and frankly does not lend itself to confident tight fixing.

Compliance of the first sample we received was exasperatingly excessive, but a later sample gave a less well-damped resonance at a sensible 9Hz, indicating suitable matching with most tonearms.

LAB REPORT

A very fine-looking frequency response gave a gently 2-3dB downtilt across the band, and held within 0.5dB of a straight line throughout. There was some evidence of small mechanical resonances here and there, particularly above 5kHz.

Separation showed some mild asymmetry but achieved consistently high values throughout the range, best in the midband but very well maintained towards the frequency extremes, with slight evidence of ultrasonic spuriae.

SOUND QUALITY

'High drama' is a phrase lifted from the panel comments to describe a sound favoured by all listeners (but one) for its 'liveliness', the exceptional 'space' and 'air', decent 'speed' and fine timing and integration. Treble detail was resolved with consummate ease and lack of 'grain'. And this was the first over-compliant sample; its replacement seemed to bring the bass into better focus.

When re-auditioning, tracking weight was found to be critical in obtaining the best sound, 1.25g giving best sonic results under our conditions, though compromising the tracking margins somewhat.

The one general complaint about the *MC10* was a slightly intrusive brightness about the balance. This probably aided its exceptional analytical capabilities, but could be a touch fatiguing, particularly on poorly mixed material.

CONCLUSION

Though a touch temperamental, the *MC10* makes a genuine contribution towards the state of the art, making a strong claim to a 'best bar none' title. Demanding recommendation, this distinctively well engineered and solidly constructed moving-coil model certainly goes a long way towards justifying the high price.

TEST RESULTS

Type, mass	low output moving coil, 7.3g
Stylus type	van den Hul
Stylus inspection result	excellent vdH
Output Level (1kHz, 5cm/s)	0.38mV
Relative output (0dB=1mV/cm/s)	−20dB
Channel balance	0.5dB
Channel separation (L,R)	30, 30dB
Tracking ability (L,R)	80, 72μm
Frequency response limits 100Hz-5kHz	+1, −1dB
Frequency response limits 30Hz-20kHz	+1, −2dB
Separation L on R 80Hz, 3kHz, 10kHz	35, 42, 38dB
Separation R on L 80Hz, 3kHz, 10kHz 33333337,	50, 35dB
Response limits ref computer mean, 1kHz-15kHz	+1, −1dB
Response limits ref computer mean, 1kHz-20kHz	+2.5, −1dB
Test tracking weight, loading	1.6g, n.a.
LF resonance frequency, 13.5g arm (vert, lat)	8, 6Hz
Estimated compliance (vert, lat)	20, 35cu
Recommended arm effective mass	6-12g
LF resonance rise, 13.5g arm (vert, lat)	11, 12dB
Typical selling price	£500

First reviewed: 1985. Rating: Recommended.

THE HEART OF THE SYSTEM . . .

. . . is the amplifier, whether or not it has valves. Here Martin Colloms discusses the factors which determine amplifier sound quality, and the magic of 'tubes'.

What makes a good amplifier? To answer this, we must outline the important aspects of amplifier performance. Taking technical parameters first, the primary specification is power, usually quoted as watts per channel into 8ohms (sometimes 4ohms), but this in itself can give a misleading impression when amplifiers are being compared.

A decent-sized amplifier would offer 100W per channel (or 20dBW) while to be significantly larger, another would have to be heading towards 200W (23dBW). Here the figures in brackets are expressed on a more relevant logarithmic scale, where 0dBW = 1W into 8ohms, relating rather more closely to the human hearing response to loudness than the watts per channel figure. With reasonably efficient speaker models offering an 87-90dB sound level for 1W input (measured at a distance of 1m), a 40 or 50W per channel (around 17dBW) will provide quite generous sound levels of 100dBA in a typical room. It is easy to be over-impressed by the wattage ratings of amplifiers, when in practice a doubling of watts gives only relatively small 3dB increase in loudness. In fact, a doubling of subjectively perceived loudness would require the power to be increased by approximately ten times!

Possibly of greater importance is an amplifier's load driving ability — whether it can drive a range of loudspeakers whose real load characteristics, as seen by the driving amplifier, can vary far below the nominal 4-8ohm specification. Some loudspeakers can momentarily reach 2.5ohms and only the tougher amplifiers can stand the pace. One particular audiophile loudspeaker, the Apogee *Scintilla*, is now only available in a nominal 1ohm low impedance form. Particular care needs to be taken when selecting a compatible amp; for example a 100W (20dBW) model will normally need to offer a peak current capacity of 15-20A while use with the *Scintilla* will require a 30A capability as a baseline; for a 200W, 23dBW amplifier, 60A will be needed. Given the moderate sensitivity rating for this particular speaker, amplifiers below 100W (8ohm rating) will not be suitable.

ARGUMENT

A number of subsidiary parameters are also quoted in connection with an amplifier's technical specification and performance, and there is continuing argument concerning the importance of such factors as harmonic and intermodulation distortion, damping factor, frequency response, channel separation and the like. However, it is very hard to show any conclusive relationship between these technically valid measurements and perceived subjective sound quality.

Once a basically good technical performance has been attained, the pursuit of technically good measurements for their own sake can actually prove destructive to the production of good sound. As an analogy, it seems quite easy to measure the acceleration performance of a car based on the popular 0-60mph time, but this single figure cannot convey the flexibility of the engine, the aptness of the gear rations, or even how many gear changes were needed. Over a given route, the handling and cornering performance may actually matter far more than the outright accelerative performance or top speed potential.

An amplifier can also be similarly misjudged. In the real world, how it sounds and how it behaves are more important than any printed circuit specification of performance claim. It is in this territory that truly high performance amplifiers can make their mark. They virtually defy attempts to quantify their performance under lab conditions yet can provide extraordinary listening experiences in an appropriate audio system.

THE 'HIGH END'

Enthusiasts with high expectations will readily appreciate the sonic quality of a good amplifier as opposed to the performance of an audio workhorse in almost universal daily use. Standards are very high indeed in the upper reaches, and some very costly equipment is available. It is possible to spend up to £20000 on an amplifier system but it must be said that these are few and far between and the equipment is neither widely available or necessarily well received by the critics. Real 'high end' equipment may begin at around the £2000 level, this rough figure including both the pre-amplifier or control section as well as the separate power amplifier. Some very fine systems are available in the price range £2000-£10000, and many committed listeners make serious choices in this area knowing that such an investment will maintain a high standard (given maintenance) for many years to come.

During the late '50s and '60s, the best audio products used vacuum tube or valve active devices, and a number of these are still giving good service. Towards the end of this period, the transistor based designs became more successful and of course in terms of the audio market taken as a whole, the transistor dominates today. At the high end, however, some valve designs managed to keep a foothold, as they were believed to offer superior sound quality and while they were commercially in decline, the valve designers still persevered.

Today some of the finest top end amplifiers still use valves, with such companies as the Audio Research Corporation and Conrad Johnson leading the field. Fine bipolar or transistor designs are also in production, such as the Krell range, the Robertson *40-10* and the like.

The question then arises, should it be valve or transistor? Below £500 there is no choice and it has to be transistor — some fine models do exist, though, such as the *Cyrus 2/PSX* (£460). At £800, it is possible to go valve, for example, with the Croft power amplifier and their *Micro* preamp. The Beard *P35* is another good valve power amplifier at under £700, to which the Croft *Micro* may be added. In this price range, there are several notable transistor alternatives, such as the Cambridge Audio power amp at £500, the fine Audiolab *8000P* at £450, and the Musical Fidelity new series pre-amps.

The choice of pre-amplifier may be less critical. A valve pre-amp may offer the most natural tonal quality but may not accept moving-coil cartridges well enough to achieve low noise figures — something transistor amps achieve easily.

On the power amplifier side, although they are very costly, valve designs can give a realistically transparent and subtle stereo image, portrayed with fine depth and ambience. The overall precision and impact can also be right up with the best, though in general, valve amps require careful consideration of the accompanying speakers and their loading. Fine transistor power amps can prove a shade less transparent and revealing of stereo depth, but conversely, they can drive many speakers as effortlessly as if they were small power stations, and in this respect they are described as being 'load tolerant'.

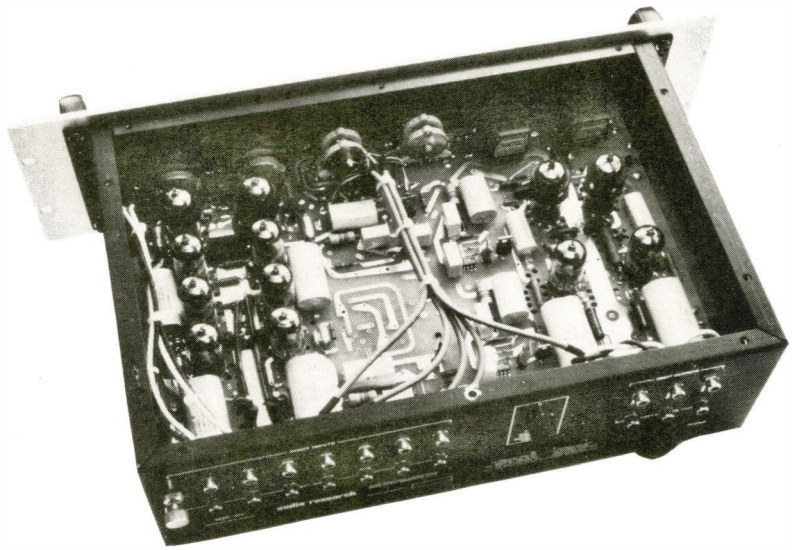
Take the case of the *Scintilla* loudspeaker — a Krell or other similar device is the right choice here, whereas for a more straightforward loading such as a Magneplanar or an Infinity, a valve design can be used, perhaps on the grounds of overall 'musicality.'

In general Class 'A' transistor amplifiers such as the Krell warm up to correct operating temperature quite quickly, while some A/B designs may take 30 minutes to a full hour before they are at their best. The valve models are pretty good after five minutes and continue to improve slowly thereafter.

One final point concerning high end tube or valve models is that they can require periodic maintenance and valve replacement — against this, most transistor models are usually maintenance-free for periods of several years at a time. Like a highly-tuned engine, valve designs need more frequent check-ups, which is just one of the penalties one has to pay for their true 'high end' performance.

AUDIO RESEARCH SP10/M100

ABSOLUTE SOUNDS, 42 PARKSIDE, LONDON SW19. TEL: 01-947 5047



These true 'high end' products are extremely expensive, and together with matching cables will cost in the region of £10,000. Excepting the odd regulator, tubes (valves) are used throughout, while the basic specification is 100W, 20dBW per channel. Since something of this size may be purchased for as little as one fiftieth the cost of the two Audio Research units, we have to be talking of something pretty substantial in terms of differences in sound quality for the differential to begin to be justified. In fact, both these products are virtually state of the art, and their advanced circuit design is in this case reflected by their exceptional standard of sound quality.

The *SP10* has been with us for several years now, and is presently in *Mk II* form. A still higher performance version called the *SP11* is to be made available at a higher cost — this will be a hybrid design mixing FETs and valves and should aspire to the ultimate.

While the *SP8* was the Audio Research Company's original flagship pre-amplifier, and is still one of the world's finest, the *'10* followed as an expression of what was possible if no practical limits were imposed. In a sense the *M100* mono block power amplifiers can be seen as a similar expression. The excellent *D115 II* power amp represents a practical view of a high performance stereo chassis, but in the *M100* incarnation, a *D115* frame becomes a mono power amp, with all its resources devoted to just one channel.

Left at this point, such an amplifier would have certain advantages, but ARC were not content to let it rest here. New generation circuitry was evolved for the *M100*, to lift the performance well beyond the previous, already very good, standard. High current output drivers have been fitted, while the output biasing scheme has been improved with the advantage of easier setting up. Capacitors have also been eliminated from earlier stages by using dc coupling, this augmented by an additional servo amplifier to stabilise the correct operating points, dynamically and statically. ARC's balanced cross-coupled circuit technology is retained including the special coupling for the output tubes, both to the primary and secondaries of the superb output transformers.

The *SP10* pre-amplifier is a two-box affair, the second box containing the power supply, which on the samples I have used so far suffers from some mild transformer hum. Comprehensive inputs include a disc input suitable for moving-coil cartridges of healthy output, and the ideal loadings may be selected conveniently by a front panel switch. A 'straight line' design, no tone controls are present, and the signal paths are wideband. A bypass switch routes the disc signal direct to the output stage, avoiding the 'balance' and 'mono-stereo' selector sections.

Pre-amplifier circuitry include advanced cascode configurations with paralleled low noise valves at the input to improve the overall dynamic range. Good channel separation is assured by the separated internal design and extensive use of regulated supplies to isolate the channels and indeed the separate stages. ARC have long made it a policy to devote as much attention to the sound quality effects of their power supplies as to the amplifying circuitry itself.

On matching, the *SP10* is capable of driving quite long cables — up to 15 metres if required. On the *M100* power amplifiers, output taps are provided for 16, 8 and 4ohm loads, but the *Scintilla* speaker (by the same importer) is a special case.

SOUND QUALITY

These are both truly exceptional products. They worked superbly as a pair, effortlessly delivering musical dynamic sound stages, and at the end of the review it proved hard to part with them! Taking the *SP10* first, it is clearly one of the world's finest, capable of superbly focused, stable stereo images, finely textured and virtually grainless. Matching the manufacturers 'High Definition' specification, the *SP10* gave a rewarding separation of the individual musical strands in complex scoring. Images showed very good scale, particularly in width terms, while the depth and ambience were also both very good.

Essentially neutral, all areas of the audible frequency range were reproduced very well. A particular strength concerned subjective dynamics, where the *SP10* drew and held one's attention by maintaining the 'drive' and 'life' in the programme. This proved true of both classical and popular material over a wide range of programme quality.

Turning to the *M100*, this power amplifier initially left us speechless. It was one of those great products that can genuinely expand one's horizons and point to the way ahead. The finest amplifier I have ever had the pleasure to hear, in my view its margin of superiority is appreciable.

Its tonality was extraordinarily rich — one might think too much so if one did

not know better. The treble was devoid of grain and false projection while the bass was immensely deep and powerful, suggesting that one's speakers had been set in a concrete sub-floor. Against this authoritative, pure musical character, the amplifier displays a sparkling lively transient performance with thrilling dynamic impact. Dynamic contrasts took me by surprise, so revealing was this amplifier's performance in this particular area. It was excellently transparent, this quality held over a very wide frequency range, and it allowed the *M100* to produce excellent subjective depth in the stereo image. The latter was of huge scale, yet remained superbly and stably focused. Who could wish for more?

Lab Report

We experienced no problems with headroom using the *SP10*, since it could produce more than 80V output from a moderate 780ohm output impedance. At nominal 0.5V outputs, with an IHF standard input the harmonic and intermodulation distortion figures were very good over the whole frequency range, for example 0.003% at 1kHz. An increase in intermodulation was noted via disc. Noise levels were very good for the nominally moving-magnet disc input and when this was used as a moving-coil compatible input with the appropriate loading, noise levels were just satisfactory; but this is a technical qualification only, and in practice, many owners use Koetsus and other similar cartridges with fine results.

Figures for input overload relate to two gain conditions, set to 'high' for moving-coil and 'low' for moving-magnet. Good overload margins were shown for both conditions, while the reducing margin at high frequencies is not uncommon with valve pre-amps. Channel separation varied depending on whether the crosstalk was measured right on left or left on right, and was fairly unimpressive at high frequencies. However, no adverse subjective effects were noted as a result of this. The RIAA equalisation was highly accurate, though with a slight hint of bass shelving: −0.5dB by 20Hz.

The *M100* power amplifier comfortably met its 20dBW specification when working into an 8ohm load correctly matched. Output impedance was a moderate 0.46ohms, and it showed a good power bandwidth provided that the appropriate load tap was used. Current delivery was pretty good for a valve amplifier and it also proved surprisingly load tolerant. Distortions were satisfactory at full power and improved markedly at more realistic, lower powers. For example, by 0dBW, 1 watt, the 19/20kHz intermodulation distortion had fallen to −72.3dB compared with −47.6dB at full level.

Noise levels were satisfactory while the frequency response was very wide, extending from less than 0.5Hz to 33.5kHz for small −0.5dB limits. Within the audio range it was almost perfectly flat though some variation will be imposed on the output impedance by speaker loading differences. A good result was obtained for the power modulation test, producing a graph dominated by pure harmonics of the input frequency.

Conclusion

Both these products are currently secure at their respective price points. Given good matching to the source, the *SP10*'s performance was impeccable and truthfully upholds the 'high definition' description on its front panel. One cannot argue with its very fine sound quality. If possible, such review approval is extended still further in the case of the *M100* power amplifier, whose performance bordered on the magical. The comments were all highly positive for this amazing product, one which must surely be destined to make its own audio legend.

Test Results

Rated power into 8ohms, maker's spec	100W(=20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.6dBW	21.1dBW	20.4dBW
Both channels, 4ohm load	—	17.6dBW	—
One channel, 2ohms, pulsed	—	16dBW	—
Instantaneous peak current		+12A	−12A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−47.9dB	−52dB	−41.8dB

NOISE*

Disc (mm) input (IHF, CCIR weighted)	−71dB
Disc (mc) input (IHF, CCIR weighted)	−57dB
Aux/CD input (IHF, CCIR weighted)	−72dB

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	37.7dB	36.0dB	24.4dB
Disc (mc) input (IHF)	43.2dB	41.3dB	21.5dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Input data	socket type	sensitivity	loading	
Disc (mm) input	Phono	0.49mV	47kohms	500pF
Disc (mc) input	Phono	0.13mV	100ohms	11nF
Aux input	Phono	29mV	4.7kohms	50pF
Power amp	Phono	69.5mV	100kohms	—

Output, pre-amp (tape)	84.9V max, 780ohms
Disc equalisation error, 30Hz-15kHz	+0dB, −0.58dB
Size (width, height, depth)	48 × 14 × 34cm*
Typical price inc VAT	£3897, £2850 each

*SP10 only (power supply unit is same size)

AUDIOLAB 8000C/8000P

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

These modern all transistor designs offer impeccable specifications, and yet much care has also been devoted to how they sound. The 8000C pre-amp in particular is extremely versatile — for example, it includes low noise moving-coil inputs as well as moving-magnet. Sensible tone controls are fitted, which are virtually inaudible in terms of their effect on the sound quality when not in use, while two tape decks and many inputs may also be accommodated. A headphone outlet fed by its own small power amplifier, is also provided in the pre-amp. The 100W (20dBW) per channel power amplifier has no controls bar the on/off switch, while speaker connection is via standard 4mm socket/binding posts..

SOUND QUALITY

Used with good cable, the Audiolab separates provided an impressive standard of sound quality, proving tidier, more refined and also more powerful than the 8000A integrated amp. High levels were produced into both loadings, 105dBA into 8ohms and 104dBA into 4ohms.

The good standard of stereo depth was maintained, and interestingly, that slightly cold 'clinical' quality of the 8000A was also preserved, this better suited to mildly rich speakers and cartridges. Precise and detailed with a clean articulate bass, the Audiolabs' competitive scores set them apart in their price territory.

LAB REPORT

Covering the power amplifier first, this was clearly a very 'gutsy' performer with immaculate figures for power bandwidth, adverse load delivery and peak current, here to the test limit of ±40A! The pulsed delivery into 2ohms corresponded to 400W per channel into this load. All distortions were very low, in fact negligibly so, while dc offsets were also microscopic, thanks to the special dc servo in the amplifiers.

The pre-amp also measured very well, with flat frequency responses, good noise levels, sensible sensitivities and impedances, plus fine overload margins. Stereo separation was very good. The pre-amp could provide up to 10V output, from a low source resistance of 100ohms.

CONCLUSION

For '86, the pre-amp loses the contentious IEC rolloff on the disc input while both units were found to be notably improved — to the order of 10% on listening test scores for the pre-amp, and probably more for the power amplifier. Commended in the 1985 edition, the pre-amp has held its competitive position, ranking high in its price category. Previously the power amplifier was held back but now has blossomed into a fine model with a more natural tonality as well as improved stereo perspectives. This powerful, load tolerant model is well priced, and is now strongly recommended.

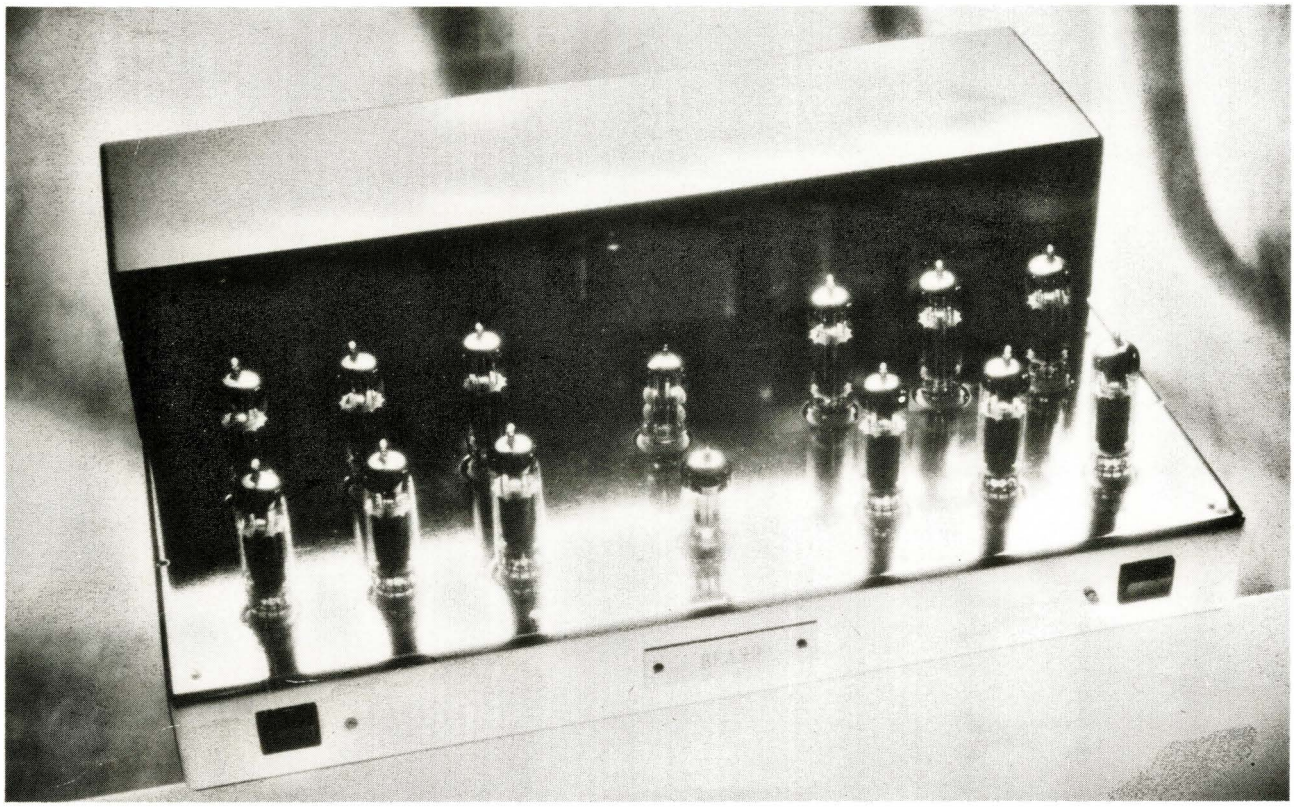
TEST RESULTS

	Pre- and power amplifier		
Rated power into 8ohms, maker's spec	100W(=20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	21.6dBW	21.8dBW	21.4dBW
Both channels, 4ohm load	19.6dBW	20.0dBW	19.6dBW
One channel, 2ohms, pulsed	−dBW	20.3dBW	−dBW
Instantaneous peak current		+40A	−40A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	<−90dB	−93dB	−74dB
NOISE			
Disc (mm) input (IHF, CCIR weighted)			−70dB
Disc (mc) input (IHF, CCIR weighted)			−67dB
Aux/CD input (IHF, CCIR weighted)			−70dB
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	26dB	31dB	30dB
Disc (mc) input (IHF)	30dB	26dB	25dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.28mV	47kohms 50pF
Disc (mc) input	Phono	0.018mV	10ohms —nF
Aux input	Phono	15/52mV	20kohms —pF
Power amp	Phono	1100mV	47kohms 320pF
Output, pre-amp (tape)			>5V 100ohms
Disc equalisation error, 30Hz-15kHz			+0dB, −2dB
Size (width, height, depth)	45 × 8 × 34cm,		45 × 8 × 34cm
Typical price inc VAT			£275 £450

First reviewed: 1985 (restested, 1986). Rating: Recommended.

BEARD P35 POWER AMPLIFIER

BEARD AUDIO SYSTEMS LTD, UNIT B1, ASKEW CRESCENT WORKSHOPS, LONDON W12 9DP. TEL: 01-749 4258



Built superbly, on a massive chrome chassis, this latest Beard power amplifier uses a simple straightforward circuit design, with high quality components with substantial reservoir capacity. Output valves are EL84s, six per channel giving a 35W rating in ultralinear configuration.

A large central toroidal transformer supplies the two channels, which have independent rectification and storage. 'Floating' biasing simplifies the construction though each valve needs to be individually set in production after 'burn in' at the factory.

A standby mode may be selected where appropriate, providing half power and a vastly increased operating life. Speaker connection is via Michell gold plated binding posts which take cable or plugs up to 4mm.

SOUND QUALITY

Beard's best yet, this amplifier proved capable of higher sound levels than its rating suggested, and could reach 102dBA on the 8ohm load. Mild transformer hum was noted on our final sample, so it probably should not be located too close to the listener. The sound was considered transparent, with pleasing depth and ambience plus an elegant, airy tonal quality. Slightly bright, it nevertheless reproduced complex vocals particularly well, while both bass and treble registers were rated pretty good in this category. Other key qualities included good low level detail and dynamics; overall, a lively musical effect with reasonably good stereo focus.

LAB REPORT

In the table, our clipping limit of 1% distortion was relaxed to 3% to accommodate the rising high frequency distortion of this model. For the rating the 2ohm delivery was quite healthy, while the peak current level of 5.5A mean indicated a fair load tolerance. At rated power, the 20kHz harmonic distortion approached 3% but improved at lower power levels. Conversely, the more important high frequency intermodulation result was pretty good, and better still at lower powers.

Predictably, stereo separation was excellent, due to the virtually double-mono construction. Rated as satisfactory as regards load tolerance, this low feedback design gave a consistent output impedance of 1ohm, which would slightly modify the perceived tonal balance of some speakers.

CONCLUSION

While this amplifier will need some care in matching it to a given system, it offered a genuinely high sound quality, with that distinctive and valued transparency associated with better valve designs. Considering the high build quality it was well priced, and comes confidently recommended.

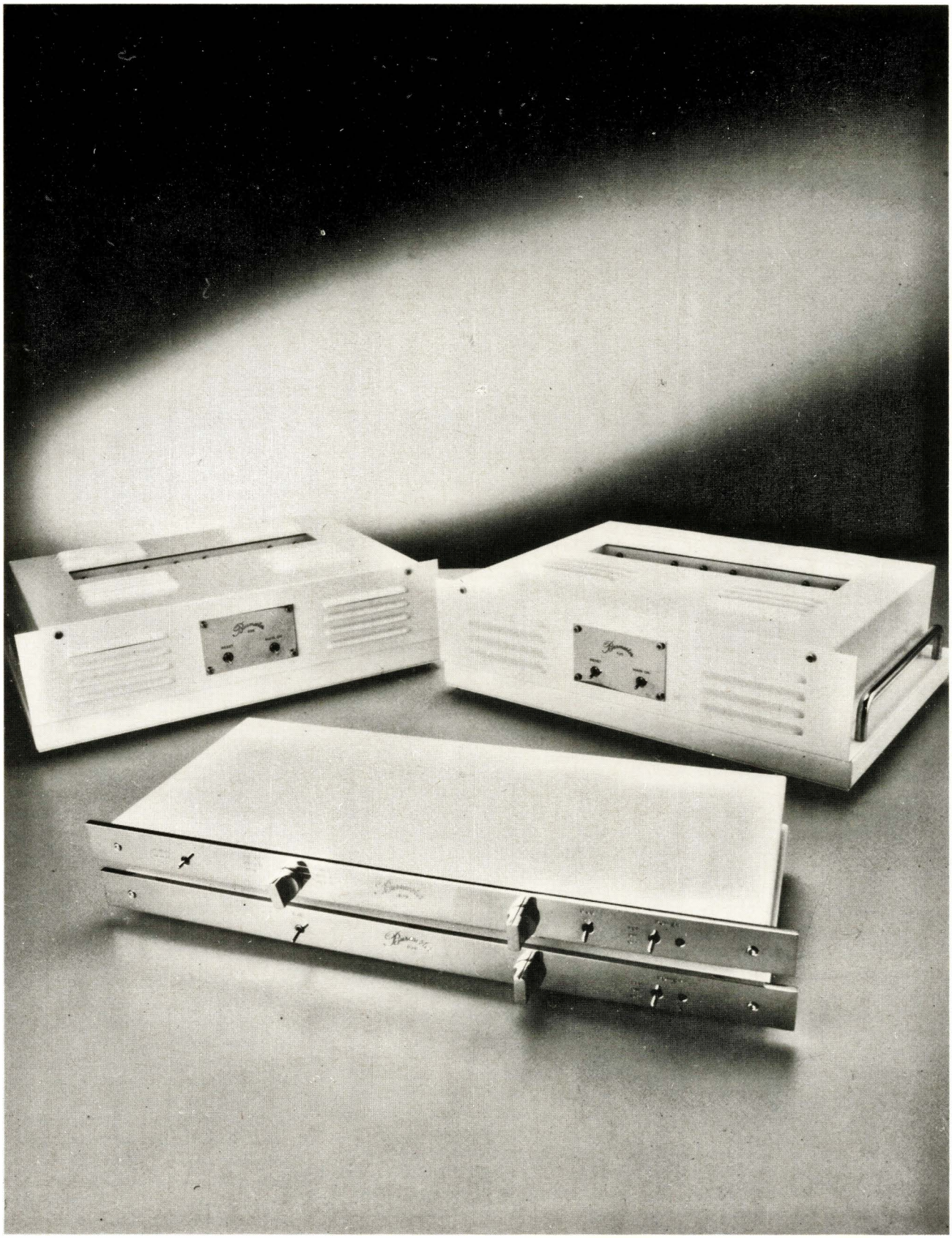
TEST RESULTS

Rated power into 8ohms, maker's spec	35W(=15dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.3dBW	16.5dBW	15.7dBW
One channel, 4ohm load	11.7dBW	11.8dBW	7.7dBW
One channel, 2ohms, pulsed	–dBW	12.4dBW	–dBW
Instantaneous peak current		+6.5A	–6.5A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–57.1dB	–58.2dB	–33.3dB
Intermodulation, 19/20kHz, rated power, aux input	–60.4dB		

NOISE

Aux/CD input (IHF, CCIR weighted)	–86.0dB		
Residual, unweighted (volume control at min)	–70.0dB		
Output impedance (damping)	0.88ohm	0.88ohm	0.84ohm
Input data	socket type	sensitivity	loading
Power amp	Phono	160mV	650kohms 320pF
Size (width, height, depth)	44.5 × 15 × 33.5cm		
Typical price inc VAT	£695		

First reviewed: 1986. Rating: Recommended.



BURMESTER 838/846/850 SYSTEM — ALSO AVAILABLE IN BLACK

BURMESTER 838/846/850

AUTOMATION SCIENCES, CO, 20 LITTLE GADDESDEN, BERKHAMSTEAD, HERTS HP4 IPA. TEL: 044284 2786

It is now three years since we first gave an enthusiastic welcome to the Burmester *785* pre-amplifier, one of a line of very high-quality components built in West Berlin by Dieter Burmester and imported to the UK by Automation Sciences. We have since been able to evaluate the more costly pre-amplifier combination of *838* disc pre-amp and *846* high-level pre-amplifier. Disc-only users may only require the *838*, while the *846* will provide other input facilities. For this edition, we completed the system with a pair of Burmester *850* mono power amplifiers, which offer a similar specified performance to the legendary *828*, at around half the cost. Described as load-tolerant, the amplifier is rated at a 100W 8ohms (20dBW), with a doubling of power into 4ohms. A version is also available that has been especially designed for use with the *Scintilla* in its one ohm form, optimised for high output current rather than voltage according to the *Scintilla* needs. Our samples were very early production ones, coming finished in white enamel. Black is also an option, to match the finish on the complementary *838/846* pre-amplifier units.

With the new balanced design of the *838/846*, the *850* follows suit and may be driven either balanced or unbalanced as required. Further improvements in cable sound can be the result. The *850* is unusual in that the balanced view is continued throughout, and in consequence the output is itself bridge balanced. Thus each monoblock contains two separate high current 25W amplifiers. A very substantial reservoir capacity is provided, of 4× 33000μF per unit, whilst the main amplifier circuit is very 'short', using hybrid techniques and a balanced input module. A non magnetic alloy chassis is employed, and the overall construction as well as the components are all of top quality.

SOUND QUALITY

Perhaps closest to the latest *838/846* series pre-amplifier, the *850* will form a well matched and balanced system when used with these products. Auditioned in an absolute context as part of a very high performance system, the *850* performed very well in its solid-state class. Notably refined, it conveyed an enviable feeling of stability coupled with a coherent, consistent sound quality that extends over almost the entire frequency range. The bass was both fast and dynamic, with just a hint of weight loss at very low frequencies. The midrange was unusual in its natural tonal quality, nearer to a valve than a transistor amplifier in this respect.

Fine control was maintained through the treble, which was free from 'glare' or 'edge' yet also lacked some air and sparkle. Stereo depth was generally good though some loss of ultimate transparency and far space ambience was noted. Overall it was elegant, highly controlled — in fact, almost unemotional.

LAB REPORT

In the lab, the *838* provided an extremely uniform disc equalisation with excellent balance and little response tailoring at the band extremes. Set to the 0.33mV sensitivity for 1V output, the mc input level was 0.45mV which was coupled to a fine signal to noise ratio. This unit will be silent with most mc cartridges. Overload margins were sufficient but must be augmented by an appropriate choice of sensitivity; this should be set as low as possible (that is, for lowest gain). Offsets, balance, distortion and separation were all exemplary, and in fact such results are typical of the best laboratory test equipment.

Turning to the *850*, designer Dieter Burmester proves his well-balanced view of amplifier performance in this fine set of test results. The specification was comfortably met with power maxima of over 150W. Power bandwidth and load tolerance were excellent, distortions were essentially negligible at all powers and frequencies, while a very healthy peak current capability was shown, averaging ±34.5A. Even our standard *850* would attempt a 1ohm *Scintilla*, never mind the special version! The frequency response was wide and flat, though the input impedance was rather low, is well matched to other Burmester products.

A fine result was also obtained for the power intermodulation test, while supply harmonics were well rejected. On test it was noted that one mono-block ran pretty hot, to a case temperature of some 50°C while the other ran somewhat cooler. Mechanical hum was moderate.

CONCLUSION

The *838*'s strong points include extreme neutrality, dry clean bass and notably sharp stereo focusing. While not quite entering the territory of the best tubed devices, the current *838* and *846* are very fine pieces of equipment, and are recommended.

The *850* is the power amplifier Burmester owners have been waiting for — a new high performance fully balanced design, compatible with the latest balanced series pre-amplifiers. These superbly built and finished products are somewhere near the top of the solid state tree, and deserve serious consideration.

TEST RESULTS

Rated power into 8ohms, maker's spec	100W(=20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.9dBW	21.1dBW	20.9dBW
Both channels, 4ohm load	19.8dBW	20.0dBW	19.9dBW
One channel, 2ohms, pulsed	–dBW	21.5dBW	–dBW
Instantaneous peak current		+33A	–36A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–80dB	–92dB	–62dB

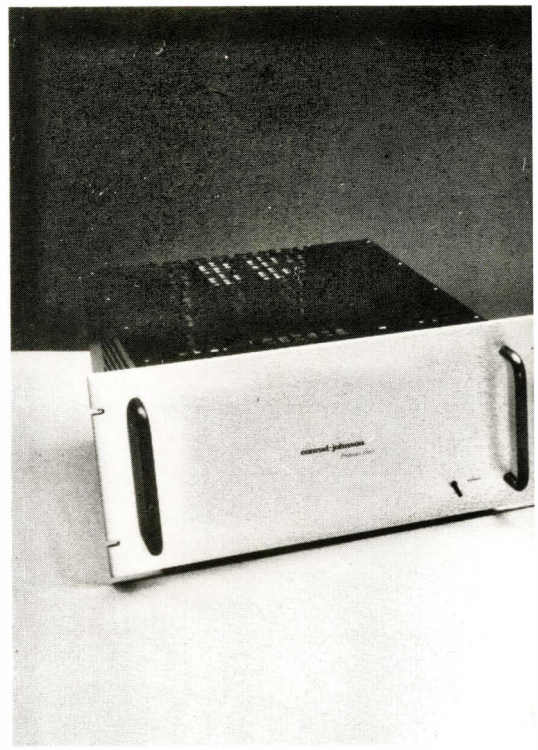
NOISE

Disc (mc) input (IHF, CCIR weighted)	–73dB		
Aux/CD input (IHF, CCIR weighted)	–99dB		
Input overload	20Hz	1kHz	20kHz
Disc (mc) input (IHF)	15dB	15dB	15dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono		– adjustable
Disc (mc) input	Phono	0.045mV	adjustable
Aux input	Phono	180mV	20kohms –pF
Power amp	phono	130mV	9.9kohms 2.6nF
Output, pre-amp (tape)	9.5V max, <1ohms		
Disc equalisation error, 30Hz-15kHz	+0.05dB, –0.25dB		
Size (width, height, depth)	48 × 4 × 21cm, 31 × 12 × 41cm		
Typical price inc VAT	838, £990; 846, £1050; 850, £2650 pair		

CONRAD JOHNSON PREMIER THREE/ PREMIER FOUR

AUTOMATION SCIENCES CO, 20 LITTLE GADDESDEN, BERKHAMSTED, HERTS HP4 IPA.
TEL: (044) 284 2786



Most prestigious of the Premier line of pre-amplifiers, the *'Three* has enjoyed the status of an audio legend for some years now. A valve or tubed model of advanced design, it has been regarded as one of the most musically accurate pre-ampifiers made, and is a fitting partner for either of the major Premier power amps, namely the stereo 100W per channel *Four* and the mono-block, twin chassis, 200W per channel *'Five*.

At present, a customer may order a bypassed version of the *'Three*, with channel balance and stereo/mono selector functions omitted electrically, although the controls remain on the front panel. Such bypassing further shortens the 'straight line' of the circuit design approach, where for example, all tone controls and filters have been left out. Recent circuit improvements to the *'Three* include the use of van den Hul silver-plated single strand mono crystal copper wire in critical signal paths.

Over the past few months we have had the oportunity to audition an original version, a more recent bypassed model, and finally, a sample of current production. With each stage, we found significant advances in sound quality, although, in line with the practice of several other companies, such as Quad here in the UK, CJ do not make a habit of publicising such changes.

Finished in a champagne gold, the aluminium front panel of the *'Three* complements the black casing. This is a full 19in wide model with rack mount facilities and black handles. The moving-magnet disc input is relatively low noise, and will also accept the higher output moving-coil cartridges such as the van den Hul *MC10* and *MC1B* or the Koetsus.

Other inputs include tuner, aux/CD, tape 1 and tape 2. Monitoring is also possible from both tape outputs, though the cross-dubbing facility takes some working out and is not as simple to use as that of many Japanese designs. All sockets are phono type and are gold plated.

Inside, the build is of the highest quality with selected tubes and custom CJ polystyrene capacitors of massive size and excellent quality. The disc input section comprises five triodes arranged as two cascaded cascodes with a cathode follower output; these circuits give maximum output and low noise. The line stage uses four triodes, with cathode followers buffering each triode amplifier. Comprehensive solid state regulation is employed for all supplies, including heaters. The inbuilt transformer is silent and virtually vibration free.

Specific features include the mechanical decoupling of the main board on anti-vibration mountings, with a non-magnetic lower cover positioned adjacent to the circuit board track. Overall, the construction is low resonance, with what at first sight seems an excessive number of fixing screws. The US mains outlets are inactive for UK operation.

The *Four* power amplifier is built on a massive aluminium chassis some 22in deep overall and a decent shelf is therefore required to support its substantial 80lb weight. Alternatively, it will also fit 19in rack centres. The thick alloy front panel is in champagne gold, bare except for the carrying handles and the large on/off lever.

A tube design, it uses four Philips EL34 output valves per channel in a standard ultra linear output configuration. The output transformer is tapped for optimum switching into 4, 8 and 16ohm loads. LEDs are provided for rapid setting of the optimum bias points. Large power supplies are used, and overall the circuit is a straightforward one, but built with the highest quality parts to attain a high standard.

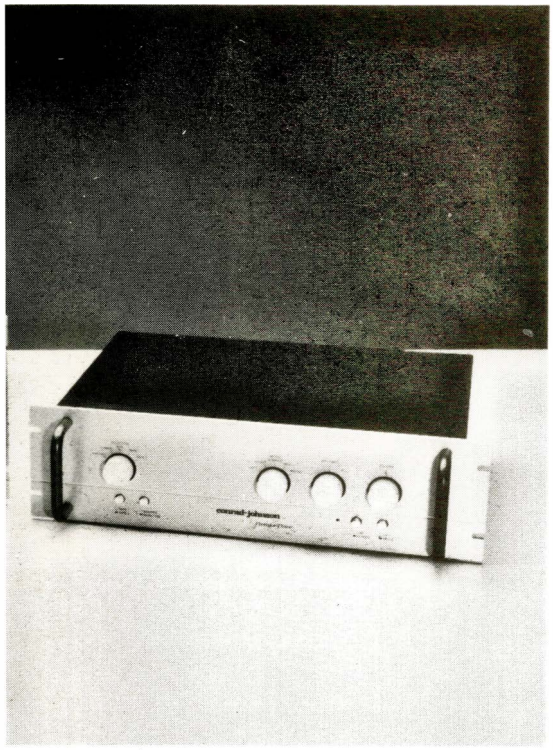
SOUND QUALITY

When auditioning the *Premier Three*, the accompanying power amplifiers included the *'Four* and the *'Five*, the Krell *KSA100*, and the Audio Research *D115 II* and *M100*. Speakers included the Spendor *SP1*, Celestion *SL600* and the Magneplanar *MGIII II*. There was little doubt concerning the pedigree of the *'Three*. Stereo images were seductively and sympathetically presented with excellent depth and ambience. Focus was very good, while the resolution of subtle detail was even better. Tonal quality was outstanding with very natural mid ranges, and little of the excess richness of earlier designs. The treble was also outstanding in clarity, and the lack of perceptible distortion, while the bass also set very high standards for depth, speed and attack.

Sound stages were broad and spacious yet coherent and believable. It was a pleasure to use for extended listening and we found the current model to be quieter, more transparent and more dynamic than the originals, confirming the evolutionary improvement that has taken place for this top line performer.

The *'Three* worked very well with all of the above mentioned amplifiers, particularly so with the *D115 II* in its price context.

I had auditioned an earlier *Four* model some two years ago, with good results bar a 'softness' in the bass, an area where the *'Five* excelled. The current *'Four* is, however, a sonically new amplifier. The bass is fine — clean, powerful, extended and pretty tight. In the mid the sound was well focused — sweet and ambient, extremely



natural with excellent instrumental separation. Most of the treble range was of almost equivalent stature but with a hint of imprecision out at the edge of the audible range.

Stereo images were very well focused with first rate stage width and height coupled with excellent depth of the broadest midrange area. Here the transparency and resolution bordered on state of the art. Ambience was its forte — without any falseness, it proved revealing of instrumental locations in an exceptional manner.

Dynamics proved to be another strong point, since this amplifier has a big heart and would generate genuinely high sound levels without any strain, both on 4 and 8ohms.

Lab Report

Taking the *Premier Three* first, the RIAA equalisation met fine ±0.15dB response limits, 12Hz to 40kHz, when fed into a typical load. The response fell marginally by 0.4dB at 20Hz when fed into a low 10kohm load, reaching −3dB at 10Hz. Channel balance was excellent and distortion via the line input was negligible. The high frequency intermodulation via the disc input was uninspiring but in line with other valve amplifier results. Noise levels were low, from a subjective viewpoint, though numerically the moving-coil equivalent result is just satisfactory.

Input overloads were ample while the output headroom was exemplary, measuring up to 78volts from a low 50ohm source impedance; suitable for long cable runs if required. Channel separation was generally good, and better than for most other tube models.

Bandwidths were wide; for example, the line input was −0.5dB and 6Hz and 140kHz, −3dB at low 1kHz and above 400kHz. For disc, the −3dB points were 1Hz and 120kHz, with no subsonic filtering.

Rated at 100W per channel (20dBW) the *Premier Four* cruised at that level over the midband, with some diminution at the band extremes. Depending on the allowable distortion limits, various 20kHz power levels could be quoted. Peak current was generous, at +14.5A, increasing to almost 19A on the 4ohm tap. In addition the output levels were in general only 1dB greater on 8 as compared with 4ohm taps, with the latter preferred for general use. This amplifier was surprisingly load tolerant, and would drive a wide range of loudspeakers. At full power the distortion was weak at the band extremes, but was much better in the vital midrange as well as at lower powers; here the figures were beyond reproach. At full power the high frequency intermodulation was fine, improving to an excellent −84dB at around 1 watt.

Noise levels were electrically fine, and transformer hum moderate. Frequency response was very flat at ±3dB from 0.5Hz to 57kHz. Output impedance was higher than usual at around 0.6ohm, this reducing to 0.46ohm via the 4ohm tapping. Easy to drive, the *'Four* behaved well in clip, showing a good overload headroom.

Conclusion

The *Premier Three* is a musically accurate and graceful performer, of unusually easy sound and which proved versatile for a wide range of inputs including the moving-coil cartridges with a sufficiently healthy output. A neat single-box unit with low noise, I found it a delight to use and felt that it amply justified its high price when compared with the alternatives. A world-class audiophile product, we found the *Premier Three* certainly deserved its reputation.

With an excellent sound quality as well as a substantially good lab tested performance, this 100W (20dB) power amplifier gave good service during the review. Subjectively it was rather louder than the figures indicated, and it could produce volume levels sufficient for demanding programme. Its performance as regards depth, ambience, mid tonality and transparency was in the top class making it one of the finest amplifiers in this elevated price bracket. In fact as regards the vital midrange and with respect to its high loudness ability, it is probably the best in its group.

Test Results

Rated power into 8ohms, maker's spec	100W (20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.8dBW	20.6dBW	19.7dBW
Both channels, 4ohm load	14.0dBW	18.2dBW	11dBW
One channel, 2ohms, pulsed	—	17dBW	—
Instantaneous peak current	+15A, −14A		
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	see text	−61dB	−35dB
NOISE			
Disc (mm) input (IHF, CCIR weighted)	−73dB		
Disc (mc) input (IHF, CCIR weighted)	−55dB		
Aux/CD input (IHF, CCIR weighted)	−75dB		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	40.4dB	41.7dB	29.8dB
Disc (mc) input (IHF)	—	—	—
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Input data	socket type	V sensitivity	loading
Disc (mm) input	Phono	0.18mV 45kohms	—
Disc (mc) input	—	—	—
Aux input		0.04mV 0.10kohms	0.61pF
Power amp		85mV 90kohms	—
Output, pre-amp (tape)	78V max, 50ohms		
Disc equalisation error, 30Hz-15kHz	+0dB, −0.3dB		
Size (width, height, depth)	48×14×38cm		
Typical price inc VAT	£3400, £3600		

COUNTERPOINT SA7/SA12

ABSOLUTE SOUNDS, 42 PARKSIDE, LONDON SW19. TEL: 01-947 5047

One of a range of Californian valve pre-amplifiers, the *SA-7* is an elegantly simple design, offering unusually high gain on what is nominally a moving-magnet disc input. Set for IHF 0.5V output, the disc input sensitivity is just under 0.2mV, which in practice will be found sufficient for use with a number of moving-coil cartridges (this producing satisfactory noise levels). The all triode circuitry uses no feedback throughout. The tape output is a high impedance when on disc, and should not be loaded, even by an interconnect cable, when not in use.

Rated conservatively by the manufacturers at 100W (20dBW) per channel, the *SA-12* is a low-feedback hybrid design, having tube drivers and MosFet output devices.

SOUND QUALITY

Properly interfaced, the *SA-7* pre-amplifier provided a sound quality well beyond its price class, and bridged the gap to models at £1000 plus. It sounded alive and open, with an involving, dynamic quality. Good articulation and detail were both maintained over the whole frequency range, while stereo width and depth were presented well. Essentially musical, in tonal terms it nonetheless showed a hint of upper mid thinness, while the upper treble sounded a little 'careless' — not fully focused or precise enough.

As for the *SA-12*, this impressive power amplifier proved capable of high sound levels in an exciting dynamic manner. Like the *SA-7*, it showed very fine mid transparency, but was a trifle untidy at band extremes. Overall the standard was high, a little better than the *SA-7*, with clear stereo of decent depth and focus.

LAB REPORT

The power amp delivered around 200W programme, confirming its generous dynamics. With an average peak current of 40A, it was beefy and load tolerant too (giving 800W true peak per channel into 2ohms). Distortion was just satisfactory at 0.5%, mid band, with the output resistance moderate at 0.33ohms. The high frequency intermodulation result was rather disappointing, and was perhaps associated with the moderate treble 'grain' we heard.

For the pre-amplifier, the intermod result was little better and only acceptable when used as a moving-coil input. Moving-magnet signal levels tended to overload it, but background noise was quite low.

CONCLUSION

The *SA-7* has maintained its competitive position and for the price, it offers an inspiring transparency, plus a feeling of involvement; a near-audiophile performance here. The *SA-12* is another very worthy introduction offering a surprisingly similar sound. The *SA-12* is a real powerhouse, our subjective ratings indicating that it is probably the finest available in its power/price grouping. Magneplanar speakers spring to mind in this connection — here is an economical *MGIII*-driver, louder even than the Krell *KSA-100!* Both these Counterpoint models are comfortably recommended.

