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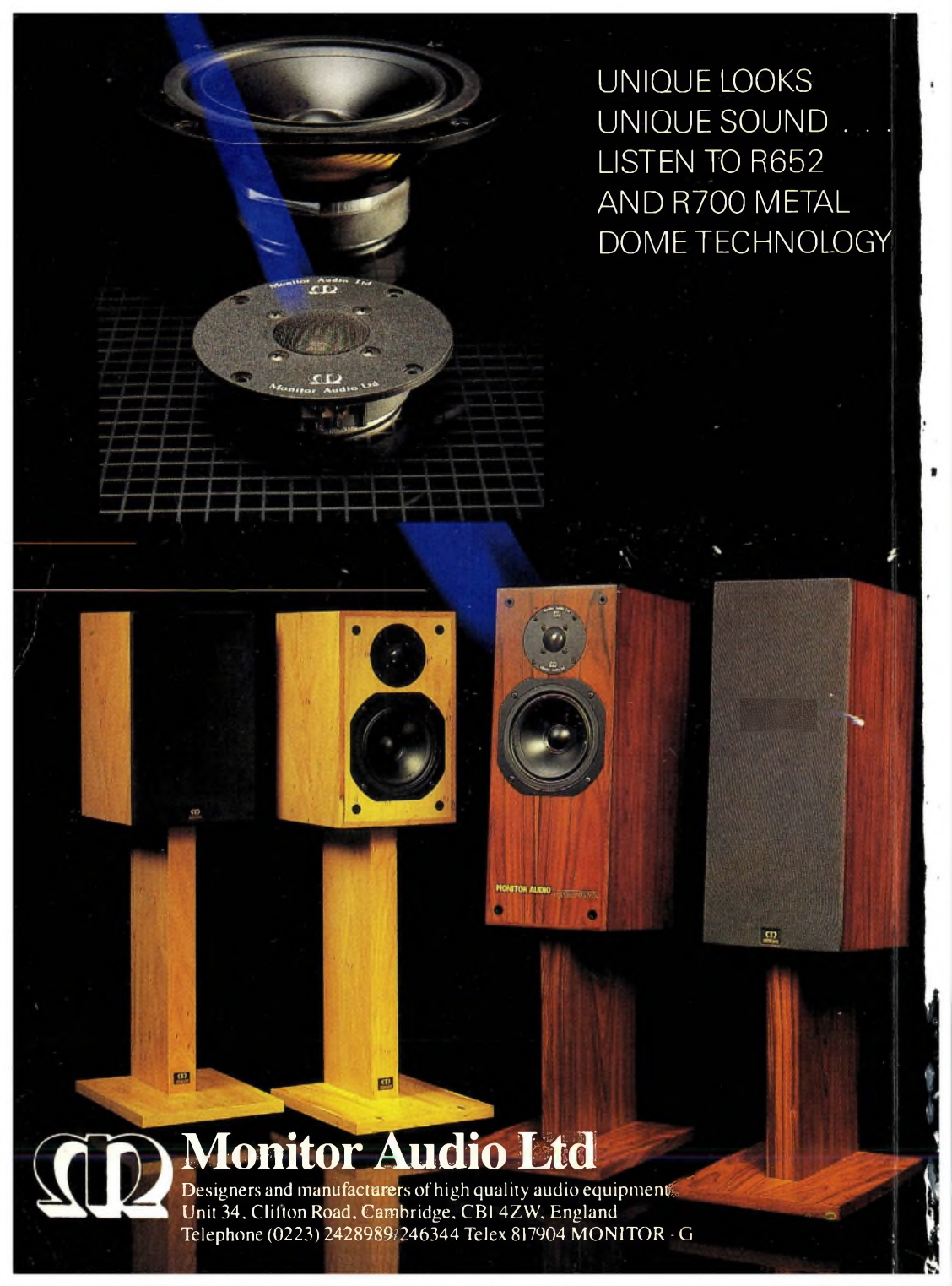

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LOUDSPEAKERS 1986/87

BY MARTIN COLLOMS

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INTRODUCTION

Returning to Choice *after five years, little appeared to have changed on the surface, but strong currents have already introduced a new design, and have brought several innovations to this 1986* Loudspeakers *issue, much of which has been completely re-written.*

As the years pass new models are launched but old loudspeakers by no means fade away. We are obviously limited in the total pages we can publish, so each edition brings an increasingly difficult task of dropping or summarising reviews of many perfectly viable models. To avoid extending the amount of Summary reviews, we have reduced the reprinted reviews to single pages and the basic data can now be found in the Comparison Chart (pp180-183). Those wishing to catch up on the full measurement details of earlier reviews should refer to the previous edition.