TEST RESULTS

Pre- and power amplifier

Rated power into 8ohms, maker's spec	100W(=20dBW)

Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	21.1dBW	22.7dBW	17.8dBW
Both channels, 4ohm load	17.9dBW	18.2dBW	17.1dBW
One channel, 2ohms, pulsed	–dBW	23.0dBW	–dBW
Instantaneous peak current		+46A	–35A

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–44.4dB	–46.3dB	–46.7dB

NOISE

Disc (mm) input (IHF, CCIR weighted)	–72dB
Disc (mc) input (IHF, CCIR weighted)	–58dB
Aux/CD input (IHF, CCIR weighted)	–72.7dB

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	–2dB	12dB	11dB
Disc (mc) input (IHF)*	18dB	32dB	37dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.17mV	45kohms 300pF
Disc (mc) input*	–	0.17mV	45kohms 300pF
Aux input	Phono	31mV	28kohms 110pF
Power amp	Phono	105mV	89kohms –pF

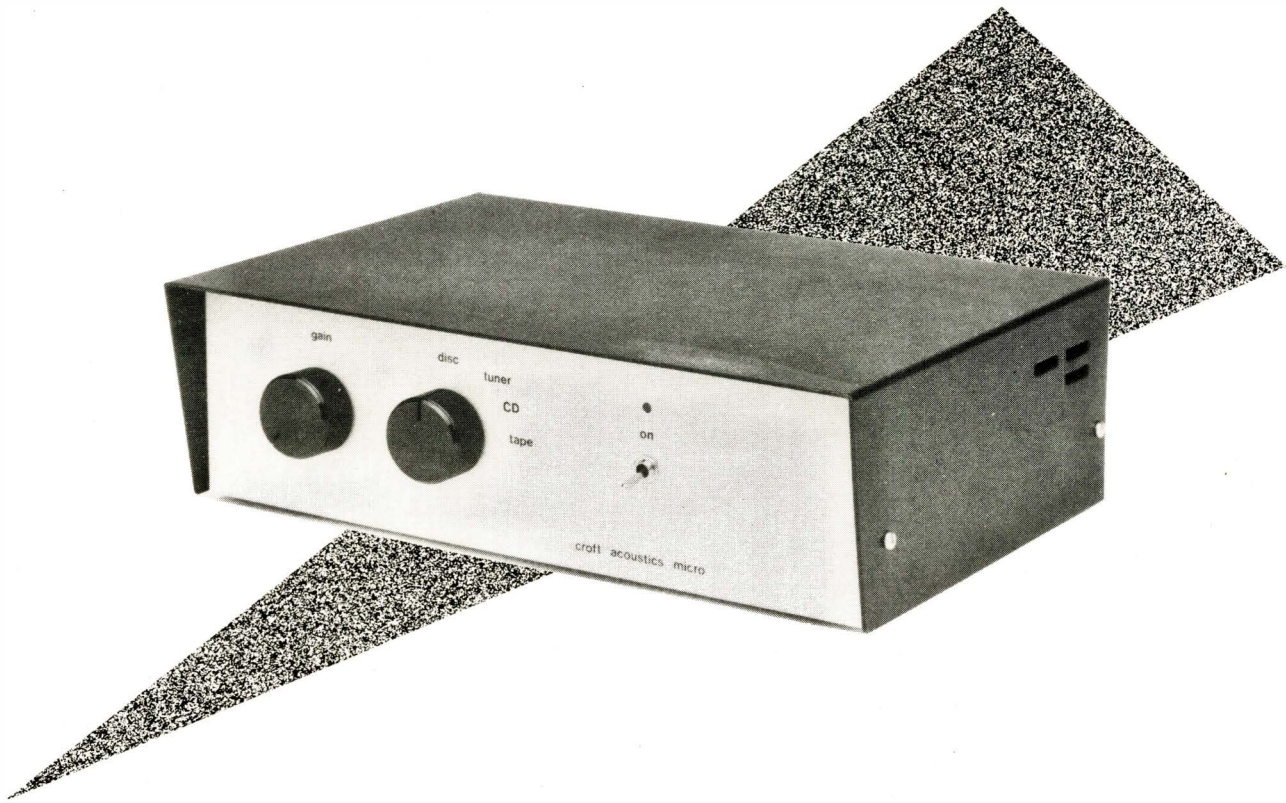
Output, pre-amp (tape)	>15V max, 860ohms
Disc equalisation error, 30Hz-15kHz	+0.1dB, –0.3dB
Size (width, height, depth)	48 × 12 × 34cm
Typical price inc VAT	£795, £1300

**Same input used for moving-coil*

First reviewed: SA7, 1985 (reassessed 1986); SA12, 1986. Rating: Recommended.

CROFT MICRO PRE-AMPLIFIER

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



This inexpensive valve pre-amp offers a single moving-magnet disc input (just adequate for the higher output moving-coil cartidges provided the power amp sensitivity is healthy enough), plus CD, tuner and tape.

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

SOUND QUALITY

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

A similar result was obtained via auxiliary (CD). The bass showed drive and extension, with the treble just a little 'fuzzy'. Detail and depth effects were fine and stereo images were well focused. It proved notably unfatiguing, with a stable, coherent quality.

Background noise was also satisfactorily low when used with moving-coil cartridges of decent output such as the van den Hul *MC10 Super*.

LAB REPORT

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

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

CONCLUSION

We really liked this modest pre-amp. If carefully interfaced to a selected system, the sound quality competed with some of the best pre-amplifiers costing two or three times the price, and for the valve enthusiast, the *Micro* is a godsend. An exceptional product, it must be strongly recommended.

TEST RESULTS

DISTORTION

Total harmonic distortion,	20Hz	1kHz	20kHz
aux input	−76.0dB	−78.3dB	−76.5dB

Intermodulation, 19/20kHz, rated power, aux input −93.1dB

Intermodulation, 19/20kHz, at 0dBW, disc (mm) −41.0dB

NOISE

Disc (mm) input (IHF, CCIR weighted) −73.5dB

Aux/CD input (IHF, CCIR weighted) −92.0dB

Residual, unweighted (volume control at min) −86.5dB

DC offset, pre-amp left 0mV, right 0mV

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	22.8dB	24.0dB	5.9dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

STEREO SEPARATION

Disc input (mm)	61.2dB	62.8dB	36.0dB
Aux input	101.3dB	82.0dB	57.3dB

Channel balance, disc, at 1kHz 0.37dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	2.92mV	47kohms, 110pF
Aux input	Phono	550mV	480kohms, 45pF

Output, pre-amp (tape) 11.1V max, 500ohms

Disc equalisation error, 30Hz-15kHz +0.26dB, −0.16dB

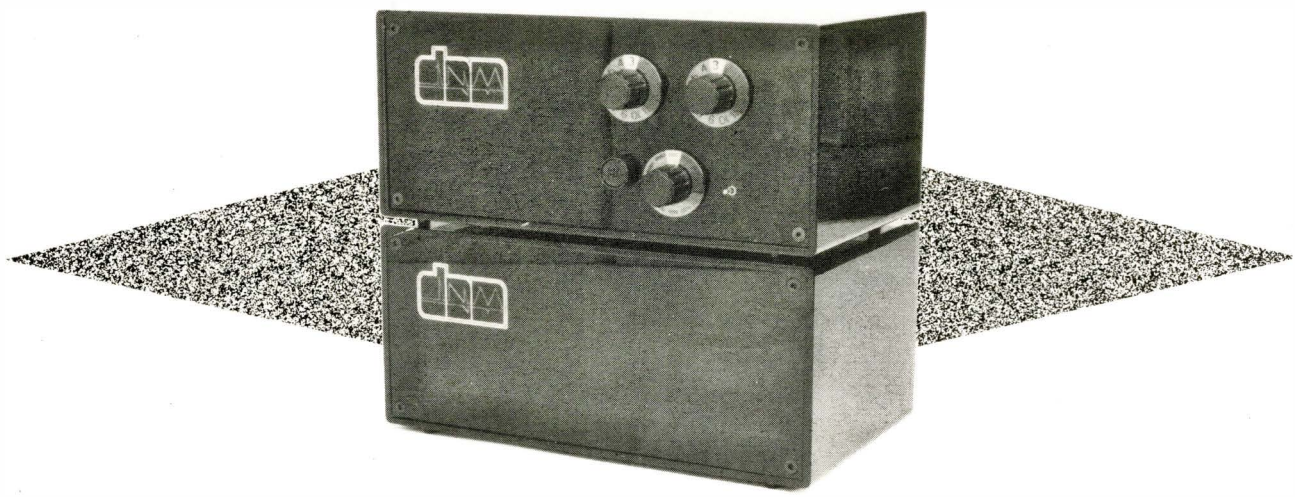
Size (width, height, depth) 25.5×7×18.5cm

Typical price inc VAT £150

First reviewed: 1986. Rating: Recommended.

DNM 2A and SERIES 3 PRE-AMPLIFIER

DNM Supplies, 42 St Thomas Road, Brentwood, Essex CM1 4DF. Tel: (0277) 225865



DNM is a small British company founded by Dennis Morecroft, a designer dedicated to sound quality and specialising in pre-amplifiers. Now well established, the range is founded on a basic chassis/motherboard providing signal and power supply interconnection. The various circuit boards plug into this chassis and allow expansion of input and output facilities; linking plugs may also be removed from the back to allow connection of additional power supplies.

Thus the least expensive pre-amp, the *Primus*, supplied with a single power supply unit, forms the heart of the system, and may be expanded internally as well as via additional supplies to become the most expensive model.

The *Primus* is equipped with disc input a choice of mm or mc, plus an auxiliary or direct CD input and the line output amplifiers. Extra input cards may also be fitted plus tape buffer output cards.

Sound Quality

Although the *Primus* version is the cheapest in the series there was no doubt concerning its high audio quality. It sounded confident and clear via the CD input, with a fine exposition of detail throughout the frequency range. Stereo depth and width were well presented. Via mc, the sound was of similar quality. The mid register was pleasantly accurate in tonal balance, rivalling the finest semiconductor pre-amps in this respect, and only in the treble did we note some imprecision, where a touch of fizz was heard but not judged serious.

Moving up the range the addition of more power supplies in the first *2A* form provided an all-round improvement, in fact the maximum available for the CD input. Still more power supplies progressively improved the analogue disc input performance, with the sound showing more control and confidence, also with an enhancement of dimensional quality. The treble also showed improvement.

Lab Report

Up to 4 volts output was available from a low source resistance, which is enough for any power amplifier. The total harmonic distortion and high frequency intermodulation results were very fine, and were associated with good input overload margins. Channel separation was also very good and given the dual volume controls, channel balance was also good. Noise levels were fine and sufficiently low for all but the least sensitive of moving-coil cartridges.

Conclusion

The *Primus* and *2A* series remain available while a new Swiss-assembled *Series 3*, with acrylic case was also auditioned. After an initial hiccup due to out of tolerance board alignment, the costly *Series 3*, with its special single power supply, outperformed the top *2A* triple supply version and will (presumably) ultimately replace it. From the *Primus* upwards these units deserve recommendation, providing a neutral sound with fine ambience and exceptional clarity.

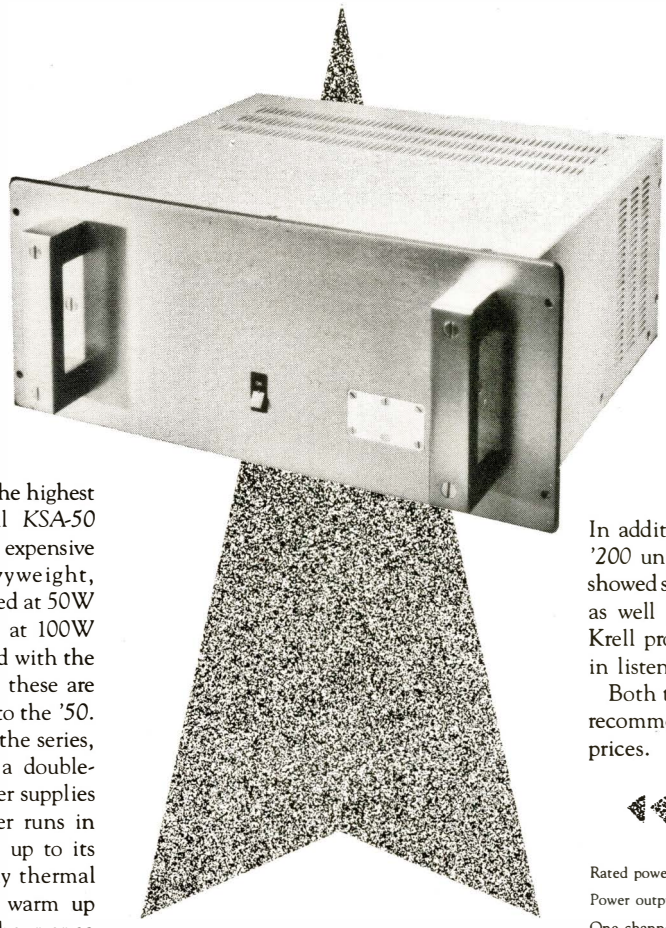
Test Results

	Preamplifier		
Total harmonic distortion,	20Hz	1kHz	20kHz
Aux input	−78dB	−87dB	−76dB
Intermodulation, 19/20kHz, aux input			−100dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm)			−95dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−95dB
NOISE			
Disc (mc) input (IHF, CCIR weighted)			−64dB
Aux/CD input (IHF, CCIR weighted)			−88dB
Residual, unweighted (volume control at min)			>−90dB
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)*	26dB	27.5dB	29dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Disc input	89dB	80dB	67dB
Aux input	95dB	90dB	60dB
Channel balance, disc, at 1kHz			0.03dB
Input data	socket type	sensitivity	loading
Disc (mc) input*	—	0.1mV	47ohms −nF
Aux input	Phono	85mV	13kohms −pF
Output, pre-amp			4V max, 33ohms
Disc equalisation error, 30Hz-15kHz			+0dB, −1.8dB
Size (width, height, depth)			22 × 11.5 × 13.5cm
Typical price inc VAT			Series 2A from £450, Series 3 from £1000

First reviewed: Series 2A, 1985; Series 3, 1986. Rating: Recommended.

KRELL PAM5/KSA50

ABSOLUTE SOUNDS LTD, 42 PARKSIDE, LONDON SW19. TEL: 01-947 5047



Built and finished to the highest standards, the Krell *KSA-50* power amplifier is an expensive American heavyweight, though modestly rated at 50W (17dBW) per channel. Versions at 100W and 200W are also available, and with the exception of the power output, these are broadly similar in performance to the *'50*.

As with the larger models in the series, the *KSA-50* is constructed as a double-mono design, with massive power supplies to each channel. The amplifier runs in pure Class A into 8ohm loads up to its rated power, and employs steady thermal conditions as well as a rapid warm up (minutes rather than the usual hour or so for other Class A designs.) The fan is relatively quiet producing no more noise than the large toroidal transformers fitted. The *'50* now benefits from circuit and constructional improvements. The *PAM-5* uses a single external power supply and offers good moving-coil input facilities.

SOUND QUALITY

Re-auditioned for 1986, the Krell *KSA-50* has held its own. It remains a powerful, musical-sounding model, giving good stereo depth and ambience, fine clarity and excellent stereo focus. Tidy and controlled, dynamics were very good, and its high rating position was maintained. The *PAM-5* is a welcome newcomer, in our view now quite to *KSA-50* standard, and a very worthy partner overall. Essentially neutral, the *PAM-5* gave good definition throughout the frequency range with a good measure of 'excitement' and involvement in its sound. The special CD input was rather better than the auxiliary for this signal source, and comparably good results were obtained on analogue moving-coil.

Compared with the finest references, the Krells betrayed a mild 'dryness' and a hint of dimensional restriction but the results remained very good.

LAB REPORT

Rated at only 17dBW, the *KSA-50* typically produced on continuous ratings a 19.9dBW output level, and such was the extraordinary power bandwidth that no significant fall occurred from 20Hz to 20kHz, relative to 1kHz. Likewise the loss into 4 and 2ohms was small. Peak output was approaching 100W, reading 19.9dBW, with 18.2dBW still provided into 2ohms, the Krell proving to have one of the 'stiffest' output and power sections measured. Peak power into 2ohms exceeded 250W. Peak current output was ±32A, which was sufficient for the worst loads.

Both pre-, and power amplifier were exemplary on other parameters. Noise level and separation were fine, and all distortions negligible at all levels below clipping. Substantially accurate the RIAA equalisation is slightly tailored for a specific sound.

CONCLUSION

In addition to the *KSA-50*, the *'100* and *'200* units were auditioned recently, and showed small but progressive improvements as well as greater power. Superbly built, Krell products remain a good investment in listening pleasure.

Both the *KSA-50* and the *PAM-5* are of recommendable quality, despite their high prices.

TEST RESULTS

	Pre- and power amplifier		
Rated power into 8ohms, maker's spec	50W(=17dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.9dBW	19.9dBW	19.9dBW
Both channels, 4ohm load	19.7dBW	19.7dBW	19.65dBW
One channel, 2ohms, pulsed	–dBW	18.2dBW	–dBW
Instantaneous peak current		+32A	–32A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–86.0dB	–89.6dB	–72.5dB
NOISE			
Disc (mm) input (IHF, CCIR weighted)	–		
Disc (mc) input (IHF, CCIR weighted)	–60.0dB*		
Aux/CD input (IHF, CCIR weighted)	–88.0dB		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	–dB	–dB	–dB
Disc (mc) input (IHF)	20.8dB	20.5dB	21.5dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Input data	socket type	sensitivity	loading
Disc (mm) input	–	–mV	–kohms	–pF
Disc (mc) input	Phono	0.076mV	100ohms	–pF
Aux input	Phono	136mV	9.4kohms	80pF
Power amp	–	–mV	–kohms	–pF
Output, pre-amp (tape)	8.25V max, 11ohms		
Disc equalisation error, 30Hz-15kHz	+0.30dB, –0.65dB		
Size (width, height, depth)	48 × 5 × 29cm, 48 × 21 × 43cm		
Typical price inc VAT	£1589, £2300		

**improved since our test*

First reviewed: PAM5, 1986; KSA50, 1983 (reassessed 1985, 1986). Rating: Recommended.

LE TUBE PRE-AMPLIFIER

ABSOLUTE SOUNDS LTD, 42 PARKSIDE, LONDON SW19. TEL: 01-947 5047

An economic 'minimalist' amplifier of excellent build quality and solid durable finish, this product is designed and made by the small craftsman manufacturing division of *L'Audiophile* magazine, which is based in Paris. Supplied in the UK by Absolute Sounds, *Le Tube* is priced at just under £500 with moving-magnet, tape and aux/CD inputs. A bi-polar head amplifier called *Le Pré Pré* is also available if moving-coil is required, and we managed to fully audition, but not to lab test, this component.

Twin volume controls are fitted and conveniently the inner edges of the knobs are grooved, allowing a rubber 'O' ring to be retro-fitted, effectively 'ganging' the controls for operating convenience.

A separate power supply is used, allowing the amplifier to be very compact and yet free from transformer-induced hum. Inputs and outputs are in phono, with straightforward impedances, promising trouble-free interfacing. Inside, components of selected audio grade quality are fitted and the construction standard is very high.

SOUND QUALITY

Early on in the listening tests, this unit established a very good sound quality rating, which held when the exceptional head amplifier was also brought into service.

Depth and ambience sounds were reproduced with authority, the unit distinguished by its 'open' transparent nature. The bass was not quite up to the same standard as the mid and treble ranges which were highly rated for tonality and definition. The sound was direct and explicit with very good stage width and focus, while perspective 'layering' was rendered well.

Both inputs were highly rated and the addition of the head amplifier showed little impairment bar a touch of brightness, a mere hint of upper treble 'grain' and a marginal loss of depth.

LAB REPORT

This well engineered product performed well in the lab, with the exception of the distortion results. Set for a modest 0.5V output the high frequency intermodulation was poor, both via disc and auxiliary; however, the figures improved rapidly at lower drive levels. Channel separation was fine and good signal to noise ratios were obtained. The RIAA equalisation met a good standard but could not be classed as entirely neutral; in fact on our sample, measurement showed the −3dB points for the disc frequency response were 9Hz and a high 260kHz.

CONCLUSION

If moving-coil sensitivity is not required then *Le Tube* will offer a clean view with very good stereo, fine depth and transparency plus a neutral, musical sound all at an economic price. Adding the head amplifier does lift the cost, but more importantly did not impair the sound. At its competitive price, this well built valve pre-amplifier design certainly merits recommendation.

TEST RESULTS

Pre-amplifier (separate mc head amplifier)

Total harmonic distortion	20Hz	1kHz	20kHz
aux input	−52.4dB	−51.9dB	−54.3dB

Intermodulation, 19/20kHz, rated power, aux input −21.3dB

Intermodulation, 19/20kHz, at 0dBW, disc (mm) −16.8dB

NOISE

Disc (mm) input (IHF, CCIR weighted) −70.2dB

Aux/CD input (IHF, CCIR weighted) −79.6dB

Residual, unweighted (volume control at min) >−90dB

DC offset, pre-amp left 2mV, right 2mV

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	25.8dB	27.7dB	21.5dB
Aux/CD input (IHF)	12.8dB	11.8dB	11.8dB
Disc input (mm)	76.0dB	78.9dB	46.9dB
Aux input	66.6dB	59.6dB	38.3dB

Channel balance, disc, at 1kHz 0.11dB

Input data	socket type	sensitivity	loading	
Disc (mm) input	Phono	5.0mV	57kohms	—pF
Aux input	Phono	145mV	230kohms	70pF

Output, pre-amp (tape) 7V max, 615ohms

Disc equalisation error, 30Hz-15kHz +0.12dB, −0.75dB

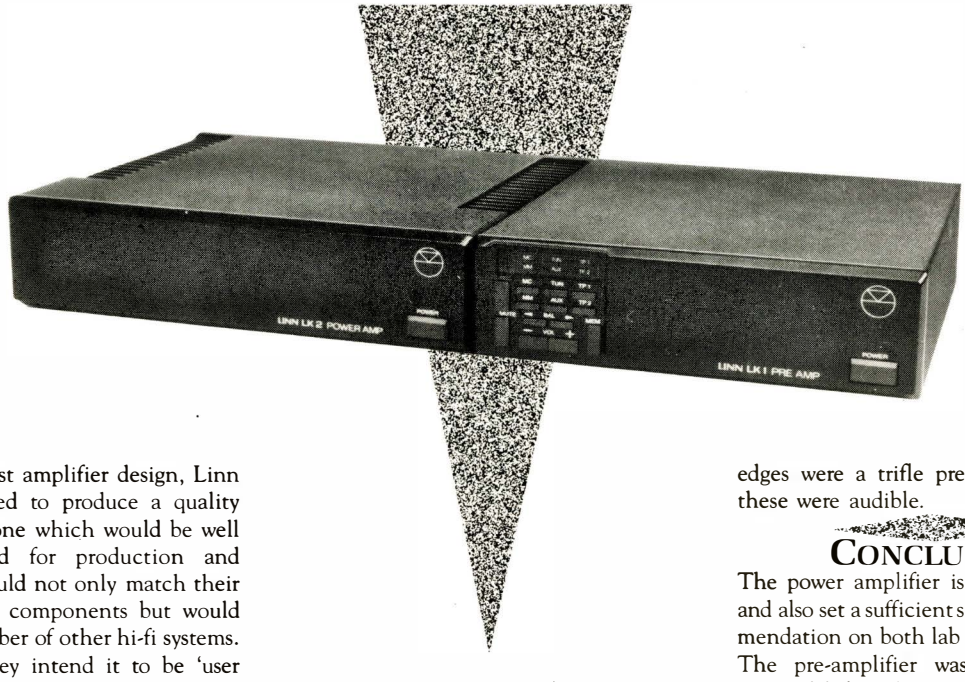
Size (width, height, depth) 20 × 7 × 22cm (12 × 7 × 26cm)

Typical price inc VAT £535 (Le PrePre, £423)

First reviewed: 1986. Rating: Recommended.

LINN LK1/LK2

LINN PRODUCTS LTD, 257 DRAKEMIRE DRIVE, CASTLEMILK, GLASGOW G45 9SZ. TEL: (041) 6340371



In their first amplifier design, Linn have aimed to produce a quality product, one which would be well engineered for production and which would not only match their own top-quality components but would also fit in a number of other hi-fi systems. Furthermore, they intend it to be 'user friendly', with simple operation and an optional remote control.

Rated at a load-tolerant 60W (18dBW) per channel, the power amplifier has fully regulated power supplies and in this respect resembles a mildly down-sized Naim *NAP250*. The pre-amplifier incorporates electronic selector switching, balance and volume control, the last not a gain-controlled amplifier but a better-sounding ladder attenuator whose steps are selected electronically — thus there are no moving parts. Moving-coil and moving-magnet cartridge disc inputs are provided plus two tape inputs and auxiliary (CD!). The disc inputs are the usual phonos, with a five pin 'XLR' Cannon for tape in/out and three-pin for tuner, aux. and, separately, the main outputs for left and right channels. Linn can supply the necessary inter-connect cables.

SOUND QUALITY

Falling below the 'very good' category in the listening tests, the official tabulated rating for sound quality is the rather clumsy designation of 'good++'. The Linn proved to be self-effacing and was pleasantly 'musical', with a nicely balanced mid-treble, free from the usual hardness or glare.

Its good quality held throughout the frequency range and it also sounded quite transparent, revealing a fair measure of ambience and depth. A little 'dark' textured and somewhat restrained, some of the drama and excitement in the test programme appeared to be diluted.

Overall, it lacked subjective extension at the frequency extremes, sounding mildly 'enclosed'. We found that the sound was however commendably consistent throughout on all the inputs.

LAB REPORT

Linn informed us that for future production, the line amplifier gain would be increased by 8dB (×2.5) while the pickup sensitivity will be increased just 3dB, allowing 5dB more headroom on the overload figures. On the level test, 103.5dBA sound levels were attained, with negligible loss into the 4ohm load.

Almost exactly as specified, the power delivery was solid down to 2ohms, with ample 14A peak current. Distortions were low except for the intermodulation results via the disc inputs; the new overload figures will improve upon the tabulated results by around 10dB. The dc offset for the power amp was a little high at nearly a tenth of a volt. Given the adjustable sensitivity and the new headroom, the overload figures are considered satisfactory. Channel separations were fine throughout, while channel balance was generally good, but deteriorated at the −60dB setting. The auxiliary and power amplifier input impedances were on the low side — purchasers should check whether it is suitable for a given pre-amp and signal sources.

On RIAA equalisation, the midband was flat, but overall the rolloffs at the band edges were a trifle premature; I believe these were audible.

CONCLUSION

The power amplifier is durable, tolerant and also set a sufficient standard for recommendation on both lab test and audition. The pre-amplifier was marginally less successful, but the two succeed in working well together. In view of the facilities offered, the good build quality and overall competence, the combination can be recommended.

TEST RESULTS

	Pre- and power amplifier		
Rated power into 8ohms, maker's spec	60W(=18dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.6dBW	18.6dBW	18.5dBW
Both channels, 4ohm load	16.4dBW	17.6dBW	17.5dBW
One channel, 2ohms, pulsed	−dBW	18.8dBW	−dBW
Instantaneous peak current		+14.0A	−14.5A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−68.5dB	−85.6dB	−74.0dB

NOISE

Disc (mm) input (IHF, CCIR weighted)	−76.5dB
Disc (mc) input (IHF, CCIR weighted)	−71.3dB
Aux/CD input (IHF, CCIR weighted)	−79.2dB

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	21.9dB	19.0dB	11.0dB
Disc (mc) input (IHF)	16.1dB	15.6dB	16.4dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

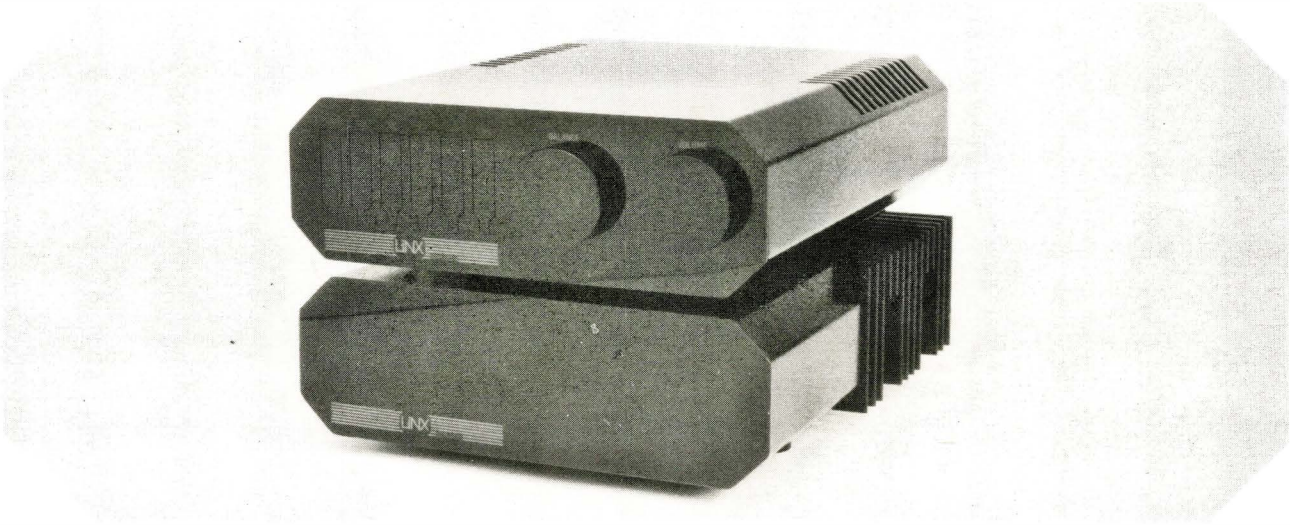
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.75mV	50kohms 500pF
Disc (mc) input	Phono	0.053mV	150ohms 11.0nF
Aux input	XLR	133mV	10.0kohms 220pF
Power amp	XLR	120mV	5.70kohms 3.5pF

Output, pre-amp (tape)	6.25V max, 28ohms
Disc equalisation error, 30Hz-15kHz	+0.13dB, −1.40dB
Size (width, height, depth)	26 × 8 × 33cm
Typical price inc VAT	£800 (remote control £50 extra)

First reviewed: 1986. Rating Recommended.

LINX STRATOS

HTS GROUP, CHURCH ROAD, LANE END, HIGH WYCOMBE, BUCKS HP4 3HH. TEL: (0494) 881685



Linx, a New Zealand manufacturer, have presented the *Stratos* design as a set of separate components, though the distributors are not at present intending to make the units available separately. The power amplifier is itself divided, to comprise a pair of mono units. The interior design of the pre-amp has also been arranged to preserve a double mono aspect as far as possible. It uses a touch panel for source switching and a large, good-quality volume control. The circuitry is discrete, with fine components in evidence. Both moving-coil and moving-magnet cartridges are catered for, but with a 'straight line' approach — no balance or tone controls are provided.

The power amplifiers are direct-coupled complementary, using parallel pairs of MosFets. Rated at a substantial 120W (21dBW), the amp uses a sizeable power supply with high-current 10,000μF reservoir capacitors and a large screened power transformer. Mechanical hum levels were low.

SOUND QUALITY

High sound levels were attained, free from stress of adverse clipping effects up to a measured 108dBA, and with only a small loss into the adverse load. This is certainly a 'big' amplifier.

Overall it did well on audition, scoring 'very good'. Initially very impressive, it portrayed depth well, with a good standard of control, clarity and focus, plus a decent grip on dynamics. Subjectively, it sounded 'open' with a wide frequency range, but tonally there was a hint of hardness and thinness in the upper mid, which occasionally gave a compressive effect. On disc the quality held well with both moving-coil and moving-magnet cartridges, though the latter input was clearly superior. Again the whole effect was of firm control, good focus and a decent rendition of ambience and depth.

LAB REPORT

Confirming the high sound levels, the peak programme power reached 200W with very little loss even into 2ohms (22.8dBW here equivalent to 800W true!). The continuous ratings were lower but still good, with fine load tolerance shown by the ±33A peak current available.

On single tones the distortion levels were low but the table showed some weakness on the high frequency intermodulation test at the normal review input levels, notably on the disc inputs. This was due to the reduced input overload margins in the high frequency ranges, but these were ultimately deemed satisfactory, with a strong improvement at lower input levels. Input noise levels appeared to be unexceptional while dc offsets were satisfactory. Given its double mono construction the channel separation was surprisingly average at around 44dB throughout the pre-amplifier! This was queried with the distributor, but was not resolved by press date.

Channel balance was nicely maintained, and the general input characteristics were fine. RIAA equalisation was fine below 1kHz but shelved above 3kHz. On moving-coil this loss increased to −2.5dB at 20kHz, which was felt just a bit excessive.

CONCLUSION

An expensive amplifier, the Linx faces strong competition in the UK market. The sound quality was very good, but not exceptional in its price category. Load tolerance was good, coupled with a massive peak power delivery, and undoubtedly the power amplifiers are the stronger half of the package. Nonetheless the pre-amp, while not quite '100%', still sounded well. Overall a full recommendation is inappropriate; but this is certainly a substantial product worthy of serious consideration.

TEST RESULTS

Pre- and power amplifier			
Rated power into 8ohms, maker's spec	120W(=21dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	21.1dBW	21.3dBW	21.0dBW
Both channels, 4ohm load	19.4dBW	19.5dBW	19.3dBW
One channel, 2ohms, pulsed	−dBW	22.8	−dBW
Instantaneous peak current		+33.0A	−34.0A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−71.9dB	−71.2dB	−70.7dB
NOISE			
Disc (mm) input (IHF, CCIR weighted)	−67.7dB		
Disc (mc) input (IHF, CCIR weighted)	−67.0dB		
Aux/CD input (IHF, CCIR weighted)	−68.2dB		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	31.6dB	30.8dB	17.5dB
Disc (mc) input (IHF)	27.4dB	26.5dB	17.4dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.18mV	47kohms 250pF
Disc (mc) input	Phono	0.015mV	4.7ohms 1.20nF
Aux input	Phono	10.2mV	89kohms 85pF
Power amp	Phono	125mV	42kohms 1.6nF
Output, pre-amp (tape)	4.84V max, 880ohms		
Disc equalisation error, 30Hz-15kHz	+0.16dB, −1.93dB		
Size (width, height, depth)	24 × 9 × 31cm, 25 × 9 × 30.5cm		
Typical price inc VAT	£1400, complete		

First reviewed: 1986. Rating: Worth Considering.

MISSION CYRUS TWO AND PSX

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

Mission's *Cyrus One* and *Two* look very similar but important internal differences distinguish them, as well as the matter of some £100 sterling! For the *Two*, the output level has been increased to 50W (17dBW) and output current has also been doubled. Higher quality components are used while the disc stage has also been extensively upgraded to produce an 11dB improvement in noise level via mc with optimised input loading. No balance, tone or any other controls are present, save for volume.

The internal construction follows the *'One*, using a single printed circuit board, plus a large Holden and Fisher toroidal mains transformer. The direct coupled output uses fast complementary output transistors in classic class A/B mode while the single power supply is shared between the channels.

SOUND QUALITY

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

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

LAB REPORT

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

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

CONCLUSION

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

TEST RESULTS

Integrated amplifier

Rated power into 8ohms, maker's spec	50W(=17dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.7dBW	17.8dBW	17.6dBW
Both channels, 4ohm load	14.4dBW	14.7dBW	14.6dBW
One channel, 2ohms, pulsed	−dBW	15.4dBW	−dBW
Instantaneous peak current		+22.5A	−17.5A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−85dB	−80dB	−75dB

NOISE

Disc (mm) input (IHF, CCIR weighted)	−76dB
Disc (mc) input (IHF, CCIR weighted)	−69dB
Aux/CD input (IHF, CCIR weighted)	−80dB

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	38dB	36dB	36dB
Disc (mc) input (IHF)	26dB	23dB	23dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

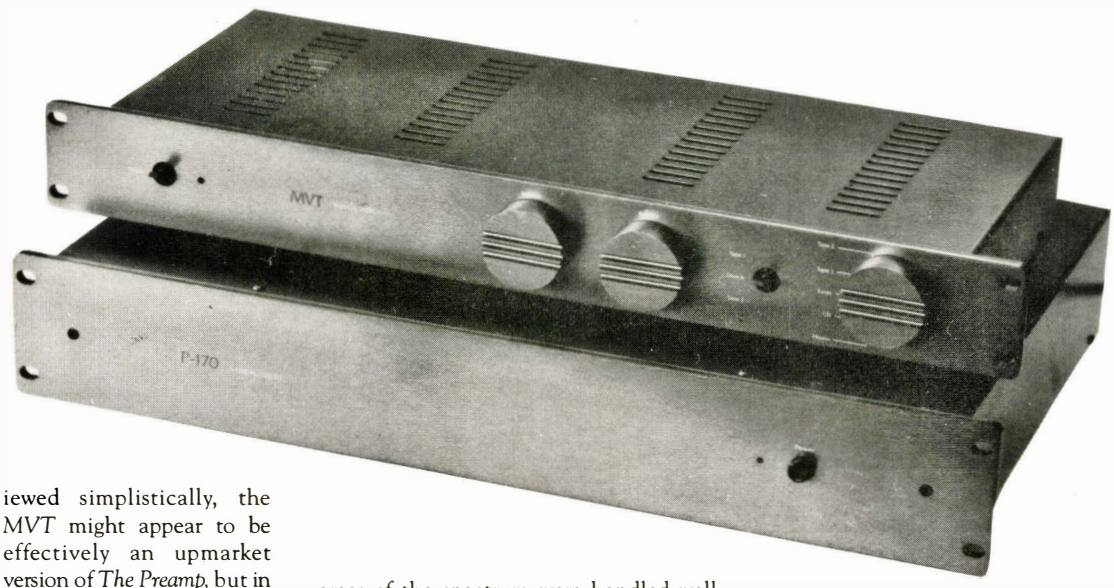
Input data	socket type	sensitivity	loading	
Disc (mm) input	Phono	0.33mV	47kohms	260pF
Disc (mc) input	Phono	0.023mV	470ohms	7pF
Aux input	Phono	60mV	14kohms	300pF
Power amp	—	−mV	−kohms	−pF

Output, pre-amp (tape)	75V max, 700ohms
Disc equalisation error, 30Hz-15kHz	+0dB, −1dB
Size (width, height, depth)	21 × 9 × 34cm
Typical price inc VAT	£260 (£460 with PSX)

First reviewed: 1985 (restested, with PSX, 1986). Rating: Best Buy (with PSX, Recommended).

MUSICAL FIDELITY MVT/P170

MUSICAL FIDELITY LTD, UNIT 34, SAPCOTE TRADING ESTATE, DUDDEN HILL LANE, LONDON NW10. TEL: 01-451 7555



Viewed simplistically, the *MVT* might appear to be effectively an upmarket version of *The Preamp*, but in fact it is rather more than this. Front panel facilities on the *MVT* include a full selector switch plus centre-detent balance control, while the power supply is a substantial outboard unit. The finish is excellent — in appearance, these new Musical Fidelity units almost resemble a sort of British Krell. Input sockets are gold-plated phonos, while the output connections are duplicated in XLR. The *MVT* can also give a phase-inverted output if required.

Providing a visual match for the *MVT*, the *P170* is a slimline 85W per channel (19dBW) MosFet power amplifier, constructed in a true double-mono configuration. The circuitry is a very simple, with moderate negative feedback and an input based on an IC op amp.

SOUND QUALITY

The *P170* established a strong position in the listening tests, well ahead of the *Studio T*, for example. Relaxed and spacious, it was clearly powerful, yet clean and controlled. Stereo images were well resolved with fine focus and pleasing depth. 'Grainy' and veiling effects were held to small levels while the bass performance set a competent standard.

The final *MVT* review sample was simply a knockout in its class. Sonically, this unit has suddenly entered the 'big time' of the £2000-plus amplifier systems, with a combination of delicacy and immediacy, dimension and focus which proved beguiling. Sounding wide and open, all areas of the spectrum were handled well with first rate perspectives.

LAB REPORT

Taking power amplifier first, the *P170* showed some mild weaknesses at high frequencies and into low impedances, while easily exceeding its nominal rating on 8 ohms with music programme, reaching 150W per channel. It just held spec into 4 ohms 1kHz, in fact attaining a true 150W here. Peak current was unexceptional, but did not appear to constrain the performance unduly. Distortions were generally good though the high frequency intermodulation result relates to a rather lower power. Stereo separation was very good though the input impedance was rather low at 6.5kohms. At the output, DC offsets were negligible.

The *MVT* pre-amplifier showed excellently low distortion as well as good overload head room. The channels were well balanced, with above average separation and the inputs were sensibly specified with fine signal to noise ratios. Disc RIAA equalisation was accurate while the final output impedance was low enough for long cable runs.

CONCLUSION

The *P170* acquitted itself well, achieving a fine standard in its price category and a recommendation is clearly in order, particularly for use with kinder speaker loads. The *MVT* attained audiophile status, proving hard to fault, and then only by comparison with far more costly equipment. At under £1000 this amplifier can take on some of the world's finest and therefore comes strongly recommended.

TEST RESULTS

Pre- and power amplifier

Rated power into 8ohms, maker's spec	85W(=19dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.3dBW	21.0dBW	17.4dBW
Both channels, 4ohm load	17.7dBW	18.9dBW	16.6dBW
One channel, 2ohms, pulsed	–dBW	14.7dBW	–dBW
Instantaneous peak current		+8.0A	–9.5A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–88.0dB	–94.0dB	–82.9dB

NOISE

Disc (mm) input (IHF, CCIR weighted)	–77.0dB
Disc (mc) input (IHF, CCIR weighted)	–72.5dB
Aux/CD input (IHF, CCIR weighted)	–93.0dB

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32.0dB	31.9dB	31.2dB
Disc (mc) input (IHF)	27.0dB	25.7dB	25.7dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	1.78mV	46kohms 60pF
Disc (mc) input	Phono	0.09mV	94kohms 25pF
Aux input	Phono	89mV	45kohms —pF
Power amp	Phono/XLR	n/a	n/a n/a

Outputs, pre-amp	7.8V max, 100ohms
Disc equalisation error, 30Hz-15kHz	+0dB, –0.34dB
Size (width, height, depth)	48 × 6 × 20.5cm, 48 × 6 × 23cm
Typical price inc VAT	£990, £460

First reviewed: 1986. Rating: Recommended.

MYST TMA3

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

An amplifier built to very high standards but in low production volumes, the Myst has a distinctive cobalt blue case complemented by a satin silver alloy front panel. The controls are reduced to a bare minimum, namely power, volume and just two selector buttons.

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

A combination of integrated circuit and discrete transistor technology is employed, each where considered appropriate. Via mc the input is a virtual earth or shunt feedback current input, considered by many to be the ideal loading, and an input buffer is placed before the RIAA equaliser stage. The CD input bypasses the line buffer and is fed directly to the power amplifier via the volume control.

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

SOUND QUALITY

Scoring above average the *TMA-3* sounded a trifle lean, even bright in tonal balance terms, but this did not impart noticeable brittleness. Tidy and well integrated in character, it provided moderate depth to the stereo images, and above average focus. The bass was found to lack some definition, and did not throw full 'weight'.

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

LAB REPORT

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

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

CONCLUSION

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

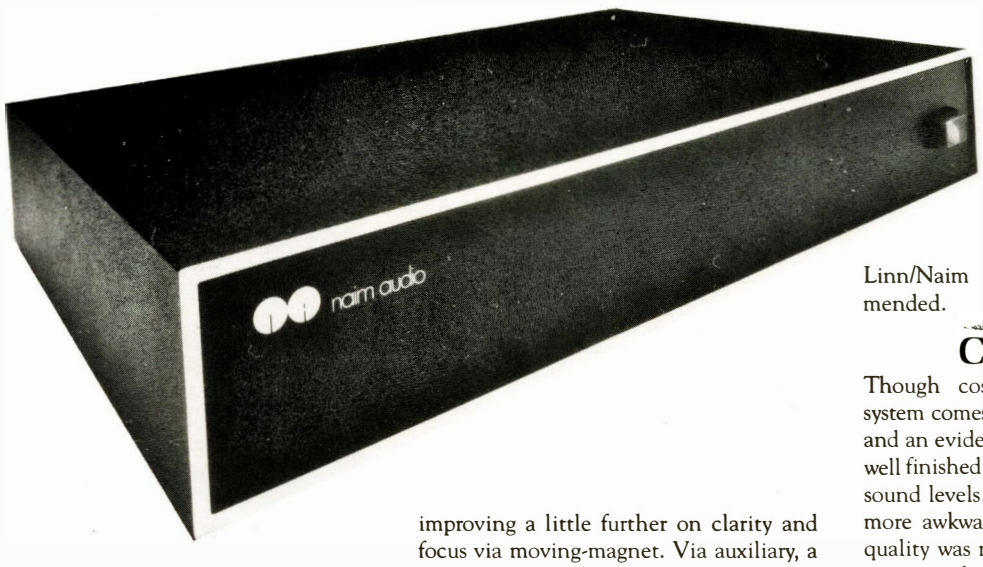
TEST RESULTS

	Integrated amplifier		
Rated power into 8ohms, maker's spec	35W(=15dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.7dBW	16.7dBW	16.7dBW
Both channels, 4ohm load	14.2dBW	14.3dBW	14.3dBW
One channel, 2ohms, pulsed	−dBW	14.6dBW	−dBW
Instantaneous peak current		+12A	−12A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−80dB	−68dB	−50dB
NOISE			
Disc (mm) input (IHF, CCIR weighted)	−66dB		
Disc (mc) input (IHF, CCIR weighted)	−66dB		
Aux/CD input (IHF, CCIR weighted)	−72dB		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	20dB	20dB	20dB
Disc (mc) input (IHF)	10dB	6dB	6dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	63mV	47kohms 200pF
Disc (mc) input	Phono	see text	see text
Aux input	DIN	40mV	>50kohms 110pF
Power amp	−	−mV	−kohms −pF
Disc equalisation error, 30Hz-15kHz	+0.08dB, −0.55dB		
Size (width, height, depth)	43 × 21.5 × 6cm		
Typical price inc VAT	£250		

First reviewed: 1985. Rating: Recommended.

NAIM NAC32/NAP250

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



Designed as a system, these Naim components are rarely assessed as separate items. It is probably true to say that their manufacturer has dominated the UK audiophile amplifier area for many years now.

The *NAC32* lacks tone controls or filters but can offer moving-coil and moving-magnet disc inputs, as well as tuner and tape. Sockets are mainly DIN, but the latest *32/5* version has BNC phono inputs. Both units are built to an excellent constructional standard, the *250* power amplifier using a refined version of a traditional quasi-complementary circuit, direct-coupled and employing high quality power regulators, these as complex as the amplifier itself.

SOUND QUALITY

Though the price is high, the *32/250* quickly demonstrated the standard of sound quality appropriate to its high reputation.

Although a trifle 'doctored' or 'band-limited' in character, with a mildly 'forward' stereo presentation, the amplifier sounded superbly confident and controlled. It proved to be both detailed and articulate throughout the frequency range and held a good standard of image focus and reasonably good depth. Relaxed and musical, the performance was both involving and revealing.

Via moving-coil the results were fine, improving a little further on clarity and focus via moving-magnet. Via auxiliary, a good impression of the scale and attack present on the PCM programme was also given. It clipped well and could provide 103dBA into the normal speaker load, with a decent 101dBA into more difficult loads. Good subjective volume levels were possible, with more 'power' than the specification suggests.

LAB REPORT

Rated at 70W (18dBW) the *32/250* showed a superb power bandwidth into 8 ohms, delivering 19dBW. The loss into 4 ohms was very small, though the amp disliked the 2 ohm pulses at 20kHz. A sufficient ±16A peak current rating was noted, with the fall in level from 8 to 2 ohms held to just 2.5dB, which was a fine result. This is clearly a load tolerant model. Distortion levels were low, except at high frequencies where the results were poorer than average, and were considered just satisfactory. Disc equalisation showed a broad, tailored response, very uniform through the middle octaves, and 1dB down at 20Hz and 10kHz.

NAIM NAP135

Each mono *'135* power amplifier is essentially an uprated *NAP250* with the massive power supply feeding only one channel, giving nearly 100W peak with good load tolerance. The distinctive 'Naim sound' was there, slightly bandwidth-limited, with a highly precise up-front stereo image and dry character; it gave a feeling of confident, controlled authority. With application mainly to Linn/Naim systems, the *'135* is recommended.

CONCLUSION

Though costly, the *'32/250* amplifier system comes with an excellent reputation and an evidently high build quality. It was well finished and produced reasonably high sound levels, with a fine tolerance of the more awkward speaker loads. The sound quality was rated at the 'very good' level, consistently maintained via the various inputs and over the whole dynamic range. The two units are well matched to each other, and set a standard that justifies recommendation despite the substantial price.

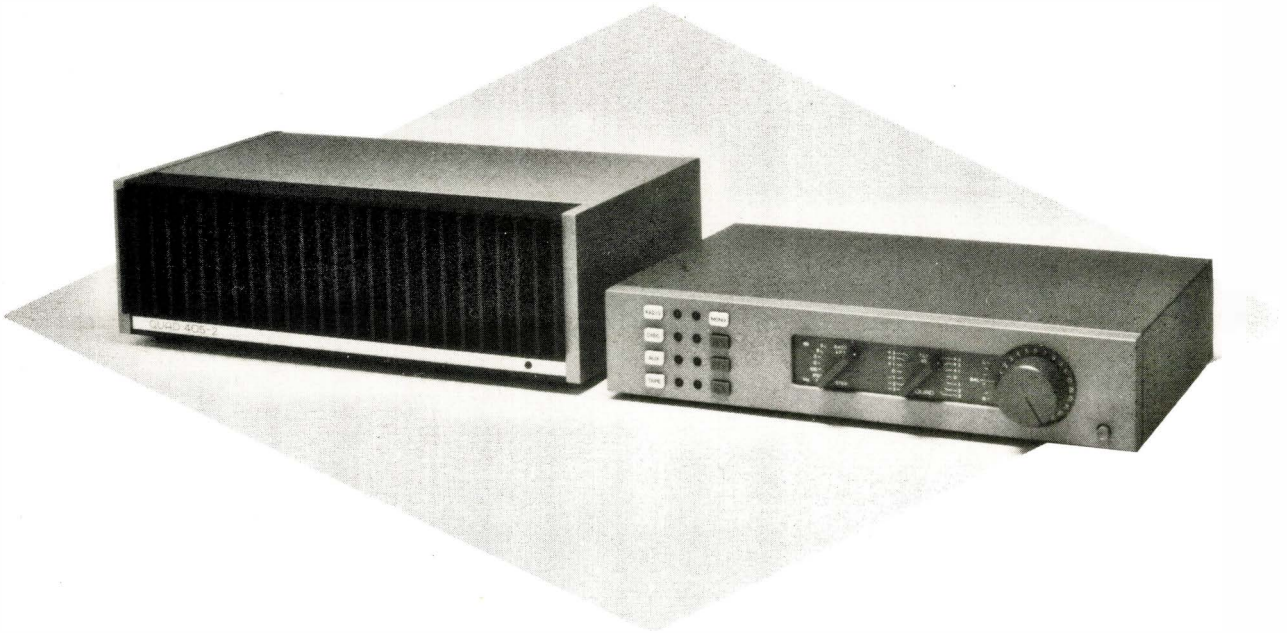
TEST RESULTS

NAC 32/250	Pre- and power amplifier		
Rated power into 8ohms, maker's spec	70W(=18dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.0dBW	19.0dBW	19.0dBW
Both channels, 4ohm load	18.3dBW	18.3dBW	18.3dBW
One channel, 2ohms, pulsed	16.3dBW	16.5dBW	16.9dBW
Instantaneous peak current		+16A	−16A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−80dB	−80dB	−63dB
NOISE			
Disc (mm) input (IHF, CCIR weighted)	−79dB		
Disc (mc) input (IHF, CCIR weighted)	−72dB		
Aux/CD input (IHF, CCIR weighted)	−80dB		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	32dB	32dB
Disc (mc) input (IHF)	25dB	25dB	25dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.20mV	46kohms 100pF
Disc (mc) input	Phono	0.01mV	1kohm
Aux input	DIN	10.3mV	20kohms 220pF
Power amp	XLR	105.4mV	18kohms 190pF
Output, pre-amp (tape)	7.7V max, 4.9ohms		
Disc equalisation error, 30Hz-15kHz	+0dB, −0.7dB		
Size (width, height, depth)	32 × 20.5 × 8.5cm, 32 × 43.5 × 8.5cm		
Typical price inc VAT	£368, £822		
	(Hi-Cap power supply, £328 extra)		

First reviewed: NAC32/250, 1983; NAP135, 1985. Rating: Recommended. For full lab report on NAP135, see issue 39.

QUAD 34/405

QUAD ELECTRO ACOUSTICS LTD, 30 ST PETERS ROAD, HUNTINGDON, CAMBS PE18 7DB. TEL: (0480) 52561



Quad's *34* and *405* are a very well-established 100W per channel pre- and power amplifier combination. The *405* 'Current Dumping' power amplifier is now in MkII form and seeks to serve more difficult loudspeaker loads than previously accommodated, this overcoming a known drawback for *405* purchasers in the past. The compact *34* pre-amp is attractively styled, and offers good versatility. Moving-magnet and moving-coil input modules are user-interchangeable, with alternative loading as well as sensitivity options available).

SOUND QUALITY

Scoring rather above average over the spectrum of listening tests, the result was nonetheless not too promising in view of the high attainment achieved by some of the latest generation of amplifiers.

Via disc (moving-coil) the sound was pleasantly neutral, particularly in the mid register. Both bass and treble resolution were above average though it was not especially transparent. Stereo images were rendered with only average focus and depth, but via moving-magnet the sound did improve slightly as regards clarity. Via the auxiliary input some additional improvement was noted, but this was insufficient to raise the subjective rating into the 'Good' category. The treble was still showing some mild 'feathery muzziness', while the bass could have offered more extension and impact, this especially noted on digital programme.

LAB REPORT

Rated at 100W (20dBW) the Quad *405* met specification over the 20Hz to 20kHz power bandwidth. Into 4ohms the bandwidth loss was more serious but this result may be due to the operation of protection circuits. Peak current measured ±8A which was not really enough for the output level. Peak output held well from 8 to 4ohms, but fell by a total of 7.8dB into 2ohms. Really severe loads are not recommended.

Input characteristics were typical and though the moving-magnet capacitance was rather high, this could be easily altered if required by the dealer. As supplied the pre-amp has a rather limited output, of just over 0.6V, but a resistor change inside (Quad-approved) will allow an increase to several volts if required for use with other power amplifiers of 1-2V sensitivity. The RIAA equalisation was uniform in response, and sensibly tailored to rolloff the output beyond the audible range.

CONCLUSION

These two finely-constructed components partner each other well, and for basically 8ohm speaker loads, they can offer a pleasant and consistent sound, with considerable versatility. In particular the special tone controls provide for a wide range of adjustment to cope with some of the more difficult programme sources available, and would for example suit a collector with an extensive disc library.

The sonic attainment was however not in our view quite sufficient at the price for a full recommendation, but the system nonetheless remains worthy of considerations.

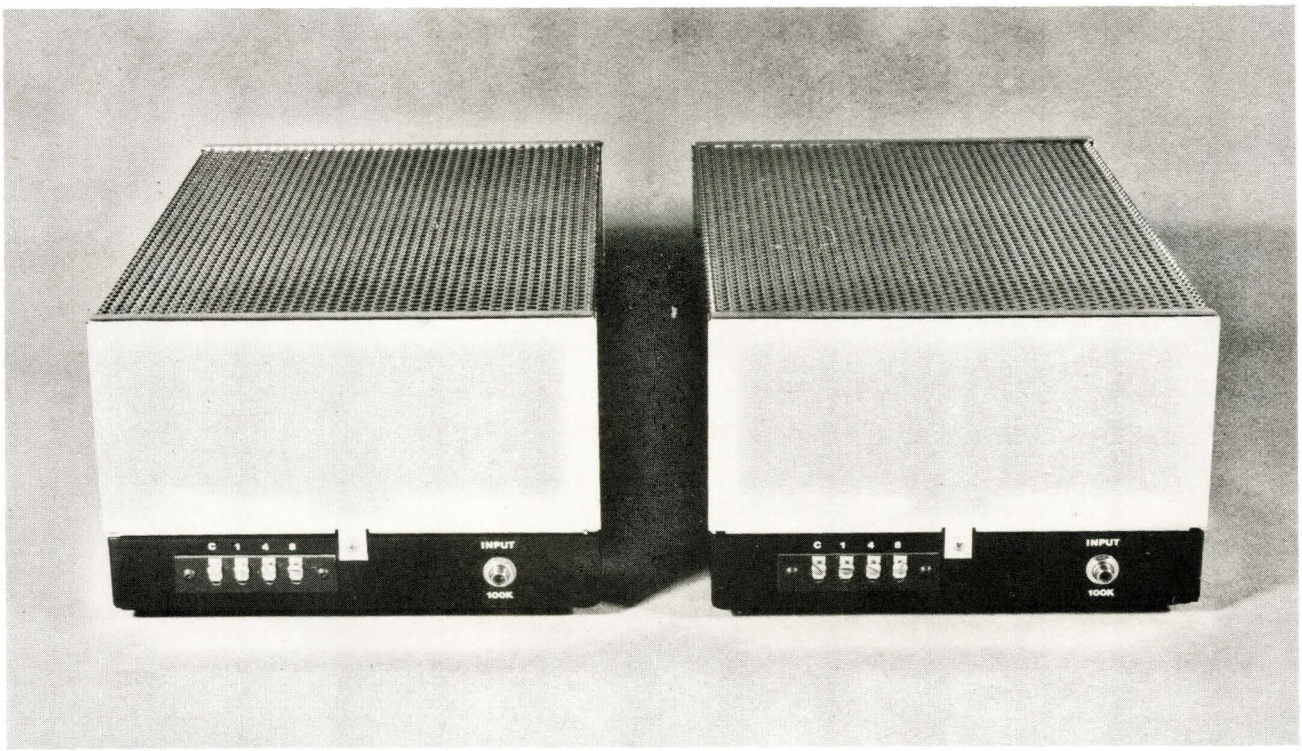
TEST RESULTS

Pre- and power amplifier			
Rated power into 8ohms, maker's spec	100W(=20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.4dBW	20.6dBW	20.3dBW
Both channels, 4ohm load	15.3dBW	19.1dBW	15.3dBW
One channel, 2ohms, pulsed	12.7dBW	13.2dBW	10.4dBW
Instantaneous peak current		+8A	−8A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−68dB	−79dB	−66dB
NOISE			
Disc (mm) input (IHF, CCIR weighted)	−80dB		
Disc (mc) input (IHF, CCIR weighted)	−74dB		
Aux/CD input (IHF, CCIR weighted)	−81dB		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	30dB	19dB
Disc (mc) input (IHF)	27dB	27dB	16dB
Aux/CD input (IHF)	20dB	20dB	20dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.30mV	48kohms 277pF
Disc (mc) input	Phono	0.013mV	100ohms 22nF
Aux input	DIN	11.3mV	—kohms —pF
Power amp	DIN	53.0mV	37kohms 300pF
Output, pre-amp (tape)	0.65V max, 800ohms		
Disc equalisation error, 30Hz-15kHz	+0dB, −0.35dB		
Size (width, height, depth)	32 × 21 × 6cm		
Typical price inc VAT	£249, £289		

First reviewed: 1983, subsequently retested. Rating: Worth Considering.

QUICKSILVER POWER AMPLIFIER

VITAL SYSTEMS, 38A THE MEADOW WAY, HARROW WEALD, MIDDLESEX HA3 7BW. TEL: 01-863 8988



Utterly traditional, these US built mono power amplifiers even use valve rectifiers and no regulation. Fixed bias is employed with the 8417 output valves biased to 63mA each, a comfortable enriched Class 'A' rating. Large (for a valve amp that is) 320μF reservoir capacitors are used in a CLC smoothing circuit incorporating a choke, the latter section feeding the low level stages. The simple signal paths are coupled with quality polypropylene capacitors, the input is direct coupled, while the output is transformer coupled, push-pull ultra-linear. At the secondary (feedback coupled) tappings for 8, 4 and 1ohm operation, are provided, the last being for direct connection to ribbon drivers. The mains switch is single pole, unshrouded — I would like to see an improvement here!

SOUND QUALITY

Well, good amplifiers do exist after all, even if they appear to have been designed back in 1955! The *Quicksilver* scored 'excellent' on the listening tests and achieved this standard mainly by virtue of a top class transparency. With that quality properly established, the rest fell neatly into place. It proved to be powerful, producing quite substantial sound levels. Bass was highly rated for 'speed' and articulation, but with a hint of richness and overhang. Slightly mellow, the treble remained airy and open with clear, articulate detail. The mid was considered neutral while the stereo focus, width and depth were all extremely good. Finally, it was also dynamic, lively and full of interest as well as possessing a low 'fatigue factor'.

LAB REPORT

On programmed peaks it reached 102dBA, based on a peak level of 18.5dBW (around 75W). A good power bandwidth was shown at rated power, this indicative of a high-quality output transformer.

Another surprise was the remarkable load tolerance with a peak current of 13.5A; clearly this is a load-tolerant amplifier. On the 4ohm tap it would even handle 2ohm loads!

Low feedback is a feature of this design and resulted in rather high distortion of 1% midband, and nearer 3% at the frequency extremes. Better intermodulation results were observed, while distortion improved greatly at lower powers. Noise levels were fine, though some transformer hum was present on our samples. The output impedance was rather high at 1ohm; sufficient to change the sound of many speakers to some small degree.

CONCLUSION

This amazing amplifier demonstrated just how poor the lab results can be while at the same time attaining a top class sonic standard. Its load tolerance was a surprising asset, and the sound quality was heading toward the £2,500 level. It offered its own unique strengths, of which transparency was its trump card; warmly recommended, but check the transformer hum and overall system compatibility carefully.

TEST RESULTS

Rated power into 8ohms, maker's spec	60W(=17.5dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.5dBW	17.6dBW	16.9dBW
One channel, 4ohm load	15.6dBW	15.3dBW	14.4dBW
One channel, 2ohms, pulsed	–dBW	15.0dBW	–dBW
Instantaneous peak current		+14.0A	–13.0A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–30.0dB	–41.5dB	–34.6dB

NOISE

Aux/CD input (IHF, CCIR weighted)	–91.0dB
Residual, unweighted (volume control at min)	–79.0dB

Output Impedance (damping)	1.0ohm	1.0ohm	1.1ohm
Input data	socket type	sensitivity	loading
Power amp	Phono	120mV	100kohms –pF
Size (width, height, depth)	23.5 × 15 × 36cm		
Typical price inc VAT	£1550 (pair)		

First reviewed: 1986. Rating: Recommended.

ROBERTSON FORTY TEN

ABSOLUTE SOUNDS, 42 PARKSIDE, LONDON SW19. TEL: 01-947 5047

This US-designed transistor power amplifier is built by the Singapore-based David Tan company Robertson Electronics. It already enjoys a fine reputation in the States, which we found to be fully justified.

A compact design, it is built mainly of steel plates, bar the vertical heat sink fins which are in higher conductivity aluminium. No controls are present, aside from on/off. Signal input is via gold plated phonos, outputs via large gold plated 4mm socket/binding posts. Mechanical hum levels were satisfactorily low. Rated at 60W/channel, it is claimed to be highly load tolerant, and is also easy to drive by any valve pre-amp.

Construction is of excellent quality, though elements of its mechanical design do appear to be unnecessarily complex. A simple output fuse is used for protection, this unbypassed and not subjected to any feedback correction.

SOUND QUALITY

The high sonic standard immediately put it into the front rank, well into Krell territory. It was as transparent and dimensional as the very best semi conductor amplifiers, as well as a number of valve amps to boot! It possessed lively dynamics, with a clean open character, while transients were effectively reproduced throughout the frequency range, and the bass was very firm with excellent extension.

Stereo images were very well focused particularly in the treble, where it was outstanding. It was good enough to show much of the merit of the *SP8 II*, in fact, and within its reasonably generous power compass it proved very tolerant and would drive practically anything.

Slightly clinical in tonal balance, it also proved unfatiguing, and most satisfying over long listening sessions.

LAB REPORT

A superb power bandwidth was shown at a level somewhat greater than the claimed specification. A little over 19dB/W was available on programme peaks, which is some 100W, and the output fell very little into lower impedances.

Pulsed power into 2ohms measured 18dB/W or 240W into that load. The fuse blowing that we noted on 4ohm continuous loading will not occur on music signals in use.

Distortion was satisfactory at full power, rapidly improving at lower levels, while the high frequency intermodulation was excellent. The dc offsets were fine, noise levels low enough to be inaudible and stereo separation was excellent. Output impedance was negligible. The frequency response was very wide, measuring 1dB from 1.3Hz to around 100kHz.

CONCLUSION

Here is a neat little powerhouse which you can fit and forget. With a strikingly good lab and subjective performance, this relatively economical transistor design deserves to succeed, setting the standard for the state of the art in its price category, and indeed for many amplifiers above that! Warmly recommended, many audiophiles need to go no further.

TEST RESULTS

Power amplifier

Rated power into 8ohms, maker's spec	60W(=18dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.9dBW	19dBW	19dBW
Both channels, 4ohm load	Fuse	Fuse	Fuse
One channel, 2ohms, pulsed	–dBW	18.0dBW	–dBW
Instantaneous peak current		+28A	–28A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–67dB	–18dB	–56dB
Intermodulation, 19/20kHz, rated power, aux input	–90dB		

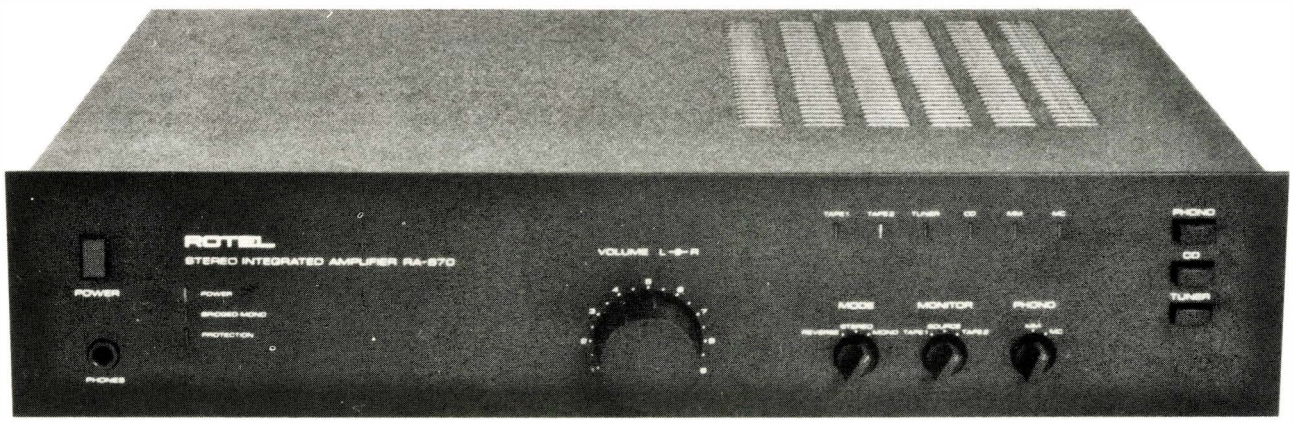
NOISE

PA input (IHF, CCIR weighted)	–82dB		
Residual, unweighted (hum)	–75dB		
DC output offset	left 13mV, right 6mV		
PA input	–98dB	–95dB	>70dB
Output impedance (damping)	.03ohm	.03ohm	.06ohm
Input data	socket type	sensitivity	loading
Power amp	Phono	1200mV	51kohms 110pF
Size (width, height, depth)	43 × 10 × 19cm		
Typical price inc VAT	£987		

First reviewed: 1985. Rating: Recommended.

ROTEL RA-870

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



Rotel's refinement of their larger amplifier designs has followed much the same path as the development of the current *RA-820BX* from the original *RA-820* budget amplifier. First launched for the 1983-4 season, the *RA-870* has now been re-designed to incorporate much of the *RC-870/RB-870* technology, and it now becomes in effect more or less a 'BX' version.

Modestly rated at 60W per channel, it may be set in bridged mono mode and used together with an *RB-870* power amp to give a system of typically 200W per channel.

SOUND QUALITY

Proving substantially loud on the maximum level test, the *'870* attained a comfortable 106dBA with negligible loss into 4 ohms. Certainly justifying its price it achieved a 'good plus' on audition, with the CD input having a small lead on absolute quality.

On disc, it portrayed stereo images with a good sense of scale, with decent depth and ambience. Focusing was stable and clear with good stage width. Dynamics were fine, though the overall effect was slightly veiled and it was apparent that more absolute definition would certainly have helped here.

Via Compact Disc, the detail improved, and a worthwhile standard was achieved. Compared with the top examples, it remained slightly flattened in its representation of stereo depth perspectives, while the treble was a touch sibilant. However, the bass was well above average and it handled high power levels with authority and control.

LAB REPORT

On peak programme rating this amplifier doubled its manufacturer's rating, reaching 20dBW. Even at 2ohms, it managed 20.3dBW (400W), this backed by a generous peak current capacity which exceeded 30A. Power bandwidth was exceptional, even into 4ohms. Throughout the lab tests the distortion figures were low and most of the input noise levels were also very respectable.

With negligible dc offsets, the output impedance was very low at around 0.06ohm. Input overload margins were ample, while channel balances were accurately maintained. The RIAA equalisation curve showed a well designed midband of high accuracy over a 50Hz to 20kHz bandwidth with some sensible tailored rolloff outside the band.

CONCLUSION

Rotel's designers have learnt the lessons derived from the *'820* — their whole range has now been revitalised. All now attain a similarly high standard of sound quality, and offer a range of additional facilities as well as higher power outputs. The bridge mode option was a special feature of the *RA-870*, and if coupled with an additional *RB-870*, would make an economical high power (300W) system. As it stands the *RA-870* is well placed in the recommended class.

TEST RESULTS

	Integrated amplifier		
Rated power into 8ohms, maker's spec	60W(=18dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.9dBW	19.2dBW	19.0dBW
Both channels, 4ohm load	17.6dBW	18.1dBW	17.9dBW
One channel, 2ohms, pulsed	–dBW	24.6dBW	–dBW
Instantaneous peak current		+30.0A	–40.0A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–78.0dB	–81.8dB	–71.3dB

NOISE

Disc (mm) input (IHF, CCIR weighted)	–74.6dB
Disc (mc) input (IHF, CCIR weighted)	–63.0dB
Aux/CD input (IHF, CCIR weighted)	–78.6dB

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32.3dB	30.7dB	30.5dB
Disc (mc) input (IHF)	35.5dB	34.0dB	33.9dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.33mV	47kohms 110pF
Disc (mc) input	Phono	0.048mV	180ohms 0.5nF
Aux input	Phono	22mV	52kohms 50pF
Power amp	–	–mV	–kohms –pF

Output, pre-amp (tape)	10.5V max, –ohms
Disc equalisation error, 30Hz-15kHz	+0dB, –1.02dB
Size (width, height, depth)	43 × 10 × 34cm
Typical price inc VAT	£285

First reviewed: 1983, retested 1986. Rating: Recommended. For full lab reports on RC-870, RB-870, see issue 39; for RA-820BX see issue 44.

SUGDEN C128SL and P128

J E SUGDEN & CO LTD, VALLEY WORKS, STATION LANE, HECKMONDWIKE, WEST YORKS WF16 0NF. TEL: (0924) 404088

PRE-AMP ONLY SHOWN

In this powerful combination from one of the most famous names in British hi-fi, the power amplifier consists of a pair of mono units, physically separate. The *P128* uses Mos-Fet output stages and is rated at 130W per channel.

In the *C128* pre-amp discrete transistor 'op amp' stages are used with a special selection of component types.

SOUND QUALITY

On our most recent type review sample, the moving-coil input performed well and gave a fine sound. The moving-magnet input was fine. As a combination, the *C128/P128* scored a respectable 'good plus' on audition, the mid tonal balance proving pleasantly sweet and lacking the usual hard or brittle quality so often encountered. Stereo focus and image precision were fine and good ambience and depth were also heard. The sound was well detailed, bass good and the treble better still.

Via auxiliary a neutral, musical sound emerged with only a mild restriction of depth. Auditioned separately, the power amplifier sounded slightly bandlimited with a mild lack of crispness and a slightly inarticulate exposition of transients and dynamics. It proved to be a 'powerhouse' reaching 107dBA into the normal speaker and 104.5dBA into the adverse load, making it one of the most powerful models tested. It also sounded pleasant in mild clip and could get very loud indeed.

The pre-amplifier, tried separately, proved capable of a still better-focused and defined sound, and is potentially in the 'very good' class with a most musical overall character.

LAB REPORT

The 8ohms continuous output over the power bandwidth was close to specification at 21.5dBW. A good bandwidth and level was maintained into 4ohms on continuous drive. A quite good peak current capacity was measured at +21, −23A, this reflected by the good peak level delivery. A substantial peak 22.8dBW into 8ohms (nearly 200W) fell to 21.5dB 4ohms, and a still reasonable 18.0dBW into 2ohms. At full power to 20kHz, harmonic distortion was worsening but elsewhere both IM and harmonic distortion levels were very good. Signal-to-noise ratios were also satisfactory. The power amp dc offset was satisfactory.

Input overload margins were exemplary and while stereo separation was satisfactory it was measured as strangely constant over the spectrum.

Perhaps contributing to the sweet sound via disc, the RIAA equalisation rolled off above 10kHz, to −3dB at 20kHz, which was a trifle premature.

CONCLUSION

Taking the *P128* first, this very powerful unit is sweet-sounding, and produces good stereo, offering quite good value for money. Where wide dynamic range is required with an output of 200W and good load tolerance, the *P128* is well worth considering. The *C128* offered a front rank performance in its chosen price category. This pre-amp is a versatile and most competent design, which can give much musical pleasure, and is therefore comfortably recommended.

TEST RESULTS

Rated power into 8ohms, maker's spec	130W(=21dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	21.9dBW	22.0dBW	21.5dBW
Both channels, 4ohm load	19.7dBW	20.0dBW	19.4dBW
One channel, 2ohms, pulsed	17.2dBW	180dBW	17.4dBW
Instantaneous peak current		+21A	−23A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−75dB	−95dB	−85dB

NOISE

Disc (mm) input (IHF, CCIR weighted)	−78dB
Disc (mc) input (IHF, CCIR weighted)	−72dB
Aux/CD input (IHF, CCIR weighted)	−84dB

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	36dB	36dB	36dB
Disc (mc) input (IHF)*	35dB	36dB	31dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	4.5mV	49kohms 200pF
Disc (mc) input	Phono	0.25mV	500ohms 600pF
Aux input	Phono	85mV	50kohms 30pF
Power amp	–	−mV	−kohms −pF

Output, pre-amp (tape)	>7V max, 50ohms
Disc equalisation error, 30Hz-15kHz	+0dB, −0.5dB
Size (width, height, depth)	47 × 9 × 23cm
Typical price inc VAT	£275

(Note: distortion, noise and dimensions are pre-amp only)

First reviewed: 1983, subsequently retested. Rating: C128SL Recommended, P128 worth considering.

TANNOY SR-840 POWER AMPLIFIER

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This superbly built studio-class amplifier has a fine pedigree and is in part derived from the Tresham line, as this company is now part of Tannoy. The 840 does not have phono socket inputs, but instead XLR and ¼in jack inputs are provided, while speaker output is via massive 30A binding posts. A massive creation of considerable weight, it comes equipped with one of the largest toroidal mains transformers that I have ever seen. The specification discusses ratings down to 2ohms continuous per channel, and the transformer is commensurately rated for this arduous duty. The basic spec is 250W per channel, or 900W mono bridged.

SOUND QUALITY

Mechanical hum was moderate, while very high, unstrained sound levels were possible. This was one of the biggest amps tested and 111dBA was attained into 8 ohms, with 110dBA into 4ohms — a powerhouse indeed!

Few doubts were expressed on sound quality and on the listening test scores, the amplifier established a 'very good' overall rating. Focus was fine, but with a slight constriction of stereo depth and image width. The treble register was musical with good definition, while the bass was effortlessly powerful and extended, yet with very good articulation and speed. Tonally, the mid was judged to be slightly 'clinical', but this did not detract much from the rating. Compared with the best examples, it could sound slightly veiled and lacking in 'air' but conversely it handled dynamics well, and gave an impression of power and ease, a relaxing effect conducive to low levels of 'listening fatigue'.

LAB REPORT

Considering its high output level, the peak output current was somewhat lower than expected though at over 40A this should not give any trouble except with reactive loads below 3ohms, or resistive loads below 2ohms. Peak 8ohm levels exceeded 500W per channel, and this level was held even into 2ohms. Clearly a conservatively rated model, the 4-8ohm bridged output level will typically lie in the 1,500 to 1,800W range!

Measured distortions were negligible, noise levels fine and dc offset at the output was virtually zero. Channel separation was very good, with an output impedance at a very low level. Channel balance was held to a typical 0.02dB. It represented a very easy pre-amplifier load with 67mV required for the IHF 1watt output, and by our measurements, full clipping would require around 2V.

CONCLUSION

This very powerful, professional amplifier has passed the critical listening test associated with more delicate exotics intended for 'audiophile' hi-fi use. Lab performance was very good, while the load tolerance was fine, and the power output exceptional. Its very good sonic rating probably means that this amplifier was the best tested of its power rating. Given its high standard of engineering, it represented good value and is recommended.

TEST RESULTS

	Power amplifier		
Rated power into 8ohms, maker's spec	250W(=24dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	25.0dBW	25.2dBW	24.8dBW
Both channels, 4ohm load	23.8dBW	24.1dBW	23.7dBW
One channel, 2ohms, pulsed	−dBW	26.4dBW	−dBW
Instantaneous peak current		+45A	−40A
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−80.9dB	−80.6dB	−68.3dB
NOISE			
Aux/CD input (IHF, CCIR weighted)			−83.0dB
Resididual, unweighted (volume control at min)			−82.0dB
DC output offset			left 1mV, right 1mV
Output impedance (damping)	0.05ohm	0.05ohm	0.11ohm
Input data	socket type	sensitivity	loading
Power amp	XLR	67mV	32kohms 1.6nF
Size (width, height, depth)			48 × 13 × 46cm
Typical price inc VAT			£1093

First reviewed: 1986. Rating: Recommended.

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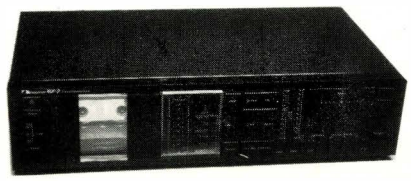

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APOGEE SCINTILLA

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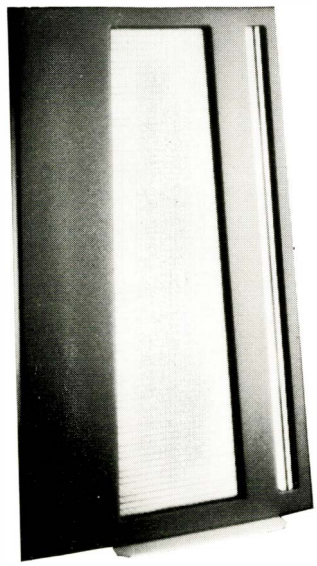
Arguably the most interesting speaker technically, the *Scintilla* is certainly one of the most expensive products included in this issue at £4,950 a pair. When considering purchase, the buyer must also take into account certain special problems, the first being the low impedance of this speaker which falls below 1ohm. Its loading is essentially resistive in nature by virtue of a simple crossover, but it does require a very powerful amplifier — one capable of supplying substantial current. At present in the UK this can be satisfied by another line imported by the *Scintilla* agents, namely the Krell *KSA100*. The later addition of a second *KSA100* would allow double mono operation, with bi-wiring and bi-amping to each system, a technique which optimises the performance.

When this speaker was originally tried on the 4ohm tap of an ARC amp, the resulting sound, while of excellent quality, proved quite inadequate with regard to the maximum volume level attained. The Quicksilver mono valve amps are unusual in that they have a 1ohm tap which will drive the *Scintilla* to modest levels, but since this inefficient speaker requires both volts and current, only a transistor amplifier with a high muscle factor is really appropriate here. On test we used a *KSA100* with great success while the loan of a pair of *KSA200* monoblocks also prodced really effortless sound levels. Originally obtainable in either 1ohm or 4ohm form, the *Scintilla* now comes in 1ohm form only, and so lesser amps are ruled out.

A second problem concerns the open panel design which, conversely, is a great strength in terms of freedom from box colorations. However, it does generate a back wave which reflects from the rear walls; such open panel speakers are highly critical with regard to room placement, and in some rooms do not work well at all. At this price level both dealer and listener must be prepared for a decent home trial, and consider an alternative if the *Scintilla* doesn't work out.

This speaker comprises a large scale, substantially-built panel, essentially two-way and using a massive bass-mid range panel of semi-ribbon construction coupled with a vertical line mid/tweeter — a true ribbon 1.9in wide and running for much of the considerable 1.5 metre high of this visually striking system. Each speaker measures 88cm wide at the base, tapering



to 74cm at the top. Flanking the main ribbon element is a group of four 0.5in higher frequency ribbons, two at the front and two at the rear. The overall set forms a complete unit handling the frequency range above 500Hz. The bass element is of pleated aluminium foil reinforced by specially placed strips of Kapton film. The diaphragm is not self-supporting and is suspended on compliant mountings to decouple the resonance modes via the mechanism of differential tuning and also to endow the system with the additional freedom of partial pistonic motion. It is driven by an array of bar magnets bonded to the perforated back steel plate. The bass system represents a considerable radiating area, comparable with eight 12in woofers, and is also capable of a respectable excursion.

This is an extremely heavy and awkward product — it takes two people to unpack and place the systems (180lbs each). Their relatively shallow 9cm depth is stabilised by an aluminium plate foot, secured by strong diagonal struts at the rear.

All components used are of the highest quality while the panels themselves are rigid and inert. The total weight is so high that questions of spiked feet and the like are largely irrelevant — the *Scintilla* virtually beds itself into the floor without need for such aids.

SOUND QUALITY

Here is a speaker that has some extraordinary qualities seemingly quite devoid of subjective panel resonance or coloration it offered a seamlessly broad frequency range of almost unparalleled definition. From 50Hz upwards, the bass/mid range was superbly natural. Piano was reproduced with a strong sense of the instrument actually being in the listening room and it also seemed to avoid the 'mechanical' quality so prevalent in the hi-fi reproduction of piano. The left hand playing was a revelation in terms of tonality and in the discrimination of subtle intonation and style of playing. This astonishing performance was maintained throughout the midrange to the treble, providing an exceptionally lifelike rendition of human voice. Singing was delightful, with exceptionally good focusing and a strong feeling of dimensional solidity. The treble was sweet, lacking sibilance or 'edge' and showing excellent transparency. This was not the only area of transparency however as this vital 'high end' quality was held through the midrange right down into the mid-bass. Localisation was heard in the low frequency range as if for the first time.

Stereo images showed fine width, height and depth over a wide frequency range regardless of the complexity of the programme scoring. No trace of audible distortion could be heard at any conceivable power level, the system possessing all the hallmarks of very low distortion.

In the bass it was seen to offer a very powerful performance extending to a solid 20Hz in my room, though I found the overall bass level below 40Hz to be a little on the heavy side. Such a response is better suited to larger rooms, 26 to 36ft long, rather than my 19ft 6in, and its correct low frequency balance was confirmed subsequently.

Tonally, the speaker's character was marginally 'rich' with an audible presence depression, this proving kind to matching solid state amplifiers and helping to produce a pleasing overall balance. Properly set up, this speaker was capable of a supremely musical and authoritative performance.

LAB REPORT

Due to difficulties in visiting any anechoic chamber with this weighty example some tests were carried out in my listening room. Sensitivity was rather low (1ohm) at 79dB/W which is below that of an *SL 600* for example. The watt here is referred to a nominal 8ohms reference so in truth the *Scintilla's* efficiency is very low indeed. Since a Krell *KSA100* will in fact produce

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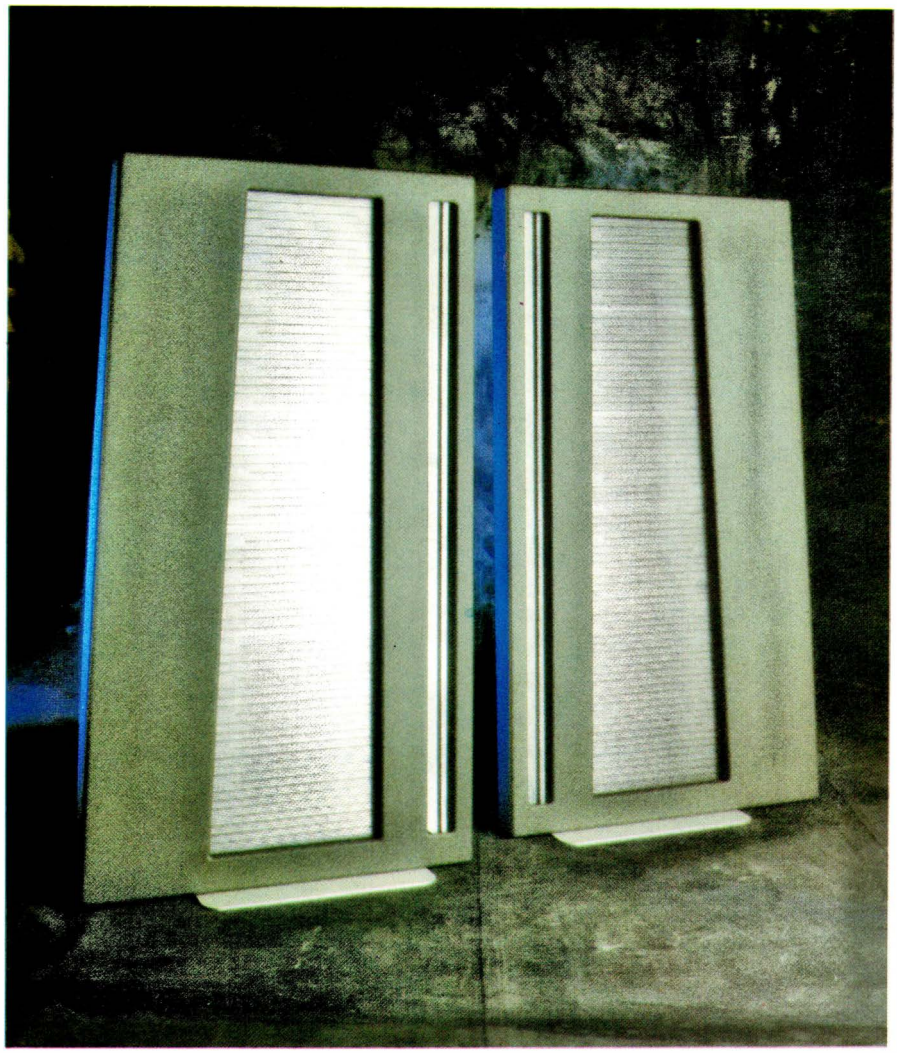

SCINTILLAS NEED CAREFUL ROOM PLACEMENT

over 150W per channel at peak currents over 40A, its good compatibility with the *Scintilla* is easy to appreciate.

Measured close up, the bass panel showed a pretty uniform response which did extend down to 20Hz, albeit with a gentle rolloff. Similarly smooth results were obtained in the higher frequency range up to 16kHz. Between 16 and 17kHz, some interference occurred between the ribbons and the slot aperture in which they are mounted, but no real evidence of related subjective effects were noted during the auditioning. Good integration was shown by the off-axis set of responses, agreeing with the wide driver bandwidths.

In the room the computed listening area response was better than expected in view of the known effect of back wave cancellations. From 40Hz to 16kHz the response was quite uniform, if gently downtilted, with the slight rich tendency we noted. Below 40Hz the bass rose by some 8dB as seen in the 25Hz and 30Hz third-octave bands. How this sounds depends largely on placement and the size of the room.

The impedance curve showed a loading of typically 0.9ohms up to 1.8kHz, above which point it improved to around 2.5ohms. Very low resistance speaker cable is essential for best results and to minimise power losses in the connection.

Some sample tests were made for distortion and showed that in the bass, even with a substantial 96dB sound level, the distortion was of a low harmonic order, at around 1%. At higher frequencies, 0.05% to 0.1% distortion was typical; these are excellent results.

CONCLUSION

The Apogee *Scintilla* is not perfect — for my taste at least it is a mite bass heavy and is mildly recessive in the presence region — but it nonetheless offered a superbly coherent, wide-range sound which was at times surprisingly lifelike. Its piano and voice reproduction was a revelation while a fine stereo image focus and exceptional level of transparency is held over a very wide frequency range. No subwoofer need be contemplated. In real terms its coloration is very low and while it was a beast to drive well, it will reward with a sound stage of great scale and authority. A true audiophile system, it is well worth the effort and expense needed to obtain the excellent results that are possible.

TEST RESULTS

Size (height×width×depth)	145×88×9cm deep
Recommended amplifier power per channel (for 96dBA per pair at 2 metres minimum)	high current, 100 to 200W
Recommended placement	on floor, free space
Frequency response, within ±3dB at 2 metres	40Hz to 16kHz
Low frequency rolloff (−6dB point) at 1 metre	approx 20Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	approx 79dB/W
Approximate max sound level (pair) at 2m	103-105dBA*
Impedance characteristic (ease of drive)	very poor
Forward response uniformity	very good
Typical price per pair, including VAT	£4,950

*Higher than expected due to forward 'throw' and directivity.

AUDIOSTATIC ES200

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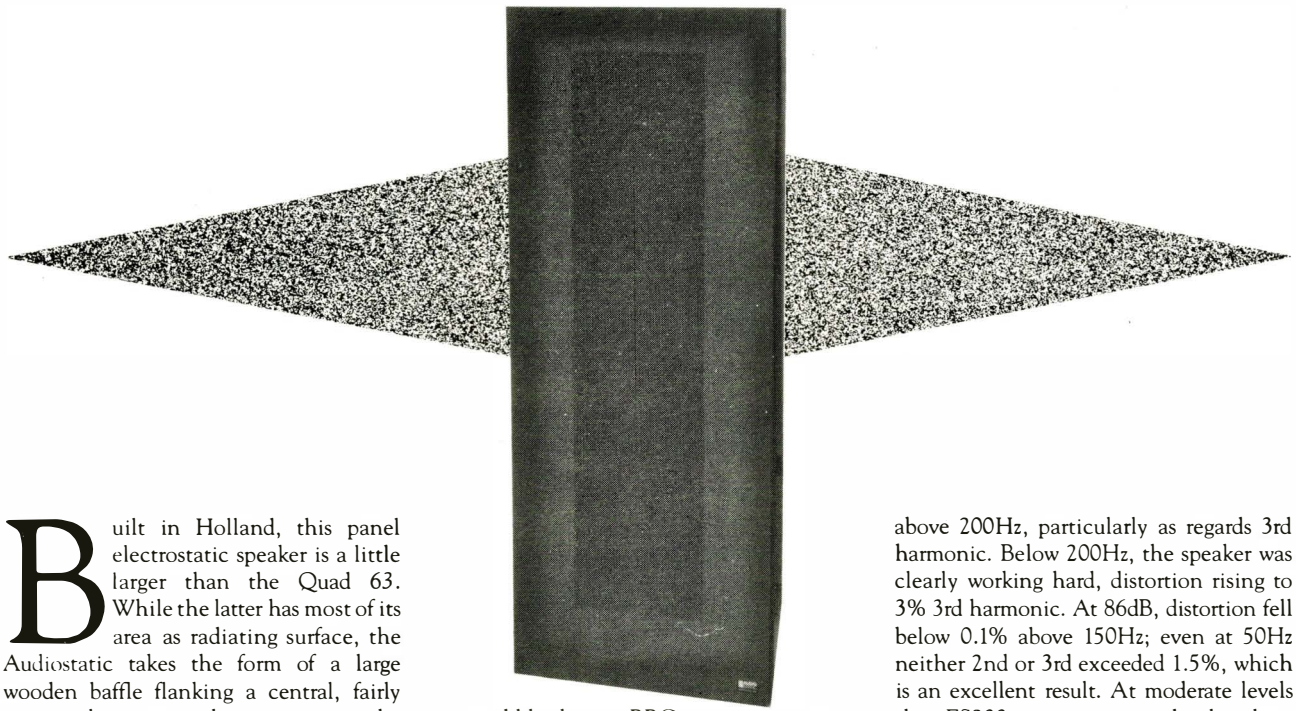


Built in Holland, this panel electrostatic speaker is a little larger than the Quad 63. While the latter has most of its area as radiating surface, the Audiostatic takes the form of a large wooden baffle flanking a central, fairly narrow electrostatic element running the full height of the enclosure. To some degree this provides a line source with the baffle augmenting the room drive at the lower frequencies. The effective width of the source reduced with increasing frequency, maintaining a good lateral off-axis response. This is achieved by the use of a sophisticated transformer step-up system, called 'Mirror-Drive'. A low voltage 'mains plug' power supply feeds power to the speakers, this stepped up internally to the high polarising voltage. Heavy and stable enough for floor mounting, these speakers benefit from use on low rigid frames, around 10-15cm high, and the agent also recommends the use of floor spikes. Connections are via sturdy 4mm socket binding powers. As with all open-back systems, use well away from the rear room wall (at least 1.5m) is mandatory and in fact large rooms are preferable. Overall constructional quality and finish are excellent, and Audiostatic also produce compatible sub woofer systems.

SOUND QUALITY

It was clear that a definite limitation was present in the bass power handling and on several of the rock tracks, powers over 50 watts were ruled out. The speaker was felt to sound imbalanced with a forward mid-range plus a lack of richness and 'scale' in the upper bass/lower mid. However this response complemented some sources to an incredible degree. BBC announcers were unbelievably life-like, with their usual 'chestiness' perfectly controlled. Aside from the tonal imbalance, the sound was very pure, transparent and full of detail, and succeeded in sufficiently impressing the panel to achieve a respectable score. Bass was fairly extended, but a touch lumpy and muted, while the treble was generally very good if slightly prominent in the extreme upper range.

Stereo images were well focused and, given appropriate material, the depth effect was also substantial. Undoubtedly this is an analytical speaker.

LAB REPORT

Pair matching was good over most of the range save for a 1.5dB difference in sensitivity, this averaging 80.5dB/W. With a peak power capacity of 50-75W, this speaker was not capable of high sound levels, the maximum being typically 93dB for a stereo pair at the listening position.

Anomalies in the 2 metre off-axis responses prompted us to take an additional 15° off-axis curve for this model. Even then, the output fell rapidly above 5kHz. The forward energy peaked at 1kHz, compensating for the measured axial dip. It was also very axis-sensitive in the vertical plane, with the 15° off-axis response collapsing above 1kHz, so the listener should aim to be on axis.

Distortion at 96dB/1m was very good above 200Hz, particularly as regards 3rd harmonic. Below 200Hz, the speaker was clearly working hard, distortion rising to 3% 3rd harmonic. At 86dB, distortion fell below 0.1% above 150Hz; even at 50Hz neither 2nd or 3rd exceeded 1.5%, which is an excellent result. At moderate levels the *ES200* is an outstandingly clean loudspeaker.

Barely dipping to 4.5ohms at 20kHz, the impedance was typically 10ohms, and is regarded as a relatively easy amplifier load.

CONCLUSION

This is a costly speaker with an idiosyncratic performance. The main mid and treble performance is superb but the tonal balance is 'off'. The bass is weak in power as well as inadequate in level, and the speaker is also very insensitive. However it is definitely not a write-off, and with its audiophile pretensions it is well worth trying. It might suit some customers' requirements — fabulous on piano and string quartets, and pretty good on non-rock bass.

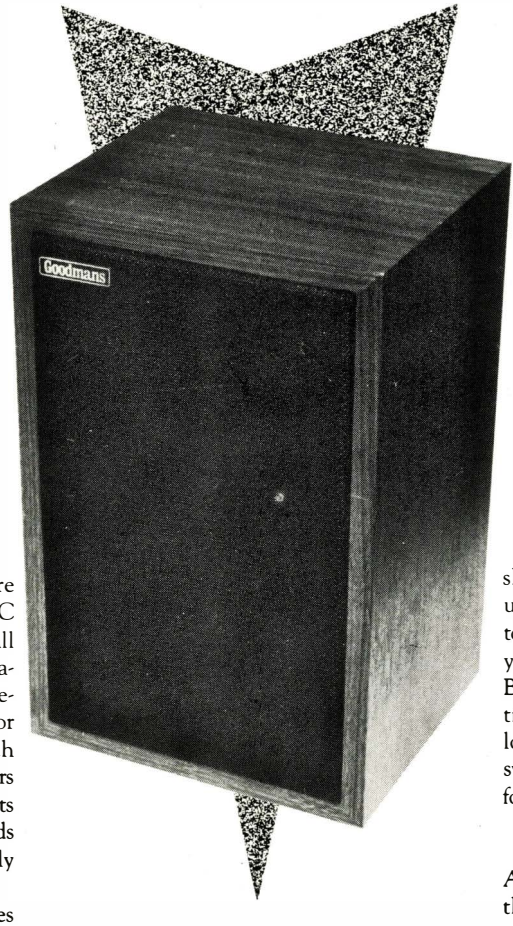
TEST RESULTS

Size (height × width × depth)	129.5 × 53 × 23cm
Recommended amplifier power per channel (see text)	100W
Recommended placement	well clear of rear wall
Frequency response, within ±3dB at 2 metres	see text
Low frequency rolloff (−6dB point) at 1 metre	45Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	80-82dB/W
Approximate max sound level (pair) at 2 metres	93-95dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	fair
Typical price per pair, including VAT	£1395

First reviewed: 1985. Rating: Worth Considering.

BBC LS3/5a

GOODMANS LOUDSPEAKERS LTD; SWISSTONE LTD (ROGERS); SPENDOR AUDIO SYSTEMS LTD.
ALL MANUFACTURING TO FIXED SPECIFICATIONS UNDER BBC LICENCE



Three manufacturers are currently licensed by the BBC to produce *LC3/5As* — all must stick to the Corporation's tight specifications. Designed as a miniature broadcast monitor for cramped spaces, it has stood up to much larger competition for more than 10 years now, by offering a fine sound quality in its own right. It suits mounting on high stands well clear of room walls at approximately ear level.

A sealed plywood box of 5½ litres volume, the *3/5A* is a two way system employing selected KEF drivers, which comprise a 110mm Bextrene cone bass/mid range and a 19mm plastic dome treble unit. An elaborate and costly crossover is employed to equalise the drivers to a strict specification.

SOUND QUALITY

The *LS3/5A* has consistently done well in previous live-versus-recorded sessions and fairly well on analogue programme sources. However, with digital material, problems which were only hinted at when using stereo analogue material were now clearly apparent, making the design sound more dated. Several areas attracted criticism — the bass lacked extension and sounded boomy in the upper bass register, while the mid had a noticeably hard, nasal quality and the treble seemed forward with a grainy, 'zitty' effect at the extreme top end. Some tubby, wooden and boxy colorations were also evident, while its only moderate rendition of stereo depth was apparent, as in the past, by comparison with certain less expensive designs.

It continued however to provide good voice detail and articulation, with a reasonably accurate tonal balance. Comparison between the Goodmans and Spendor versions showed great similarity while an original model from Audiomaster (no longer in production) used in previous tests sounded slightly dimmer by comparison, with less mid nasality. However the difference was small by speaker standards.

LAB REPORT

Sensitivity was low with this design, here measuring 81.5dB/W, necessitating a minimum of 30W per channel. A 50W maximum is suggested although with care 100W amps may be used. The bass rolloff −6dB point measured 57Hz, quite good for the size while pair matching was very good (all three current makes) and the impedance curve never dipped below 7.5ohms, qualifying it as an easy 10ohm load. Modest 96dBA maximum sound levels are possible.

Reference curves were taken for the Goodmans and Spendor samples and showed good agreement with the reference unit, though the 1.2kHz prominence seems to have become more pronounced over the years. This perhaps reflects a change in the B110, although it is still within specification. By modern standards the response looks a trifle lumpy, though in its time the system was regarded as a very smooth performer.

CONCLUSION

At risk of offending the BBC, we feel that the *3/5A* is due for a revision; as a working broadcast tool it no doubt does its job, but as a piece of value engineering it is beginning to fall behind. Other speakers have shown a progressive reduction in price as well as an improvement in sound quality, but the *LS3/5A* has steadily increased in price more or less in line with inflation. But on the most recent listening tests, inconsistently perhaps, the *LS3/5A*'s scores just regained it a recommendation!

TEST RESULTS

Size (height × width × depth)	30 × 18.5 × 16cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(30)–50W
Recommended placement	open stands
Frequency response, within ±3dB at 2 metres	see text
Low frequency rolloff (−6dB point) at 1 metre	57Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	81.5dB/W
Approximate max sound level (pair) at 2 metres	93dBA
Impedance characteristic (ease of drive)	excellent
Forward response uniformity	good
Typical price per pair, including VAT	£220

First reviewed: Rogers, 1978; Goodmans and Spendor, 1983 (retested 1984, reassessed 1985). Rating: Recommended.

CELESTION SL6S

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP. TEL: (0473) 73131

When Celestion first launched their high-quality compact speaker on to the market some five years ago, the concept was so successful that the phrase 'SL6 size' passed into the hi-fi language. Research using laser velocimetric measurement and computer animation had led Celestion to base the original *SL6* design around an advanced technology tweeter and a conventional mid/bass driver of refined construction. Celestion also developed a 'no-compromise' version, the *SL600*, and this continues while the *SL6* itself is replaced by the new *SL6S* reviewed here.

The *SL6* tweeter was built around a copper metal dome produced by electro deposition (for low mass and consistent thickness). This dome had a much higher-frequency first bending mode ('breakup') than any conventional cloth or plastics tweeter dome. But although this tweeter with its clean detailed sound made the *SL6* a highly successful product it was also one of the major limitations on the design — it was very insensitive.

The conventional chipboard cabinet in the *SL6* was a compromise that 'slowed' bass reproduction and generally muddled the sound in the lower registers. The *SL600* overcame this problem with a revolutionary cabinet fabricated from alumiumium honeycomb laminate.

In producing a replacement for the *SL6*, Celestion had to address a number of problems. The tweeter had to be more senstitive, this allowing the design to be engineered with a flatter overall response; the cabinet had to be more rigid to contribute less in the bottom octaves. The mechanical performance of the mid/bass unit needed improving to enable the two units to crossover more easily and to 'speed up' the bass response of the driver.

TECHNICAL FEATURES

The sealed cabinet (measuring 37×30×25.5cm) is now made in Medite with reduced panel thickness to reduce energy storage (and 'time smearing') while an internal figure of eight brace and inset back panel are used to improve cabinet rigidity. Foam damping is now used internally.

The 165mm Kobex-coned mid-bass is now built into a lugged die cast chassis which is bolted into and not clamped into the cabinet. The mid/bass unit incorporates what is effectively a mechanical crossover or filter in its complex surround. The PVC material used to terminate the *SL6* cone was good at reducing travelling waves in the cone but was stiff and robbed the bass of impact, leaving some listeners unsatisfied.