This 1986 edition has 32 new reviews, then we have re-auditioned and revised measurement on 'evolution' versions of half a dozen existing models, reprinted the three elaborate 'high end' models, from the recent *Choice* special *The Collection*, and added edited reprints of some 50 established models, plus another dozen or so in summary form. In all, a pretty comprehensive coverage of the loudspeaker market.

An innovation in presentation is a series of bar graphs, set to scale, which make up a performance summary on each of the new reviews.

CONTROVERSIES

Loudspeaker reviewing and comparative reviewing are both riddled with controversies. Though there is arrogance in attempting to review loudspeakers comparatively, there is also humility in accepting the difficulties involved, and the validity of alternative points of view. Ultimately there is the belief that comparison is the only way to achieve true perspectives on the whole market, using test methodology that represents the current state of the practical art.

The lone one-off review can be very good indeed, particularly when covering unique and elaborate designs such as the three reviewed in *The Collection*. Fascinating though such exotics are, 99 per cent of the hi-fi speakers sold are wooden boxes containing two or three drive units and a crossover network. This is where the perspective of the large scale group test comes into its own, and creates its own invaluable frame of reference.

One source of controversy in the industry has been Martin Colloms' involvement in consultancy as well as reviewing. Having worked with Martin for a decade, I know without the shadow of a doubt that his integrity and credibility are the last thing he would risk. Any prior consultation on a particular design is always declared, and where a significant design input is involved the review has been written by David Prakel, based on the unavoidably neutral results of objective measurements and 'blind' panel listening tests. If there is a possible source of concern to Martin and myself, it is that the speakers which he has helped design have been doing suspiciously well, and there is a certain circularity in using the same room during both design and evaluation. Ironically, the role of the room currently seems to be a major pre-occupation of leading loudspeaker designers, and by the time the next edition gets under way, we ought to have come up with some answers. In the meantime, the reader should take this caveat into account.

A final source of controversy concerns the *Choice* system of recommendation, and the qualification criteria thereof. It might be said that we fail to acknowledge the marketplace by showing less than overwhelming enthusiasm for some of today's most fashionable designs. That is as it should be: fashion leaders are apt to be extremists, while *Choice* is obliged to consider broad compatibility and fundamental neutrality as vital criteria. A model without formal recommendation may well be ideal under the right circumstances, and its very inclusion indicates that fairly stringent pre-selection procedures have already been passed. Those who have the confidence to make their own judgements should certainly do so; we can merely provide a guide and warn of the various devices that can often mislead the ear.

Paul Messenger

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CHOOSING & USING LOUDSPEAKERS

If you're planning to spend one or even several hundred pounds on a new pair of loudspeakers, it does make sense to take at least as much care over the decision as one would in buying a pair of shoes. If you get the shoes wrong your feet will protest, so if you get the loudspeakers wrong your ears will rebel, and you will find yourself not using the system as much. But with hundreds of alternatives to choose from, each distinguished from its rivals by a different permutation of jargon, how do you begin to narrow the choice, and even start to make a selection? Cue for a little jargon-free advice!

The first step on the road is to try and specify one's own personal and particular requirements, he writes glibly, opening several cans of worms. It is possible to do this on a basic, simplistic level, checking the price, size and intended location. But there are real benefits for those prepared to take a little more trouble. With a little care, the assistance of the data in this book, and (hopefully) the co-operation of a skilled retailer, the end result can be that much more worthwhile.