Laser analysis showed termination to be completed half-way through the roll surround and so the outer half has been replaced by soft rubber, allowing bass the articulation and 'speed' it previously lacked. The coil on this unit has been rewound to reduce its inductance which again gives the bass better attack.

The copper dome has been replaced by a lighter press-formed aluminium dome which has a higher first bending mode (allowing the controversial notch filter to be removed from the crossover). This unit is also more sensitive.

The crossover now allows for better integration of the two drivers while a change of slope on the high pass leg has changed the polar dispersion allowing greater freedom with positioning the speakers vertically. Screw terminals have given way to gold-plated binding posts. Twin-pillar 'L Series' speaker stands are recommended.

SOUND QUALITY

Auditioning *SL6S* and *SL6* speakers side by side showed up the latter's compression, slight veiling and cabinet 'honk', especially at high level replay. Stereo imagery from the *SL6* now seemed 'smaller' and less free.

The *SL6S* has a generous, open sound with excellent stereo depth and precision, but it is an altogether brighter sound than the *SL6*. This is immediately obvious in a comparison of the speaker frequency response curves, treble energy being up by nearly 2.5dB in places.

Fast, impactful bass and drum recordings demonstrate how much more capable the *SL6S* is at reproducing both the attack and power of the note without losing its tonal qualities — this especially noticeable in plucked acoustic bass.

Discs which produced cabinet resonance problems in the *SL6* indicate that the *SL6S* has none of the resonant 'clogging' coloration in the bass which marred the otherwise excellent sound from the *SL6* for certain listeners. Powerful electric bass and kick drum notes are reproduced now without hump or drumming resonance.

The *SL6S* comes much closer than the *SL6* to the exceptional stereo imagery available with the much more expensive *SL600*. The *SL6* can sound spacious but a little muddled beside the *'S*, which achieves an openness and depth of image with a true sense of the recorded acoustic. Extra treble energy makes the speaker just a little bright and shows up a trace of a squeaky or pinched coloratoin in high 'cello notes; the midband is still sweet and articulate.

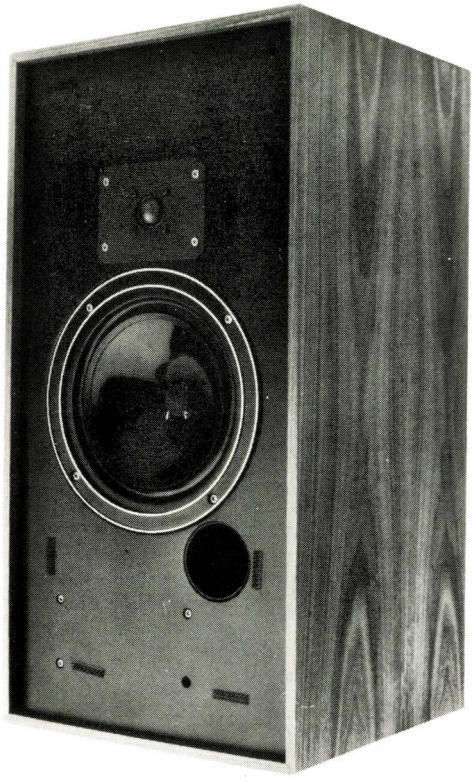
CONCLUSION

Retaining the great strengths of its predecessor, the *'S* loses nothing of the former design's sweetness and detail. Bass performance is improved in extension and attack while the speaker now has a flatter response with a more even output and better treble dispersion allowing greater freedom as regards room placement. Fine stereo imagery and a 'tactile' focus to the sound are the hallmarks of this excellent speaker, now audibly improved, more sensitive yet easier to drive.

David Prakel

HARBETH HL1 IV

HARBETH ACOUSTICS, 1a BIRCHANGER ROAD, SOUTH NORWOOD, LONDON SE25 5BA. TEL: 01-654 9549



Since its introduction the *HL1* has been subject to small detailed improvements culminating in the latest Mk IV version reviewed here. A 50 litre enclosure, reflex tuned by a large 62mm diameter tunnel port, the cabinet is of thin wall high quality veneered plywood, with bituminous panel damping and extensive seam battening. Front and back panels are well screwed down and a sculptured foam grille improves the cabinet diffraction. An exclusive polypropylene 200mm covers the bass/midrange, and a 25mm Audax soft dome tweeter the high frequencies, with a good quality crossover dividing the input at approximately 2kHz. Provision has been made for sensible matching of mid and high frequencies using an auto transformer to aid consistent frequency balance.

SOUND QUALITY

The original *HL1* proved to be of monitor quality, and survived comparison with live sounds very well. On complex recorded programme in stereo it was a little weaker with some sibilant and chesty effects on vocal.

Fully reauditioned in Mk IV form (this arrived too late for new measurements except a room curve), the *HL1* bettered its earlier result by offering a clearer, more dynamic sound. Improvements in mid clarity were heard leading to still greater transparency as well as more precise transient definition. Our samples were slightly bright (Harbeth knew this, and stated that the treble level would be reset in production). Overall the balance remained very good while the bass was somewhat underdamped in the reflexed area, more suited to classical than rock programme in this respect.

LAB REPORT

A useful above average sensitivity of 87.5dB was recorded, which is on target and not compromised by the impedance; this was judged to be a good amplifier load, typically of the order of 8ohms with a 6.6ohm minimum. While some high phase angles were apparent (for example, 70° at 2kHz) the impedance was substantial enough at these points to avoid censure. The −6dB rolloff point was noted at 46Hz, and with a 100W per channel amplifier limit, a good maximum sound level of 102dBA should be possible in a typical room.

The axial response at 1m was fairly uniform and ignoring a 5kHz notch, met ±3dB limits, 55Hz-18kHz. Third harmonic distortion levels were also very well controlled at 96dB, typically measuring 0.5% or better above 150Hz. The less annoying second harmonic content peaked at 8% around 100Hz, and this might be audible on sustained bass notes. The system fared less well on a diet of 100W pulses despite the low 2Hz repetition rate. Although perfect a 500Hz, a +0.3dB expansion occurred at 5kHz generating 5% of second and 1.8% of third harmonic distortion. Crossover saturation is the probable cause at this equivalent 100W programme level.

CONCLUSION

Reassessed, the *HL1 IV* was technically very similar to the *III*, except for the revised bass mid unit, this custom built by Audax on a cast frame, using the advanced TPX cone polymer. With notably improved midrange the design will continue to stand the test of time, and carries a strong *HFC* recommendation.

TEST RESULTS

Size (height × width × depth)	63.5 × 32.5 × 30.5cm
Recommended amplifier power per channel (for 96dBA per pair at 2 metres minimum)	15-100W
Recommended placement	on stands away from walls
Frequency response, within ±3dB at 2 metres	63Hz to 18kHz
Low frequency rolloff (−6dB point) at 1 metre	46Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	87dB/W
Approximate max sound level (pair) at 2 metres	102dBA
Third harmonic distortion (96dB at 1 metre)	v. good 65Hz-2%. 100Hz-1%. 200Hz-0.2% 500Hz-0.35%, typically 0.3%
Impedance characteristic (ease of drive)	good
Forward response uniformity	v. good
Typical price per pair, including VAT	£343

(Note: Measurements taken on Mk III)

First reviewed: 1985 (HL, 1978; HLII, 1979; HLIII, 1981).
Rating: Recommended.

INFINITY REFERENCE STANDARD IIB

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

The US company, Infinity, have established an audio legend with their amazing *Reference Standard* loudspeaker system, now in *Series III*form; an idea of its size may be gained from its 1,500lb shipping weight, with the stereo pair employing a total of 12 300mm servo controlled bass units, 24 planar mid drivers and 72 tweeters. These systems are custom installed in a purchaser's home, and perhaps represent about the most serious investment in listening that anyone could make!

In addition to the *IRS III,* there are two other models in the Infinity Reference series, the *IB* which was demonstrated at last year's Heathrow Penta show, and the *IIB* which is the subject of this review. As I write, I am sitting in front of these systems, with a large area of natural mid-tone oak veneer, rising some 1.6 metres from the floor. The breadth of each is 57cm, this enhanced both acoustically and visually by a convex curvature to the front panel. Including plugs and grille, the system is however quite slim measuring some 30cm deep. The systems come right and left handed, with the distinguishing feature of the range being the use of Infinity's own drivers, specifically the planar foil EMIM mid units and the EMIT high frequency drivers. Infinity also build their own polypropylene-coned woofers.

In the *IIB,* the three mid units are mounted in a vertical line, and come into operation above 150Hz, this a favourably low crossover point. As a group the mid array continues to 800Hz, while above this point the central module continues above to 4kHz in order to maintain good directivity. The upper section of the baffle is open and the mid drivers are bi-directional, open-backed units, thereby assuring freedom from box coloration. The treble units are closed-back, and to maintain the balance of sound between front and rear, a second tweeter is fitted facing rearwards. Representing a vertical slot each tweeter radiating aperture is 50×15mm, and a second tweeter with a reduced radiating area of 15×22mm is employed to maintain good directivity above 8kHz. The tweeters are mounted laterally with respect to the mid drivers, but potential polar problems are minimised by the essentially linear phase, time-aligned nature of the planar drives.

The lower five-eighths of each baffle is backed by a rigid sealed-box enclosure driven by a pair of high power 250mm bass drivers. Employing BBC-style flared poly-propylene diaphragms, these well-damped units would normally present a relatively limited bass extension; however, in the *IIB* they are designed to work with a matching low frequency equaliser, which suppresses the natural system resonance and results in a range claimed to extend to 29Hz, ±2dB; without such a design, a 60Hz rolloff point could be expected.

In the US, floor mounting is anticipated, but our experiments have shown that a rigid low stand of 75-100mm height can improve the sound, adding speed and power to the bass. Such a stand requires point contact at both floor/stand and stand/speaker interfaces, with adjustable spikes for the floor and 'Tip Toes' or similar for the speakers.

If the speaker is elevated it is important to adjust the vertical angle or tilt so that the optimum mid-treble axis is directed at the listener, as this ensures optimum clarity and focus from the system.

BI-AMPLIFICATION

This is certainly a complicated speaker to set up, and while it can be used with a single stereo amplifier, it really comes into its own when bi-amped. In this mode, only the low pass arm of the crossover frequency is electronic and the rest is passive. Nevertheless, this allows optimal choice of bass and mid/treble amplifiers to be made according to quality, availability and finance.

The basic price is £3,500 and the importers, Automation Sciences, are offering a package complete with a custom solid-state bass amplifier and a Conrad Johnson *MV50* valve mid/treble amplifier for a total of £5,000. This provides an attractive start, but the real dynamic quality of the *RSIIB* can only be realised using larger amplifiers with substantial 4ohm power ratings. To maximise its performance on test, we used an ARC *D115 II* for the bass and a C-J *Premier Four* for the mid-treble, making around 4×120W programme available into this load. Infinity discuss amplifers in the 75-300W range and this topic deserves serious consideration by the dealer and customer; given the amplifier requirements the end price may vary over quite a wide range.

SOUND QUALITY

Once set up and properly in phase, the system as a whole provided five pre-set level controls affecting the frequency response and covering 8kHz to 20kHz, 4kHz to 8kHz and 1kHz to 4kHz, with a general control below 1kHz and finally one for the bass below 100Hz. Practice and skill was required to 'voice' the system; but conversely, the response flexibility allowed precise adjustment to be made, largely compensating for the overall characteristics of the hi-fi system on site. Thus the speaker can be fine-tuned to optimise its relationship with both the system and the room. In our tests, bass and contour settings were left close to the recommended levels, while the 1-4kHz level was kept at the specified 12 o'clock level. The upper units were preferred when set between 10 and 11 o'clock.

First impressions were of an open, unboxy sound of large scale and with impressive soundstage height and width. Initially it sounded 'different' to other systems, with some recognisable idiosyncracies, but it proved so easy to live with sonically (if not visually for me!) that one became adjusted to it very quickly. Set for the optimum mid tonal balance, the bass in my view was excessive for small rooms, but was nonetheless very highly rated for speed, depth, tonality, resolution and ultimate power. Full orchestra was handled very well, including the amazing Telarcs, as was the *HFN* 'garage door' track. Essential at this price level, the *IIB* possessed regions of uncompromised transparency, particularly above 500Hz where space, air and subtle detail were reproduced with ease. In my room the stereo focus was good rather than excellent but I am assured that in bigger rooms allowing a greater subject spacing, the focus continues to improve, as it does for example

with the Magneplanars. Below 500Hz it seemed somewhat recessive by comparison with our references, while cello and piano left hand seemed a touch lightweight and could have done with more power and projection. Coloration was generally low, though the planar drives did have their own distinctive quality.

While the sound could be adjusted to give good tonal balance and a smooth overall result, this quite free from hardness or compressive effects, at times there was a feeling of separate units, as if they were just a little removed from perfect blending.

Lab Report

The system type precluded full anechoic testing, but representative axial measurements were carried out, plus the revealing computer-generated response in-room.

Given the complications of bi-amplification, the basic sensitivity was estimated at around 90dB, which is high, making the most of smaller amplifiers and providing high sound levels with large ones, for example up to 110dBA in-room for a stereo pair. This is a genuinely large-scale system, with low distortion and a wide dynamic range. Checks on impedance showed 3.6ohms at 100Hz and 3.5ohms at 1kHz, so a 4ohm rating should be assumed and the matching amplifiers chosen and used accordingly.

Using near field measurement, the bass was well extended to 30Hz, −3dB, and was only 6dB down at 25Hz. Notwithstanding the measurement difficulties, it was nonetheless felt that the overall axial responses were somewhat uneven. We had expected a smoother, and better integrated output given the kind of ⅓ octave averaging employed. The curves varied quite a lot with small changes in mic position, indicating broad driver overlaps. It was also noticeably directional in the vertical axis, this also noted during the setting-up procedure.

In-room, on the optimum setting, and with computer averaging, the output settled down noticeably. The range 60Hz to 15kHz was almost within ±2.5dB, a respectable achievement. Output appeared uniform and well integrated, except in the low bass where some 5dB lift was present at 50Hz reaching 10dB at 30Hz and 25Hz, this not as subjectively damaging as one might have expected. In larger spaces, this performance will probably be close to correct.

Conclusion

This impressive large-scale speaker may be used in a number of ways, in packages including power amplifiers that cost from £5000 to around the £7000 level. Its many controls complicate the issue, but ultimately allow great versatility with respect to system matching and optimum room interfacing. A little uneven in performance, it had areas of truly great performance including such aces as low coloration, transparency and sweetness; furthermore it can play loud and has near effortless extended dynamic low distortion bass. As such, it demands to be taken seriously.

Test Results

Size (height × width × depth) ____ 160 × 57 × 30cm
Recommended amplifier power per channel (for 96dBA per pair at 2 metres minimum) ____ 100 to 250W
Recommended placement ____ on low stand, free space
Frequency response, within ±3dB at 2 metres 50Hz to 17kHz
Low frequency rolloff (−6dB point) at 1 metre ____ 25Hz
Voltage sensitivity
(ref. 2.83V or 1 watt into 8ohms at 1 metre) approx 90dBW
Approximate max sound level (pair) at 2 metres ____ 110BA
Impedance characteristic (ease of drive) ____ average 4ohms
Forward response uniformity ____ good
Typical price per pair, including VAT £3450 (inc LF equaliser)

JBL 250 Ti

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

Flagship model of the JBL Ti series, the 250 is a large and imposing speaker of unusual design. The key feature of the Ti range is the development (at last!) of a new dome tweeter that offers a performance and consistency commensurate with JBL's high standards.

Made from a thin foil of titanium (chemical symbol Ti), the dome's design is such that no significant resonances or break-ups occur within the working audio range. As such its performance closely approaches that of the fabled acoustic piston with a perfectly defined behaviour.

The *250 Ti* is a large floor standing enclosure, superbly finished in natural oil veneer, with its rounded front edges and tweeter mount executed in solid hardwood. Built as mirror image pairs, these substantial monoliths include two 'tapers' in their structural form — a prominent inwards taper from the base to the top, slightly tilting the line drawn between the drive units, with the second taper reducing the depth of the enclosure towards the top. Height is an imposing 1.32m (52in) and the speaker sits very stably on its massive base section, 0.57m wide by 0.36 deep (22.5 × 14in). Weight is also sizeable at 68kg (150lbs) and two people are required to lift each enclosure.

Grilles are dimensioned to cover the lower three drivers, leaving the striking tweeters and mounting exposed, leading at least one visitor to remark upon the 250's 'Cyclopean' appearance. The 16mm thick grille frame is unrebated; internal rebating can help reduce acoustic reflections at the grille, but JBL have avoided the worst effects by spacing the grille away from the front panel on 15mm spacers.

In this generous four-way design, the bass is handled by a 360mm diameter doped pulp-cone driver, powered by a massive 100mm motor unit with an edge-wound copper voice coil. A rigid cap seals the diaphragm centre while the edge is suspended on a quite narrow polyurethane foam surround. Energised by a massive magnet of the SFG type (symmetrical field pole structure) which offers low distortion from ceramic magnets, the unit is built on a rigid cast alloy frame and operates up to 400Hz.

Frequencies between 400Hz and 1.4kHz are allocated to a 200mm midrange unit, a traditional design with a ribbed pump cone but an oversize 50mm motor-coil. This unit is self terminating via its integral doped surround.

Classed as a midrange but in fact operating in the low treble from 1.4kHz to 5.2kHz, the third driver has a 100mm polypropylene cone, terminated in a high-loss synthetic roll surround. The cone material is loaded to increase its stiffness, and extend its operating range. JBL's curves suggest a response good to 6kHz, and like the other cone drivers, this one has a rigid cast frame.

Finally, the tweeter is a 25mm dome made as one piece from 25 micron titanium foil, this including the surround. The latter uses JBL's proprietory Diamond Pleat pattern to provide the necessary compliance to allow dome motion. A side effect of this form of construction is the higher than usual fundamental resonance coupled with a high mechanical Q factor. As part of the design strategy JBL have used a compensator network to flatten the input impedance of the tweeter and in addition they have chosen a higher crossover frequency than usual — 5.2kHz instead of the usual 2.5 to 3.5kHz.

An electrical compensation technique is also applied to the bass driver circuit to flatten its characteristic and smooth the crossover response. Built to a high standard, the crossover capacitors include bypass components to improve the transient response of the electrolytic types.

Electrical connection is via 4mm socket/binding posts, and this region of the back panel also carries an array of screw down connector bars which may be rearranged as desired, to provide tonal balance control via attenuation of the upper three drivers. The tweeter runs at 0, −1, −2.5 and −4.5dB, the lower treble 0, −0.1, −2.5 and the mid, 0, −1.5, and −3dB.

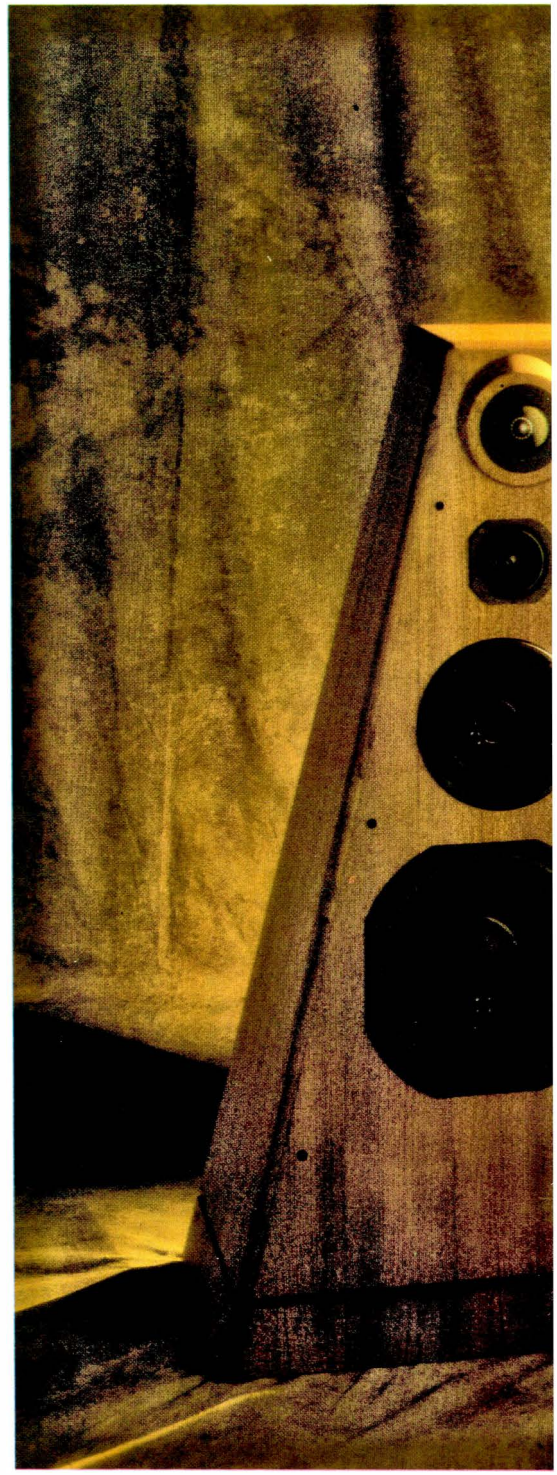
We carried out listening tests early on and defined the most accurate sound in the test system and room to be with the mid at 0, and the two upper units both wired for −1dB. The measurements and final auditioning relate to these conditions.

The low frequency enclosure is reflex tuned by a large, 105mm diameter tunnel port, 130mm deep and with a 30Hz bass resonance. On test the low bass was sometimes felt to be excessive and for experiment, a light plug of polyester wadding was placed in the ducts, a push fit to prevent it moving. In general this was preferred and room responses taken for both conditionsl seemed to back this opinion.

SOUND QUALITY

First impressions of the *250* were encouraging. Big in image scale, with an effortless feeling of power in reserve, the speakers' physical height lent a related feeling of height and 'dimension' to the sound. It could be driven hard with up to 350W peak programme per channel without any signs of distress or limiting. It could also handle big inputs in the bass, delivering a massive floor-shaking 'slam', rather excessive with the reflex ports undamped. Using the plugs the bass was subjectively considered to be well extended but lost its leaden quality, the sound gaining in articulation and percussive impact.

Taken overall, the speaker seemed relatively clean and surprisingly sweet. The historic JBL 'nasality' and 'bite' were absent, and it could handle a difficult chorus of treble voices without subjective



PHOTOGRAPH: DAVID CHAMBERS

hardness or aggression. Such a performance would produce a sympathetic reaction with many listeners!

Proceeding further, the subjective analysis was extended to the stereo properties, which we found rather disappointing. Stereo depth was surprisingly weak, the sound transparent in places but in general rather shallow in dimensional terms. Recorded ambience and hall acoustics did not develop properly — stereo focus was good, but not outstanding, for example, not in the same class as the *SL600* or the KEF *104 II*.

Tonally 'even' with the optimised attenuator settings, the voice range was a rouch 'grating' and thinned while the treble, although specifically of excellent quality, did not blend perfectly, showing mild excess sibilance.

With broad orchestral music, a mild cluttering of frequency bands was felt to be associated with individual drive units, though this was much less obvious on popular programme material.

On piano it was unimpressive, the right hand range was sometimes near-xylophonic, while the left hand was occasionally nasal. Essentially distortion free, the speakers seemed to sound slow and undynamic, and were felt to be less involving than we had anticipated.

Lab Report

The impedance characteristic showed a fine 8ohm result, making this an easy-to-drive design. The sensitivity was on target at a high 89dB/W, providing high sound levels of up to 109dBA in-room. Amplifiers from 50W to 300W per channel would be sensible, chosen according to room size, sound level required and quality.

A fair representation of the anechoic response in third octaves was achieved. The preferred mild depression in the treble was seen, but otherwise the speaker met tight ±2.5dB limits from a low 30Hz to 20kHz. The −6dB point was below 25Hz! Looking at the forward responses, the 30° and 45° off-lateral outputs were good, aligning well with the major axial response above. A deeper loss occurred in the 15° output taken above axis (unlikely in practice in view of this speaker's reach above a seated listener) and was centred in the upper crossover region.

Turning to the computer averaged room response, the bass of the standard product was clearly excessive, rising 10dB above the otherwise well defined main response. Only very large spaces could accommodate this characteristic, one which I have noted with other very large US systems. With the ports damped, a much better low frequency balance was achieved and here it was plain that ample bass output remained, at least to 25Hz.

Conclusion

As factory referenced, these speakers showed a significant excess in the bass and treble. Having carried out the adjustments described above, an accurate in-room response was achieved, both measured and subjectively assessed. The design is also superbly built and finished, has a high power handling and volume capability, low distortion and an extended smooth response.

However, in general this speaker did not show the required level of dynamic presentation, transparency and stereo depth expected from a flagship model at this price level, and I would therefore advise a serious audition prior to purchase.

Test Results

Size (height × width × depth)	132 × 57 × 36cm
Recommended amplifier power per channel (see text)	25 to 250W
Recommended placement	free space on floor
Frequency response, within ±3dB at 2 metres	30Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	25Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	89dB/W
Approximate max sound level (pair) at 2 metres	109dBA
Impedance characteristic (ease of drive)	straightforward
Forward response uniformity	good+
Typical price per pair, including VAT	£3299

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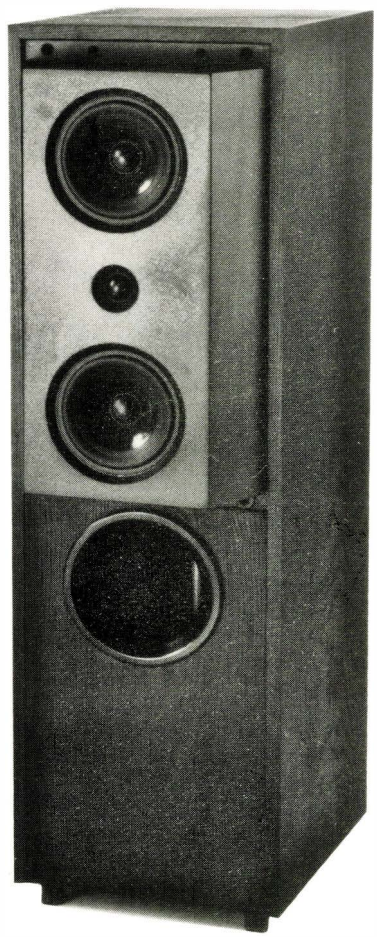


A complex speaker of very advanced design, the *104.2* uses a total of five drivers. Inside the enclosure are two 200mm pulp cone bass units, these mounted facing each other vertically and back loaded by sealed chambers above and below. Their frontal output feeds a damped central chamber, which is fitted with a large diameter, high velocity port, the effect being that of a second-order resonant circuit with a 12dB/octave rolloff below bass resonance. The port continues to transmit output above resonance, right up to the lower crossover frequency of 150Hz. From 150Hz to 3kHz or so, two 110mm Bextrene cone midrange units operate in parallel, these mounted above and below the 25mm soft dome treble unit, which is ferro-fluid damped.

The enclosure is extremely rigid and well damped, with a low acoustic output and the system employs a very complex crossover with full compensation for input impedance. The assembly reflects a 4ohm resistive load, optimally matched to modern amplifiers.

SOUND QUALITY

When first auditioned in 1984, our early pair of *104.2*s immediately showed many good qualities, among them dry quick transients, very good stereo focus with fairly good depth, much fine instrumental detail and considerable clarity in the midrange. Conversely, these samples had a slightly odd bass quality which reduced its ability to differentiate between bass sounds, nor was the bass subjectively well extended. The treble was of generally good quality but the mid showed a significant forwardness, which compressed depth and gave a hardened, thinned quality to the tonal balance. However, production models have overcome most of the points of earlier criticism.

LAB REPORT

Pair matching was very good at better than ±0.75dB while the reference mid band sensitivity met the high specification at 92dB/W, albeit for a 4ohm system on an 8ohm 'watt'. The grille is best left on and is properly integrated acoustically. The main mid octave showed a 2dB lift after the lower frequency range while the −6dB point registered a modest 50Hz. Out at 2 metres the forward response family looked very tidy, while the '15° above' response indicated the cabinet axis should be directed at the listener. Tight ±2dB limits sufficed for a 65Hz to 20kHz axial response, though some band to band imbalances were suggested. KEF's distortion specification was a touch optimistic in extending to 20Hz, but actually the *104* did offer low levels of distortion over the entire range. On compression, we noted an excellent 0.11dB while the intermodulation product was negligible, since the 400Hz signature tone appeared above the crossover point.

As claimed, the impedance was almost perfectly flat reflecting a uniform 4ohm resistance, and uncritical of most amplifiers or cable type. For extended high power drive, 4ohm rated amplifiers are a sensible choice.

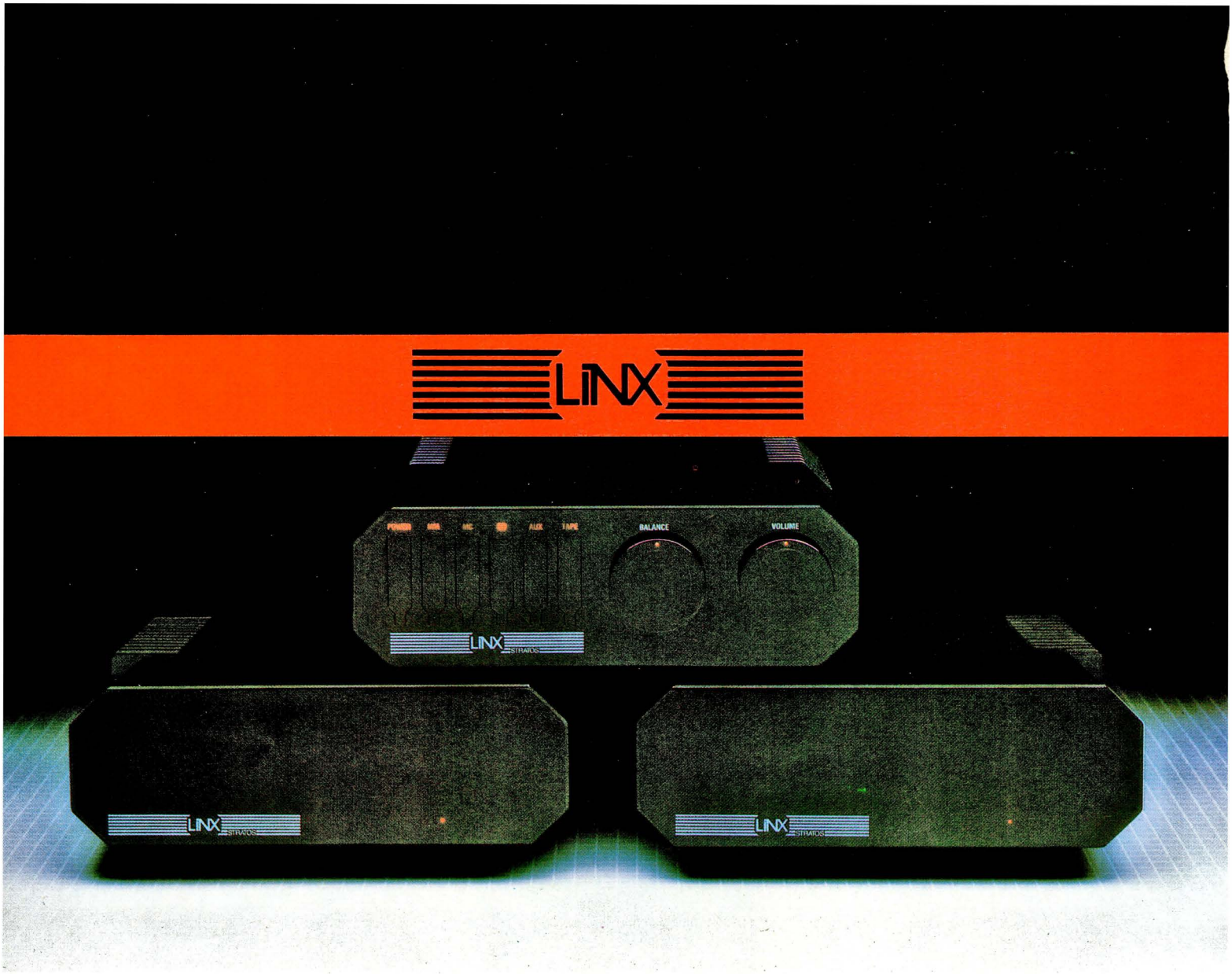
CONCLUSION

Our original samples were premature, and revisions made to subsequent UK production have resulted in significant improvements. The bass now sounds more open and better integrated with the midrange, while the latter also has more body. In addition the upper-mid hardness has been ameliorated, all this with barely a noticeable shift in the original response curve. It remains a touch lively and 'up front' with some treble grain, but its merits can now assert themselves, and in its current production form, the speaker qualifies for recommended status.

TEST RESULTS

Size (height × width × depth)	90 × 28 × 41.5cm
Recommended amplifier power per channel (for 96dBA per pair at 2 metres minimum)	(10)—200W
Recommended placement	floor, away from side walls
Frequency response, within ±3dB at 2 metres	60Hz-20kHz
Low frequency rolloff (−6dB point) at 1 metre	50Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	92dB/W
Approximate max sound level (pair) at 2 metres	110dBA
Impedance characteristic (ease of drive)	an easy 4ohm load
Forward response uniformity	very good
Typical price per pair, including VAT	£769

First reviewed: 1984; retested 1985. Rating : Recommended.



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MAGNEPLANAR MGIIIa

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Still one of the largest and most expensive models in this survey, the *MGIIIa* is a recent, high level introduction to the US-made Magneplanar range of open-back planar speakers. Its recent claim to distinction is the incorporation of a tweeter forming a line source almost the full height of the speaker, nearly two metres. The tweeter and the other panel elements are 1.5 metres high.

As the name 'Magneplanar' implies, the speakers are magnetically driven (not electrostatic) and have voice coil windings laid out over the entire surface area of the thin plastic film driver diaphragms.

In this three-way model, the mid is handled by a high definition film element covering approximately 30Hz to 6kHz. Below 300Hz, the bass radiator takes over, this more robust film element occupying more than 50% of the considerable radiating area. Being bi-directional, like the panel electrostatics, it is also very sensitive and will benefit from a large room, standing well clear of the rear wall — 1.5 to 2.0 metres is a starting point.

The mid and treble units are fused separately while the crossover used very high quality components. During test I found the system a little bright and replaced the treble fuse with a 1.8ohm 10 watt resistor, an alternative now approved by the manufacturers.

SOUND QUALITY

Auditioned (using the 1.8ohm resistors) the *MGIIIa* excelled on our tests. With a fine sense of scale and perspective, it also handled dynamic contrasts well, and was liked on both simple and complex material. Detail was extremely good, the treble clear and open, the mid sweet and natural, while the bass was articulate, informative and almost tactile on percussion. Low bass was pretty good if not really outstanding. Stereo focus was surprisingly good for a large panel and it seemed uncritical of either listening position or vertical axis. It gave a spacious, relaxed impression, free from the usual wooden, horny or other speaker colorations. Tonally it was considered a touch heavy in the upper bass, but remained very tuneful even here. It was consistently faithful to a wide variety of source and made even budget amplifiers sound good!

LAB REPORT

The *MGIIIa*, like other large panel speakers, does not obey the inverse square law and hence the 1 metre sensitivity was not too helpful, here averaging around 85dB. At a 3 metre position it sounds more like 86dB/W, an average sensitivity. Power handling was up to 300W programme allowing levels for a stereo pair of up to 105dB, a substantial if not deafening level. Pair matching was very good, with the −6dB point estimated at 35Hz.

The axial frequency response suggested a gently falling output with rising frequency, though this did not fairly represent the perceived output at the listening distance. ±2.5dB sufficed for 80Hz to 18kHz, a pretty smooth result. Out at 2 metres the family of off-axis responses were surprisingly good, and while some variation appeared at each axis, a fair representation of the speaker's overall output was still apparent. The treble dispersion was particularly good from the narrow ribbon tweeter.

Moderate distortion was evident at low frequencies, but above 150Hz distortion was particularly good, especially third harmonic, and it was quite exceptional at 86dB. Compression measured a very low 0.03dB, with negligible intermodulation, while the impedance was uniformly low. With 1.8ohms added in place of the treble fuses, it did not fall below 4ohms, and averaged a 5ohm load, mainly of a resistive nature.

Room averaged, the *MGIIIa* demonstrated a fine overall balance though the bass was not as uniform as some box systems, partly due to room reflection. The treble rolloff was smooth and gradual, as it should be.

MAGNEPLANAR SMGa

This model, the 'small' Magneplanar, sells for £697 in the UK and as such, finds itself in company with models such as the Celestion *SL600* and the Spendor *SP1*. An open panel design, using stretched thin diaphragms, it loosely fits the market position of the old Quad electrostatic; but as with other Magneplanar models, the working principle is magnetic, not electrostatic, and thus no power supplies or matching transformers are required. The motor coil is dispersed over the surface of the diaphragm, energised on one side by an open array of bar magnets — this is a single-sided

MAGNEPLANAR MGIIIA

rather than push-pull design.

Rated at an almost uniform 4ohms impedance, this speaker uses two radiator elements arranged as vertical strips, with the 200mm wide bass section operating to 550Hz, while the 20mm wide mid/treble unit takes the upper range. Element height is 1 metre, so there is still a substantial radiating area. Designed for floor standing, with rear supports which are adjustable for listening angle, this is a speaker which needs to be very carefully sited to get the best results. Almost by definition the results of the blind listening test will be compromised by the difficulty of arranging the optimum position for all panellists.

Despite the above reservations the *SMGa* performed pretty well on blind auditioning, though the results did vary according to the panellist and his position. The panel commented that the speaker sounded 'big' and effortless and handled power well; low bass was deficient while the upper bass was rather bloated. Tonally, the midrange was rather dim and with a downtilted character with increasing frequency. The presence range was muted while the treble was uneven in places, almost to the point of 'phasiness'. Coloration in the box or cone sense was delightfully absent and in this area it sounded very natural. It played tunes well in the bass despite its uneven character, and the impression was of an easy forgiving nature, not really to be regarded as accurate, but nice to live with.

With a solo listener, and the speakers optimally positioned, good but not outstanding levels of stereo focus could be obtained.

CONCLUSION

While not accurate in the monitoring sense, the *SMGa* offered high power handling, a true open-backed non-boxy sound, plus low distortion. Tonally rich, in the right room, it provided a satisfactory musical experience, with more than a hint of the *MGIIIa*. Purely on test result, this speaker merits a 'worth considering' — though some would give a recommendation on its other merits. A well set-up home trial is suggested prior to purchase.

The *MGIIIa* is a true audiophile loudspeaker, of excellent sound quality. It has set new standards for stereo performance, clarity and depth for the price, while its generous acoustic scale and dynamic range helps to convey much of the original character of the recorded performances it reproduces. A purchaser in this elevated price range should seriously investigate the *MGIIIa*, and it must be recommended.

TEST RESULTS

MAGNEPLANAR MGIIIa

Size (height × width × depth)	180 × 62 × 38cm
Recommended amplifier power per channel (for 96dBA per pair at 2 metres minimum)	(25)–300W
Recommended placement	well clear of walls
Frequency response, within ±3dB at 2 metres	70Hz-19kHz
Low frequency rolloff (−6dB point) at 1 metre	35Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	84-86dB/W
Approximate max sound level (pair) at 2 metres	106dBA
Impedance characteristic (ease of drive)	an easy 4ohm load
Forward response uniformity	very good
Typical price per pair, including VAT	£2882

First reviewed: MGIII, 1984; SMGa, 1985. Rating: MGIIIa, Recommended; SMGa: Worth Considering

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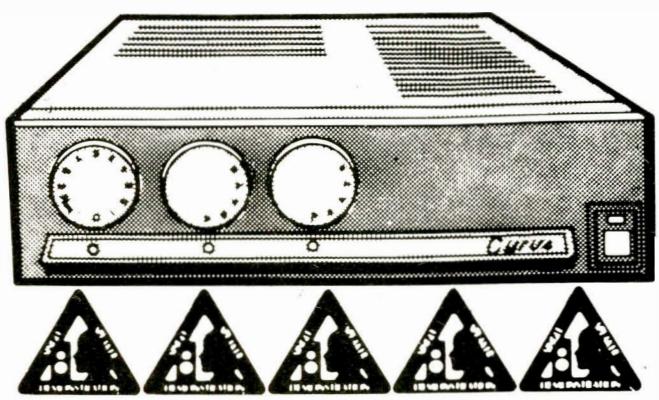

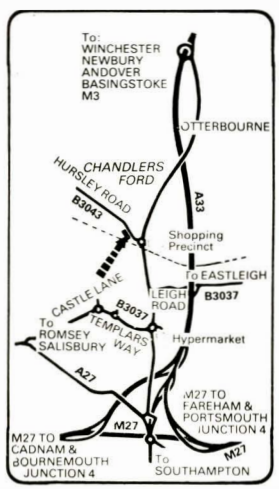

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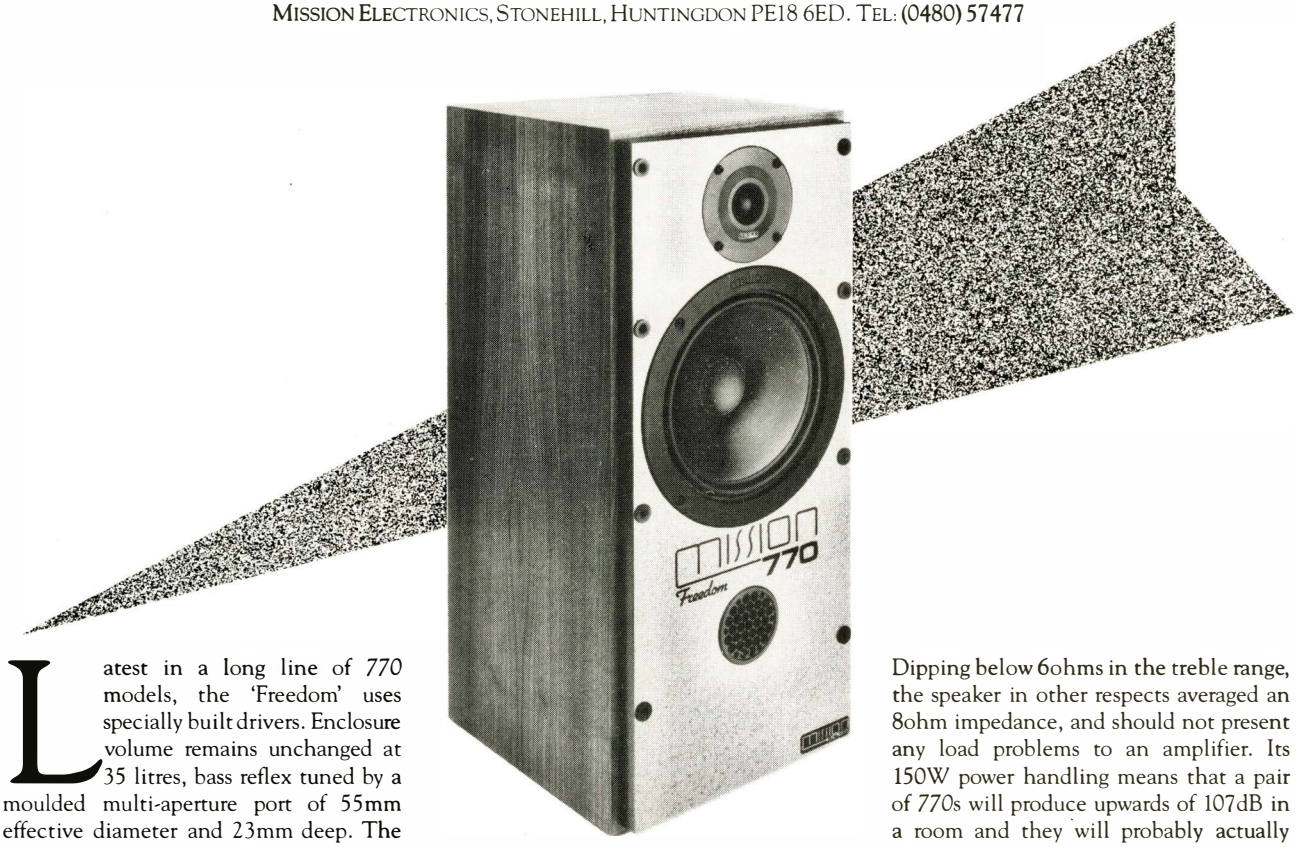

Latest in a long line of *770* models, the 'Freedom' uses specially built drivers. Enclosure volume remains unchanged at 35 litres, bass reflex tuned by a moulded multi-aperture port of 55mm effective diameter and 23mm deep. The custom-built polypropylene bass driver is 210mm in diameter and has a hard centre cap, with a cone flare changing to straight-sided as the perimeter is approached. A die cast frame and generous magnet are used. The treble range is covered by a version of the SEAS 25mm polyamide soft dome which is ferro-fluid damped, and the cross-over is a 12dB/octave design, with four good quality elements plus one resistor. The system is hard-wired with good quality cable, and 4mm socket binding posts are fitted for rear connection.

Excellently finished in walnut veneer, the enclosure is well built, and fitted with a single large foam block for absorption, with bitumen pads applied to control the panel resonances. 20mm thick medite is used for the front panel, and the grille has a low acoustic profile. The system is designed for use on matching low stands.

SOUND QUALITY

We tried the low stands with the speaker backed to the wall but felt the coloration was more severe in the lower midband. Good results were however obtained using our 42cm high stands when the *770* scored average in the auditioning. Mixed reactions were obtained; this speaker appears to have a distinctive character which can appeal. It sounds highly transparent, crisp and clear, revealing much detail and the natural acoustic of recordings, and brings the performers closer to the listeners.

Bass was dry, with the midrange somewhat forward, which produced for example, a 'clangy' piano sound. Treble was just average. Tonally, it was a bit small and 'thin' sounding and when driven really hard above 200W, the sound was 'abrasive' suggestive of crossover saturation. However, at decent levels it suited rock programmes very well, with a punchy beat and as one panellist put it, 'plenty of go'.

LAB REPORT

The axial reference response showed a high 91dB/W sensitivity with a slightly restricted bass, reading −6dB at 55Hz. The grille has little effect, which was good, while the pair matching was also good, at within ±0.75dB. Out at 2 metres, ±2dB limits sufficed for a 70Hz to 20kHz frequency range, while the drivers seemed well integrated, with consistent off-axis responses. Both axial traces did indicate an upper mid plateau, 600Hz to 1.6kHz, and the overall balance was a touch 'forward'. Dipping below 6ohms in the treble range, the speaker in other respects averaged an 8ohm impedance, and should not present any load problems to an amplifier. Its 150W power handling means that a pair of *770*s will produce upwards of 107dB in a room and they will probably actually sound louder than that!

CONCLUSION

The *770* has its own virtues — dynamic impact, an up-front clarity, and an ability to be used close to the wall. Good engineering plus a farly good panel rating also apply here. It just retains a recommendation with the qualification that it should be carefully auditioned to ensure that it is the 'right one' for you and your system; classical music enthusiasts are likely to favour the *770* less than rock specialists.

TEST RESULTS

Size (height × width × depth)	61 × 27 × 30cm
Recommended amplifier power per channel (for 96dBA per pair at 2 metres minimum)	10–150W
Recommended placement	on high stands
Frequency response, within ±3dB at 2 metres	60Hz–20kHz
Low frequency rolloff (−6dB point) at 1 metre	55Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	91dB/W
Approximate max sound level (pair) at 2 metres	107dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	very good
Typical price per pair, including VAT	£380

First reviewed: 1984. subsequently retested. Earlier 770, first reviewed 1979; 770S, 1983. Rating: Recommended (non-rock use, Worth Considering).

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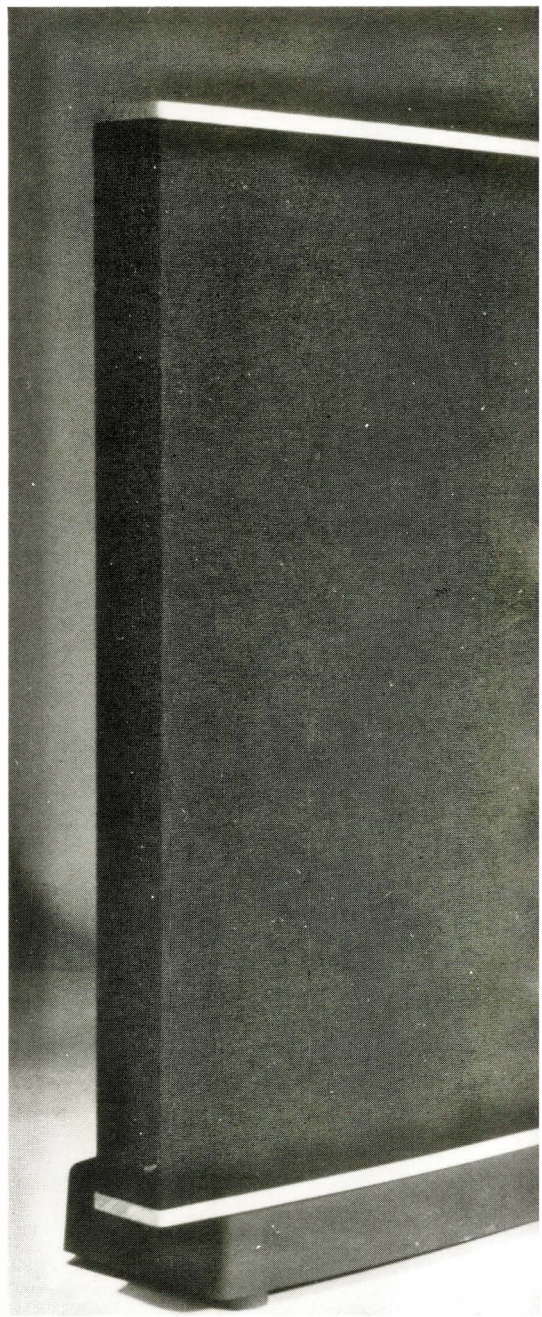


Respectable scores were nevertheless achieved throughout the sessions.

Development work on this design started, as the model number suggests, as long ago as 1963, though it did not go into production until 1981. In the '63, the old *Electrostatic*'s problem areas, namely directivity, bandwidth sensitivity, power handling and amplifier loading, have all found at least partial solutions, albeit at a high price.

A single large-area damped plastic film diaphragm has been electrostatically energised to operate as a phased array of eight concentric elements, and the emerging wavefront is an approximate simulation of the radiation from a theoretical point source 30cm behind the centre of the panel. A high voltage delay line feeding the multiple elements incorporates compensation for the clamped boundary of the diaphragm, and also equalisation for the axial frequency response. The size and apportionment of frequency range and delay to the elements allows control of directivity, which is adjusted to give a smooth and uniform decay at increasing off-axis angles. But it should still be borne in mind that the directivity of the '63 is poor by comparison with the best moving-coil designs, and that the speaker remains rather critical of listening angle.

The latter characteristic presented a problem on tests, since in the modest confines of my listening room only two of the six Quad panellists could be in the optimum zone, and when used as suggested on the floor at our typical 3-3.5m listening distance, the main axial treble response was directed nearer to their chests than their ears. Accordingly, the speakers were elevated by about 20cm on open stands and marginally tilted backwards. Further auditioning was also conducted with solo listeners to augment the panel's subjective data.

The Quad 63 is a bipolar design which generates regions of acoustic power fore and aft, but is suppressed in the sideways directions. In consequence a rather different drive of room reverberation results compared with small box speakers which are considerably more omni-directional. Thus even if the Quad did provide an identical axial frequency response to a low coloration moving-coil model, it would not sound the same due to the significantly different room reverberation tonal balance.

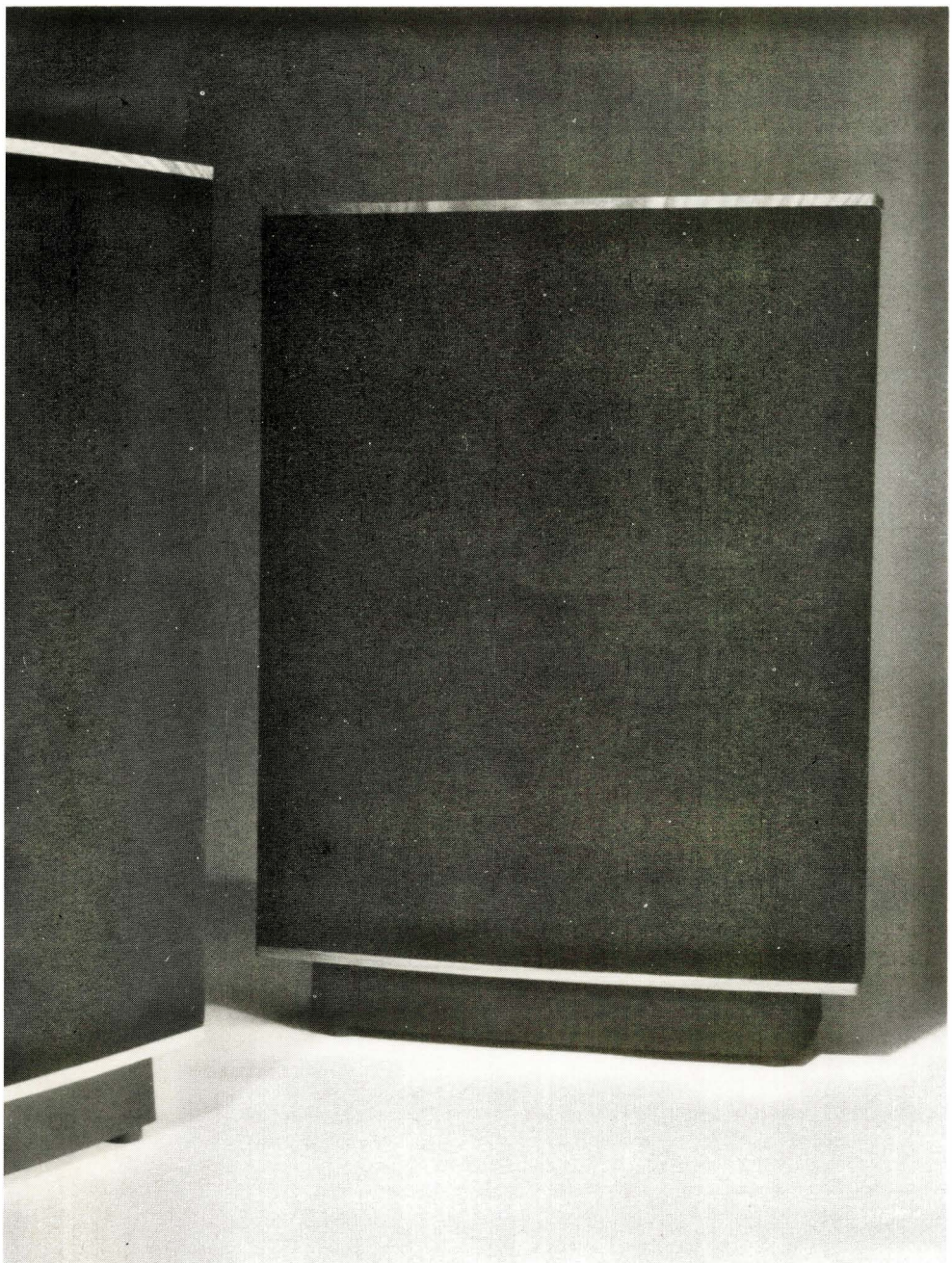
SOUND QUALITY

At risk of appearing to make excuses for the 63, the subjective data did partly reflect its directionality, and side positioned listeners were not well served. Prolonged solo sounds suggested that to some extent the sound was something of an acquired taste, and that if its particular qualities appealed, these could assume such overriding importance that no other model would suffice. On first hearing however it can sound somewhat 'dead' and 'clothy' due in part to the loss of reverberant energy in the upper frequencies when compared to a conventional speaker. A trace of a 'whistly' quality in the extreme treble was audible to a few keen-eared listeners, while the sweetness and integration of the mid/treble band at first lends a dim impression until experience shows that the necessary treble detail still exists but in an unusually natural form.

Listeners accustomed to a dynamic and punchy bass of good power handling, particularly on rock-oriented programme, found the 63 disappointing since it could not play very loud, and the bass power, though more extended than an *LS3/5a*, was little greater. Without the 'liveness' and 'excitement' of some of the better box systems, it at first appears to lack detail and transparency. But prolonged listening showed that this was due to the misleading frequency balance, and that on axis superb image depth as well as detail were apparent.

LAB REPORT

The sensitivity reading was not comparable with a normal speaker due to the doublet directivity, and furthermore, the 1 metre reference response was theoretically too close, risking proximity and integration errors. Approximation or not, the reading was below average at 84dB/W, the reference response meeting ±2dB limits between 50Hz and 9kHz, outside of which some irregularities were charted which could not be wholly blamed on proximity, as a 2m



and 3m-distance frequency response check verified.

Averaged in ⅓-octave bands at 2m, the speaker demonstrated a superbly even mid and low range response, with some mild 'lumpiness' above 5kHz. The response sensitivity to axis was shown by a measurement just 7.5° off-axis vertically, which revealed more than a 5dB loss above 12kHz. The output decayed much more than average off-axis, but the decay pattern was exceptional in terms of consistency and evenness. In practice the bass rolloff point was indeterminate, depending on the listening room boundaries and in particular the distance to the rear wall (with zero bass when placed against the latter). In open air or in large rooms 34Hz −6dB is possible, but at a modest acoustic level.

While not as kind a load as Quad suggest, the speaker should not cause most amplifiers too much trouble, but when the speaker is heavily overloaded it protects by a short-circuit 'crowbar' which may damage some amplifiers and dips to 3.5ohms were recorded at 50Hz and 10kHz. Above 60Hz, even at a full 96dB, the distortion performance was superlative, though the '63 would not accept inputs over 30W or so below this frequency without diaphragm rattling. Above 100Hz the distortion was 10-100 times better than usual but due to the speaker's protection circuit compression occurred at a 100W peak input; however at 50W, just 3dB less, the pulse reproduction was simply too perfect to register measurements.

Conclusion

Since our original review minor improvements have been made to this speaker, notably considerably revised protection circuitry, allowing louder and better reproduction of bass transients. While not a powerhouse, it does at least now do respectable justice to the bass on rock material, particularly if this is digitally derived and hence free of overhang or subsonic excitation. Fully re-auditioned for recent editions, it achieved very respectable scores, especially on digital master programme.

The Quad has uniquely musical qualities through the vital mid registers, and deserves auditioning on high quality material if its blend of strengths and weaknesses are to be fairly assessed by the intending purchaser. The results continue to justify a *Choice* recommendation despite the elevated price.

Test Results

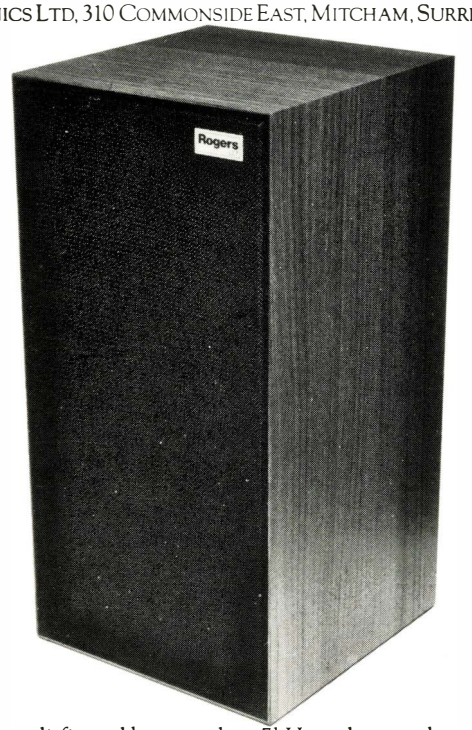
Size (height × width × depth)	93 × 66 × 27cm
Recommended amplifier power per channel (for 96dBA per pair at 2 metres minimum)	(25)—100W
Recommended placement	on open stands clear of rear wall
Frequency response, within ±3dB at 2 metres	40Hz to 18kHz
Low frequency rolloff (−6dB point) at 1 metre	34Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	84dB/W
Approximate max sound level (pair) at 2 metres	99dBA
Impedance characteristic (ease of drive)	fairly difficult
Forward response uniformity	good*
Typical price per pair, including VAT	£1338

*see text

First reviewed: 1981 (reassessed for each subsequent issue). Rating: Recommended.

ROGERS LS7

SWISSTONE ELECTRONICS LTD, 310 COMMONSIDE EAST, MITCHAM, SURREY. TEL: 01-640 2172



Rogers' *LS7* is a fairly compact stand-mounted system, with an internal volume of 30litres. The excellently finished ported enclosure is constructed of 12mm bituminous damped MDF with a reinforced 19mm-thick MDF front baffle.

The bass/midrange unit has a nominal diameter of 200mm, and uses a generous magnet, a high-power voice coil and a patented polypropylene cone possessing the classic BBC profile. A selected version of the Celestion *HF1000* soft-dome 25mm tweeter covers the remaining frequency range. Internal wiring is to a high standard, the *LS7* typifying Rogers' traditionally fine workmanship.

SOUND QUALITY

The panel were highly impressed by the *LS7*. It was felt to be tonally accurate and well balanced, with an extended and uniform frequency response. Good instrumental detail was preserved throughout the frequency range, while coloration was held to a consistently low level.

Stereo images were spacious, focused and full of the intended recorded-acoustic detail. Images also demonstrated impressive depth, with an almost crystalline transparency.

The *LS7* provided good extension in the bass, and while they seemed slightly 'leaden' footed here, powerful and clean articulation were in evidence. The sound was consistently clean and free of boxy effects.

Very mild criticisms were recorded concerning a slight edgy and sibilant treble, with a mild vocal chestiness but neither was of much consequence. The speaker gave fine results on analogue sections but clearly excelled on the digital programme.

LAB REPORT

The *LS7* showed fine pair matching when measured at 1 metre, the axial response disfigured by a notch at 7kHz and removal of the grille gave better results. The well-damped bass response was uniform and well balanced in character, extending to 48Hz, −6dB, which was fine for the size of enclosure. Sensitivity was above average at 88dB/W, and an impressive 200W power capacity was established. Maximum sound levels of 106dBA were possible from a stereo pair, while as little as 10W would give interesting results. The sensitivity was not compromised by the impedance, which showed only a minor dip at 8kHz, with a mean value of 10ohms, thus making the *LS7* a very good amplifier load.

ROGERS LS6

The newer *LS6* slots in below the established *LS7*, and offers a similar basic package in terms of size but at a lower price of little more than £200. A newly developed polypropylene cone is used for the bass/midrange unit, this built on a steel frame and fitted with a generous magnet. The treble is handled by a 19mm soft plastic domed SEAS unit, crossing over at around 3.5kHz. Standing 51cm high, this speaker is suited to free space mounting on solid stands, like the *LS7*. The 23 litre enclosure is reflex tuned to 50Hz by a 50mm diameter port.

Scored with greater consistency by the panel, the *LS6* achieved a very similar rating to the *LS2*, though with superior bass extension and power handling. The '6 was found to be very well balanced with a transparent, informative mid, and an open, airy nature. Stereo depth was quite well developed, and good width as well as image focus were observed.

Quite lively and dynamic, coloration was generally low though the bass lacked attack and real extension while the upper treble could sound grainy on occasion. It handled high powers well, showing a convincing superiority here over the *LS2*, but not quite reaching the standard set by the *LS7*.

CONCLUSION

With its neutral balance, smooth response, fine stereo and a consistent off-axis uniformity, the *LS6* also provided low distortion as well as good power handling into the bargain.

Clearly 'digital ready', the *LS7* in its latest form provides a remarkably well-balanced subjective and objective performance. All aspects of sound quality such as extension, balance, stereo clarity and coloration were very good, while technically speaking it was easy to drive, low in distortion, sensitive, and consistent as regards frequency. Though now above our 'Best Buy' price limit, the *LS7* remains a strongly recommended speaker.

TEST RESULTS

ROGERS LS7

Size (height×width×depth)	56×27×28cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10)–200W
Recommended placement	open stands
Frequency response, within ±3dB at 2 metres	55Hz to 18kHz
Low frequency rolloff (−6dB point) at 1 metre	48Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	88dB
Approximate max sound level (pair) at 2 metres	106dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	very good
Typical price per pair, including VAT	£335.50

First reviewed: LS7, 1983 (retested for subsequent editions); LS6, 1985. For full lab report on LS6, see issue 41. Rating: Recommended.

SPENDOR SP2

SPENDOR AUDIO SYSTEMS LTD, UNIT 12, STATION ROAD INDUSTRIAL ESTATE, HAILSHAM, SUSSEX BN27 2ER. TEL: (0323) 843474

With the original *BC1* and its virtual successor the *SP1* well established, Spendor has been researching a less expensive 30 litre alternative for a few years now. The *SA2* came first, to some degree then eclipsed by the superior and cheaper *Prelude*. Now, developed from the *SP1* and sharing that fine model's 200mm polypropylene coned bass-mid unit, we have the *SP2*. The treble is handled by a special version of the established Scan *D2008* tweeter, a 19mm soft dome offering a superior performance, and in this case, ferro-fluid damped. Optimum positioning is in free space, on 40-50cm high stands.

The finely veneered enclosure is critically balanced by an optimum choice of chipboard grade and thickness, the panels bitumen damped internally. This is a reflex loaded design, tuned to 33Hz, and the ducted port is internally damped by a foam lining, this absorbing the energy due to higher resonant modes in the duct.

SOUND QUALITY

On test the *SP2* achieved a very high ranking position, only a little behind that of the *SP1*.

Stereo images were well focused, and showed very good width and depth. Well balanced tonally, the response sounded very uniform, though with a touch of softness in the low bass, the latter showing good extension. In the upper mid, a hint of hardness was noted, plus slight wispiness in the high treble.

In the Spendor tradition, the *SP2* offered a highly articulate, detailed midrange. Dynamics were presented well, the system sounding open and relatively uncoloured. Just a touch of boxiness was present in the low midrange, but even this was much less than usual.

LAB REPORT

Reference sensitivity was about average at 87dB while the axial frequency response showed a highly uniform characteristic, ±2.5dB 50Hz to 15kHz. The bass was well extended, reaching 45Hz, −6dB.

A minimum power rating of 15W was indicated while it coped with up to 150W peak programme, the latter generating decent sound levels of 104dBA from a pair in a typical room. The impedance curve showed an easy load, aiding the sensitivity in amplifier terms.

At 2 metres, the ±3dB response was wide at 48Hz to 20kHz, with the set of forward responses showing quite excellent uniformity. A slightly down-tilted response was seen, this typical of subjectively well balanced compact box systems. In the listening room the speaker showed an even, well balanced characteristic with good power down to 30Hz. Integration was very good through the frequency range.

At the high 96dB sound level, the distortion above 150Hz held to a moderate 0.4%, bar some minor clutter above 100Hz. With level reduced to 86dB, third harmonic averaged 0.25%, second 0.1%, these both fine results.

CONCLUSION

Spendor now have their compact 30 litre monitor. Offering great consistency and accuracy, it slots in neatly below the *SP1*, conceding little to that respected, larger model. With its natural, extended response, low coloration, wide dynamic range, easy amplifier loading and very fine stereo, the *SP2* is a class winner and is strongly recommended.

TEST RESULTS

Size (height×width×depth)	50×26×30cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(15)–150W
Recommended placement	rigid open stands
Frequency response, within ±3dB at 2 metres	48Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	45Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	87dB/W
Approximate max sound level (pair) at 2 metres	104dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	excellent
Typical price per pair, including VAT	£390

First reviewed: SP2, 1985; SP1, 1984. For full lab report on SP1, see issue 41. Rating: Recommended.

TANNOY VENUS

TANNOY PRODUCTS LTD, THE BILTON CENTRE, CORONATION ROAD, CRESSEX IND ESTATE, HIGH WYCOMBE, BUCKS. TEL: (0404) 450606

Tannoy's *Mercury* is an established 'Best Buy' speaker; in a higher price and quality category, the *Venus* is similarly sized, though with an internal volume of around 30 litres as against the *Mercury's* 19 litres, and it comes in a real walnut veneer finish. It has a substantial 6cm diameter and 6cm deep port, reflex tuning the enclosure to 48Hz.

Both drivers are made by Tannoy and comprise a 25mm plastic dome tweeter with a 210mm bass/midrange. The latter has a generous magnet, the whole being built on a steel frame with critically flared polypropylene cone.

The sturdy enclosure is built of 19mm chipboard, bitumen damped with interior absorbent. The drive units are 'time aligned', in that the treble signal passes through a time delay network to synchronise it with the midrange, while the crossover is a basic 12dB/octave type; including the time delay network, a total of 16 elements are employed. The 9mm thick grille panel is unrebated and is probably best left off to get the best results.

SOUND QUALITY

Scoring a substantial 'good plus' the *Venus* has done well on audition. It was felt to be well balanced, with an extended wide range response, with a touch of bass excess. Coloration was comparatively low, while the sound was considered 'open' although it stayed 'sweet'. A touch of grain was occasionally noted in the treble.

The stereo imaing was fine, the speaker demonstrating good perspectives with fine depth and ambience as well as good focus and stage width. Coloration was comparatively low, with just a touch of 'plastic cone' and some mid boxiness. It handled high sound levels well, surviving a respectable 300W peak programme and it still sounded civilised and well controlled.

LAB REPORT

This speaker demonstrated an average sensitivity of 86.5dB/W. Low frequency rolloff was at 47Hz, good for the size and price, while pair matching was also good, with just an absolute difference of just 1dB overall. The axial response was quite smooth, and better still with the grille detached. A mildly downtilted response was indicated, the overall trend meeting ±2.5dB limits from 50Hz to 20kHz, grille detached.

With a 200W power handling maximum sound levels of 104dB should be possible from a stereo pair, particularly as the impedance does not fall below 6.4ohms, allowing an 8ohm rating for this well balanced design. Driven to 96dB, distortion was higher than expected, though still mainly innocuous second harmonic. At a reduced 86dB level, it improved to a 'satisfactory' level.

Out at 2 metres, the off axis response showed excellent integration with the benefits of time alignment fully realised. This was as perfect a medium-sized two way as I have seen.

CONCLUSION

Smooth and sweet was the panel's impression of this well finished and carefully built loudspeaker. It does most things pretty well and is also easy to live with. Its subtlety and good stereo pleased the panel, whose scores suggested that Best Buy rating is appropriate.

TEST RESULTS

Size (height × width × depth)	53 × 30.5 × 27cm
Recommended amplifier power per channel (for 96dBA per pair at 2 metres minimum)	(15)—300W
Recommended placement	on open stands
Frequency response, within ±3dB at 2 metres	48Hz-20kHz
Low frequency rolloff (−6dB point) at 1 metre	47Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	86.5dB/W
Approximate max sound level (pair) at 2 metres	106dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	excellent
Typical price per pair, including VAT	£269

First reviewed: 1985. Rating: Best Buy. For full lab report on Mercury, see issue 41.

WHARFEDALE 708

WHARFEDALE LOUDSPEAKERS LTD, SANDLEAS WAY, CROSSGATE, LEEDS LS15 8AL. TEL: (0532) 601222

A high-quality compact design, this loudspeaker heads in the direction of the Celestion *SL6*, with some of the technology of the '600 thrown in as well. Wharfedale use a 200mm polypropylene bass/mid unit driver, this covering built on a self-locking diecast chassis.

A 12dB/octave crossover divides the range, feeding the higher frequencies to the 19mm alloy dome tweeter. This new Wharfedale unit gives an exceptional response, free from breakup until its first upper resonance at about 45kHz.

The enclosure is very light and non-resonant, built of a 25mm thick foam-cored sandwich with melamine laminate outer skins. The entire volume of 14 litres is filled with highly absorbent acoustic foam to reduce sound transmission from within the enclosure to the outside. There is no grille.

SOUND QUALITY

Scoring favourably on blind auditioning, the sound quality of the *708* matched its price. Coloration in the traditional sense was very low, though some residual panel-associated 'warmth' was evident in the low midrange.

Stereo focus was to a high order with good representation of depth and ambience. Tonally it was accurate, if a touch rich, and musically proved capable of representing the scale and tonal balance present in the recording.

A good frequency range was observed with fair bass present to low frequencies. The upper bass was firm and played tunes well while the treble was limpid, smooth and unexaggerated. Decent power levels were handled well with good clarity and dynamics.

LAB REPORT

Measured at 1 metre the axial frequency response gave a below average 85dB/W sensitivity. Given a generous power handling of up to 150W, satisfactory maximum sound levels of 102dBA were within reach. A minimum power of 25W per channel is our suggestion. The bass rolloff was 54Hz, −6dB, which is average for the size, but it was nicely damped.

On the median axis, the response showed some ripples from 5-7kHz, this somewhat variable with axis. When averaged at 2 metres, the *708*'s output looked good in the lateral plane but dipped sharply in the crossover range at 15° above axis. Clearly a decent stand height is essential, 40-55cm. A 60Hz to 15kHz frequency range fitted ±3dB limits, the overall effect being smooth, and gently downtilted with increasing frequency. Not falling significantly below 6ohms, this speaker was classed as a relatively easy amplifier load. In-room, the response was extended with good upper range control. Some mid dominance was evident from this measurement.

CONCLUSION

Wharfedale have a respectable achievement in the *708*. Offering a fine stereo performance it has a 'classical' tonal balance. Ideal for free space mounting on high quality stands. In its price class, the value rating on lab and listening tests indicated a strong 'worth considering' verdict, though I now feel it should be in the recommended class on grounds of its relaxed musicality.

TEST RESULTS

Size (height×width×depth)	49×25.5×22cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(25)–150W
Recommended placement	on stands
Frequency response, within ±3dB at 2 metres	60Hz to 15kHz
Low frequency rolloff (−6dB point) at 1 metre	54Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	85dB/W
Approximate max sound level (pair) at 2 metres	102dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good plus
Typical price per pair, including VAT	£350

First reviewed: 1985. Rating: Recommended.

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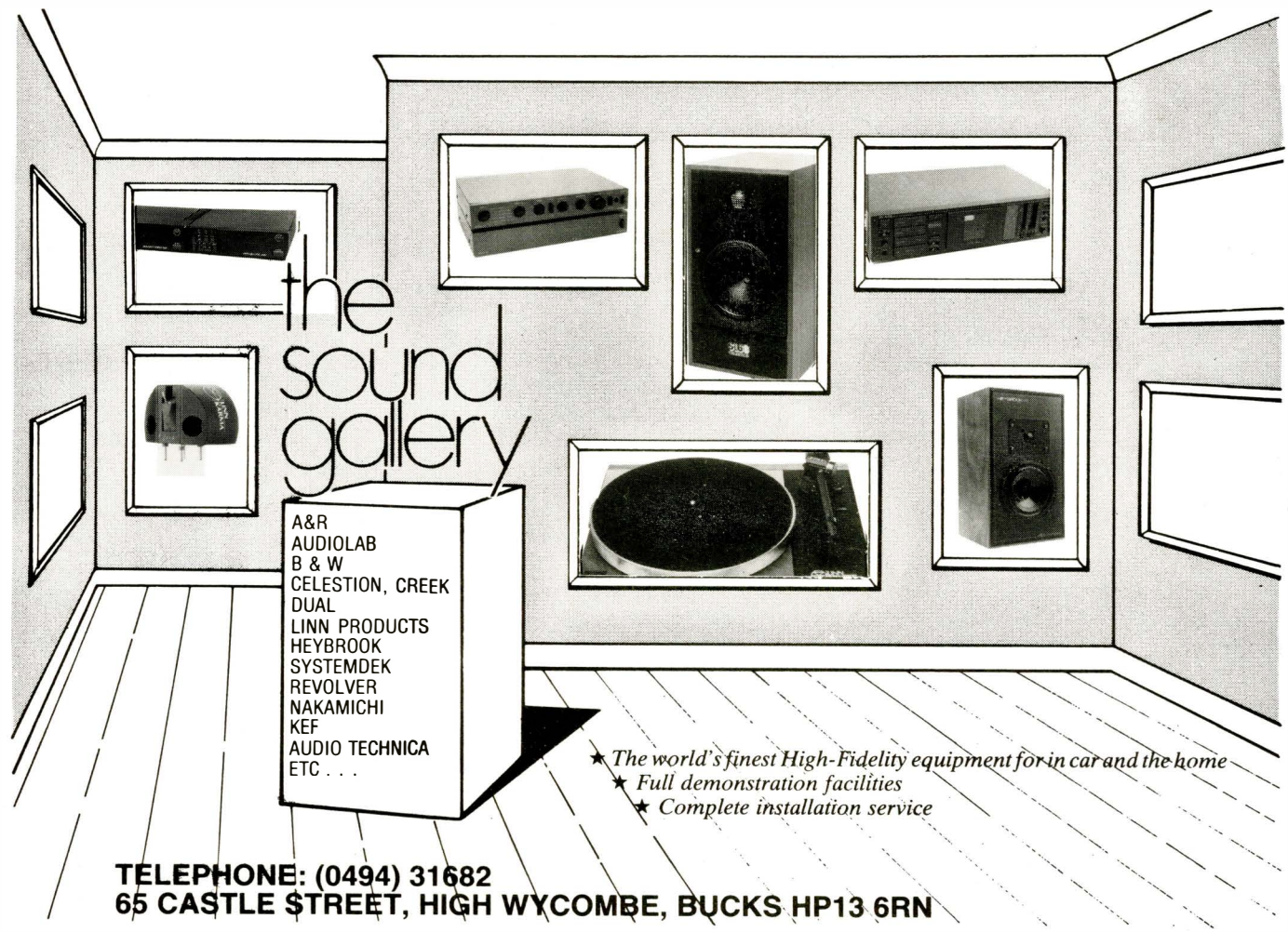


YAMAHA NS1000M

YAMAHA ELECTRONICS (UK) LTD, YAMAHA HOUSE, 200 RICKMANSWORTH ROAD, WATFORD, HERTS WD1 7JS. TEL: (0923) 33166

The Yamaha *NS1000* was in fact originally reviewed several years ago in the first issue of *HFC Loudspeakers* (1976), when the author, Angus McKenzie, purchased a pair for high level monitoring. Though it had been retested for subsequent editions, we nonetheless felt that the Yamaha 'flagship' should again be completely reassessed, and very worthwhile this proved to be.

The *NS1000* is a relatively compact, superbly-crafted three-way sealed-box speaker, of a highly rigid and braced construction, with an exterior black paint surface that is best described as 'piano' finish. Working best on strong stands, it can also be placed near, but not too close to the rear wall; 30cm is about right.

The bass driver is a top-class 300mm pulp cone unit, built on a die-cast alloy frame and employing a massive motor system. The protective grille over the bass driver rings a little, and fussy owners could discard them, as we did for our tests. The mid and treble units, 85mm and 30mm respectively, are Yamaha's unique ultra-hard berylium dome units, both fitted with front phase correctors. Level controls are also provided for mid and treble, and we obtained the best balance and curves with mid at '−2' and treble '−1'.

A high-quality, high-power crossover divides the frequency range at around 600Hz, and 5kHz, with spring clips for electrical connection at the rear of the speakers.

SOUND QUALITY

This speaker has historically attracted some censure, notably on analogue-based programme. Past criticisms included a bass that was too damped and dry, with a somewhat coloured mid and a treble that was a trifle fizzy and uneven. However this time round, using mainly digital programme, the speaker appeared to 'come to life', and produced an impressive sound. The bass was quite exceptional, with superb control and articulation, as well as fine depth to formant frequencies. It appeared to produce good stop-start transients, and was also sufficiently transparent to reproduce the natural acoustic on many recordings. Stereo images were also well focused and a decent depth effect was obtained.

Some coloration was still evident, namely a slightly deadened presence range with some mid nasality and a trace of lispiness and grain to the treble, this accentuated on distorted programme.

On high-quality material however its 'monitor' label appeared justified judging by the results, and high sound levels were also possible, with negligible subjective distortion.

LAB REPORT

A high 90dB/W sensitivity was recorded, this being slightly compromised by the impedance, which dropped to 4 ohms at 80Hz. This qualifies the speaker as a fairly difficult load.

System resonance was 35Hz, which was lower than the previous samples, and good bass extension to 40Hz, −6dB, was achieved, with a desirably slow dampened rolloff below this point. The axial response was pretty uniform at 1 metre but by 2 metres some 'lumpiness' had crept in through the mid treble. Aside from this however the forward integration was very good over the range of measurement axes.

Turning to a computer-averaged room response, the clean extended bass was clearly evident, with the treble register well shaped; overall quite a balanced result.

At 96dB sound level, distortion was remarkably low, with third harmonic much less than 0.1% above 500Hz and second averaging just 0.3 to 0.5%, even at lower frequencies. At the 86dB level, distortion was exemplary, with a further improvement in third harmonic, second averaging 0.15% above 200Hz, and 0.3% at lower frequencies. This makes it the best in the issue as far as distortion results are concerned.

The speaker had a high peak power capacity of up to 200W and high sound levels were possible from a stereo pair — up to 108dBA in a typical room!

CONCLUSION

The long-lived *NS1000* remains competitively priced. Superbly engineered and finished, it can provide powerful, clean, articulate and extended bass despite its compact dimensions, and also sets a good standard elsewhere. Stereo images were well formed, the distortion was excellent and available sound levels high, as was the sensitivity. Satisfactory on analogue sources and really coming into its own on digital, the *NS1000* is a worthy contender, and the *HFC* recommendation continues.

TEST RESULTS

Size (height × width × depth)	67.5 × 37.5 × 32.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10)−200W
Recommended placement	30cm from wall on rigid stands
Frequency response, within ±3dB at 2 metres	50Hz to 16kHz
Low frequency rolloff (−6dB point) at 1 metre	40Hz
Voltage sensitivity (ref. 2.83V or 1 watt into 8ohms at 1 metre)	90dB/W
Approximate max sound level (pair) at 2 metres	108dBA
Impedance characteristic (ease of drive)	below average
Forward response uniformity	very good
Typical price per pair, including VAT	£950

First reviewed: 1976; retested 1978 and subsequently reassessed; retested 1983 and subsequently reassessed 1984, 1985. Rating: Recommended.

STATE OF THE CD ART

Since CD was launched three years ago, players continue to improve and at least one or two have begun to reach an 'audiophile' level of sound quality. Martin Colloms charts their development.

When CD players first emerged, they were greeted with a conflicting mixture of enthusiasm and mistrust. Reviewers who were keenly aware of the technical potential of the digital medium tended to welcome the development, promising as it did a freedom from record wear, the advantage of silent disc surfaces and negligible wow and flutter. The laboratory specifications for CD were exemplary, and figures for frequency response, harmonic distortion at normal levels and for channel separation were far superior to that produced by the analogue or black disc. The new silver digital disc with its non-contacting laser pickup appears to hold all the aces when compared with vinyl, where in essence a hard point is dragged along a groove pressed in soft plastic.

However, the fact is that black discs will remain a considerable market force for some time to come. The case for a good analogue turntable is still a strong one even though interest appears to be waning. The casual music buyer, who has an audio system as part of his home entertainment, may find the relatively limited CD catalogue sufficient for his needs. A CD player is a logical part of such a system, and this is where the major sales are currently occurring. However for the serious music enthusiast, CD is rather limiting and is likely to be so for some time to come. The reason is simply that CD factories have yet to reach full capacity and demand outstrips supply. The record companies are also tending to restrict the catalogue to guaranteed popular sellers, both classical as well as jazz rock, and at the time of writing the secure position of a Dire Straits album as the best-selling title serves to illustrate the point. The committed music enthusiast who perhaps already possesses a considerable collection of more specialised music will find that CD hasn't much to offer as yet — even now, the vast majority of newly released material is still on black rather than silver disc. So while the present mass sales prove the success of CD, the case for music in its wider sense rests at present with analogue.

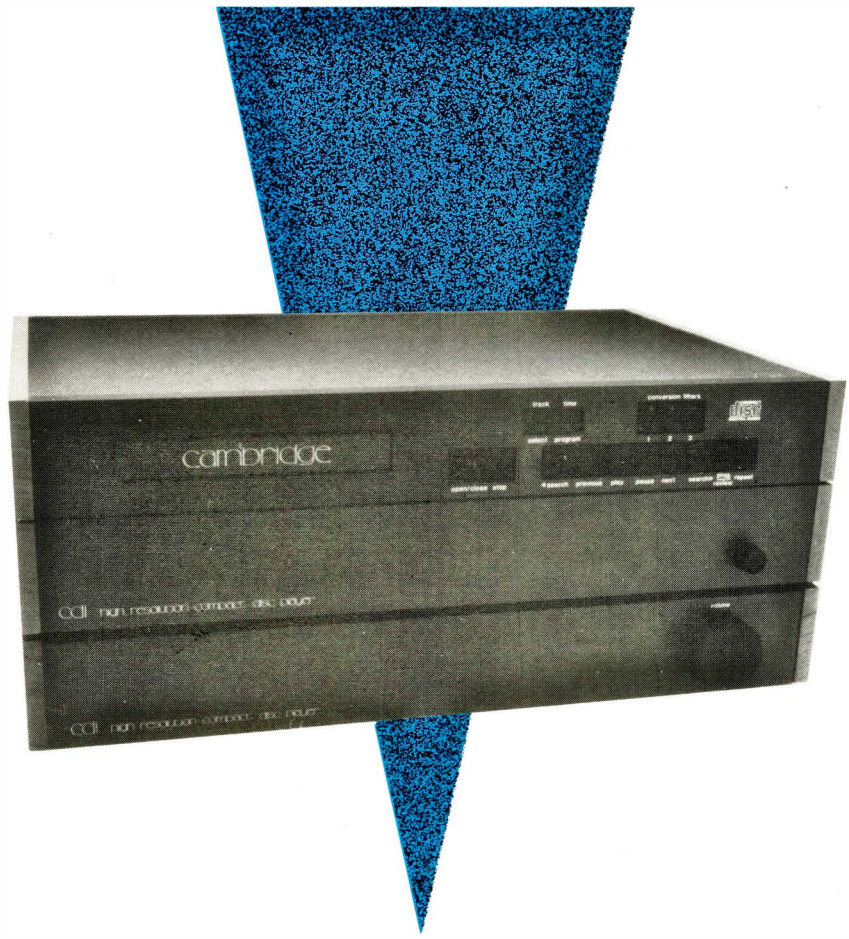
A music lover with an extensive collection of black records rightly sees it as a valuable investment and will continue to value a high performance analogue disc playing system. The demand for these players will continue to the highest price levels, despite some of the minor frustrations we have all experienced with our relatively fragile vinyl recordings.

Many enthusiasts have simply added a CD player to their equipment, taking advantage of its easy, non-critical connection to an amplifier. They pick and choose amongst the CD catalogue seeing it as a longer-term investment. The basic price of a CD player is now below £200, but the cost of the CDs remains rather expensive — typically double that of a vinyl equivalent. If you are buying records at a considerable rate, the cost differential soon adds up. Silver disc prices are expected to fall eventually but nonetheless the prediction is that they are unlikely to reach black disc levels for many years yet.

Sound Differences

Finally there is the question of sound quality. There is a world of difference between the average vinyl disc player and a good one. Probably 98% of vinyl record players in use are substandard by hi-fi criteria, and even a modest CD player would have little difficulty in demonstrating its audible superiority. However, if a carefully selected set of components is set up, with proper installation and alignment, the results with vinyl can be very good indeed — so good in fact, that given the best quality recordings, certain audiophiles maintain that the finest analogue is still superior to the finest CD. Given that the best CD players cost between £1500 and £2000 this leaves a massive budget for a competing analogue player; in fact a standard high quality line up, such as the Linn/*Ittok/Karma*, would give the best CD player a run for its money at around the £1200 level. Yet if black disc is inferior by measurement and may well have some audible wow on some records, how then can it sound superior to CD?

The answer is not an easy one, but has something to do with the youth of CD as



a medium. Analogue disc has endured for decades, and has reached a steady state of musical refinement. Designers in CD are still learning how to get good results and variations between CD players are surprisingly great when assessed from an audiophile viewpoint.

A perfectionist may regard even the best CD player as very satisfactory rather than as a satisfying musical medium. However this picture is slowly changing as CD players evolve and improve. From the standpoint established by the best tubed (valve) amplifiers, CD sound is said to be closer to a middle-rank transistor amplifier, good as this may be.

Price Range

At present, fine-sounding CD players are available at a wide range of prices. It is possible to buy the 'budget' Philips *CD150*, a model of noted sound quality, for as little as £200. This could easily be taken as the basis of a modestly-priced but good quality system, and if you choose wisely, it is possible to find machines of increasing quality at price breaks of £300 and £450. Up to the £500 level, it is possible to combine the attributes of good sound plus a wide range of modern convenience features such as infra-red remote control, which will carry a full numeric keyboard for rapid entry of any desired CD track, together with programming facilities to enter tracks in any desired order, deleting unfavourable ones. Index-search for those special discs is also available, this a more elaborate cueing for particular sections of extended classical works. Readout of total track time and individual track times is also possible, making recordings easier to judge.

A few CD machines even have a power volume control facility, actuated via the remote handset. Such features can be most useful and contrast strongly with the manual-only operation of top analogue turntables. And of course, CD convenience also extends to playing times, which can exceed one hour, while an LP needs changing or turning over every 20 to 30 minutes.

In terms of technology, the cheaper CD players tend to employ single time shared 16 bit digital convertors, the Philips decks being the honourable exception with their 14 bit, four times oversampled decoders. However Philips and Marantz are soon to release 16 bit versions of their more expensive players and once launched these are expected to make a big impact on the market. Preliminary trials even of early sub-standard prototype samples have been very promising.

Moving up from the lowest priced CD decks, those using 16 bit with two times oversampling make their appearance, this technology led by Yamaha, who have also produced a wide range of related players for other brands including Sansui, Sanyo, Fisher, Audio-Technica, NEC and TEAC among others.

Sony held back for a while but have now introduced their two times oversampling system with digital filtering, which they have dubbed 'ultralinear'. All their better models employ this system right up to and including the audiophile-grade *CD-P552/DA-S702* combination. Recently other makers have also taken CD more seriously and are beginning to indulge in the use of dual convertors with advanced circuitry in order to improve sound quality, noted examples coming from TEAC and Denon.

UK Advances

In the UK, advances in CD quality have been achieved by applying successful audio design enhancements to existing CD player technology. Based on Philips mechanisms and electronics, Mission, Meridian and Cambridge Audio have all produced individual machines at a greater cost, but offering superior sound. Mission's *7000R* (14 bit four-times oversampled) is a continuing winner at £450, while the Meridian Pro at £675 is reckoned to be the best in its price category.

Sony provide competition here, aided by excellent build, finish and facilities, for example in such machines as their *'302* (now *'303*) model at around £500, the *502ES* (£700) and the highly-regarded *'552/'702* combination at the £2000 level. All these have full remote controls. Finally, the Cambridge Audio *CD1*, at an admittedly steep £1500, is arguably the current world-beater in terms of ultimate and 'involving' sound quality.

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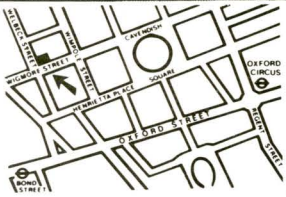

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AIWA DX-1200

AIWA (UK) LTD, UNIT 2, DUKES ESTATE, WESTERN AVENUE, LONDON W3 0SY. TEL: 01-993 1672

A midi-sized model, finished in satin black, the Aiwa *DX-1200* incorporates a drawer loading mechanism which is distinguished by its need to insert the disc upside down.

Providing track number and timing in minutes and seconds, both per track and for the overall disc, the display also shows the required numbers in index mode. No numeric keyboard is present, but entry is rapid via the forward and back 'skip' buttons. Tracks may be set to repeat in their entirety on or over selected passages — the so-called 'A to B repeat' feature.

Aiwa's rear panel includes a socket for 'deck sync' for cassette deck recording, an 8 pin DIN socket marked 'Digital Out' presumably for connection to a computer and a connection for the remote control unit in Aiwa's matching system.

The Aiwa design uses a single 16 bit shared D/A convertor with 2× over-sampling, this similar to the current Yamaha models. 7 pole discrete LC filters follow the converter's channel separator.

SOUND QUALITY

Scoring a little below average, the *1200* proved to be a competent performer, and generally set a good CD standard. Critical analysis suggested that the upper bass lacked a little in definition and attack, with the mid register a touch forward and two dimensional, with the treble slightly brash and exposed. In stereo terms the image was a trifle narrowed and softer in focus.

LAB REPORT

Channel balance was excellent throughout, though the frequency response did show a small rise to 20kHz, this being a maximum of +0.6dB and probably inaudible.

Channel separation was also very good at typically 97dB. The usual interchannel phase difference due to the time-shared converter was reduced to 45° by the 2× over-sampling.

At peak level the total harmonic distortion was good but unexceptional at −98dB, 1kHz and showing −80dB of beat noise at 20kHz. However, at reducing modulation levels, very good figures were displayed showing the full 16 bit linearity. This was confirmed by the minor +1.5dB level error at a set −90dB. The high frequency intermodulation results were good, at almost 100dB down at full level, and close to the limit at 10dB below peak. Output level was standard at virtually 2V. Track access was fairly rapid at 6.5 seconds. Mechanical noise was moderate and the machine performed excellently on the error correction tests.

Spectrum analysis for the −10dB two-tone intermodulation did show a poorer than average performance on aliasing — the upper difference tone at 24kHz was only 23dB down, which is a little too close to peak level for comfort.

CONCLUSION

While this player undoubtedly fulfilled its intended purpose very competently it did not have a sufficiently competitive edge to attain the recommended category. An important component as part of the matching Aiwa stacks, it is nonetheless worth considering, even for independent use.

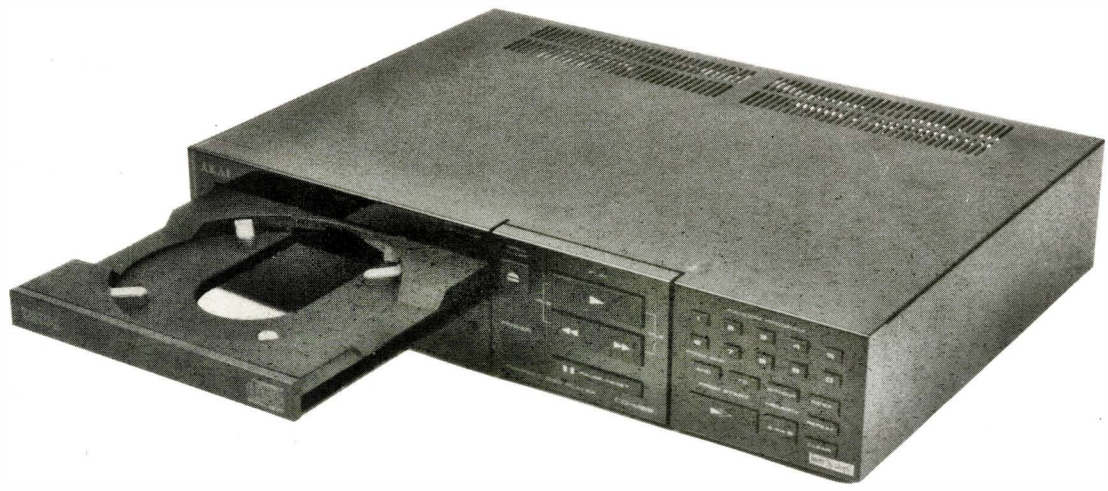
TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.14dB	0.14dB	0.14dB
Stereo separation		−97dB	−96dB	−94dB
Channel phase difference		0°	2.5°	45°
Total harmonic distortion, 0dB		−88dB	−87dB	−80dB
Total harmonic distortion, −10dB			−83dB	—
Total harmonic distortion, −60dB			−48dB	—
Total harmonic distortion, −80dB			−27dB	—
Intermodulation, 19kHz/20kHz, 0dB			−97dB	
Intermodulation, 19kHz/20kHz, −10dB			−90dB	
Frequency response, left channel			+0.5dB, −0.15dB	
Frequency response, right channel			+0.5dB, −0.15dB	
Signal-to-noise, 20Hz-20kHz unweighted			−99dB	
Signal-to-noise, CCIR/ARM, 1kHz ref			−93dB	
Output level, 0dB, left/right			2.02V/1.99V	
Output impedance			922 ohms	
De-emphasis			correct	
Track access time			6.5 secs	
Error correction capability			>900μm gap, >800μm dot	
Mechanical noise			moderate	
Spuriae up to 100kHz			−112dB	
Resolution at −90dB			+1.5dB	
Headphone socket			yes (variable output)	
Dimensions (w×d×h)			33×30×7cm	
Estimated typical purchase price			£380	

First reviewed: 1985. Rating: Worth Considering.

AKAI CD-M88

AKAI (UK) LTD, UNIT 12, HASLEMERE HEATHROW ESTATE, SILVER JUBILEE WAY, HOUNSLOW, MIDDLESEX. TEL: 01 897 6388



Features of the '88 include a full numeric keyboard, direct track access, audible music cueing plus a large fluorescent display showing all available information, including indexing.

Track access was rapid in operation, though the machine did emit the odd chirp, plus a constant high pitched 'swish' that I found a nuisance, although others failed to notice it. Akai's comment was to suggest location away from the listening position, thereby exploiting the remote control facility.

Internally, the circuitry was fairly conventional, with a single time shared 16-bit digital to analogue convertor chip, this the popular Burr Brown type. In the output circuitry, the low impedance output is directed around the box to the front panel variable level control, then routed back to the rear panel socket; all the results in this review relate to the factory-built as supplied, but we also checked the effect of bypassing the level control and short wiring the output socket to the final integrated circuit output. I am sure that the resulting improvement would be considered worthwhile by an audio enthusiast — we judged about 0.6 of a point in 8 on subjective scores. When direct wired a much lower and constant output impedance is obtained, to better drive the interconnect cable.

SOUND QUALITY

Rated well above average, this player was much liked on audition. Despite a hint of brightness and forwardness in tonal perspective, it proved clear and clean throughout the frequency range. Good stereo depth and transparency were its hallmarks, while the bass showed a pleasing extension as well as precise control. By CD standards the treble was also sweeter than usual. Stereo images were well focused and worn discs were played with confidence. The player also showed good vibration resistance.

LAB REPORT

Channel matching and balance were excellent while the frequency response showed that a hint of treble lift — about 0.4dB rise in the final 1½ octaves to 20kHz.

Channel phase shift showed the usual 70-80° difference at 20kHz, due to the shared converter. Slight compression was shown at peak level, but this was hardly seen in the −93dB distortion at 1kHz, full level. Good distortion results were maintained at 20kHz, and at reducing output levels, mid band. The −24dB result at −80dB signal level showed close to 16 bit linearity while an odd −90dB level offset was noted as −4dB left and −1.5dB right, a reversed curvature at the resolution limit. The intermodulation results were about average — very good nonetheless, at −89dB for the full modulation, difference tone product.

Error correction proved excellent. Signal-to-noise ratios were quite typical, while spurious signals up to 100kHz were well rejected by 108dB or more.

CONCLUSION

The sound quality alone ensures this machine a Best Buy rating. The lab performance shows a basically good design with a stable, precise optical transport. This one is confidently recommended, providing that its minor mechanical noise does not put you off. Congratulations Akai!

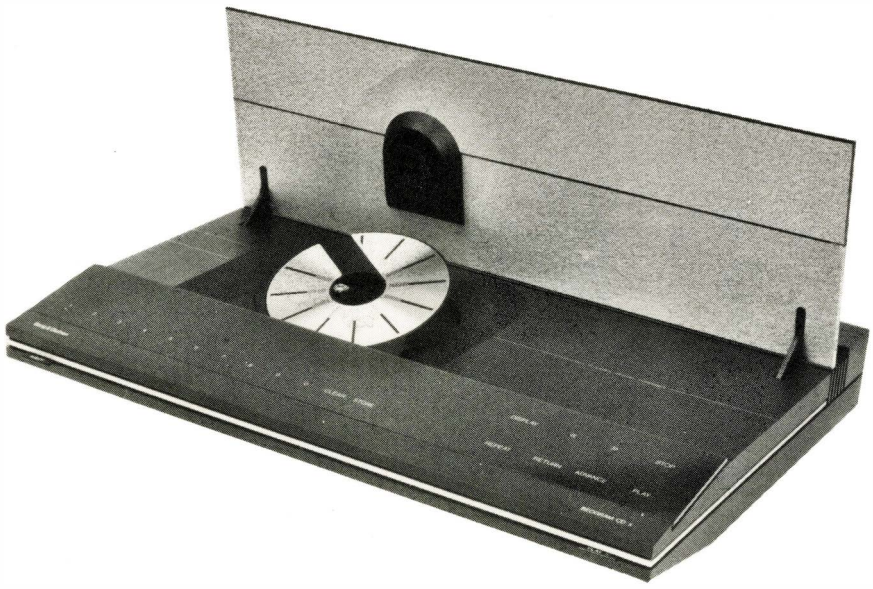
TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.02dB	0.02dB	0.02dB
Stereo separation	−85dB	−86dB	−77dB
Channel phase difference	0°	0°	76°
Total harmonic distortion, 0dB	−96dB	−93dB	−82dB
Total harmonic distortion, −10dB		−84dB	—
Total harmonic distortion, −60dB		−50.1dB	—
Total harmonic distortion, −80dB		−24.7dB	—
Intermodulation, 19kHz/20kHz, 0dB			−89.5dB
Intermodulation, 19kHz/20kHz, −10dB			−88dB
Frequency response, left channel			+0.37dB, −0dB
Frequency response, right channel			+0.37dB, −0dB
Signal-to-noise, 20Hz-20kHz unweighted			−98dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−92dB
Output level, 0dB, left/right			2.01V/2.01V (variable)
Output impedance			100 ohms
De-emphasis			correct
Track access time			3.8 secs
Error correction capability			>900μm gap, >800μm dot
Mechanical noise			mild chirps, high pitched 'swish'
Spuriae up to 100kHz			−108dB
Resolution at −90dB			+1.5dB
Headphone socket			yes (variable output)
Dimensions (w×d×h)			35×26×7.1cm
Estimated typical purchase price			£399

First reviewed: 1985. Rating: Best Buy.

BANG & OLUFSEN CD-X

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



A visual match for B&O's *3000* system, the *CD-X* is excellently styled and finished, and although it is based on the Philips *CD101* series bears no physical resemblance to the Philips models.

Up to 20 tracks can be programmed and a numeric key array provides for quick entry while the souped-up transport gives rapid track access. The large and easily read display shows overall time track and track numbers.

Following the Philips system, and using many Philips components, the B&O employs the four times oversampling technique, with a 96th order digital filter, two separate 14 bit digital to analogue convertors, plus slow analogue filtering thereafter.

A performance close to Philips standard was expected and realised. The fixed output cable is in fact of the Philips variety, with the original tinned phono plugs.

SOUND QUALITY

Listening tests indicated a superior performance, a little above that of the Philips equivalents. The bass was firm and secure, while the treble was tidy and well defined. Stereo was well focused, with presentable depth, and the tonal balance was pleasantly sweet, with transients well produced.

LAB REPORT

Channel balance was very good at 0.1dB and on frequency response measurement for both channels a very slight bass droop was evident, plus the usual minor ripples of the Philips digital filter. The overall frequency response met fine +0.1, −0.25dB limits.

Channel balance was typically better than 90dB, while predictably the inter-channel phase difference was zero over the entire frequency range. Showing good linearity, the low level distortion figure and the level error at −90dB suggested a good linearity, close to 15½ bit. Mid band distortion approached −100dB full level, while at 20kHz, the in band products held to an excellent −94dB.

High frequency intermodulation results were above average although the 100kHz intermodulation spectogram revealed some beat products up-band. The 24kHz component was satisfactory at −56dB, with additional products in the 60-70kHz region. The result for the spurious outputs on the deck with single tone signals is now shown; but here the spuriae could reach above −60dB, despite an intrinsic suppression close to 100dB. This is typical of the Philips circuit.

Output was standard at 2V, sourced from a low 50 ohms output impedance. Error correction was excellent.

CONCLUSION

Given its performance, the price, the fine build quality, excellent finish and good facilities, this B&O player scores a strong recommended rating.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.01dB	0.01dB	0.01dB
Stereo separation	−94dB	−96dB	−89dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	−95dB	−98dB	−94dB
Total harmonic distortion, −10dB		−76dB	
Total harmonic distortion, −60dB		−41dB	
Total harmonic distortion, −80dB		−22dB	
Intermodulation, 19kHz/20kHz, 0dB			−89dB
Intermodulation, 19kHz/20kHz, −10dB			−78dB
Frequency response, left channel			+0.1dB, −0.25dB
Frequency response, right channel			+0.1dB, −0.25dB
Signal-to-noise, 20Hz-20kHz unweighted			−108dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−109dB
Output level, 0dB, left/right			2.09V/2.11V
Output impedance			50 ohms
Track access time			5.2 secs
Error correction capability			>900μm gap, >800μm dot
Mechanical noise			low
Spuriae up to 100kHz			−60dB to −100dB
Resolution at −90dB			+3.5dB
Headphone socket			no
Dimensions (w×d×h)			43×31×7.5cm
Estimated typical purchase price			£349

First reviewed: 1985. Rating: Recommended.

CAMBRIDGE AUDIO CD1

CAMBRIDGE AUDIO SYSTEMS INTERNATIONAL, HOME FARM, DIDDINGTON, HUNTINGDON, CAMBRIDGESHIRE PE18 7EJ.
TEL: (0480) 811811

The long awaited Cambridge CD player has been on sale in the US for many months before finally becoming available here in the UK. Rumour had it that the *CD1* was one of the world's best sounding players, which is as it should be, given that its price is also one of the highest. We were fascinated to see how it would stand up to our current reference the Sony two unit player combination comprising a *DA-S 702es* decoder plus *CD-P 552es* player; in fact, the Cambridge is also a two unit system, and in the UK at least undercuts the Sony duo by at least £500.

Like the Mission and Meridian machines, the Cambridge design is founded on the Philips system with its four times oversampling and digital filtering. Cambridge have chosen the Philips *'104* chassis as the main building block, this a solid cast metal structure with horizontal drawer loading mechanism. From this point onwards however the design of the *CD1* diverges from that of other machines. For example, while the D/A convertors are physically 14 bit Mullard Philips integrated circuits, no less than 6 are used, three per channel. On each channel two essentially operate in parallel, increasing the dynamic range, while the third is employed as a high speed ranging element, assessing bit errors and offering correction. Before oversampling the theoretical resolution is some 18 bits, which is enhanced to 20 bits by oversampling. Dither is specifically appplied to suppress high order errors, improve resolution and end up with a true 16 bit performance.

As with the Meridian, changes have also been made to the Philips disc transport, notably to the laser head servo and to the tracking. The actuator responses have been adjusted to minimise the error rates, a factor held to affect sound quality.

The dual power supplies are located in the upper deck unit with the main digital circuitry and of course the transport. The isolating suspension has also been modified, with an additional anti-vibration mounting which involves lead beams tuned to 1Hz. Two interconnect leads fitted with DIN plugs link the upper and the lower units, and the latter draws its power from the former. Specially selected components are used in the filtering and output circuitry to maximise audio quality.

Operating facilities are basic Philips *'104* including that machine's small fluorescent display illuminated in green. However, the pushbuttons are of instrumentation quality and should give a long life.

Three additional buttons can be used singly or in combination to offer a selection of seven audio filters. These filters provide subtle modifications to the upper frequency characteristic, altering amplitude and phase, being designed to complement some of the upper range characteristics of available digital programme. On test these filters were experimented with and it was found that several settings could indeed improve some of the brighter and edgier recordings, moderating them to a more musical balance.

SOUND QUALITY

For reference purposes the *CD1* was set to filter 'one', its nominally flat position. One complication concerned its relatively high output level of 4V for full modulation, which is double the usual figure, and intended to allow the *CD1* to be coupled directly to a power amplifier by making use of the high quality passive volume fitted to the lower deck.

Once correct levels had been established, accurate listening could begin. In fact, this machine showed its true mettle right from the opening bars of the first disc we played, James Newton Howard. It seemed to combine the best attributes of the superior machines tested so far.

In basic character it could be said to resemble the Meridian *Pro MCD*, demonstrating a similarly musical tonal quality. As CD goes, the Cambridge showed this most clearly on orchestral strings, managing to avoid the tendency to brittle 'wiriness' so often heard. In the bass it gave an excellent performance, showing an impressive feeling of extension and power allied to excellent control on percussion. It could portray depth to a surprisingly high degree over the entire frequency range, here rivalling the exceptional transparency of the *'702* decoder unit.

In the treble the *CD1* remained sweet and musical over a wide range of sources. Some discs which had appeared vague in the treble imaging or unduly sibilant seemed to be tamed by the *CD1*, bringing them into clear focus. Stereo images were very stable and well formed, showing very good width and considerable depth.

One strong area of the *'702* performance concerned its competent handling of programme dynamics. Here a player can appear to provide a sound which can be involving or exciting, or alternatively flat and lacking in life. The *CD1* shares the musically-involving dynamic quality of the *'702*, yet its presentation was more relaxed and 'laid back' both in programme and image terms.

Still better results were obtained when we bypassed the pre-amplifier and connected the *CD1* direct. For an audiophile CD enthusiast, this mode provides the best sound of all.

LAB REPORT

The adjustable variations in filter response

only affected the upper treble and the primary response fitted the Philips pattern with the usual minor ripples in the upper range. These are harmless and amount to 0.2dB giving a mild loss of output where they were present. A small loss in output was noted at low frequencies (some 1dB down at 20Hz) but this related to the 10kohm loading of the pen chart recorder used for the measurements. With most pre-amplifiers, the input impedance is rather greater than this, and the low frequency rolloff will move to a correspondingly lower frequency. For example, with a typical 50k input impedance, the −1dB low frequency point will appear at 4kHz. In theory CD players can respond down to dc, and several models in fact specify frequency responses down to 2Hz.

Fine channel separation was shown, together with very good channel balance. Even at 20kHz, the separation still averages 106dB. As a true dual-convertor deck the phase difference between channels was zero. At full level, distortion figures were good rather than excellent, but quickly improved at lower modulation levels. The low distortion at −80dB coupled with the excellent result for level offset at −90dB confirmed the manufacturer's claims of genuine 16 bit performance. On high frequency intermodulation it was fine while the de-emphasis operation was correct. A maximum of 4.25V was available from a low 108ohm output impedance. Mechanical noise was very low, while the track access time was just satisfactory at 9 seconds. No problems occurred with error correction and it easily met the top test disc standards here.

Electrical noise levels were exceedingly low, with the recorded figures for this machine being at the threshold of measurement and in fact all met or beat −112dB, whether weighted or unweighted.

Conclusion

The advanced design and circuitry of this top class CD player have clearly paid off in its exceptional performance. With such a machine, compatibility with upper grade audiophile electronics is assured, and the intrinsic merits of CD as a medium, such as silent surfaces, and inaudible wow and flutter, can make themselves felt. I enjoyed listening to the *CD1*, and consider it to be the best-sounding machine *Hi-Fi Choice* has so far tested.

Test Results

	20Hz	1kHz	20kHz
Channel balance	0.18dB	0.07dB	0.12dB
Stereo separation	−114.6dB	−108.8dB	−106dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	−82.6dB	−83.2dB	−83.9dB
Total harmonic distortion, −10dB		−74.7dB	−
Total harmonic distortion, −60dB		−43.6dB	−
Total harmonic distortion, −80dB		−26.5dB	−
Intermodulation, 19kHz/20kHz, 0dB	−82.3dB		
Intermodulation, 19kHz/20kHz, −10dB	−72.2dB		
Frequency response, left channel	+0.31dB, −0.43dB		
Frequency response, right channel	+0.30dB, −0.43dB		
Signal-to-noise, 20Hz-20kHz unweighted	−113dB		
Signal-to-noise, CCIR/ARM, 1kHz ref	−113dB		
Output level, 0dB, left/right	4.25V/4.25V		
Output impedance	108 ohms		
De-emphasis	5kHz, −4.63dB; 16kHz, −9.25dB		
Error correction capability	>900μm gap, >800μm dot		
Mechanical noise	very low		
Spuriae up to 100kHz	−52.4dB		
Resolution at −90dB	+0.38dB		
Headphone socket	no		
Dimensions (w×d×h)	45×37×19cm		
Estimated typical purchase price	£1500		

MERIDIAN PRO MCD

BOOTHROYD STUART LTD, 13 CLIFTON ROAD, HUNTINGDON, CAMBRIDGESHIRE PE18 7EJ. TEL: (0480) 57339

Meridian have long been associated with digital audio, and indeed, they were the first to demonstrate a conceptual speaker prototype which incorporated amplifiers and the final D/A convertor in the speaker itself. Their early use of a Philips CD player led to research on its improvement and culminated in the extensive Meridian rebuild of the Philips top-loading player models *CD-100* and *'101*, in the form of the well accepted *MCD* player.

Demands for a still better performance led to further research which culminated in the release of the *Pro MCD*. Here a second section has been added below the main player, and this has allowed a proper expansion of circuit boards and power supply to make the designer's life easier and hence facilitate further improvements.

The price is high for a basic non-remote-controlled player, but then all the effort has gone into the performance; the only other available machines that can lay claim to improved sound quality cost up to three times as much! The *Pro* also incorporates some additional features. For example, an 'absolute phase' switch is provided on the front panel, allowing correction to CD recordings where this proves worthwhile in a given system — a small point but important for some users. The machine also shows whether or not the disc being played employed pre-emphasis. Japanese pressings tend to have this while many European ones do not. Some critics claim to note a general difference in sound quality with pre-emphasised discs, but a fair examination of the facts suggests that there is little correlation between the two. For those who would like to have an idea of disc error rates, a weak flashing LED indicator (it requires dimmed lights to be visible) shows this aspect, while another light will flash to show whether a major error has occurred that requires interpolation.

Meridian pioneered research into vibrations in the disc itself, and have marketed an add-on rubber damping mat as an accessory. In the case of the *Pro*, this is a permanent feature. It hangs from the centring clamp, visible as the loading tray is raised.

Display and controls are derived from the Philips original; up to 15 tracks can be programmed and displayed but there is no numeric read-out. Thus neither track timings nor indexing are available. Entry of track numbers beyond 15 (a rare occurence) requires repeated button pressing, while mentally counting. The overall programme may be set to repeat while the cueing does not provide the audible output or 'music cueing' which a feature of almost all up to date machines.

Inside, one discovers that the original Philips mechanism is extremely well-built, using a solid diecast metal chassis, plus precision optical head — later designs from Philips and Japanese competitors are built almost entirely of plastic. The heavy servo head slows track access and some of the recent decks are very rapid in this respect providing track access in one tenth of the time. It is up to the individual purchaser to rate the importance of these various facilities.

By using a second chassis fitted below the original, Meridian have been able to separate the analogue circuits from the digital, and provide the dual 1540 14 bit digital convertors as well as their associated analogue circuitry with separate higher performance power supplies. Following digital filtering, selected 5534 integrated circuit op amps are used to complete the slow rolloff analogue filtering and finally provide the phase-invert option. In contrast to the majority of players the Meridian uses a dc servo system and is direct coupled at the output, so dispensing with the usual output capacitors. These can be a weak point in many inexpensive decks.

Other design details include special attention paid to reducing jitter on the master crystal oscillator, and adjustments made to the laser servo and tracking systems, to minimise error rates.

SOUND QUALITY

Anyone paying the price of the *Pro* player has a right to expect something special in terms of sound quality, and in this respect, the *Pro MCD* certainly delivers. Extended auditioning in a high performance system showed that many aspects of the sound produced by good middle rank players could be improved upon, much as a superior amplifier can improve on the performance of a budget model.

Fundamentally, the *Pro MCD* possessed a well-balanced, musically neutral sound, essentially free from the 'glare' and 'hardness' present in the upper and mid-range of many moderately-priced players. In addition, traces of the edge grain and even 'fizz' often audible in the treble register were absent with the Meridian. In the bass, the sound was firm, with good dynamic attack and well defined extension.

If compared with an early player the *Pro* might be judged mellow, but I do not think that this is really the case, though it is true that the frequency response was measurably if slightly on the rich side. However, it is in terms of its stereo imaging that the good tonal balance scores and the player excels in correctly delineating the natural per-

spective and depth layering in complex orchestral works. Above all, it was easy to listen to. Compared with the finest references, its only failings, and it must be stressed that these are minor, concern a lack of ultimate transparency, and associated far space depth, coupled with a mild loss of dynamic impact and excitement. As those reference machines cost so much more than the *Pro*, the Meridian can be seen to have performed very well on the listening test.

Lab Report

The frequency response followed the Philips pattern, as might be anticipated from the use of the four-times oversampling technology. A very slight additional loss was evident above 15kHz, but it would be hard to say whether this would be audible in practice. Minor response ripples were characteristic of the digital filtering employed. In contrast to the cheaper *MCD* player, the *Pro* is typically non-inverting.

Interestingly, the general order of test results were no better than for the *MCD* itself (reviewed last year in *HFC: CD Players & Turntables*). The results were good, though not in the top class. For example, on the 19/20kHz intermodulation at −10dB level, results as good as −90dB have been achieved, while the *Pro MCD* measured −77dB; still a fine result in amplifier terms.

Output was to the 2V standard from a very low source impedance of 12ohms. Noise levels were very good, while error correction was to the highest standards. Even some damaged discs played better than usual. Our sample displayed a good linearity and the step error at −90dB was held to 2.5dB average, indicating a resolution of 15¾ bit, very close to the 16 bit standard.

Conclusion

Given the present state of the art, Meridian's designer Bob Stuart has shown that the so-called 14 bit system has great strengths (when four times oversampled) and may be developed to an audiophile standard. Unless you can spare £1500 or more there is no better sounding player available in the UK, and the *Pro MCD* can be recommended with confidence. Primarily for music lovers, it may not satisfy those who also value versatile facilities and remote control.

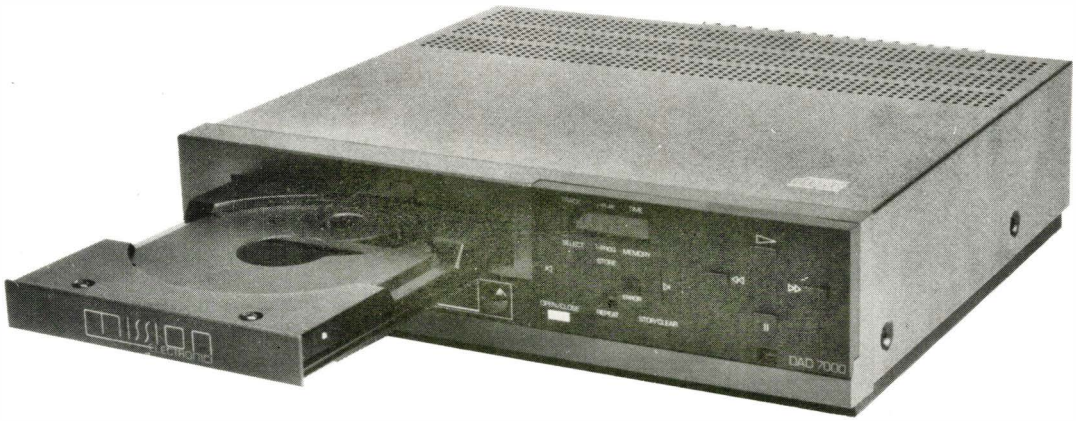
Test Results

	20Hz	1kHz	20kHz
Channel balance	0dB	0.01dB	0.1dB
Stereo separation	−108dB	−105dB	−80dB
Channel phase difference	0°	0°	1°
Total harmonic distortion, 0dB	−96.7dB	−91dB	−85.6dB
Total harmonic distortion, −10dB		−82.3dB	—
Total harmonic distortion, −60dB		−44dB	—
Total harmonic distortion, −80dB		−23.5dB	—
Intermodulation, 19kHz/20kHz, 0dB			−85dB
Intermodulation, 19kHz/20kHz, −10dB			−77dB
Frequency response, left channel			+0.1dB, −1.2dB
Frequency response, right channel			+0.1dB, −1.1dB
Signal-to-noise, 20Hz-20kHz unweighted			−103dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−95dB
Output level, 0dB, left/right			2.04V/2.04V
Output impedance			12 ohms
De-emphasis			correct
Track access time			14 secs
Error correction capability			>900µm gap, >800µm dot
Mechanical noise			very low
Spuriae up to 100kHz			−110dB
Resolution at −90dB			+2.5dB
Headphone socket			yes (variable output)
Dimensions (w×d×h)			32×24×16cm
Estimated typical purchase price			£675

(Note: *for lab report on MCD, see issue 40*)

MISSION DAD7000R

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



Like Meridian, Mission have been researching improvements to a Philips CD player, but chose the later *104* model as the basis for their rebuilding. In fact, the two British companies have different views of CD priorities but in our judgement neither can claim superiority until the CD medium has fully matured; at present the system seems to benefit from a wide range of relatively minor adjustments.

Mission's modifications include improvements to the D/A convertor circuitry, power supplies and the output filtering. However, Mission are still fitting the low grade output cable present on the original *104*, this known to degrade the sound quality rating (in out tests, by around ½ a mark out of ten) when compared with good cable; Mission have said this cable was to be deleted, but clearly have not yet got round to it. Ratings for this review relate to the machine as supplied, but when fitted with decent cable, linear crystal or van den Hul, its position improves to near the top.

SOUND QUALITY

As supplied the *7000R* gave fine results on the listening tests. In tonal balance it was a trifle lightweight, if slightly thinned in the upper mid range, but not seriously so. Its strong quality was a lively dynamic nature with clear exciting transients reproduced without grain or blurr. Stereo focus was precise with a good resolution of depth if with a mildly narrowed sound stage. Articulate detail was preserved throughout the frequency range, and the treble quality was well above average.

LAB REPORT

Mission have tailored the response a little and on my test 10kohm loading, a slight rolloff was evident at both frequency extremes, but small enough to be difficult to criticise. Total harmonic distortion was low, close to the limit for the Philips system, with a very good −93dB result for the in-band noise products of a 20kHz 0dB tone. Midband distortion approached 0.0015% at full level, and this together with the level error at −90dB, suggested a good 15½ bit resolution.

This result confirms that the Philips 14 bit convertors approach 16 bit in the oversampled mode. However, the higher frequency intermodulation results were just average, though still pretty good. A spectogram taken at the −10dB test level showed the cleaner down band performance and better filtering of the Mission version compared with the *CD104;* in particular it is worth noting that the spuriae in the 60-70kHz band were suppressed by 77dB.

The fixed output level was close to standard, sourced from a 308 ohm impedance and rising to 2.2K at 100Hz.

CONCLUSION

Given the fine sound quality and the pricing, the Mission *7000R* can be warmly recommended. With the use of a good cable, achieved by discarding the one presently attached in the factory, still better results are possible. Flying phono sockets could be fitted to the existing cable cut short, or even better still, a service technician might fit a new cable to the appropriate connections inside.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	0.02dB	0.02dB	0.02dB
Stereo separation	−87dB	−89dB	−69dB
Channel phase difference	0°	0°	0.5°
Total harmonic distortion, 0dB	−97dB	−98dB	−93dB
Total harmonic distortion, −10dB		−83dB	—
Total harmonic distortion, −60dB		−43dB	—
Total harmonic distortion, −80dB		−20.5dB	—
Intermodulation, 19kHz/20kHz, 0dB			−87dB
Intermodulation, 19kHz/20kHz, −10dB			−78dB
Frequency response, left channel			+0.05dB, −0.8dB
Frequency response, right channel			+0.05dB, −0.8dB
Signal-to-noise, 20Hz-20kHz unweighted			−106dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−104dB
Output level, 0dB, left/right			2.07V/2.07V
Output impedance			308 ohms
De-emphasis			correct
Track access time			4.5 secs
Error correction capability			>900µm gap, >800µm dot
Mechanical noise			low
Spuriae up to 100kHz			−71dB
Resolution at −90dB			+3.3dB
Headphone socket			no
Dimensions (w×d×h)			32×30×9cm
Estimated typical purchase price			£450

First reviewed: 1985. Rating: Recommended.

PHILIPS CD104B

PHILIPS ELECTRICAL LTD, CITY HOUSE, 420-430 LONDON ROAD, CROYDON, SURREY CR9 3QR
TEL: 01-689 2166

Philips' early top-loading player was substantially built on a large die casting, and the *'104* is distinguished by the same quality of construction. The transport and laser system are also founded on precision castings, these isolated from the outside by a rubber decoupling system.

The decoding system is original to Philips, and consists of four times oversampling, operating with dual 14 bit digital to analogue convertors and a mixture of high slope digital filtering plus low slope analogue output filtering. Many other manufacturers have adopted or adapted this system, which so far has given a competitive edge to reproduced sound quality.

Operation is relatively simple and straightforward, with low mechanical noise levels.

SOUND QUALITY

Following the Philips tradition for good CD sound, the *'104* scored rather above average, in spite of the generally improving sound quality of the new generation of players. The sound was lively and clear with good focus, convincing transients, and a fair presentation of stereo depth. Stage width was fine, while the mid was slightly forward and nasal in tonal quality. The bass was pretty good, and the treble basically tidy and well defined.

LAB REPORT

Channel separation exploited the dual convertors to the full, while interchannel phase difference was virtually zero.

With reducing level, the midband distortion increased correctly, reaching −22.6dB at a −80dB recorded level. For a −90dB level the gain error was mild at 3.4dB and the overall resolution was close to 15½ bit, showing the improvement afforded by oversampling.

The high frequency two tone 19/20kHz intermodulation results rated about average taking, for example, the spectrum analysis at −10dB test level. Here, downband clutter could be seen below 5kHz, while the 24kHz component was around −53dB. The higher frequency components were not well rejected, and similar signals appeared on lower frequency signal tones as well, a feature typical of the Philips system.

Frequency response met +0, −0.35dB limits from 20Hz to 20kHz, both channels, and the ripple is regarded as inaudible.

Track access from a cold start was slow, but once in play mode it skipped to the 15th test track in just 2.5 seconds. As usual with Philips machines the error correction was excellent.

CONCLUSION

Though now keenly priced, the Philips nonetheless faces strong competition from the Japanese machines — but this aside, the *'104* gains recommendation in its own right.

TEST RESULTS

	20Hz	1kHz	20kHz
Channel balance	<0.2dB	<0.2dB	<0.2dB
Stereo separation	−128dB	−123dB	−98dB
Channel phase difference	0°	0°	0°
Total harmonic distortion, 0dB	>−94dB	>−94dB	>−86dB
Total harmonic distortion, −10dB		−82.4dB	—
Total harmonic distortion, −60dB		−40.6dB	—
Total harmonic distortion, −80dB		−22.6dB	—
Intermodulation, 19kHz/20kHz, 0dB			−89dB
Intermodulation, 19kHz/20kHz, −10dB			−79dB
Frequency response, left channel			+0dB, −0.35dB
Frequency response, right channel			+0dB, −0.35dB
Signal-to-noise, 20Hz-20kHz unweighted			−106dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−106dB
Output level, 0dB, left/right			2.055V/2.074V
Output impedance			33 ohms
De-emphasis			correct
Track access time			9 secs (2 secs from play)
Error correction capability			>900μm gap, >800μm dot
Mechanical noise			low
Spuriae up to 100kHz			see text
Resolution at −90dB			+3.4dB
Headphone socket			no
Dimensions (w×d×h)			32×30×9cm
Estimated typical purchase price			£249

First reviewed: 1985. Rating: Recommended.

SONY CD-P552/DA-S702

SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF. TEL: STAINES 61688

Sony now have an impressive line-up of machines, entirely replacing their earlier models. The flagship of the range is the elaborately engineered *CD-P552es/DA-S702es* combination.

The *CD-P552es* is a complete stand-alone player, basically similar to the *502es* but with a higher performance as well as an additional digital data bus output via a single co-axial cable. When used in combination, the *'552es* is merely a transport, since full high-quality signal demodulation is carried out by the *DA-S702es* digital processor.

The *'702* uses an oversampling technique with a 96th order digital filter as well as separate high speed digital to analogue convertors of a new design. With a great emphasis on sound quality, some performance specifications for this decoder are actually poorer than, for example, the previous *CD-P701es*. In other areas, such as high frequency linearity, the superiority of the new system was obvious.

In use, the *'552* is linked to the *'702* via a single cable, with the *'702* automatically registering the incoming sampling frequency (the *'702* will also operate on the 32kHz and 48kHz standards). All the normal facilities on the *'552* remain operative, including the comprehensive remote control, the latter including power operated level, although this is only available via the lower quality variable level socket on the *'552*.

SOUND QUALITY

Listening tests were dominated by the *'702*, via its fixed output, although additional tests were made on the *'552* via its fixed and variable outputs as well. In rank order, the *'552's* variable came last, its fixed output came second, but the *'702* was a handsome first. However, even via its worst output the *'552* led the field in 1985 tests. Moving to the fixed output a 0.5 point improvement in score was heard, while the *'702* defeated our established 1-10 scale by scoring 11! Its performance was so convincing that our expectation as to what was possible from CD had to be revised.

The *'552* showed a fine level of bass precision and extension, and it produced well focused stereo images with fine depth. At times it could sound a touch larger than life, this coupled with rather close perspectives on some programme sections. It proved to be lively and open with a high resolution of detail as well as a generally civilised tonal balance.

Transferring to the *'702* the improvement was striking, akin to moving from a good transistor to a good valve preamplifier. The tonal balance was rich and natural sounding, with an impression of weight and power. Stereo images were sufficiently solid to provide a near tactile quality, and depth planes were beautifully resolved. The bass was 'quick' and excellently articulate, mid transients were deceptively clear and the treble was both sweet and subtly detailed. Its full qualities were not appreciated until it was partnered with a top quality amplifier system, namely an Audio Research *D115* and *SP8 11*.

LAB REPORT

Though for the time being the units are not available as separate items, the lab testing included both the *'552* proper and the *'702*. The former showed an amazingly flat frequency response (not printed); almost ruler flat, it was −0.05dB −0.06dB, 20Hz to 20kHz. The *'702* showed a mild treble lift of +0.24dB resulting from its need to operate over a range of sampling frequencies. Channel balance was excellent for both sections at typically better than 0.1dB. Channel separation was very good on the *'552* but the separate convertors of the *'702* allowed it to reach 100dB of separation even at 20kHz. Its interchannel phase shift remained at zero degrees while the *'552* a mild shift of up to 40° at 20kHz was measured. Downband noise and distortion were very good at 20kHz, reaching −90dB for all outputs but at lower frequencies the *'552* had the higher ultimate resolution. It achieved 0.0001% while the *'702* stuck at a nonetheless very good 0.0015%. At lower modulation levels, the *'552* maintained its superiority though neither machine was exceptional here. The *'552* gave a −90dB signal error of 4.5dB while the *'702* was surprisingly poor at +9dB. These figures suggest 15½ bit resolution for the *'552* and a poorer 15 bit for the *'702*. This was not a subjective problem as the listening results indicated.

Both outputs demonstrated very good figures for high frequency intermodulation, the *'702* again slightly poorer than the

'552. The latter's spectogram showed the −97dB result at the 10dB below peak modulation level. Excellent clarity was shown, with spurious components excellently rejected, both up and down band of the fundamental signals. Ultimate spurious rejection was an amazing 120dB for the '552 and 105dB for the '702.

While both units use two times oversampling, their phase response was not quite as linear as the Philips system, which is truly linear phase within the audible bandwidth. The Sony does however come very close to linear phase, as pulse responses testified. All the fixed outputs provided a nominal 2V, useful for comparative tests, though the '702 could provide up to 5V via its variable output, possibly helpful in studio applications. For the '702 the output impedance was low and constant at 104 ohms, while the '552 offered 330 ohms on its fixed output, and useful variable impedance up to a high 5.8 kohms via its adjustable output. The latter is not really suited to direct power amp connection.

The transport was amazingly fast, reaching chosen tracks almost as one's finger left the button. Mechanical noise was very low. With their new range, Sony now comfortably meet the error correction targets and these units easily covered the worst test error. Signal-to-noise ratios were very similar for the two outputs, with the '552 having the slight edge. The 92.5dB (CCIR ARM 1kHz) for the '702 without pre-emphasis was fine nonetheless. The transport also proved very resistant to shock, a mark of the fine servo design.

Conclusion

This luxury combination was excellently made and finished, offering every conceivable feature and facility. Error correction was superb, the track access almost spontaneous, while the transfer response was highly accurate and virtually linear phase. Reinforcing these qualities the sound quality was outstanding.

Favourably standing comparison with similarly-priced top line analogue turntables, the *CD-P552es/DA-S702es* gains a solid recommendation — price is no constraint here, if the product really delivers the goods, as this one so obviously does. After our 1985 tests, the future of high-quality CD looked considerably more hopeful in the light of this product development.

Test Results

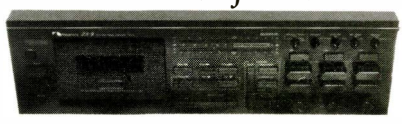
	20Hz	1kHz	20kHz
Channel balance	0.13dB	0.1dB	0.13dB
Stereo separation	−97dB	−103dB	−89dB
Channel phase difference	0°	0°	40°
Total harmonic distortion, 0dB	−96dB	−101dB	−90dB
Total harmonic distortion, −10dB		−85dB	—
Total harmonic distortion, −60dB		−43dB	—
Total harmonic distortion, −80dB		−20dB	—
Intermodulation, 19kHz/20kHz, 0dB			−100dB
Intermodulation, 19kHz/20kHz, −10dB			−97dB
Frequency response, left channel			+0.05dB, −0.06dB
Frequency response, right channel			+0.05dB, −0.06dB
Signal-to-noise, 20Hz-20kHz unweighted			−100dB
Signal-to-noise, CCIR/ARM, 1kHz ref			−94dB
Output level, 0dB, left/right			2.00V/2.00V (also variable)
Output impedance			330 ohms (variable up to 5.8 kohms)
De-emphasis			correct
Track access time			1.3 secs
Error correction capability			>900μm gap, >800μm dot
Mechanical noise			very low
Spuriae up to 100kHz			−120dB
Resolution at −90dB			+4.5dB
Headphone socket			no
Dimensions (w×d×h)			43×35.5×8cm
Estimated typical purchase price			£2000

(Note: test results for CDP552 alone; see text)

First reviewed: 1985. Rating: Recommended.
For full lab reports on CD-P302 and CD-P502 (also recommended) see issue 40.

WHAT'S RIGHT WITH CASSETTES?

There's still an enormous gap between what the Compact Cassette is capable of achieving and what it usually achieves in practice. But, as Noel Keywood explains, there is plenty of scope for improvement now and in the future.



A cassette user of some experience said to me the other day, cassette is a great medium if you can afford a Nakamichi, but if you can't — forget it! By this he meant that really good cassette decks capable of effectively exploiting the medium are still rare, and this is very much the case.

Back in 1964, the launch of Compact Cassette was accompanied by a fairly comprehensive set of standards explaining and governing its performance. But there are still arguments, misunderstandings and discrepancies over some aspects of behaviour, most notably replay response. Whilst this situation continues, most manufacturers treat cassette with less regard than either LP or Compact Disc, so perpetuating its role as a low-fi medium.

SOFTWARE

Approaching Compact Cassette from the software end of things, we see much the same attitude. Until recently, tape duplicators, ruled by the economics of the music business, have been obliged to make musicassettes at the highest rate possible, using the cheapest tape. The results have indeed been low-fi, as everybody is aware, and it seems almost perverse to spend £1000 on a cassette deck of the sort I have reviewed in *The Collection* just to make the most out of them. As they say, you can't make a silk purse out of a sow's ear, so the money would be wasted, were it not for the additional ability to make recordings.

Inexorably, this situation is beginning to change. It is as money flows into the business from spiralling sales of cassette decks, musicassettes and blank tapes that people in the hi-fi and music industries (mainly the latter) are beginning to look up and say 'hey, we're doing well — perhaps we could do even better!'.

And improvements are now being made by tape duplicators in a strong drive to improve the quality of musicassettes. It is, after all, at least theoretically possible to transcribe direct from a copy master tape on to a musicassette without any intermediary processes. This alone suggests near-perfect results, from what would in effect be a third-generation master, at minimum cost. Every time I think of the capital cost and complexity both of the record pressing process and of CD manufacture, cassette seems to make much more sense!

SUPER-FI CASSETTES

There are some super-fi cassettes available that prove this contention too. I have two made by Sheffield Lab for Nakamichi. They are real-time transcriptions from a copy master tape, made using a Nakamichi ZX-9 and TDK metal tape. Stunning sound quality vividly demonstrates just what cassette could be like, manufactured at a fraction of the capital cost of LP or Compact Disc mastering.

As matters stand with normal musicassettes, the most recent good ones are beginning to sound quite respectable. I would not go so far as to say they rival anything other than poor LPs or CDs, but treble extension has now been firmly attained, with plenty of energy present up to 15kHz or more. This has improved stereo imaging, eliminated dullness and provided a sense of clarity. Yet it still takes a very expensive cassette deck, which is a complicated and very exact piece of engineering, to fully reveal these properties.

Recording

For some time now it has been possible to make recordings on cassettes that were as much limited by source quality as by anything else. The best decks with the best tapes can now copy a Compact Disc with just about imperceptible degradation. What one needs to bear in mind here is that cassette rivals LP in most areas of performance and can better it easily in some, notably distortion and speed stability.

So cassette doesn't have to be a low quality, convenience medium, even though in real life it invariably gets reduced to this role by inadequate cassette decks. A lot of the gadgetry and eye-catching displays of modern decks are superfluous, while very useful facilities like automatic tape-type identification are rare. Here's a short, critical guide to what is important in a cassette deck for good sound quality.

Replay Essentials

Many decks, which can replay their own recordings well enough, fall down on musicassette quality. This is because good musicassette reproduction requires good replay head alignment, accurate replay frequency response, accurate Dolby B tracking and reasonable speed accuracy — a deck which meets none of these conditions may still be able to reproduce its own recordings satisfactorily, since recording errors are cancelled out on replay. The first two requirements are usually poorly met on budget cassette decks and even many expensive ones, producing a dull sound and poor imaging from musicassettes. It isn't possible to gauge this from appearances. However, I would suggest that one decently recorded modern musicassette (chrome tape, Dolby B) listened to through good headphones is all that is required to make a rough judgement here.

There should be plenty of high treble, which helps to give metallic percussion instruments in particular a good, sharp, well defined 'ting' rather than that dull, sort of 'clunk' that is so common from cassette. There should be little sense of muffling or 'softness' in the sound and reasonably well defined stereo images. As a rough guide, few cassette decks costing less than £200 can actually manage very well in this area. Auto-reverse increases the potential for error too.

So far, we have found that Aiwa and Akai are generally most successful in getting azimuth and replay response reasonably accurate on their budget products. NAD have an interesting deck in the *6155*; it is unique in having adjustable replay response before the Dolby decoder, so getting tonal balance and compander tracking correct. Musicassettes can be tuned to sound right with this deck, making it one of just a few cassette decks to have any facility designed to give owners some control over musicassette quality.

A good dual-capstan transport benefits both musicassettes and home recordings by eliminating flutter distortion and tightening up temporal definition. The result is a cleaner sound with a good, tight sense of rhythm. The least expensive deck I know of with an effective dual-capstan transport is Denon's *DRM-22*. Again though, this product suggests that anything less than £200-£250 does not buy a serious hi-fi cassette deck, which brings us right back to the statement I quoted earlier that to get cassette to sound good requires expensive hardware — as expensive as that for Compact Disc.

Metal Tape

All modern cassette decks will record with metal tape, but few as yet make a good job of it. Metal tape requires a very strong bias current, which often causes the record head to overload and produce distortion. This can limit the maximum recording level to barely that of ferric tape, especially with budget recorders. Keeping record-level down to avoid messiness in the sound then makes the high hiss level of metal tape more obvious, although Dolby C goes a long way to overcoming it. However, metal's ability to accept a lot of treble before overload nearly always ensures a fine sense of treble definition, in itself quite a benefit.

Good quality ferric and chrome tapes can perform surprisingly well nowadays. Premium ferrics in a good deck can sound as good as metal in a poor one. Chromes have less hiss and often a slightly smoother sound. There's little benefit in using expensive tape in a budget deck.

It is worth remembering that audible hiss is hardly ever generated by the cassette deck itself, so this is not a consideration when buying. It is the tape used that determines hiss level, in addition to Dolby noise reduction of course. True chrome tapes like BASF *CR-E11* have traditionally been quietest, although new TDK *SA* is now an equal. Bear in mind that super-quiet tapes like these don't need and often don't accept very high recording levels, which is good, because head distortion is reduced. Hiss is barely audible with Dolby C anyway.

Current rapid improvements in musicassette quality will narrow the gap between what it currently offers and what it is capable of achieving. Meanwhile, the convenience of the medium and its ability to record will guarantee its future.

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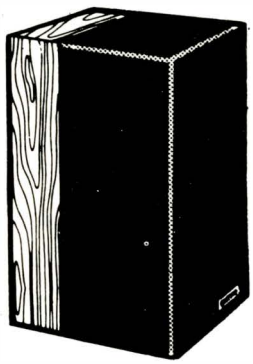

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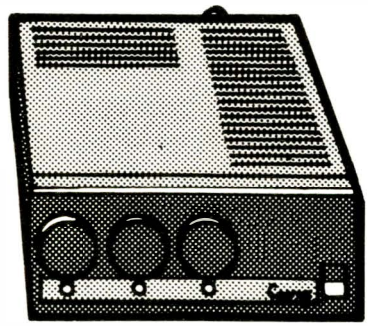

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AIWA ADR550

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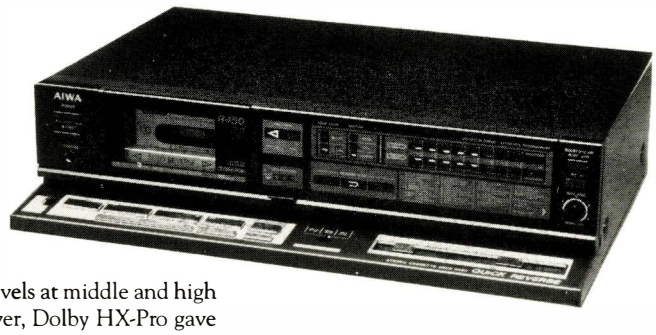

Aiwa's auto-reverse *AD-R550* has a black finish and possesses a colourful array of lights, legends and displays. It is distinguished by having Dolby HX-Pro headroom expansion in addition to the more usual Dolby B and C systems. HX-Pro is not a noise reduction system like Dolby B and C; instead it allows high frequencies to be recorded to higher levels on tape before overload occurs.

Tape types, ferric, chrome and metal, are automatically selected, which is a valuable feature. However, there's no manual override so old metals without sensing slots are incorrectly seen as chrome and cannot be used. A fine tune bias control provides tape matching with ferric and chrome.

SOUND QUALITY

Metal tape gave a neutral tonal balance, apart from 'woofy' bass. A degree of thinness on saxophone and male voice was audible too. These effects were minor though. There was a sense of pitch 'diffusion' to sustained organ notes, due to low-rate speed variation (drift/wow) and treble suffered some roughness due to flutter.

Using TDK *SA* chrome-bias tape, the *AD-R550* sounded 'thin and cold'. Treble roughness and splash on sibilants was again detected — probably due to flutter distortion. Increasing bias usefully resulted in a warmer sound.

Ferric tape again had a 'woofy' bass quality and sounded dull at normal bias. This robbed music of a sense of articulation. Again, decreasing bias improved matters. On musicassettes, replay quality was bright, detailed and open.

LAB REPORT

Aiwa have set peak record level (OVU) to −3dB below Dolby, which is too low for modern tape and peak-read meters. This results in higher tape hiss but low distortion. Our test results bear this out, with hiss around −66dB and average distortion at 0.7%. Other tests showed that the deck is inherently no noisier than usual and that bias has been set sensibly to give balanced maximum output levels at middle and high frequencies. However, Dolby HX-Pro gave less treble improvement on this deck than it did on the *AD-F990*.

All record sensitivites were 1dB out using IEC Primary Reference Tapes. Ferric and metal settings could usefully have been better in this respect. Dolby affected frequency response badly at low levels with IEC-type ferric tapes. producing a curve humped at 300Hz and falling treble and bass either side. Low level musical passages will therefore sound dull. Results were much better with chrome and metal tapes, although slight treble lift will make high level programme a bit bright. In spite of these observations though, all record/replay responses were considered good.

Replay frequency response, Dolby B tracking and speed accuracy were all well set, allowing this deck to give good fidelity with modern pre-recorded cassettes. This is something we considered valuable.

Speed stability in the form of wow was good, but an equivalent level of −21dB (9% distortion) for flutter sidebands suggests audible muddle and was not impressive.

AIWA AD-R450

This machine is Aiwa's least expensive auto-reverse deck, being in effect a simplified *AD-R550*. Although Aiwa have omitted some gadgets, the *'450* still has automatic tape type sensing. Both Dolby B and C noise reduction systems are fitted, but not HX Pro.

Speed was correct in both directions, but replay-only speed stability deteriorated from very good forward (0.07% wow) to average in reverse (0.12% wow). Much the same effect occurred when recording, but flutter was low, as was modulation noise, and in essence this is a high quality transport.

TDK *SA* gave very neutral tonal balance, with slightly fluffy HF due to saturation. Speed stability was again fine. There was enough bias adjustment range for BASF *CR-MII*; it was preferred for low hiss and excellent speed stability — even for critical organ programme.

Ferric tape (TDK *AD*) gave little distortion and even tonal balance, with well differentiated treble.

CONCLUSION

As auto-reverse cassette decks go, the *AD-R550* has some substantial strengths. Dolby HX-Pro, variable bias for accurate tape matching and excellent replay forformance combined to eclipse the performance of potential competitors. The cheaper *AD-R450* is a gadget-free auto-reverse deck of excellent basic specification.

Fidelity with pre-recorded musicassettes was fine in both directions of play and recordings on ferric and chrome tape reached a high standard too. We felt this was also an excellent machine.

TEST RESULTS

AIWA AD-R550

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	20Hz-12kHz good
Speed accuracy	+0.3% very good

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric	20Hz-15kHz very good
Frequency response, chrome	20Hz-17kHz very good
Frequency response, metal	20Hz-17kHz very good
Stereo separation	−51dB good
Distortion	0.76% good
Tape hiss, ferric	−65dB poor
Tape hiss, chrome	−66dB average
Tape hiss, metal	−66dB average
Speed variations (wow and flutter)	0.07% good
Modulation noise	−39dB average
Flutter energy (band level)	−24dB average
MOL, ferric, 315Hz/10kHz	+4.5dB/−10dB average
MOL, chrome, 315Hz/10kHz	+0.5dB/−7dB average
MOL, metal, 315Hz/10kHz	+4.5dB/−0.5dB average

INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	50mV/—V
Mic input sensitivity/overload	0.25mV/32mV
Output level	380mV
Typical price inc VAT	£220

First reviewed: AD-R550, 1984; AD-R450, 1985. Rating: Best Buy. For full lab report on AD-R450, see issue 42.

AIWA AD-F990

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Currently Aiwa's top-of-the-range model, the *AD-F990* incorporates Dolby HX-Pro 'headroom expansion' as well as the usual B and C noise reduction systems. HX-Pro allows higher treble recording levels by dynamic variation of bias. In addition to this, the 990 has Aiwa's 'DATA' automatic tape calibration system that records a short sequence of tones on to tape; the machine monitors these and makes a series of internal adjustments which allow it to give its best results with a wide variety of tape formulations.

Tape selection is automatic, catering for ferric, chrome and metal tape types. The auto tape matching system successfully accepted old metal tapes (without sensing slots) in the chrome position, giving perfect results. The adjustment range of this system is obviously very wide. Dolby selection is also automatic but this can be manually over-ridden.

SOUND QUALITY

On high level programme without sustained piano notes, it was difficult to tell the difference between the *AD-F990* and Compact Disc, when using metal tape (TDK MA). The sound was generally clean and open, with excellent tonal balance. Some harshness, due to flutter sidebands, was occasionally detected. Sustained piano notes were heard to wobble too, due to 5Hz wow. In spite of these effects though, we had to be impressed by reproduction from this machine.

Type II 'chrome' tapes also gave good results, but sounded 'softer' than metal and treble compression was occasionally detected as softening 'top'. The sound was a bit less hard than that of metal and was liked.

Ferric tape sounded a bit brittle, like metal, and noise was higher, but performance was still excellent.

Replay quality with pre-recorded cassettes was excellent, but again we noted the 'jelly-like' quality to pitch that slow-rate wow produces. Otherwise, there was good imagery, plenty of attack on transients and even tonal balance. No degradation occurred at low levels with Dolby B engaged.

LAB REPORT

Replay frequency response, Dolby B tracking head weight and speed were all accurately set, guaranteeing good fidelity with pre-recorded cassettes.

Speed stability was excellent in all areas, except for the presence of 5Hz wow sidebands at −19dB. The ear/brain is very sensitive to wow at this frequency and it is the sort of thing that is audible on organ and piano in particular. Otherwise, little energy was lost into flutter, equivalent level measuring −31dB, or 3% distortion. This is far lower than most decks and results in improved clarity by reducing mush. Conventional distortion was otherwise extremely low at all frequencies, with an average value of just 0.6%.

Peak record level (OVU) has been set −3dB below Dolby flux, even though the meters accurately peak read. Our noise figures, being relative to OVU, are therefore poor. Aiwa put advisory peak level legends on the record display though and if these are followed, noise levels will be no different from those of other good decks.

Due to DATA type tuning and Dolby HX-Pro, maximum output level values in the mid-band and at high frequencies were very high. For example, the IEC I (ferric) Primary Reference Tape had +4dB extra treble headroom than is usual, with no loss in mid-band headroom. Record/replay frequency responses were extremely flat with all tape types.

AIWA AD-F770

At around £50 less than the '990 the *AD-F770* is still packed with features, most of which are really useful. The dual capstan transport reduces flutter to give improved clarity, logic control makes its operation easier, the 'DATA' tape tuning system ensures perfect compatibility with all blank tapes, off-tape monitoring allows recording quality to be checked whilst the recording is actually being made and Dolby HX-Pro gives cleaner, less confused treble.

Curiously, the electronic circuits of this machine have +1dB plateau low frequency boost. The DATA system consistently gives +1dB treble lift with all tapes, resulting in a curious 1kHz dip in the record frequency responses measured. Dolby C emphasised the effect below about −10dB, especially around 300Hz where up to +2dB lift

appeared. This will be a just-audible effect. Otherwise the DATA system, which laudably adjusts bias, record gain and then record equalisation, produced very consistent results. It has enough adjustment range to compensate for all tapes, including awkward ones like BASF *CR-MII* and Maxell *XL-IS*. Exceptional resolution got record-gain right every time, within a fraction of a dB.

Bias was set a bit high in my opinion, favouring low mid-band/bass distortion (0.4% and 0.2%!) at the expense of treble overload which, in spite of HX-Pro, was on the low side — especially for metal tape (−2dB). I suggest the use of high saturation metals (see tape tests) like TDK *MA* and Sony *ES*, since the *770* will tune them in accurately.

The transport had little flutter and not a lot of wow either. Test tones sounded quite stable, although spectral analysis showed that some audible 'pitch indecision' was due to numerous low-level wow components clustered around 5Hz.

Recordings with Sony *ES* metal (DATA tuned) had an 'itchy' high treble, sounding fine and over-busy. Otherwise, an even tonal balance and an excellent sense of clarity made recordings on metal much like the original. Speed stability was excellent, notes having fine steadiness and treble being free of the coarseness which results from flutter.

BASF *CR-MII* had an over-large bass sound due to a small tune error with this tape. Transient edges were slightly softened too. Otherwise, it was metal-like and considered excellent. TDK *SA* was, in comparison, smooth, but in a 'creamy' and opaque sense. It was pleasant, but less revealing than *CR-MII;* bass was lighter though.

Ferric (TDK *AD*) was grainy at high frequencies, a bit smeared and coarse. There was plenty of treble though, and we felt that *AD* performed well on this deck.

Conclusion

The *AD-F770* is a high performance machine, well built and finished. Its recording quality reached a very high standard with all tape types. Replay quality with musicassetes was marred by poor adjustment, resulting in a somewhat bland sound with leaden treble; it is a pity that such a fine deck should be compromised by this important detail.

The *AD-F990* gave impressive sound quality for the cassette medium, with all tape types and with pre-recorded musicassettes. It is an impressive deck. But though the '990 benefits from its dual capstan drive, Aiwa could further hone the speed stability performance to keep this deck up with the leaders.

Test Results

AIWA AD-F990

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	20Hz-20kHz	very good
Speed accuracy	0.15%	very good

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric	22Hz-18kHz	very good
Frequency response, chrome	21Hz-18kHz	very good
Frequency response, metal	25Hz-16kHz	very good
Stereo separation	−52dB	good
Distortion	0.6%	good
Tape hiss, ferric	−65dB	poor
Tape hiss, chrome	−69dB	good
Tape hiss, metal	−66dB	average
Speed variations (wow and flutter)	0.1%	good
Modulation noise	−41dB	good
Flutter energy (band level)	−34dB	very good
MOL, ferric, 315Hz/10kHz	+4dB/−6dB	very good
MOL, chrome, 315Hz/10kHz	+1dB/−6dB	good
MOL, metal, 315Hz/10kHz	+4.4/−1dB	good

INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	52mV/—V
Mic input sensitivity/overload	1mV/65mV
Output level	330mV
Typical price inc VAT	£350

First reviewed: AD-F990, 1984 (reassessed 1985); AD-F770, 1983 (completely retested, 1985). Rating: AD-F770, Worth Considering; AD-F990, Best Buy. For full lab report on AD-F770, see issue 42.

B&O 5000

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B&O have their own ideas about everything, with results both good and bad. Incredibly, the whole body of the *5000* slides forward out of the cabinet under power when part of the fascia plate is pressed. Only play and stop modes can be operated without the 'drawer' open, and the deck was thought awkward to operate.

Good points were a sensible tape position marker and auto-return system, a large illuminated tape counter and inclusion of Dolby HX-Pro. B&O were partially responsible for development of this system, which reduces bias when high level treble signals occur, resulting in much higher maximum treble recording levels.

Connection is via a five pin DIN plug on a flying lead. This has normal line input sensitivity/impedance, so can be connected via a DIN-phono to phono sockets.

SOUND QUALITY

Maxell *MX* metal tape sounded very smooth in the *5000*, though TDK *MA* sounded brighter. Bass sounded dry. Clarity was excellent, as was differentiation of fine treble information. Pitch stability was unusually good, except for the occasional sudden waver in a note.

What did surprise us was the audibility of modulation noise on this machine. Individual piano notes were accompanied by a 'pssss', which had a phantom-like quality to it — it was always in the background, unlike the swishing of dbx, which is much more obvious.

Chrome tape (TDK *SA*) had some bass emphasis, heard as 'whoomph', and it had a dull quality that, for example, removed sibilance from speech. There was some fluffiness and loss of clarity around vocals, compared with metal.

Ferric tape also sounded fluffy or woolly around vocals, but had exceptional differentiation of fine treble information. Large, ponderous bass was again noted. The performance was very good though.

Replay quality of Dolby B pre-recorded tapes was 'soft' at low levels, lacking bite or attack, but not perceived treble. It was better at high levels, but still a bit ill-defined compared with our Nakamichi *ZX-9* reference. Imaging was satisfactory.

LAB REPORT

B&O are very consistent in their ability to comprehend and adhere closely to European (IEC) standards. This is a great strength and is the making of this deck.

It meets the IEC replay response within 1dB from 60Hz. However, a −1dB dip unfortunately positioned right in the Dolby B operating range of 2kHz-10kHz was emphasised by Dolby too, at low levels. This effect results in dulled treble with low level signals from pre-recorded cassettes. Replay speed was sufficiently accurate.

The handbook states that the deck has been adjusted to be compatible with IEC Reference Tapes. B&O now recommend TDK *MA* metal, TDK *SA* pseudo-chrome and BASF *LH-I* ferric, all of which are close to IEC Primary Reference Tapes.

Although the tape transport didn't look, feel or sound (it clanked) very sophisticated, measurement showed flutter sidebands were well suppressed. Analysis showed many wow components, but at a fairly low level. Modulation noise with TDK *SA* was high at −36dB; better than −40dB is possible with this tape.

Dolby HX-Pro resulted in amazingly high measured tape overload levels (that is, MOL). Our IEC I Primary Reference Tape (ferric) gave metal performance, chrome was almost as good and metal tape was +4dB better than usual in treble saturation headroom!

Maximum record level (OVU) is set to Dolby flux, giving −70dB tape hiss with TDK *SA*. The meters read after record equalisation, helping to compensate for music with a strong treble content. Distortion levels were reasonably low, resulting in an overall average value of 1.1%.

B&O 9000

Like other B&O products the Beocord *9000* has received a good deal of attention in view of its styling and unusual features. Press a bar marked 'eject', sited between two blank aluminium panels and the rear one magically swings upward to reveal the cassette compartment. An array of minor facilities, like Dolby B and C, tape and timer functions beside the compartment are also revealed.

Transport control buttons are on the right hand side of the deck, next to a calculator type keypad. The *9000*'s tape counter reads time, after a frustratingly long calibration period of 1.5 minutes. The keypad allows wanted programme position to be entered in terms of time, whereupon the deck will fast wind to that point. Various other search features are available too. Logic rejects punch-in recording, but allows rewind direct from record mode.

Dolby HX-Pro is fitted, allowing higher treble levels to be recorded on to tape, while Dolby B and C noise reduction are also included.

Tape selection is automatic but this can be manually over-ridden to accept ferri-

chromes and metal tape without sensing slots. Automatic tape tuning is also fitted.

Record level meters read the input signal after record equalisation (the signal that is actually going on to tape). This gives accurate indication of treble levels.

Speed stability measured quite well and band level flutter energy was low. However spectral analysis revealed wow components at 1.1Hz, 2.2Hz, 3.3Hz and capstan wow at 6Hz. Measured flutter deviation was not low for an expensive deck, measuring 0.2%. This is the most expensive single-capstan recorder we tested, and possibly the most expensive one available.

B&O have set OVU at Dolby flux level and this, plus falling treble in the replay response, helped toward a very low noise level of −74dB with TDK *SA* tape. On the other hand the overall average distortion figure was high at 2.3%.

On listening tests we found the B&O *9000* gave disappointing results with all tape types. Consistently, the music was acompanied by a low-level distortion with a gritty, blasting character that was unpleasant and wearing. The effect was probably due to a combination of speed instability, distortion and the presence of a degree of extreme-treble lift. TDK *SA* gave a neutral tonal balance but, again, there was a papery, lifeless sound. BASF *Chromdioxid II* gave better results all round. The sound was cleaner and reached a high standard.

Musicassette reproduction suffered from falling replay response; it sounded dull and had muted detail. Stereo imaging was stable and well defined.

Conclusion

We were somewhat disappointed by the performance of the Beocord *9000*. Sound quality using BASF *Chromdioxid II* was good but, in general, results were thought mediocre. Considering its high price it offers poor value for money.

Although the *5000* was found quirky to use and not without its frustrations, it offers good recording quality with modern tapes. Fidelity with pre-recorded cassettes reached a high standard too. A good machine, compromised by the dictates of B&O styling, the *5000* can be recommended.

Test Results

B&O 5000

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	40Hz-20kHz	very good
Speed accuracy	−0.4%	very good

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric	20Hz-18kHz	very good
Frequency response, chrome	20Hz-5kHz	see text
Frequency response, metal	20Hz-5kHz	see text
Stereo separation	−52dB	good
Tape hiss, ferric	−68dB	good
Tape hiss, chrome	−70dB	very good
Tape hiss, metal	−69dB	good
Speed variations (wow and flutter)	0.05%	very good
Modulation noise	−36dB	poor
Flutter energy (band level)	−28dB	good
MOL, ferric, 315Hz/10kHz	+5.6dB/−2.7dB	very good
MOL, chrome, 315Hz/10kHz	+2.6dB/−3.6dB	very good
MOL, metal, 315Hz/10kHz	+3/+3.4dB	very good

INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	65mV/−V
Mic input sensitivity/overload	0.13mV/30mV
Output level	520mV
Typical price inc VAT	£370

First reviewed: 1984 (reassessed 1985). Rating: 5000, Recommended: 9000, Worth Considering. For full lab report on 9000, see issue 42.

DENON DR-M44HX

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Denon's very successful *DR-M44* has now been uprated by the inclusion of Dolby HX Pro, and a number of other improvements, to become the *DR-M44HX*. Linear crystal, oxygen-free copper cable has been used to join the independent (siamesed) record and playback heads to the amps and there is an improved head block and positioning assembly. The counter now shows elapsed minutes and seconds, while both the range and resolution of the auto-tune circuits have been improved.

Otherwise, the *DR-M44HX* remains the same easy to use, gadget free, high-specification machine as before. It has automatic tape-type selection and high speed tape tuning to optimise performance for any blank tape.

A large fluorescent display panel houses the record level meters, the illuminated tape counter and a variety of warning legends. Dolby B and C are included, plus a switchable MPX filter to allow response to reach 20kHz with Dolby operating, if desired. Microphone inputs are absent, as is now common with expensive decks; their manufacturers expect specialised mics to be used, which usually have their own dedicated pre-amps.

SOUND QUALITY

Maxell *MX* gave a wonderfully smooth, silky sound, free of the edginess so common to metals. Some loss of clarity and insight were noticed against digital originals. Piano was not as solid as hoped; there was some pitch diffuseness. Sony *ES* gave a clearer, more up-front sound but with some slight top-end sizzle. Both metals gave impressive results, all the same.

BASF *CR-MII* reached 'metal standards' easily, except on crescendos, where slight muddying of the sound occurred. Otherwise, it combines the smoothness and confidence of *MX* with the clarity of Sony *ES*. Maxell *XL-IIS* was not too successful in comparison, having a warm and enclosed quality, with ponderous bass.

BASF *LH-MI* exhibited excellent clarity for a ferric tape, suffering mainly hiss or treble splash at high levels, if level was increased to minimise the hiss. Maxell *XL-IS* gave very similar results.

On musicassette a piano (Ashkenazy, Decca digital) didn't quite have the solidity and impact expected. Pitch 'diffusion' was again noted and felt to be the cause. Transients were softened out and imaging could have been better. Quite a lot of inner detail was lost too. The *'44HX* is now very good with musicassettes — much better than last year's *'44* — but there is still room for improvement. Actually, the *'44HX* was not better than the *'33HX* with musicassettes, but it still easily out-performs most cassette decks.

LAB REPORT

Denon's dual capstan drive, fitted with a direct drive motor on the *'44HX*, isn't of Nakamichi calibre, but it is clearly superior to single capstan types. Low rate flutter (0.08%), in the range 10Hz to 24Hz, and a trace of capstan wow (0.04%) at 6Hz did exist, but these effects were at a lowish level. Since the *DR-M44HX* is not expensive relative to its specification, Denon manage pretty well here, I feel. However, spectrum analysis clearly showed the *'44HX* to have more low rate flutter than the non-direct drive *'33HX*.

Modulation noise with BASF *CR-EII* chrome tape sank to an extremely low level of −45dB. This was due to freedom from high rate flutter and excellent tape-to-head contact.

Dolby HX Pro reduces bias in the presence of strong high frequency signals, in order to raise treble overload headroom. Certainly, it has improved them on the *'44HX*, but since chrome and metal MOL's have improved too, it appears (as with the *'33HX*) that Denon have taken the opportunity to increase standing bias, improving midband headroom too. The *'44HX* now has relatively high overload headroom right across the audio band which, together with low hiss and hum, gives it wide dynamic range.

The tape tuning system could now cope with BASF *CR-MII* — a super-chrome tape with very high treble output — and gave an almost-flat frequency response (though with an inevitable extreme-treble peak due to the nature of the tape). All other 'difficult' tapes were sucessfully tuned in, frequency response being adjusted to flatness from 30Hz to 20kHz within very fine 1dB limits. Record-gain was adjusted too, giving perfect Dolby tracking. Bias altered little, if at all.

Possibly due to claimed improved head alignment on the *'HX* model, we found less to criticise in the replay-only frequency response than previously. But the *DR-M44HX* is still no Nakamichi in this area; it gets the response ruler flat to 8kHz, after which upper treble falls away to −6dB down at 18kHz. Replay noise and hum, and transport speed were all beyond serious criticism.

DENON DR-M33HX

The *DR-M33HX*, at £290, sits between the *DR-M22* and *DR-M44HX*, borrowing features from each. It uses the dual capstan drive of the *'22*, that is without the *'44*'s direct drive motor. The independent but siamesed record and replay heads seen on both the *'22* and *'44HX* are employed here to good effect and like the more expensive deck, the *'33HX* has Dolby HX Pro, to enhance recording quality, as well as Dolby B and C noise reduction. Bias is also user-adjustable, as on the *DR-M22*.

Maxell *MX* metal gave very smooth and clear recordings, again with near perfect pitch stability. There was a small loss of inner detail on such instruments as maraccas and the delivery was just a trifle too mellifluous. Sony *ES* added some bite and verve, but with slight 'jumpiness' to treble, heard on cymbals and the like. Cymbals did however, ring strongly and clearly, undiluted by flutter.

BASF *CR-MII* super-chrome (bias set near maximum) retained inner and transient detail better than the metals, but had some bass emphasis and lost some of the solidity and sparkle of cymbals. Results were again superb though, and right up to metal standards. All recordings were made with Dolby B.

Hiss became a bit of a nuisance with

ferrics (TDK *AD* and BASF *LH-MI*), so Dolby C was used here. Quality was outstanding for ferric tape, being clearer, easier and more stable to listen to than most decks with metal tape.

DENON DR-M22

A basic machine in terms of facilities, the £200 *DR-M22* still offers certain key features that provide better sound quality, most notably closed loop, dual capstan drive, user-adjustable bias and three heads. Denon have very usefully incorporated automatic tape selection, but without any over-ride to accommodate old metal tapes without sensing slots. This simply means they cannot be recorded properly, but they can be replayed. The transport buttons are very neatly laid out in a horizontal row and clearly identified with big symbols. Full logic allows the transport to punch-in record and to rewind straight from play mode. It worked quickly and smoothly when changing mode.

Replay frequency response had slowly but steadily falling treble, which can marginally detract from the perceived attack and definition in music from pre-recorded cassettes. The fall at 10kHz was −2.5dB. Replay speed was fast at +1.2%, an amount that is just noticeable when a cassette has previously been played at the right speed.

Closed loop, dual capstan drive wsn't quite as effective on this machine as it was on Pioneer's *CT-A9* or the expensive Nakamichis, but it did still eliminate sharp flutter peaks, as it should. TDK *SA* took the flutter figure down to −30dB band level, which is relatively good. BASF *Chrom IIS* would have been even better. Some wow was measurable too but, on the whole, Denon's transport was superior to the usual standard expected.

Bias had been set to give conventional overload ceilings in the centre position of the control. Increasing bias gave rather poor treble saturation figures with ferric and chrome of −12dB or worse. As usual, there was little change in metal performance, because of its insensitivity to bias changes.

Record/replay frequency responses were very flat with IEC Primary Reference tapes, bias being set at its centre detent position.

Sound quality on metal tape was particularly clear, relaxed and unfatiguing. There was plenty of insight into a performance and fine stereo imagery. Treble quality did, however, show itself tinged with flutter distortion. We felt TDK *MA* gave a slightly cleaner sound than Denon DXM tape, because of lower flutter.

Replay performance wasn't as well defined as possible, muddying of strings and loss of immediacy being heard. Imagery and speed stability were good though.

CONCLUSION

All three Denon models have been rated as 'Best Buys'. Though it does not have *HX-Pro*, the *DR-M22* is still a fine machine at the price. The *'33HX* has a few extras compared with the *DR-M22*, most notably Dolby HX Pro, which increases overload margins and dynamic range, putting it on a par with the *'44HX* in this respect. User adjustable bias gave the deck broad tape matching, and recording performance measured well in all areas. This deck delivered excellent record/play sound quality and equally, it played musicassettes unusually well, providing a pitch-stable, tightly defined sound better than most competitors by a significant margin. Since the *'33HX* is also a delight to use, it rates very highly indeed.

On the *'44HX*, recording quality was excellent, becoming tape dependent as much as machine-dependent; the auto tape tuning system matched all tapes with a high degree of accuracy. Musicassette sound quality reached a very high standard too.

TEST RESULTS

DENON DR-M44HX

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	20Hz-11.0kHz	good
Speed accuracy	+0.2%	very good
Noise	−58dB	average

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric	20Hz-20kHz	very good
Frequency response, chrome	20Hz-18kHz	very good
Frequency response, metal	20Hz-20kHz	very good
Stereo separation	−51dB	good
Distortion	0.7%	good
Noise	−53dB	good
Speed variations (wow and flutter)	0.04%	very good
Modulation noise	−45dB	very good
Flutter energy (band level)	−31dB	very good
MOL, ferric, 315Hz/10kHz	+4.5dB/−4.5dB	very good
MOL, chrome, 315Hz/10kHz	+2.5dB/−7.0dB	good
MOL, metal, 315Hz/10kHz	+6dB/+0.5dB	average

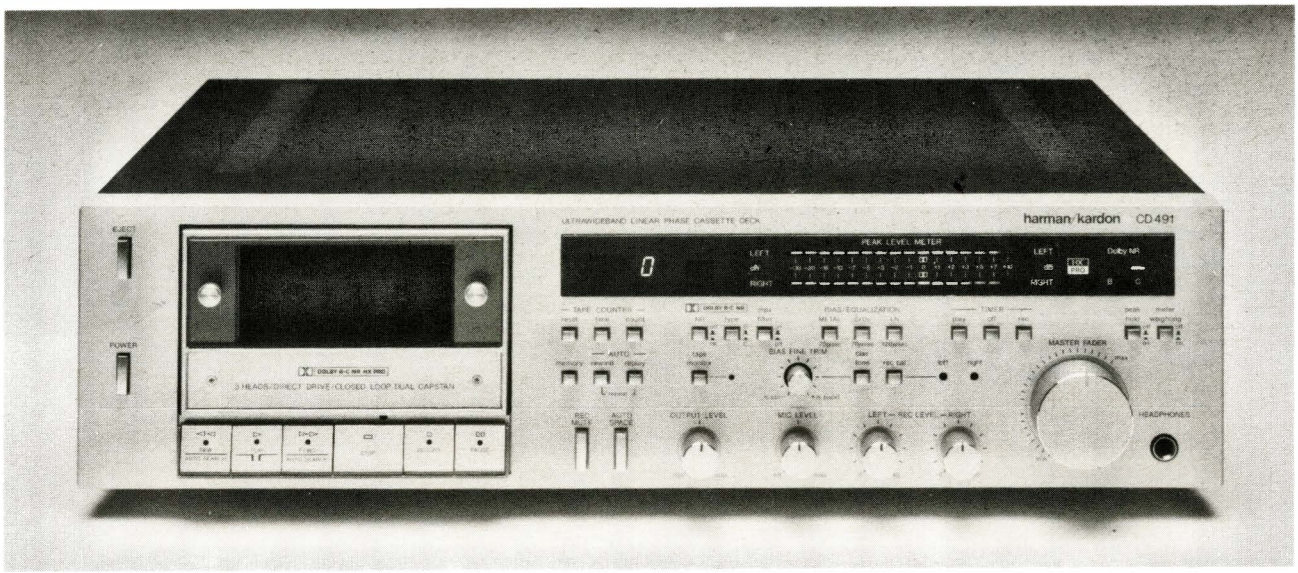
INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	80mV/>3V
Mic input sensitivity/overload	—mV/—mV
Output level	700mV
Typical price inc VAT	£340

First reviewed: DR-M44HX and DR-M33HX, 1985; DR-M22, 1984. Rating: Best Buy.

HARMAN-KARDON CD491

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



Harman-Kardon's *'491* is a large, sophisticated and button-covered deck. The transport uses dual capstan drive for improved speed stability, whilst independent record and replay heads (siamesed) provide off-tape monitoring when recording. Manual bias adjustment is provided for tape tuning, but tape type selection should have been automatic at this price.

The record level meters set OVU close to Dolby level and use two wide range LED displays covering −30dB to +10dB with good resolution. The meters also have selectable peak hold and treble equalisation emphasis options.

SOUND QUALITY

Choice of tapes for the *CD491* is more critical than usual, because of its record-equalisation peculiarities. Sony *ES* metal gave fine results without bias tuning.

TDK *SA* and Maxell *XL-IIS* both proved compatible in the 'chrome' position, suffering very little treble softening compared to metal. Fine detail was well preserved. A non-Dolby recording on BASF *CR-EII* (chrome) tape proved quiet to the point where only slight and very even background hiss was audible and not annoying. Fine transient definition was obtained on tests carried out with noise reduction circuits switched out.

Ferric tapes generally sounded brighter and less fluffy in treble quality than is common. They performed relatively well in subjective terms and we felt the *CD491* made unusually good use of them.

LAB REPORT

Well set bias (detent position) and the presence of HX Pro ensured respectable tape overload figures at low/middle and high frequencies respectively, when recording. Metal tape in particular took a lot of level, at +6dB above OVU. This performance allows the *CD491* to minimise the muddling and dullness that occurs with high recording levels, especially with ferric tape. HX Pro gives a deck like this overload margins comparable with the non-HX Pro Nakamichi decks.

Record equalisation wasn't quite right for IEC tapes, necessitating a bias increase to suppress rising treble. This affected treble overload (saturation) little and successfully 'flattened' most tapes — but not awkward super-tapes like Maxell *XL-IS* and BASF *CR-MII*, which still have excessive treble and are not really compatible. This is a drawback Harman-Kardon could have foreseen.

Replay frequency response was flat to 10kHz and then shelved downward slightly at higher frequencies. Obviously, the latest (1981) replay characteristic has been used, resulting in even tonal balance and healthy treble from musicassettes. Some Dolby B replay tracking error occurred, and this will dull low level music.

The replay amplifier had acceptably low hiss, but hum (and its harmonics) hovered around −60dB, which is not especially low. It was just audible at high gain with low level recordings.

Speed accuracy was fine and speed stability excellent, on replay only and in record-replay. Flutter was suppressed well by the dual capstan transport; analysis revealed a trace of capstan wow at 6.5Hz.

CONCLUSION

Quality of musicassette reproduction and of recordings reached a very high standard, but some super-tapes are not compatible and most European IEC-aligned tapes need bias tuning before compatibility is achieved. Otherwise, thanks to its broad range of facilities, this deck balances flexibility in use with an impressive level of performance. It is certainly recommended.

TEST RESULTS

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	30Hz-20kHz	very good
Speed accuracy	+0.5%	good
Noise	−58dB	average

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric	20Hz-20kHz	very good
Frequency response, chrome	20Hz-16kHz	very good
Frequency response, metal	20Hz-20kHz	very good
Stereo separation	−53dB	good
Distortion	1%	good
Noise	−53dB	good
Speed variations (wow and flutter)	0.04%	very good
Modulation noise	−41dB	good
Flutter energy (band level)	−32dB	very good
MOL, ferric, 315Hz/10kHz	+3.0dB/−1.0dB	good
MOL, chrome, 315Hz/10kHz	+1.0dB/−5.0dB	good
MOL, metal, 315Hz/10kHz	+6dB/+1.5dB	good

INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	40mV/>3V
Mic input sensitivity/overload	1.3mV/64mV
Output level	450mV
Typical price inc VAT	£500

First reviewed: 1985. Rating: Recommended.

NAKAMICHI CR-7

NAKAMICHI B&W (UN) LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING, WEST SUSSEX. TEL: (0903) 750750

As one of the world's most renowned manufacturers of high performance cassette decks, Nakamichi can rely on a flurry of interest and excitement when they introduce a new top model. They have to their credit some innovations of astonishing complexity, so one never quite knows what mysteries are about to be revealed by the launch of a new product.

The *CR-7*, it transpires, is evolutionary rather than revolutionary, although Nakamichi might disagree with this observation. Most captivating is the way it reapplies the single most complex idea this company has ever had, putting it to good use in a simpler, but more useful form. I'm referring to the automatic azimuth in the *Dragon* cassette deck.

When the *Dragon* was released, its auto-azimuth mechanism took all honours in hi-fi for ingenuity and monumental complexity — and this in a business where sophisticated gadgets are not uncommon. What the system provides is automatic compensation of something known as 'azimuth error' in pre-recorded cassettes.

AZIMUTH EFFECTS

Azimuth error is an angular misalignment between the replay head of a cassette deck and the recording of its playing. It results in loss of treble and inter-channel phase error, which in turn render cassettes dull, muffled and diffuse in stereo imagery. This is in any case most people's idea of what a cassette sounds like, the reason being that azimuth error is common and pervasive, but the *Dragon* eliminates it.

The *CR-7* retains the *Dragon's* motor-driven replay head that tilts left or right in order to align itself to a recording. However, it discards the *Dragon's* automatic sensing system, relying on the listener's ears instead. In other words, azimuth is user-adjustable on this deck. It might seem inferior to the *Dragon*, but in practice I find it preferable, even though the *CR-7* is not a *Dragon* replacement or update.

Nakamichi have made a fine job of honing the *CR-7's* azimuth control system so that it is very easy to use and understand. You don't need a special left-handed iridium-tipped screwdriver or computer brain to deal with this one. The head is driven by a stepping motor that moves it in minute increments of approximately 2.6 minutes of arc per step, total range being two-thirds of a degree (40 minutes) either side of a central 'upright' zero position. There's just a slight, quick whirr from the deck as the mechanism operates.

The mechanism takes electrical commands from a front panel adjustment control knob or from 'left' and 'right' buttons on a remote control unit. Yes, this is a remote control cassette deck too. It's what happens when the deck is given a remote command that will make most people's eyes light up with fascination. It will clinch a few sales too, I suspect.

Having seen hi-fi show visitors mesmerized by their RX series auto-reverse decks, which spin a cassette around like a ballerina, Nakamichi have added some pazazz to the *CR-7*. It doesn't do cartwheels (they're probably working on this), but on receiving an azimuth adjustment command the large, bright output level display reconfigures itself almost completely, which is visually startling. Nearly all of it blanks out, leaving only one long horizontal, segmented scale with an orange, illuminated central arrow above it.

The arrow represents the correct 'upright' position of the head, as defined by an International Electrotechnical Commission standard. I used a special test tape to check this was properly set, and it was, which is hardly surprising for Nakamichi. As step commands are received, the scale registers head movement and position by moving left or right relative to the arrow. Individual segments light up or extinguish. The whole thing is unique and completely captivating. But it isn't trivial, nor is the outcome spurious.

As the head approaches correct align-

ment with a recording there is an audible increase in treble content within the music. This adds a sense of clarity and in particular makes percussion, such as cymbals and triangles, sound bright, natural and well defined. Further fine adjustment then focuses stereo images and positions the stereo sound stage. The final result with a good recording is a sense of focus in stereo imaging that is rarely heard from pre-recorded cassettes, plus significantly enhanced treble quality.

Recordings made on the *CR-7* do not require azimuth adjustment and in fact when the deck is put into record mode, the replay head receives an internal command to return to its central position. If it didn't do this, sound quality, as monitored from the independent replay head, would be deceptively dull, even though the recordings were perfect. This azimuth adjustment system applies only to recordings made on other decks, and in particular to commercially pre-recorded tapes (musicassettes).

Tape duplicating plants and engineers will love the *CR-7* for its ability to show them azimuth errors so graphically. And it is this ability to display error and allow aural assessment of misalignment that makes the *CR-7*'s manual adjustment system preferable, in my opinion, to the *Dragon's* completely automatic system.

Auto Tape Tuning

But the auto-azimuth correction system is not all Nakamichi have conjured up for the *CR-7*. On past form, they would hardly consider it sufficient. For the first time in a Nakamichi, automatic tape tuning has been incorporated too. The company use a simple, fast, high resolution technique. It trims frequency response to within 0.3dB limits (at 15kHz ref. 400Hz), by altering bias, and then sets sensitivity. This is not an ideal way of going about things, but what it concedes in performance is more than made up for by the inherent quality of the deck's high performance independent record and replay heads (almost all other manufacturers use siamesed twin-heads, which have drawbacks).

Under test, Nakamichi's tuning system consistently achieved the quoted 15kHz value of 0.3dB and had enough range to cope with awkward tapes like BASF *CR-MII*. However, due to the high test frequency of 15kHz used, a few tapes with peaky treble, like BASF *CR-MII* and Sony *ES*, don't tune flat and sound a bit warm and bass heavy. Otherwise, the system provides an almost ruler flat frequency response from 20Hz right up to 20kHz.

Dual Capstans

Like all expensive Nakamichi decks, from the *BX-300* upward (that is, from £500 upward), the *CR-7* has a dual capstan transport mechanism. The main capstan, which has the task of drawing tape past the heads, is directly driven from a smooth-running motor which, Nakamichi claim, exhibits no cogging action or vibration. Tests I made of speed stability, using spectrum analysis, confirm this. The second capstan is the one that conventional decks lack. On the *CR-7* it is belt driven off the main capstan and runs to 0.2% slower, to provide constant back-tension. This largely eliminates jerking and uneven running, reducing flutter (high rate speed instability) in particular.

Two capstans can end up producing twice as much wow (low rate speed instability), unless the system is dimensioned so that drive line resonances don't correspond in frequency. This Nakamichi do, calling it a 'diffused resonance' transport. Again, high resolution spectrum analysis confirms that what little wow there is, is distributed and not discrete. The overall wow and flutter figure I obtained was a quasi-peak reading of 0.04%, which is very low. Nakamichi claim 0.027%, which proved accurate when a long term average wow was computed from a spectrum analysis.

What such speed stability provides, by suppressing wow, is a rock-stable sense of pitch that makes instruments like piano sound solid, rather than watery or slightly vague. It also eliminates corruption of tempo, making rock music in particular sound 'tighter' than is usually the case from cassette. Perhaps surprisingly, these benefits can be as discernible with musicassettes as they are with original recordings from high quality live or digital sources.

Elimination of flutter improves clarity and gives a nice, open sound, free of roughness and muckiness. This is a significant benefit of good dual capstan drive and was very evident with the *CR-7*. Super-quality cassette transports curiously make cassette sound 'un-cassette like' and the *CR-7* was no exception.

At last, Nakamichi have adopted automatic tape type selection on one of their decks, together with manual over-ride for those who have their own ideas about what equalisation to use. What this simple and not uncommon mechanism does is to identify whether a cassette is ferric, chrome or metal and set bias and eq. conditions accordingly.

The last new gadget I should mention is the tape counter, part of the bright yellow, fluorescent display panel. It provides either a four-digit count or playing time remaining and playing time elapsed. The latter two options actually require quite a lot of extra complexity, plus a microprocessor to do some quick sums. Time points can be very useful though, especially with musicassettes that are timed.

Sound Quality

Perversely, perhaps, I got most excited about the *CR-7's* sound quality with musicassettes. New internal electronic circuitry does, I suspect, give it a better balanced sound than the *Dragon*, which surprised me. There was stronger low frequency content, a better feeling of tonal neutrality and less thinness in the treble. All the *Dragon's* qualities of excellent imaging and a high degree of insight are retained though.

With Maxell *MX*, the metal tape I prefer to use, recordings were so like the original that for all intents and purposes they were identical. Tests showed that the *CR-7* gets massive levels on to metal tape before overload occurs, unlike most decks.

Using BASF *CR-MII*, a fine chrome tape, there was some slight bass emphasis and warmth due to the tuning error, but otherwise an extremely clear, smooth sound with a trace of treble softening at high levels. TDK *SA* and Maxell *UD-II* both sounded very balanced, but with an

almost subliminal sense of unease at high frequencies due to their relatively unsteady output compared with BASF chromes and Maxell *MX*.

As is often the case with very good decks, the *CR-7* made ordinary, good ferric tapes like TDK *AD* sound as good as metals can on a lesser machine. The independent record and replay heads have much to do with this, since they raise the overload ceilings of ferric tape substantially.

Conclusion

Making the *CR-7* easy to operate and providing remote control has made Nakamichi know-how more palatable to the man in the street, providing he has a very deep pocket and an equally deep love of cassettes. This deck is far less of a high-technology wrestling match than a *Dragon* or *ZX-9*, but it improves on their sound quality and still has the sort of innovatory ideas that make a Nakamichi cassette deck a product with a legend in front of it.

Test Results

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	25Hz-18kHz
Speed accuracy	+0.7% fast
Noise	−63dB

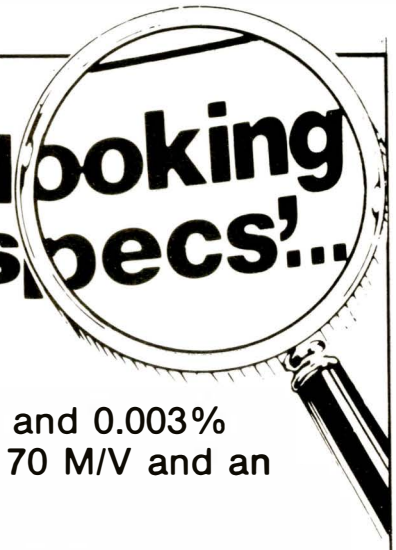
RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric (IEC I)	20Hz-20kHz
Frequency response, chrome (IEC II)	20Hz-20kHz
Frequency response, metal (IEC IV)	20Hz-20kHz
Stereo separation	−53dB
Distortion	0.25%
Noise	−54dB
Speed variation (wow and flutter)	0.04%
Modulation noise	−45dB
Flutter energy (band level)	−33dB
MOL, ferric, 315Hz/10kHz	+4.8dB/−4.5dB
MOL, chrome, 315Hz/10kHz	+2dB/−6.5dB
MOL, metal, 315Hz/10kHz	+6.8dB/−1dB

INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	43mV/>3V
Mic input sensitivity/overload	none
Output level	variable, 1000mV max.
Typical price inc VAT	£1,095

Tandberg have been looking very closely at their 'specs'... Is it time you did?...



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NAKAMICHI BX-300E

NAKAMICHI B&W (UK) LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING, WEST SUSSEX. TEL: (0903) 750750

Listening tests and lab tests consistently showed speed stability to be a very broad ranging problem on cassette decks, responsible for distortion, pitch slurring, diffuseness and many other obscure subjective phenomena. Closed-loop, dual capstan decks eliminate virtually all these degradations in one go and also isolate cassette tape from cassette mechanics, which can themselves produce severe flutter. Nakamichi use this drive system on all their more expensive decks, starting with the *BX-300E*.

Three heads have also been fitted, to allow off-tape monitoring, and user-adjustable bias for tape tuning. Nakamichi fit a single control for all tape types, so settings will have to be memorised when changing between types.

SOUND QUALITY

Metal tape (TDK *MA*) gave very neutral tonal balance, tinged by a slight extreme-treble lift. Increasing bias brought this under control and sound quality was considered excellent. There was solid imaging, good, clean treble and delightful clarity. Reducing bias resulted in treble splash and was nasty. Some low rate speed instability was still just detectable, but we were being extremely critical here and expecting Compact Disc stability from our recordings — something the *BX-300E* nearly achieved.

Chrome tape (TDK *SA*) needed some bias increase to keep treble under control, but with this it was difficult to be certain which was source and which was tape at times. These were astonishing results.

With ferric tape we found that there was a compromise to be had between best treble control (increased bias) and best treble level (decreased bias), using TDK *AD*. In the end, some softness was accepted in return for good control. Other tapes would alter these oservations though.

The *BX-300* replay quality with pre-recorded cassettes sounded less bright than our *ZX-9* reference, but had much of the image stability and cleanliness that allows close listening. It was of a very high standard.

LAB REPORT

As expected speed stability was unusually good with this deck. Flutter measured 0.07% and wow 0.04%. There was virtually no drift. Flutter sideband analysis showed there were none! Some wow was measurable, but it was minor. The deck gave an amazing performance in this area.

Bias adjustment finely trimmed metal frequency response by a few dB at 20kHz, but this is all that is needed, because metal cassette tapes are all much alike.

Chrome adjustment range was much larger, chrome and ferric tapes being more sensitive to bias change than metal. It was just sufficient, at maximum, to give perfect results with BASF *Chrom IIS* (super-chrome) and therefore TDK *SA-X* as well. The deck can therefore be matched to the best 'chrome' tapes available.

As usual with current Nakamichi decks, replay frequency response had a −1dB or so dip at 2kHz, but treble rose steadily above this frequency to +2.2dB at 18kHz. By normal standards though, replay response was very flat and extended — something that is plainly audible we find. Replay speed accuracy was perfect at the pitch control's central setting. Adjustment range was a large 7%.

CONCLUSION

The *BX-300E* was a pleasure to listen to, both with recordings made on the machine and with pre-recorded musicassettes. Re-assessed this time, it remained one of the few really excellent machines we tested.

TEST RESULTS

NAKAMICHI BX-300E

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	50Hz-17kHz good
Speed accuracy	+0.1% very good

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric	25Hz-20kHz very good
Frequency response, chrome	20Hz-20kHz very good
Frequency response, metal	20Hz-20kHz very good
Stereo separation	−53dB good
Distortion	0.5% good
Tape hiss, ferric	−66dB average
Tape hiss, chrome	−69dB good
Tape hiss, metal	−67dB good
Speed variations (wow and flutter)	0.04% very good
Modulation noise	−41dB very good
Flutter energy (band level)	−36dB very good
MOL, ferric, 315Hz/10kHz	+4.9dB/−7dB good
MOL, chrome, 315Hz/10kHz	+3.0dB/−8.2dB good
MOL, metal, 315Hz/10kHz	+6.6/−2.8dB poor

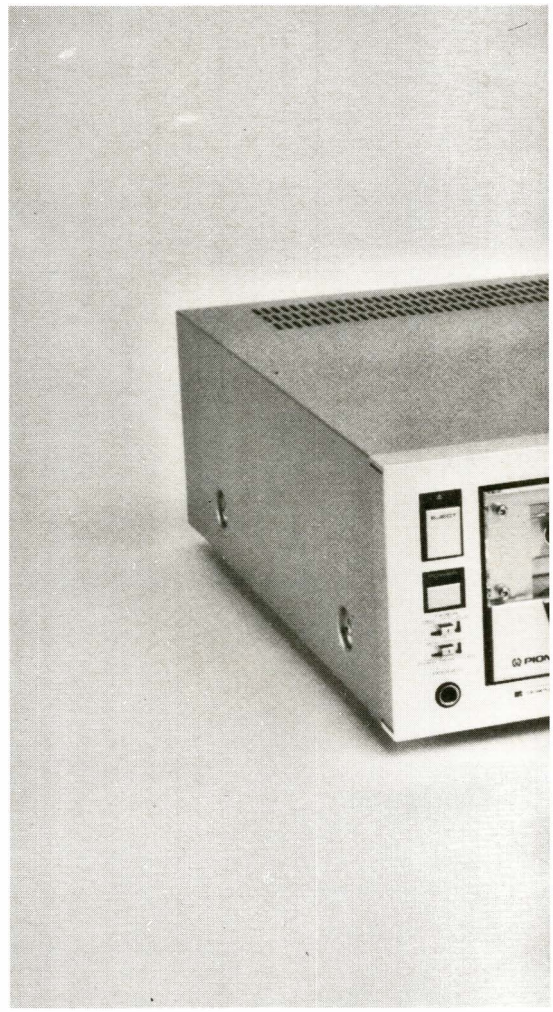
INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	65mV/—V
Mic input sensitivity/overload	NONE
Output level	930mV
Typical price inc VAT	£499

First reviewed: 1984. Rating: Best Buy.

PIONEER CT-A9X

PIONEER HIGHFIDELITY (GB) LTD, 1-6 FIELD WAY, GREENFORD, MIDDLESEX. TEL: 01-575 5757



Now in fashionable black finish and given an 'X' suffix, this deck was originally tested as the *CT-A9*. Pioneer have largely resisted the temptation to load the deck with gadgets, instead going for performance features.

To this end the deck has three heads for off-tape monitoring whilst recording. It has a tape tuning system with standard, under- and over-bias conditions available. The system also adjusts sensitivity and record equalisation. Closed loop, dual capstan drive is employed — a blessing because it can eliminate wow, modulation noise and flutter.

Tape type selection is automatic, which prevents selection error and ruined recordings. Old metal tapes without sensing holes cannot be accommodated.

The record level displays are very bright green and peak read accurately, but OVU has been set −2dB below Dolby flux, which is a bit low. In their handbook, though, Pioneer do say that peaks can run up to Dolby level.

The cassette window is back lit and the tape counter also shows time remaining. Logic control allowed punch-in recording and immediate fast rewind out of record mode. A 'tape return' button would stop play or recording and start rewind back to zero on the counter. This was simple and useful.

SOUND QUALITY

TDK *MA* tape ('peak' auto-bias) gave an exceptionally smooth, stable sound — even on difficult orchestral peaks. It was totally relaxing. Some detail and insight was missing from violin, in comparison with the CD original. The natural sibilance in vocals and speech was slightly muted too. Piano reproduced with astonishing freedom and naturalness, apparently unrelated to background tape hiss. This was especially impressive and due, in no small part, to lack of modulation noise. Pitch stability was perfect, although some wiriness was just discernible with organ.

Chrome tape (TDK *SA*) gave similar results, but was a bit blander, woollier and soft. Fine treble detail was confused or lost, partly from falling treble due to Dolby action. BASF Super Chrom *IIS*, underbiased, gave results as good as metal.

Ferric tape (TDK *AD*) gave astonishing results. Less soft and woolly than chrome (in fact, TDK *SA*), the ferric tape's treble detail was maintained as if saturation was not occuring at all. Hiss was not a problem.

Replay quality was extremely good, but fell well short of the musical insight and image solidity of our reference Nakamichi *ZX-9*, which was a surprise. Tonal balance was correct, but there was a vagueness to the sound that made it uninvolving.

LAB REPORT

Factory-set bias, obtained by not using the auto tape tuning facility, gave very high treble saturation levels, but slightly reduced mid-band overload. Consistency of performance between tape types suggested Pioneer have adjusted this deck carefully and deliberately to obtain better treble performance, at the expense of mid-band headroom — a sensible approach. Standard auto-bias ('peak') set bias even lower, giving ferric tape almost metal performance in treble saturation headroom. All mid-band overload levels (MOL's) were above OVU +3dB to +7dB with ferric, chrome and metal, so adequate headroom is maintained if advised maximum record levels are used.

Record/replay frequency responses proved flat with all tape types. Especially notable was lack of rising treble with metal tape; this ensures that nasties like 'spitching' and hardness don't prevail. Pioneer's tape tuning system was more accurate than many in this respect, but Dolby action increased treble loss at low levels.

We had to be impressed by the transport mechanism. There were virtually no flutter side-bands, resulting in an extremely low equivalent band level value of −38dB flutter distortion. This is the same as 1.2% distortion, compared with around 10% from most decks and up to 30% from the worst. It's a substantial improvement. Equally, modulation noise was exceptionally low at −43dB, compared with a typical level of −38dB. Wow had virtually been eliminated too. Spectrum analysis of the demodulated wow signal showed only 6Hz and 12Hz components and these were at an extremely low level. Wow measured 0.02%, flutter 0.06% and drift 0.03% — amazing results! Note that this deck is more speed stable than any turntable can ever hope to be and almost as stable as a CD player!

Replay frequency response was almost ruler flat from 30Hz up to 18kHz, diver-

gence being 0.5dB or less. The test tape isn't guaranteed to be more accurate than this. Replay speed was correct, but head height a bit out of adjustment. There was 1dB-2dB more Dolby B treble loss at low levels than expected.

PIONEER CT-A7X

We also tested the less expensive *CT-A7X*, which again has been designed as a straightforward no-compromise high-quality deck. Again, it has a dual capstan transport and independent record and replay heads, but is without the auto-tape tuning of the *'A9X*.

With TDK *MA* metal tape, the *'A7X* sounded 'busy' in the treble and had weak lower bass. There was no sign of coarseness or unpleasantness to the treble though. Maxell *MX* metal gave a natural tonal balance and sweet treble. Sound quality was excellent if record levels were not pushed up unduly, except that deep bass was again weak.

With TDK *SA* chrome, vocals were pushed forward in their upper registers, due to a plateau or high frequency emphasis. The sound soon become muddled, due to distortion, at high levels. It was a choice between this or some hiss.

Ferric (TDK *AD*) sounded smooth and relaxed. Treble was free of graininess or coarseness, but did 'splash' a bit. Results were considered excellent for ferric tape.

Musicassettes had a thin, gutless sound, due to lack of deep bass again. There was little depth dimensioning and poor insight into the music. Imaging was mediocre for an expensive deck and transients lacked crispness. The *'A7X* was peculiarly unimpressive with musicassettes.

CONCLUSION

Ergonomic design of the *CT-A7X* was first class, and automatic tape-type sensing proved an asset. Under test, though, the *CT-A7X* showed some surprising weaknesses. Replay response should have been more accurate and HF stability better. Adjustment for blank tapes —especially chrome — was poor. No user-adjustable bias is provided.

Sound quality with chrome tape was found tonally unbalanced but clean, due to the excellent dual-capstan transport. Results with Maxell *MX* metal were fine if record levels were kept down, but then hiss became a bit more apparent. Ferric gave excellent results. Musicassette reproduction should have been better at this price level.

However, the *CT-A9X* produces startling recordings with ferric and metal tape in particular. It was easy to use and fidelity with pre-recorded cassettes was excellent, even though not reaching the highest standards. A fine machine.

TEST RESULTS

PIONEER CT-A9X

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	25Hz-20kHz	very good
Speed accuracy	+0.3%	very good

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric	30Hz-20kHz	very good
Frequency response, chrome	25Hz-16kHz	very good
Frequency response, metal	25Hz-20kHz	very good
Stereo separation	−52dB	average
Distortion	1.4%	average
Tape hiss, ferric	−66dB	average
Tape hiss, chrome	−68dB	average
Tape hiss, metal	−67dB	average
Speed variations (wow and flutter)	0.02%	very good
Modulation noise	−43dB	very good
Flutter energy (band level)	−38dB	average
MOL, ferric, 315Hz/10kHz	+1.2dB/−4.4dB	poor
MOL, chrome, 315Hz/10kHz	−0.2dB/−6.4dB	average
MOL, metal, 315Hz/10kHz	+1.8/−0.6dB	poor

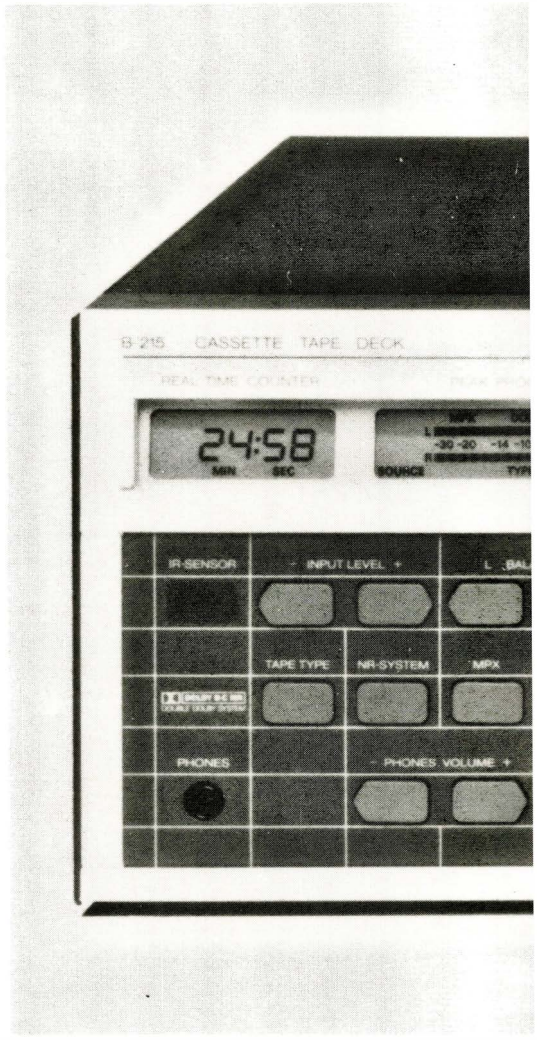
INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	50mV/—V
Mic input sensitivity/overload	NONE
Output level	580mV
Typical price inc VAT	£700

First reviewed: CT-A9X, 1984; CT-A7X, 1985. Rating: CT-A9X, Recommended.

REVOX B215

F.W.O. BAUCH, 49 THEOBALD SREET, BOREHAMWOOD, HERTS WD2 4RZ. TEL: 01-953 0091



Like its predecessor, the *B710 MkII*, this machine has been designed as much for studio as for home use. It is a no-compromise machine at a no-compromise price, solidly built and incorporating some uniquely useful features.

Revox haven't missed a trick with this one: the automatic tape tuning properly adjusts bias, record equalisation and record-gain, holding the values in non-volatile memories for instant recall when changing between tapes. Tests showed that all tapes, including awkward ones like BASF *CR-II* (super-chrome), are tolerated. Automatic tape sensing is used too, but with manual override so, for example, chrome tape can be recorded with 120μS equalisation.

A sophisticated tape 'counter' in fact measures reel speeds and computes elapsed time, allowing time points to be found, with reasonable accuracy, on any cassette, without the need to reel back to the start. Allied to this system is the ability to memorise two time location positions (called LOC1 and LOC2) which can be returned to. Or the machine can be asked to find a specified time point.

Full logic control of the transport is provided, allowing 'punch-in' record. Revox use their own twin capstan mechanism which has no fewer than four motors — there are independent speed-controlled direct-drive motors for each capstan and separate motors for each reel. Siamesed independent record and playback heads give off-tape monitoring. Dolby HX Pro is used to improve on the limited treble overload (saturation) performance of the *B710 MkII* which we noted in 1984. Dolby B and C are provided.

Infra-red remote control is available, and there is a serial link for wire-transmitted commands. No mic sockets are provided though, dedicated external units being necessary.

After careful manual-reading and some acclimatisation, the *B215* proved easy to use, but its operating sequences are not necesarily self-evident, because of strong internal logic. It was a case of 'easy — once you know how'. The transport mechanism, which is an engineering masterpiece, moves with the speed and quiet precision of the best.

SOUND QUALITY

Much like the previous *B710 MkII*, the *B215* provides recordings of the fine clarity on metal tape. There was again the sense of listening only to electronic circuits, but with a bit of hiss added, only noticeable at high volume. Stereo imaging was needle sharp and perfectly steady too. We noticed a very slight wow on critical organ music, which was a pity.

BASF super-chrome tape (BASF *CR-II*) again gave a perfectly even, steady sound, but with some slight softening and diffusion of treble on sustained high levels. It was only this feature that gave chrome away on difficult programme. Otherwise chrome had much the same lucid quality as metal tape on the *B215*.

Transients were best maintained without noise reduction and this was a perfectly valid option on the *B215*, because of its ability to accept BASF super-chrome, which has a very wide dynamic range.

Ferric recordings were slightly vague in treble quality, possessing splashy transients, and some graininess, but this is usually the case. The *B215* still did a good job with most quality ferric tapes, especially Maxell *XL-IS*.

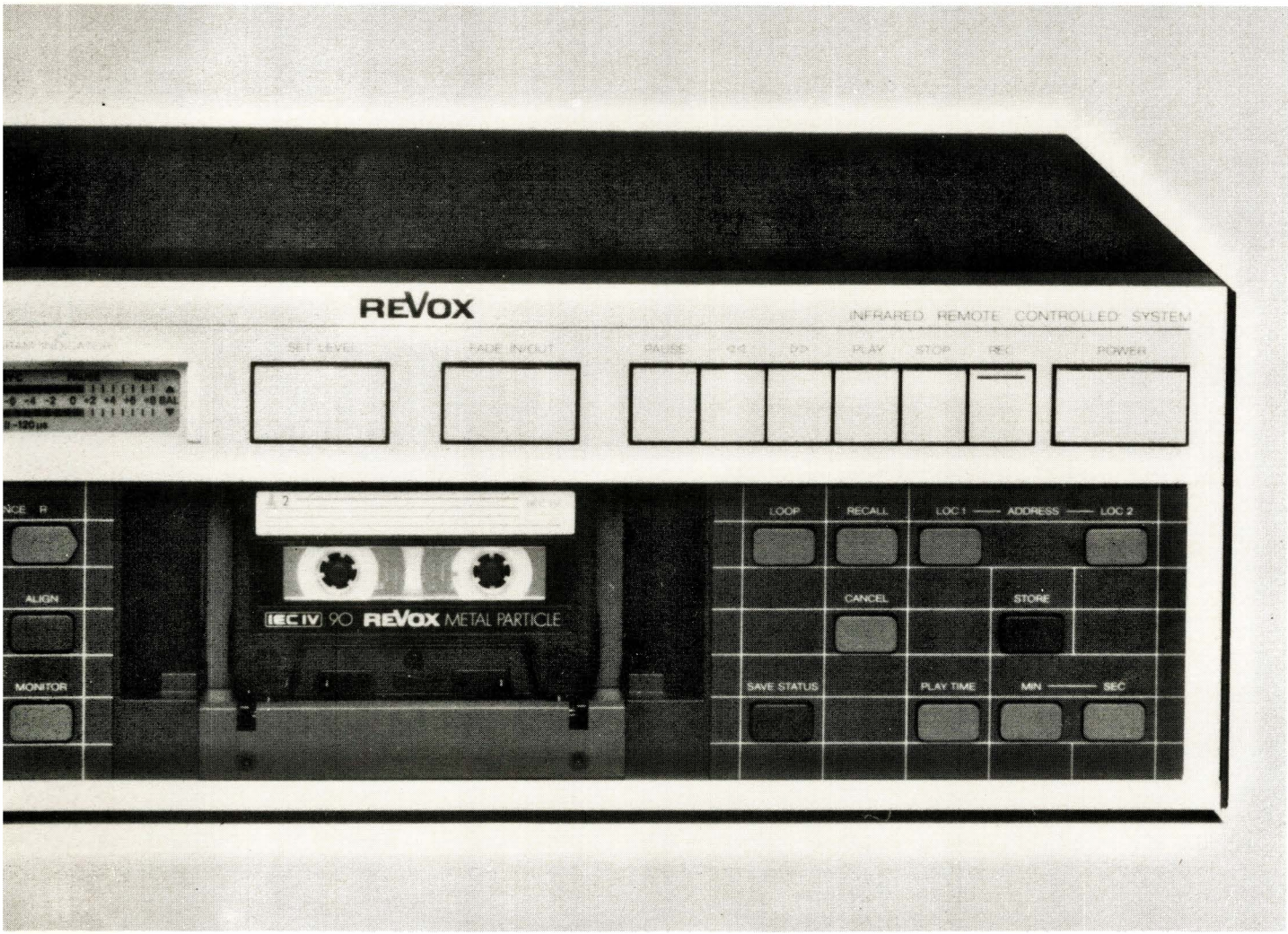
Musicassettes had a sense of depth about them; we felt this deck had the ability to delve into a performance even on relatively poor tapes — a feature noticed only on few other top quality machines. Poor tapes became entertaining, instead of being beyond use. The quality of good musicassettes was properly revealed in relatively stable imaging, cleaning treble delivery and a sense of solidity that added realism.

LAB REPORT

Revox take the same view of IEC replay response as Nakamichi, ignoring the tape as a standard and using a theoretical curve instead. This results in rising treble above 14kHz. Subjectively, the effect is slight but beneficial as pre-recorded musicassettes acquire good transient definition and sharp imaging — all other things being equal.

Speed accuracy proved adequate at ±0.5% fast and replay speed stability extremely good at 0.03% wow and flutter (DIN weighted). At −58dB the replay amps had a bit more hiss than some, but tape hiss will exceed this figure so it is acceptable. There was hum, measuring −64dB at 100Hz and −66dB at 150Hz. This could be heard under critical conditions. Since some budget machines manage better, Revox should cure this. Dolby B replay tracking was excellent.

The LCD record level meters have OVU at Dolby level. Recordings to this level were unaffected by hiss from either the record amps or replay amps, Dolby C giving



−19dB of noise reduction, reducing hiss to −72dB with BASF chrome, for example. Hum performance was mediocre, being identical to the replay-only results.

Record overload levels (MOL and saturation) are now very good, being a hair's breadth below Nakamichi levels. Distortion was higher than the rock-bottom results from a Nakamichi though, due to the latter's use of non-siamesed heads.

The computer tuning system gave a high degree of repeatability in its settings and we couldn't fault it. As a consequence, tapes always gave the same performance, even after repeated runing; some systems are erratic.

Dolby tracking was near-perfect and frequency response with all tapes ruler-flat. This was a fine and consistently repeated performance.

Spectral analysis showed negligible flutter with BASF's latest chrome tapes, but revealed slight capstan wow at 5Hz and 10Hz.

Conclusion

A complex machine, the Revox has a twin-capstan transport, with each capstan directly driven. The hubs have their own speed controlled dc motors, all four motors being mounted on a solid, die-cast chassis — as is the solenoid controlled head platform.

Computer tape tuning optimally sets bias, record gain and record equalisation for any tape. Automatic tape type sensing is employed with manual override. There are non-volatile memories for tape tune state and for remembering time points on a tape, time positions being computed automatically from hub speeds. Infra-red remote control is fitted, and so is a hardwire serial link.

The *B215* had a fine measured performance, ignoring the slight blemishes of low level hum and capstan wow, which would rarely be heard. It gave impeccable sound quality both with recordings and with musicassettes. This Revox model is undoubtedly one of the best cassette machines available.

Test Results

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	22Hz-20.0kHz	very good
Speed accuracy	+0.5%	good
Noise	−58dB	average

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric	26Hz-20.0kHz	very good
Frequency response, chrome	26Hz-20.0kHz	very good
Frequency response, metal	26Hz-20.0kHz	very good
Noise	−53dB	good
Speed variations (wow and flutter)	0.03%	very good
Modulation noise	−44dB	very good
Flutter energy (band level)	−39dB	very good
MOL, ferric, 315Hz/10kHz	+2.5dB/−1.8dB	average
MOL, chrome, 315Hz/10kHz	+0.5dB/−5.0dB	average
MOL, metal, 315Hz/10kHz	+4.0/+1.2dB	good

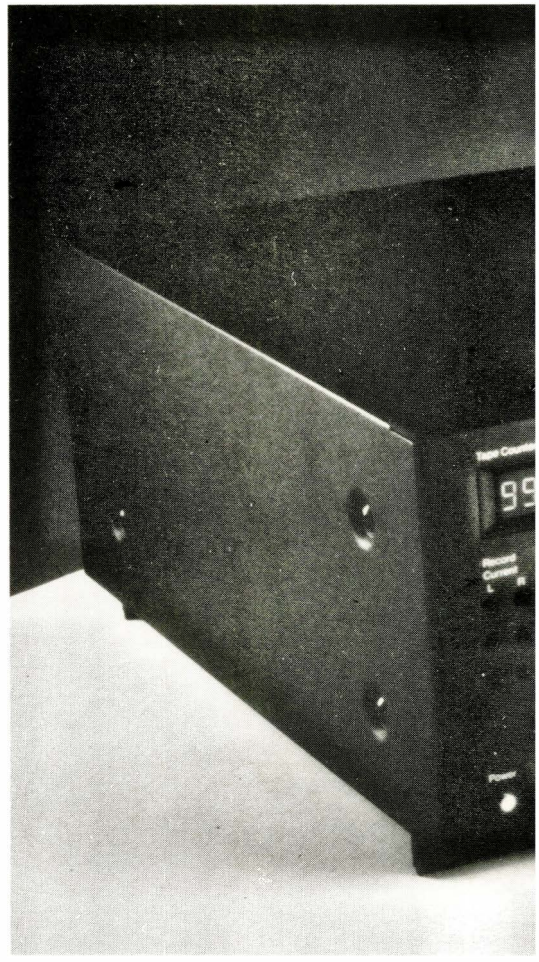
INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	50mV/>3mV
Mic input sensitivity/overload	−mV/−mV
Output level	750mV
Typical price inc VAT	£1207

First reviewed: 1985. Rating: Recommended.

TANDBERG TCD 3014A

TANDBERG LTD, REVIE ROAD, ELLAND ROAD, LEEDS LS11 8JG. TEL: (0532) 774844



There are relatively few manufacturers of highly expensive cassette decks in the world, even though those that do make them claim there's plenty of demand. Nakamichi and Teac are the best known Japanese names, whilst in Europe Revox are pre-eminent. However, in the *3014A* reviewed here, Tandberg also have a model vying for a position at the top.

Tandberg are a Norwegian company whose presence and fortunes in Britain have waxed and waned somewhat over the years. They had quite a success with a cassette deck known as the *TCD-310* some years ago and have even had a television manufacturing plant in the UK, so their commitment has been considerable. Tape decks are something of a speciality though and the *3014A* reflects this in the scope and nature of its features.

The heart of any good cassette deck is its transport system and this should be an effective dual capstan type. Tandberg's design uses four motors, one for each of the two tape hubs, one to drive the head platform into engagement with the cassette and one for both capstans. They are servo controlled, which means that a speed related output signal is produced, enabling external circuits to apply correction if necessary in order to keep speed accurate and uniform.

Like Nakamichi, Tandberg mention the problem of corresponding resonances producing cumulative speed instability in a dual capstan transport, so they too tune the rotating components to have dissimilar inertias ('mass differentiated' flywheels as they put it). However, the Tandberg transport uses belt drive from the capstan motor to the drive capstan, with a jockey belt from the flywheel to the back tension capstan. Direct drive to the main capstan at least, is more common these days. Analysis revealed more drift and low rate wow, especially at 5Hz, than I expected, but very little flutter.

INDEPENDENT HEADS

Confirmation of this company's dedication to producing a no-compromise design is found in their use of entirely independent record and replay heads. This is something that otherwise only Nakamichi dare present to the outside world. The drawback is that either the record or the replay head has to be made adjustable to counteract cassette-generated azimuth error. Otherwise, cassettes would sound different when turned over or between samples.

This is made clear in Tandberg's operating manual where they say: 'Azimuth adjustment should always be carried out before you start a recording, when you turn the cassette over or when you change to another cassette'. Since the record head is made adjustable, these observations only apply to recording, not to playing musicassettes, because the replay head is fixed. It's a system Nakamichi used with their *ZX-9* but have abandoned with the new *CR-7*, in favour of an adjustable replay head which, one could argue, makes life even more difficult. However, implementation is a key factor here.

Tandberg fit a mechanically linked azimuth adjustment knob just to the left of the cassette holder. They also provide a test system that provides a 15kHz tone. The idea is to tune for maximum signal, as indicated by the record level meters. In practice it wasn't as easy to use or so critical as the phase sensing system of the *ZX-9* or the motor driven system of the *CR-7*. It did prove effective all the same.

The main benefit totally independent heads have over siamesed types (which are more common) is that they are not performance limited by size. This allows very high recording levels to be achieved, especially at low frequencies, by minimising core saturation. It also helps to keep bass response flat, since contour effects are more easily dealt with, and it eliminates cross-feed at high frequencies, which can foul up Dolby operation when monitoring during the record process.

The benefits are most obvious with metal tape, where the *TCD-3014* can achieve +5.5dB above the IEC reference flux using the IEC IV Primary Reference Standard tape. Few decks can match this — and higher figures can be achieved with good commercial tapes like Sony *ES* and TDK *MA*. It is not achieved at the expense of curtailed treble overload margins either, by using over-strong bias, saturation being −1.5dB with IEC IV, which again is a good result. Together with lowish hiss and virtually no hum, the *3014A* provides more dynamic range than usual, especially from metal tape, solely because of its independent heads.

'DYNEQ'

Tandberg, like Nakamichi, choose not to modulate bias with Dolby HX Pro in order to gain overload headroom. Instead they have what they term 'Dyneq'. This isn't the same as HX Pro at all in fact. What it does is to prevent treble overload by dynamically reducing high frequency record equalisation in the presence of strong treble signals. As an overload prevention device, it minimises distortion rather than overcoming saturation, as does HX Pro.

In appearance the *3014A* is functional, if not beautiful. Large, round, spun-aluminium buttons are easy to press and since they actuate electrical switches, they have a light operating action. All commands go into logic circuits and thence out

to operating relays, solenoids and a motor driven head platform. This allows the use of remote control, available as an extra.

I liked the open cassette tray, which speeds up loading and viewing. However, this deck is a bit curious in that it locks the cassette into place, necessitating a separate 'release' action before it can be removed. Fast winding proved very fast, like the old *TCD-310*.

Tape Tuning

Operation of the basic transport proved slick, but some of the controls felt a bit coarse by modern standards — and this does apply to the method of tape tuning provided. A special screwdriver is supplied for bias and record gain (sensitivity) adjustment. Inevitably, it has to be poked into holes on the fascia and jiggled around until it engages a potentiometer lurking beneath. There was too much adjustment range, even with metal tapes, making the adjustment action coarse. Using 315Hz and 15kHz test tones from an internal generator, performance is trimmed independently on each channel using the record level meters as indicators. They have limited resolution, so end results are a bit variable, and lab measurement revealed that frequency response above 10kHz often deviated from flatness by a few dB or so after adjustment.

This was especially the case with Type II tapes (chromes and pseudo-chromes). Record equalisation didn't suit them very well, as a hump in response at 5kHz in the IEC II response showed. But IEC I (ferric tape) and IEC IV (metal) otherwise clearly demonstrated how the independent record and replay heads successfully gave flat bass response and strong treble output up to 20kHz.

Sound Quality

The replay-only frequency response, which affects musicassettes, was unusual in rising steadily above 1kHz, reaching no less than +3.5dB at 18kHz. This is almost certainly the prime cause of the bright sound I heard when playing musicassettes. Making a cassette deck over-bright sounding is a dangerous thing to do, because good modern musicassettes have plenty of treble, but it is still not subjectively clean enough to withstand too much emphasis. I suspect that Tandberg had dull sounding ferric musicassettes in mind when they tailored this. The rising response degrades replay hiss by a few dB as well.

Recordings with metal tape (new TDK *MA* and Maxell *MX*) remained clean and unmuddled at very high recording levels, so hiss was little problem, especially with Dolby B or C in action. The flat, extended frequency response characteristic made itself known as a lack of tonal coloration. There was, however, some slight coarseness at times and both wow and drift added a certain amount of pitch unsteadiness to critical programme, such as piano. But generally the *TCD-3014A* provided a high standard of recording quality on all three tape types and proved flexible enough to match all tapes available.

Conclusion

Tandberg have made a concerted effort with the *3014A* to wring the highest standard of performance possible out of cassette, irrespective of what complications this might involve. Their machine isn't the easiest to understand or use, but it is a very dedicated product of high performance.

Test Results

REPLAY OF PRE-RECORDED MUSICASSETTES

Frequency response	26Hz-15kHz
Speed accuracy	+0 (no error)
Noise	−60dB

RECORD/REPLAY USING BLANK TAPE

Frequency response, ferric (IEC I)	26Hz-20kHz
Frequency response, chrome (IEC II)	26Hz-17kHz
Frequency response, metal (IEC IV)	20Hz-20kHz
Stereo separation	−54dB
Distortion	0.6%
Noise	−51.5dB
Speed variation (wow and flutter)	0.08%
Modulation noise	−44dB
Flutter energy (band level)	−33dB
MOL, ferric, 315Hz/10kHz	+4dB/−5.5dB
MOL, chrome, 315Hz/10kHz	+1.5dB/−7dB
MOL, metal, 315Hz/10kHz	+5.5dB/−1.5dB

INPUT/OUTPUT PERFORMANCE

Line in sensitivity/overload	100mV/>3V
Mic input sensitivity/overload	none
Output level	variable, 720mV max.
Typical price inc VAT	£733

RECEIVING FM STEREO

A live music broadcast on BBC radio gives you better fidelity to the original than any but the finest analogue disc system can, but FM radio is neglected by many hi-fi users — if you are one of these, give it another chance!

Martin Colloms' recent tests for *Hi-Fi Choice* have attempted to cover those tuners which are the logical partners of the amplifiers covered. All were examined carefully in the laboratory and given thorough subjective tests, even though the reporting of these results is somewhat brief.

LABORATORY TESTING

Lab testing included a number of distortion measurements, for example, at 100% modulation depth, 1kHz, with the results for both mono and stereo working. Response to over-modulation was subjectively assessed on programme as well as by a 130% modulated 1kHz tone, with distortion readings here in mono.

Capture ratios of lower than 1.3dB are pretty good, the range generally between 0.6 to 3.0dB, the latter upper limit being regarded as poor. AM rejection ratios go from 50 to 80dB, the former an adequate result, the latter an excellent one.

Ultimate signal-to-noise ratios (CCIR ARM weighted with a 1kHz reference) for mono and stereo are given, the latter rather more relevant. Some tuners do add a degree of audible hiss to broadcasts. Stereo separation is measured from 1 to 10kHz, with figures of 45dB, and 35dB, 10kHz considered pretty good.

Alternate channel selectivity quantifies how well the tuner can receive a weak distant transmission spaced closely on the dial to a strong station.

AERIAL REQUIREMENTS

FM reception conditions can vary considerably with quite small differences in district, address or local geography and buildings. When purchasing a tuner for use in a difficult area, it is worth having an arrangement with a dealer to return those models that prove unsatisfactory at your location. We cannot also stress too strongly the need for a good, preferably roof-mounted aerial for FM if a hi-fi performance is to be achieved from a good tuner — a poor or badly sited aerial with multi-path effects can produce a constant 10-15% distortion on peak modulation. Fitting an aerial, if required, must therefore be included in the real cost of a tuner, and may influence or dictate the purchase of a cheaper or a more expensive model.

Aerial suppliers and riggers should have all the necessary knowledge of local reception conditions, but if in doubt, you can obtain reception area maps and advice from the BBC Engineering Information Department, Broadcasting House, London W1A 1AA, and for independent commercial stations, from the IBA Information Service, Crawley Court, Winchester, Hants SO21 2QA.

LISTENING TESTS

For the auditioning, the tuners were tried on a variety of local and regional stations at the author's North London address. Critical tests included the use of a studio quality stereo encoder and low distortion transmitter/generator, fed with master-quality digital PCM programme material. The degradation imparted by the tuners was assessed on a before-and-after transmission basis. In addition, the low-signal radio frequency and quieting performances were subjectively assessed, particularly with respect to the odd whistle which was still to be found on some digitally synthesised tuners. Stereo signal-to-noise was also assessed.

HITACHI 5500 Mk II

HITACHI SALES (UK) LTD, HITACHI HOUSE, STATION ROAD, HAYES, MIDDLESEX UB3 4DR. TEL: 01-848 8787

The long established *5500* design is now available in 'Mk II' form, still competitively priced. It proved rather complicated to measure since its various modes effectively result in four sets of tuner results! These have been sensibly simplified in the table. A field condition computer system ('FCCS') can select various modes according to reception conditions, automatically assuring optimum sound quality and noise suppression. Medium wave AM and VHF/FM coverage are offered, but long wave has been omitted. Sixteen presets are available, with auto-seek and manual tuning facilities; in addition, an RF attenuator plus narrow and wide IF options may be selected.

SOUND QUALITY

The overall sound quality was highly rated on FM, with a very low-noise background in stereo, fine instrumental detail plus clarity, together with well focused, wide stereo images. Bass was good, the mid was tonally a touch thin, and the treble pretty clean. Stereo depth was unexceptional. On the narrow IF setting the image quality was degraded, together with a loss of detail.

On AM the sound was basically satisfactory.

LAB REPORT

Previously the *5500* could overload on strong RF signals, but now the switchable RF attenuator has provided a solution. Good sensitivity was shown (10dB worse with the RF attenuator), and although the signal-to-noise ratios were very good, the muting threshold was set too low for my taste at around 7μV. On 'wide', the alternate channel selectivity was acceptable, indeed better than usual at 29dB, and when required, the narrow IF gave a fine 74dB of rejection. The multiplex pilot tones were excellently rejected. The capture ratio results varies with the different modes, from an excellent 'narrow band/single' result, to 4dB on 'wide/double'. AM rejection remained pretty constant at

around 60dB. On the best settings the total harmonic distortion was around 0.5% in stereo, worsening to 1% on 'narrow/double'.

Frequency response was rather 'tailored' with 1.8dB of bass lift by 80Hz, and the same degree of cut at 10kHz; it was 3dB down by 13.5kHz.

Conclusion

In its latest form the *5500 II* showed a versatile all-round performance, both on the RF and the audio front, though some initial learning will be needed to obtain best results. Recommended.

Test Results

Tuner	
Sensitivity for 50dB signal-to-noise Mono/stereo	5μV/55μV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	for all settings, 80dB/69dB
Muting threshold	single, wide IF 7μV (narrow 6μV)
	double wide 17μV (narrow 15μV)
Alternate channel selectivity	29dB (narrow, 74dB)
Pilot tone rejection, 19kHz/38kHz	−69dB/−123dB
AM rejection	single wide −62dB (narrow −59dB)
	double wide, −61dB (narrow −60dB)
Capture ratio	wide, 1.5dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	single, wide −66dB/54dB
	(double −65dB/−51dB)
Stereo separation, 1kHz/5kHz/10kHz	
	−52dB/−52dB/−48dB (narrow, 49dB/48dB/42dB)
Output level, 100% mod	single, wide 752mV (narrow 707mV)
Channel balance, stereo	0.24dB
Dimensions (width, depth, height)	43.5×28.5×5.5cm
Typical price inc VAT	£200

First reviewed: 1986 (FT 5500 Mk I, 1985). Rating: Recommended.

PIONEER F-99X

PIONEER HIGH FIDELITY (GB) LTD,
FIELD WAY, GREENFORD,
MIDDLESEX UB6 8UZ. TEL: 01-575 5757

Pioneer's original *F90* tuner had a distinguished record, including high ratings in previous issues of *HFC*. In contrast with the usual policy of planned obsolescence, Pioneer have chosen to enhance this model, in the form of the '99X.

A total of 16 stations, FM and medium wave in any combination, may be programmed for pre-set tuning; long wave AM is not covered. Facilities include manual and power tuning, plus a variable IF bandwidth, the latter allowing optimum audio performance in 'wide' mode. The aerial socket is soldered directly to the printed circuit, a mechanically unwise thing to do, and on our sample the initially poor sensitivity was traced to a broken connection here.

Sound Quality

This design's reputation held up during the auditioning. Good on narrow IF, it improved noticeably on 'wide'. The bass was firm and clean, with exceptional stereo stage width and focus. Image depth was fairly good, though the midrange sounded a little 'thin' with a mild 'edginess' in the treble. Complementing these FM results, the AM performance was well above average.

Lab Report

This tuner provided an exceptional sensitivity combined with an excellent front end, this ensuring a strong performance over a wide range of reception conditions. In 'narrow' mode, the selectivity was very good, with an excellent AM rejection. The capture ratio varied with IF bandwidth and was at its best on the wide setting. Pilot tones were rejected well and the results for ultimate signal-to-noise were up with the best.

Significant advances have been made over the *F90* with respect to distortion, which in 'wide' mode, full modulation stereo, held to 0.05%, −66dB — a superb result. Channel separation held well at 51dB at 1kHz, 53dB at 1kHz, 53dB at 10kHz, and the results degraded little on the narrow IF setting.

Channel balance was perfect, and the audio output was 785mV from a low output impedance of 900ohms. Frequency response was wide and flat, ±0.2dB through the midband, with the −3dB points at 10Hz and 16.5kHz.

Conclusion

This powerful tuner lacked long wave but would perform well under some of the most difficult reception conditions. The sound quality was good, both on FM stereo and AM, and a strong recommendation was assured.

Test Results

Tuner	
Sensitivity for 50dB signal-to-noise	
Mono/stereo	2.4μV/24μV (narrow IF2.0μV/24μV)
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	−81dB/−70dB
Muting threshold	13μV
Alternate channel selectivity	−15dB (narrow, 76dB)
Pilot tone rejection, 19kHz/38kHz	−60dB/−83dB
AM rejection	−76dB
Capture ratio	1.2dB (narrow, 3.0dB)
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	−69dB/−66 (narrow, −65dB/−50dB)
Stereo separation, 1kHz/5kHz/10kHz	
	−50dB/−51dB/−53dB (narrow, 41dB/42dB/47dB)
Output level, 100% mod	785mV
Channel balance	0dB
Dimensions (width, depth, height)	42×32×6cm
Typical price inc VAT	£240

First reviewed: 1986. Rating: Recommended.

QUAD FM4

QUAD ELECTROACOUSTICS LTD,
30 ST PETERS ROAD, HUNTINGDON,
CAMBS, PE18 7DB. TEL: (0480) 52561

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

Rear panel facilities include a three-pin IEC mains input, a shrouded IEC three-pin mains outlet, plus a 75ohm (female) coaxial aerial socket and a DIN audio output. Both finish and constructional standard are high.

Sound Quality

Despite digital tuning, the *FM4* had clean backgrounds free from the usual annoying whistles. By the time input reached 1mV, it showed decently quiet stereo backgrounds, and the sound quality was much favoured, scoring up with the best in this group. Stereo images were well focused, and pleasing depth was reproduced. Tonally it

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

LAB REPORT

The *FM4* was quite sensitive reaching 50dB stereo quieting (1kHz ref, CCIR/ARM) by 70μV and ultimate stereo signal-to-noise ratio by 2mV with a 66dB recorded which is a satisfactory result, and slightly better than the broadcast chain. This tuner was not at its best separating a weak from a nearby strong station, with a selectivity of around 50dB, which was rather below average. Conversely AM rejection and capture ratio were quite good. Output level was lower than usual at 300mV but good pilot tone rejection was shown. Total harmonic distortion was about average with 0.25% mono and 0.5% stereo (full modulation, left or right channel only). It also responded well to overmodulation, and attained good stereo separation.

CONCLUSION

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

TEST RESULTS

Tuner	
Sensitivity for 50dB signal-to-noise Mono/stereo	7μV/70μV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	70dB/66dB
Muting threshold	–
Alternate channel selectivity	–49dB
Pilot tone rejection, 19kHz/38kHz	–63dB
AM rejection	–61dB
Capture ratio	1.8dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	0.25%/0.35%
Stereo separation, 1kHz/5kHz/10kHz	48dB/38dB/30dB
Output level, 100% mod	300mV
Dimensions (width, depth, height)	32×21×6cm
Typical price inc VAT	£269

First reviewed: 1983. Rating: Recommended.

REVOX B261

F.W.O. BAUCH LTD, 49 THEOBALD STREET, BOREHAMWOOD, HERTS WD2 4RZ.
TEL: 01-953 0091

This is a remarkable FM tuner, closer to a professional rather than a domestic receiver in terms of build quality. For FM only, it has a host of facilities ranging from auto aerial rotation to twin volume-adjustable headphone sockets. Digitally synthesised, the tuner has space for 20 preset stations whose names may be entered on a keyboard and displayed on selection. The signal-strength meter is highly accurate and all its many facilities worked well including the variable muting threshold and variable stereo threshold. Infra-red remote control is possible, and this model is also compatible with the new line of Revox electronics. Variable and fixed output level phono sockets are provided, while the aerial input is 75ohm coaxial (male). A DIN audio socket is also included.

SOUND QUALITY

This tuner was superbly engineered, and felt 'right' when setting up for the auditioning. It proved to be sensitive, with good quieting by 50μV and almost silent at 500μV with no spurious tones or whistles. The sound quality rated as 'good', if slightly subdued and softened when compared to the original source, but very pleasant nonetheless, with a clean treble. The mid tonal balance appeared a little thin, but not seriously so, while the stereo focus was good and depth satisfactory.

LAB REPORT

The IHF mono 50dB quieting figure was impressive at 1.6μV with our 50dB stereo (1kHz ref CCIR/ARM) figure sustained at a good 45μV. This is a sensitive tuner suited to a wide range of reception conditions, particularly if the aerial rotation facility is taken into account. Alternate channel selectivity was very good and capture ratio excellent, as was the AM suppression at no less than 77dB. Distortion was low, particularly when overmodulated. Pilot tone suppression was excellent and the ultimate signal-to-noise ratios were also pretty good. Stereo separation rated as very good, reaching 60dB mid band, while audio output was ample at 2.2 volts, this variable to suit the matching amplifiers. The treble response was very flat from 100Hz to 2kHz but showed a very slight lift in the last two octaves at around 0.6dB, the output still maintained at full level at 15kHz.

CONCLUSION

This comprehensive tuner was a most sophisticated and well executed example of modern broadcast design. For the FM enthusiast with a deep pocket it would be a logical choice, and can be expected to give years of service — on a hill site in southern England many of Europe's transmitters will be accessible.

TEST RESULTS

Tuner	
Sensitivity for 50dB signal-to-noise Mono/stereo	4μV/45μV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	76dB/70dB
Muting threshold	variable
Alternate channel selectivity	–82dB
Pilot tone rejection, 19kHz/38kHz	–82dB
AM rejection	–77dB
Capture ratio	0.8dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	0.04%/0.15%
Stereo separation, 1kHz/5kHz/10kHz	60dB/51dB/39dB
Output level, 100% mod	2.2V
Dimensions (width, depth, height)	45×33×15cm
Typical price inc VAT	£989

First reviewed: 1983. Rating: Recommended.

SANSUI TU-D99XL

SANSUI (UK) LTD, UNIT 10A, LYON INDUSTRIAL ESTATE, ROCKWARE AVENUE, GREENFORD, MIDDLESEX. TEL: 01-575 1133

This slimline compact model is an upmarket design with a comprehensive specification. A quartz locked synthesiser model, it offers FM coverage as well as AM medium wave, with 8 auto-tuned preset station positions on each band. Details include a record calibration tone at –6dB on peak level, plus a local/normal switch for front end sensitivity and a normal/narrow IF switch to

aid separation of closely spaced stations. There is also a noise suppressor for weak stereo stations. At the rear, a Japanese-style coaxial connector is fitted using a special plug which has to be made up. 300ohm FM connection is via binding posts and these also serve for the AM loop antenna.

Sound Quality

Scoring very well on the listening tests, the '99 produced just slight background whistles, which had cleared by the 200μV input level, and from 500μV upwards the stereo output was very quiet. It presented a close copy of the original source, although the merest dullling of transients was noted. Otherwise the sound — stereo, depth, and tonal neutrality — all met high standards. High level RF blocking was cleared via the 'local' switch.

The AM sound was thought unpleasant with a notable hardness and ringing sound. Here it rated below average.

Lab Report

The '99X acquitted itself well in the lab tests. The RF performance was fine with very good sensitivity, a sensible muting threshold and excellent AM suppression as well as capture ratio. Selectivity was satisfactory in 'normal' and very good in 'narrow' IF mode. Signal-to-noise ratios were up with the best, while harmonic distortions held to a fine 0.1%, −60dB, in all conditions. Channel suppression was very good in normal mode and was still more than satisfactory in 'narrow'; for this tuner 'narrow' mode operation was no hardship. Output level was healthy, balance very good with the frequency response respectably flat.

Conclusion

With a front rank sound quality and a very strong RF performance, this is clearly a fine tuner design. Suited, with the 'local' switch, to both fringe and high strength locations, a versatile performance is offered, and if the AM section is not considered important, it could fit the bill nicely. The '99X represents very good value in its price sector, and qualifies for a Best Buy rating.

Test Results

	Tuner
Sensitivity for 50dB signal-to-noise Mono/stereo	2.5μV/25μV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	76dB/71dB
Muting threshold	40μV
Alternate channel selectivity	40dB/75dB
Pilot tone rejection, 19kHz/38kHz	71dB/>93dB
AM rejection	>68dB
Capture ratio	1.0dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	−60dB/−63(−60*)dB
Stereo separation, 1kHz/5kHz/10kHz	55/58/52dB(37/40/42*)dB
Output level, 100% mod	825mV
Channel balance	0.15dB
Dimensions (width, depth, height)	43×26×5cm
Typical price inc VAT	£230

**Narrow IF bandwidth*

First reviewed: 1985. Rating: Best Buy.

TECHNICS ST-G7

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

Technics have long enjoyed a reputation for producing good tuners; the *ST-G7* reviewed here is an upmarket model whose comprehensive facilities include a socket for connection to a computer terminal.

Finished in the traditional Technics dark bronze, it sports a backlit liquid crystal display like the Revox. It is a synthesiser design, and an array of push-buttons allow pre-selection of up to 16 stations from the FM and medium wave bands. A special 'gold' capacitor provides power for the preset station memories even if the unit is switched off for a week.

Automatic or manual switching for two IF bandwidths is possible affording optimised reception, and the display is also calibrated to read signal strengths in dB. Fine setting of AM and FM synthesised frequencies is possible while a recorder calibration output is also provided.

Sound Quality

Highly rated on test, the stereo quality was well in hand by 400μV of signal strength, and the background was clear of whistles once perfectly in tune. Audio quality was considered to be close to the original source, with good dynamics. Good stereo, depth and focus as well as a wide neutral frequency range were also apparent.

However, it sounded quite poor via AM with a muffled and laboured effect. Heavy coloration was also present and it was considered quite fatiguing to listen to.

Lab Report

Our test methods differ in some respects from those used to specify the G7, and the results are further complicated by a dual bandwidth IF. On 'wide', which gives best sound quality, sensitivity was normal while signal-to-noise ratios were also very good. (CCIR ARM 1kHz.) Alternate channel selectivity was satisfactory in 'wide', and good in 'narrow'. Multiplex tone rejection was excellent — no trace of it could be found! AM rejection was also excellent together with a fine capture ratio.

Harmonic distortion, while excellent in mono degraded to 'satisfactory' in stereo, which was a pity. Channel separation was very good in 'wide' but rather worse in the narrow IF mode.

Conclusion

In the optimum 'wide' mode the audio performance was very good, with the RF parameters a little less so. 'Narrow' will allow reception in difficult conditions but it is a compromise nonetheless. The overall sound quality was much liked, and if viewed together with its features and major test results, indicates a value level that is sufficient for a recommendation even at this high price.

Test Results

	Tuner
Sensitivity for 50dB signal-to-noise Mono/stereo	5μV/50μV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	77dB/70dB
Muting threshold	8μV
Alternate channel selectivity	47dB/72dB
Pilot tone rejection, 19kHz/38kHz	>90dB/90dB
AM rejection	>70dB
Capture ratio	1.5dB
Total harmonic distortion at 100% mod, 1kHz	
Mono/stereo	−70dB/−55(−34*)dB
Stereo separation, 1kHz/5kHz/10kHz	53(20*)dB/45(16*)dB/36dB
Output level, 100% mod	675mV
Channel balance	0.7dB
Dimensions (width, depth, height)	43×28×10cm
Typical price inc VAT	£370

**Narrow IF bandwidth*

First reviewed: 1985. Rating: Recommended.

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AVON

ABSOLUTE SOUND AND VIDEO, 65 Park St, Clifton, Bristol. (0272) 24975. A&R, Denon, Dual, Meridian, Mission, NAD, Quad, Rotel, Technics, Yamaha, etc. (closed Weds) BADA MEMBER. EXDA

AUDIO BRISTOL LTD, 8 Park Row, Bristol 1. (0272) 291931. AKG, Beyer, Dual, Mordaunt-Short, Revox, Sansui, Tannoy, Toshiba, Trio, Quad. Open Mon-Fri, 9-5.30, Sat 9-4.30. Home trial facilities, free installation, credit facilities, service dept.

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

PAUL ROBERTS HI-FI, 31-33 Gloucester Rd, Bristol. (0272) 429370. Stock a full range of hi-fi from over 60 brands. specialise in C.D. Dem facilities available. Open Mon-Fri 9.30-7.30, Sat 9.30-6;00. Home trial facilities. Free installation. Instant credit. Credit cards: Access, Visa, Amex. Service dept.

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CAM AUDIO, 110 Mill Rd, Cambridge. (0223) 60442. A&R, Creek, Linn, Mantra, Mission, Naim, Nakamichi, Rega, Revolver, Teac. Dem facilities: 3 single speaker rooms. Appointment required for one not for 2. Open 9.30-6.30 Mon-Sat 9.30-3.00 Thurs. Free installation, interest free credit. Credit cards: Access, Amex, Visa, Diners.

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SOUND ADVICE, The Sound Factory, Duke St, Loughborough LE11 1ED. (0509) 218254. A&R, Creek, Linn Products, Manticore, Naim Audio, Nakamichi, Nytech, Rega, Revox, Yamaha. Dem facilities: 2 studios. Appointment required. Open Mon-Sat 9.30-6. Free installation, credit facilities. Credit cards: Access, Visa. Service dept.

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GLOSSARY

AM: Amplitude modulated; see 'Medium Wave'.

ACOUSTIC BREAKTHROUGH: Sound that gets into the turntable and hence the cartridge from the air and thereby creates a risk of acoustic feedback.

ACOUSTIC FEEDBACK: If any sound in the room can find its way through the body of the record deck to the cartridge stylus, then that sound will be reproduced from the loudspeakers, along with the wanted programme material. If too much of this sound from the loudspeakers is picked up by the cartridge in this way then a vicious circle of acoustic feedback will be created.

ACTIVE: Speaker systems which contain electronic crossovers and where the drive units are connected directly to power amplifiers.

ALIGNMENT PROTRACTOR: A device used to minimise the lateral tracking error of a cartridge/arm combination.

AMPLITUDE: Size or magnitude; hence the amplitude/frequency response, known normally simply as the frequency response, which describes the relative loudness of the system at different frequencies with a constant input voltage.

ANECHOIC: Without echo; a special room or 'chamber' with thick sound absorbing materials on all surfaces to prevent reflections.

ARM MASS: More accurately called *effective* arm mass, because it is *not* the weight of the arm on a pair of scales. It is the mass of the arm and cartridge combination that appears to be concentrated at, and thus felt by, the stylus tip which is tracking a record groove. There is nothing inherently good or bad about arms with light or heavy effective mass; what matters is the manner and choice of their combination with cartridges of different compliance and the low frequency resonance produced by such combination.

AZIMUTH: With reference to tape and cassette recorders, the alignment of head gap to tape path.

BALANCE: 1) The overall relative loudness perceived at different frequencies (eg bass, treble; 2) the accuracy of the match between the two channels of a stereo transducer (eg cartridge or pair of loudspeakers).

BANDWIDTH: A range of frequencies with presumed defined upper and lower limits.

BASS: Lower part of the frequency spectrum.

BELT DRIVE: The motor has its rotational speed geared down to the required platter speed (33⅓ rpm for LP discs) by a rubber or similar resilient belt which runs round a small pulley on the motor shaft and a large pulley attached to or part of the platter.

BEXTRENE: A plastics material frequently used for bass and mid-range cones.

BIAS: *(turntable/arms)* Because the cartridge on a pivotal arm is being drawn across the record surface by the stylus tracking at an angle offset from the pivots, groove friction produces an imbalance of lateral force. Bias is the application of a compensatory lateral force acting in the opposite direction.

BIAS: *(tape)* This refers to a high frequency current passing through the record head which allows the audio current also passing through the head to produce reasonably linear magnetisation of the tape at all levels permitted by the combination of each machine with the tape. The lowest level of bias is required for ferric cassettes, a slightly higher one for ferrichrome, an even higher one for chrome or pseudochrome, and the highest for metal.

BOTTOMING: The stylus scraping on the distorted rounded bottom of the groove due to incorrect stylus geometry.

CANTILEVER: The thin rod or tube that connects the stylus to the armature and hence the cartridge body.

CAPACITANCE: An element of electrical impedance that is particularly important when matching pickup cartridge, arm leads and amplifier input characteristics to achieve a flat frequency response from discs.

CLIPPING: This is reached when a circuit is overloaded and overdriven, resulting in bad waveform distortion and audibly unpleasant effects.

COLORATION: A general term used to describe the audible effects of distortions, particularly in loudspeakers and record players. These are usually caused by frequency response irregularities and/or resonances.

COMPATIBILITY: The selection of interdependent components to achieve optimum system performance; notably arm/cartridge mass/compliance matching, cartridge electrical loading, or loudspeaker compatibility with amplifiers.

COMPLIANCE: A measure of the springiness of the cantilever/armature seen from the stylus, expressed in compliance units (cu), where 1 cu = 10^{-6} cm/dyne.

CROSSOVER: An electrical circuit which uses combinations of inductors, capacitors and resistors to divide the signal from the power amp into the required frequency bands and with any necessary equalisation for feeding to the individual drive-units of the speaker system.

CROSSTALK: The leakage from one channel to the other in a two channel stereo system.

CUTTER: Mechanism used to cut recorded signal onto lacquer master; consists of turntable, lathe, cutting head, cutting and servo amps.

DIN: German standards body, responsible amonst other things for a popular range of standard plugs and socket specifications.

DAMPING: A means of controlling resonances by means of a resistive medium (electrical, mechanical, or acoustic depending on situation).

DECIBEL (dB): A logarithmic unit that is convenient for expressing ratios that span a wide range on a linear scale. For simplicity it can be regarded as a measure of relative loudness.

DISTORTION: Literally this can mean any deviation from the original, but usually refers to harmonic rather than intermodulation distortions when not specified.

DOPING: A technique involving the application of damping to a loudspeaker driver cone in order to assist in controlling resonances..

DOWNFORCE: The weight, measured at the stylus, which holds it down in the groove.

DRIVE UNIT (DRIVER): The term used to distinguish the loudspeaker unit itself, be it bass, midrange, treble or fullrange in application, from the complete loudspeaker system which combines drive units, cabinet and crossover into a total design.

DROPOUTS: Momentary reductions of programme level due to inadequate head/tape contact caused by oxide particles shedding off the tape onto the head gap, or inadequacies in tape transport or tape.

DYNAMIC RANGE: The ratio in dBs between the quietest sound that can be successfully recorded and the loudest which can be accepted without serious distortion on an average programme.

EFFECTIVE MASS: The inertia, or mass-controlled resistance to movement, of a device, particularly important with regard to tonearms.

EFFICIENCY: The amount of acoustic power delivered for a given electrical input power.

ELECTROSTATIC: A principle employed in some loudspeaker transducers using static electricity effects to set up a polarising field within which the modulated transducer medium moves.

ELLIPTICAL STYLUS: A specially shaped stylus profile that makes the 'plan view' radius along the length of the groove smaller than the 'elevation view' contact radius viewed from the front.

EQUALISATION: *(general)* The deliberate modification of frequency response, usually in response to some engineering limitation of deficiency.

EQUALISATION: *(tape)* This refers to the necessary change in frequency response required of an amplifier so that an overall flat frequency response is obtained from a tape medium. Equalisation is required both on record and replay. Any tape recorded on a good cassette recorder should have the same inherent response when played back on another correctly set up machine, since all playback equalisations should have been standardised. These standards are normally specified by the time constants of the circuts involved, eg 70μs or 120μs (see 'Microseconds').

FM: Frequency modulated; often used to describe radio transmissions of high fidelity potential on the VHF band.

FARAD: Measure of capacitance.

FERRITE ROD: A short rod type aerial used for AM reception; may be fitted internally or externally to tuner or receiver.

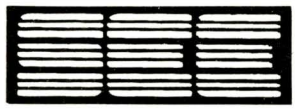
FERRO-FLUID: A magnetic fluid which is introduced into the voice-coil gap to provide damping and/or improved cooling.

FILTER: A circuit (normally) used to restrict the bandwidth of a system; may be fixed or switchable.

FREQUENCY RANGE OR SPECTRUM: Can refer to any particular group of frequencies, but commonly applied to the audible band from 20 to 20,000 cycles per second (Hz), extending from the deepest bass to the highest audible harmonics.

FREQUENCY RESPONSE: The variation in output over a frequency range, particularly of a transducer; can be expressed as a range with decibel limits, or depicted graphically.

Hz (HERTZ): 1 Hz = 1 cycle per second and is a measure of frequency which corres-



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GLOSSARY

ponds to musical pitch (the higher the frequency the higher the pitch).
HF: High frequency.
HARMONIC: Harmonics are the whole number multiples of a base frequency called the *fundamental*.
HARMONIC DISTORTION: The addition of unwanted harmonics to a signal.
HUM: A low frequency interfering sound produced by break-through or interference from mains wiring or circuitry.
IHF: American Institute of High Fidelity, an important standards body.
IEC: An international standards body.
IMPEDANCE: Measure of resistance (and reactance) in alternating (ie audio) signals; this is of some importance in the compatibility of both cartridges and headphones with amplifiers. For convenience sake is measured in ohms.
INTEGRATION: Used to describe the success with which the output from two drive units combine to give smooth output through the crossover region.
INTERMODULATION (IM): A form of distortion arising from two or more signals producing non-harmonic signals that correspond to the sum or difference of the two frequencies.
KILO (k): prefix meaning one thousand.
LED: Light Emitting Diode; an indicator light.
LF: Low frequency.
LATERAL FRICTION: The resistance to movement of an arm and cartridge combination in the horizontal plane (ie across a record), caused by friction in its bearings.
LINEAR: A transducer that produces an output that exactly portrays its input over the required operating range is described as linear, and is hence distortion free. Hence also non-linearities (distortions).
LINE-CONTACT: A special stylus profile that extends the ellipse, increasing contact length up and down the sides of the groove.
LOAD OR LOADING: The impedance (including resistive and reactive components, ie ohms, mH, pF) seen by one component looking back to its interconnected component; of importance in compatibility of cartridge/amp, and amp/headphone.
'LOUDNESS': An equalisation circuit frequency switchable on amplifiers which is designed to compensate for presumed hearing characteristics at low listening levels by boosting bass and treble.
MOL: Maximum operating level of tape normally referring to 5% distortion of 315Hz or 3.15kHz.
MEDIUM WAVE: An AM transmission band incapable of high fidelity signals.
MICRO- (μ): Prefix for units meaning one millionth of.
MICROSECONDS (μs): The time constant of a resistor capacitor combination involving a frequency response change (equalisation).
MIDRANGE, MIDBAND: The central part of the audible frequency range where the ear is most sensitive.
MILLI- (m): Prefix for units meaning one thousandth of.
MODULATION: The audio signal is 'stored' by means of modulations within a medium, eg the 'wiggles' in the groove of a plastic disc, or the magnetic coding on a tape.
MODULATION NOISE: An additional noise added to tape noise, which increases with the degree of modulation of the tape, caused by the properties of the magnetic coating. This noise has most of its energy near the modulation frequency (causatory tone).
MOVING-COIL: A transducer (eg cartridge or headphone) where the signal is generated by the movement of a coil within a magnetic field.
MOVING-MAGNET: The most common form of cartridge transduction, where the magnet moves while the coils are held relatively stationary.
MULTIPLEX FILTER (MPX): A circuit which introduces severe attenuation at supersonic frequencies to decrease interference encountered with the output from some stereo FM tuners.
NANO (n): Prefix meaning a thousandth of a millionth of.
NOISE: Random unwanted low level signals.
NOISE MODULATION: An unwelcome breathing effect that can be heard on some programme material, produced by poor noise reduction systems, or circuits.
OCTAVE: Two-to-one ratio of pitch or frequency.
OFFSET ANGLE: The angle measured between the centre line of the pickup cartridge and the line which joins stylus and arm pivot point.
OHM: Unit of electrical impedance (including reactance) or resistance; also kohm, where 1 kohm = 1,000 ohms.
OVERHANG: The extent to which the cartridge stylus extends beyond the centre of the platter is critical, and controlled by fore and aft adjustment of the cartridge on the arm.
PASSIVE: The most common type of system, where drivers and crossover are driven from a single power amplifier.
PEAK RECORDING LEVEL: A level above which distortion becomes apparent. This distortion is introduced when the oxide particles almost reach magnetic saturation, and thus will accept no more level.
PHONO: The most commonly used plug/socket combination in audio components.
PICO (p): Prefix meaning one millionth of a millionth of.
PORT: An opening in a cabinet which is tuned to charactieristics of the bass driver and the enclosure volume to provide reflex type bass-loading.
POWER AMPLIFIER: The part of an amplifier that provides power to drive the loudspeakers: usually integrated, it is sometimes a separate component.
PRE-AMPLIFIER: The part of an amplifier that accepts the input signals, sorts them, applies any necessary equalisation, and then passes the signal to the (normally integral) power amplifiers.
PRESENCE: A quality of forwardness or immediacy in a sound balance, generally related to an upper-middle frequency response boost.
PRINT-THROUGH: A pre- or post-echo of a loud signal created by magnetisation occuring from one layer to an adjacent layer after the tape has spooled or been recorded.
Q: A measure of the magnitude and shape of a resonance; the higher the Q, the sharper and more severe in amplitude the resonance.
REFLEX: A system of bass loading (using port or ABR) which offers improved efficiency and bass power handling at the expense of subsonic control compared to a sealed box.
RUMBLE: The low or medium frequency sound produced mechanically by any moving parts in a turntable, mainly the motor and platter bearings.
SENSITIVITY: The volume of sound output for a specific electrical voltage input.
SEPARATION: As between the two channels of a stereo pickup; see *crosstalk*.
SHIBATA: A special stylus extending the elliptical to a 'line-contact' type of profile.
SIDE-THRUST: A force acting on cartridges in pivoted (ie not parallel tracking) arms, due to the stylus/vinyl 'friction' acting along the line of the offset angle; hence bias or side-thrust compensation.
SIGNAL-TO-NOISE, SIGNAL/NOISE, S/N: The difference in total output when an applied signal is removed.
STYLUS: The specially shaped piece of diamond in contact with the groove and connected to the cantilever.
SUBSONIC: Below the audible range, ie below 20Hz.
SQUARE WAVE: A signal which consists of a fundamental plus a (theoretically infinite) series of odd (3rd, 5th etc) harmonics in a precise phase and amplitude relationship. It is useful for examining transient performance, symmetry, resonance control and 'ringing'.
THD: Total harmonic distortion.
TRACING: The following of the groove modulations by the stylus; hence for example tracing distortion, caused by the inability of a spherical stylus to trace the high frequency inner grooves on a disc.
TRACKABILITY: The ability of the cartridge to cope with large amplitude modulations (or of the arm and cartridge to follow the groove itself properly).
TRACKING ERROR: The discrepancy between the truly tangential angle at which a record is cut and the slightly off-tangential angle at which it is tracked by a stylus on a pivoted arm during some parts of the arm's travel.
TRANSIENT: Signal of very short duration.
TREBLE: Upper part of frequency spectrum, typically above about 3kHz.
TWEETER: A small drive unit designed to operate over the high frequency range.
ULTRASONIC: Frequencies above audibility, ie greater than 20kHz; also *supersonic*.
VERTICAL TRACKING ANGLE (VTA): The angle at which the plane of motion of the stylus is set with respect to the vertical when viewed from a side elevation of the cartridge. Should match the 20° cutter standard.
WEIGHTING: A factor or function that is applied to a measurement to increase its relevance and usefulness.
WOOFER: A drive unit that operates over the bass portion of the audio range.
WOW AND FLUTTER: Low and high frequency pitch variations (from poor tape transport of turntable platters with speed drift).

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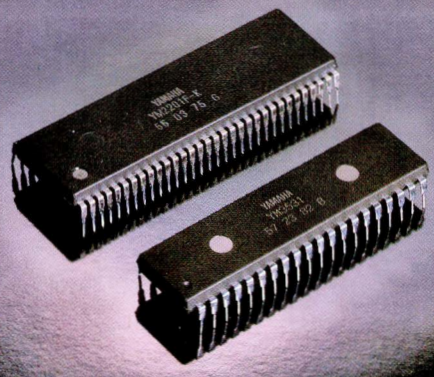

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