Setting The Budget

Those buying just loudspeakers will have a pretty good idea of the money they have available, which as ever is the fundamental bottom line of any purchasing decision. But there is — and always has been — controversy over the proportion of a budget that should be devoted to loudspeakers, *vis à vis* that spent on the other components of a system.

Ten years ago conventional wisdom recommended devoting as much as possible to the loudspeaker, as it was regarded as the weakest link in the chain. An alternative philosophy, pointing out that the loudspeaker could do nothing to compensate for an inadequate source, switched attention towards turntables and amplifiers. And as usual the pendulum probably swung too far, and is now beginning to turn back towards the loudspeaker.

Personal Preferences

Here we get into the realms of personal taste, and this requires either the painful process of individual experience or the sympathies of a competent dealer in order to establish where one's personal priorities lie. Where one listener may be barely conscious of the subtleties of stereo imagery, another will take particular pleasure in pin-pointing musicians within a recorded acoustic. Those who listen predominantly to electronic rather than acoustic instruments are liable to sacrifice coloration in favour of dynamic impact.

While a magazine can assist in presenting these alternatives, it is only through skilled demonstration that an individual can be confronted with the different but equally valid options to make an educated choice for himself.

At the time of writing I am temporarily living with a £1000 system which suits me very well, but which certainly represents one extreme. It consists of a £600 turntable with £200 amplifier and £80 loudspeakers on £100 stands. At the other (rather less) extreme, another could enjoyably combine a £500 remote control multi-source midi-system with £500 worth of high performance, low coloration loudspeakers and stands. But unless one actually has the opportunity to hear the difference between these two very distinct approaches, how can one possibly have any basis for making a choice?

Siting Is Important

The site chosen for loudspeakers is often as influential as the choice of loudspeakers themselves. Over the years I have used open stand locations, both with conventional box speakers and panel types, and also stand-mounted wall-backed designs. Each has its own strengths and weaknesses and imposes its own characteristics on the sound, so again personal preference enters into the equation. Some will suit one room layout better than another, and choice must frequently take as much account ▷

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LOUDSPEAKER BUYER'S CHECKLIST

High frequency sounds from the tweeter may 'beam' in some designs while others have purposely tailored vertical or lateral dispersion patterns. The speaker needs setting to put the tweeter at an appropriate height for the car's seated listeners

Angling speakers inwards can improve stereo imagery. Room placement for good stereo is as important as that for good bass. Experimentation with angling and relative distances from the room boundaries is recommended

Grilles on or off? Many speakers sound better with grilles removed, because of the diffractive effects of the grille frame. Can you live with naked drive units?

Electrical matching: Speakers are far more easily damaged by an amp that is under-powered than one that is 'too big'. A small amp, when driven flat out, may 'clip' the output waveform, lopping off the tops of the waves. This generates high-level high-frequency distortion products that can destroy tweeters. Big amps can only damage a speaker by pushing the drive unit out too far or by heating the voice coil over a period of time — unlikely in normal use. Loudspeaker manufacturers give a bracket for the power ratings of suitable amplifiers, so choose speakers and amp to match each other

Efficiency. A more efficient speaker is one which is better at converting electricity into sound. A speaker of 90dB sensitivity will sound literally twice as loud as one of 80dB for the same power. To achieve the same by upgrading amplifier power would require a 50W amp be replaced with a 500W model! Higher efficiency may save you expenditure on unwanted amplifier power

The stands should be inert, rigid and coupled to the floor to prevent the speaker rocking or moving. The speaker system will then be able to produce clean deep bass and stable stereo imagery

'Special' speaker cables may give subtle improvements in clarity and bass definition. In any case, use heavy-duty multi-strand cables rather than light gauge lighting flex or 'bell wire'

Where will the speakers be placed? If designed for true bookshelf or near wall location, they will only give a balanced output in that location. Speakers designed for free space do best on stands and will boom if put near walls or corners

▷ of the visual as the sonic aesthetics.

Having chosen the siting, one may then choose the loudspeakers and stands to suit. Alternatively, choose the speakers you like in the shop, and then move them around at home until they sound to your taste, because small changes in position can give big alterations in sound, particularly when operating near a rear wall.

The end result comes from a complex interaction between the loudspeaker, its support, its site, the acoustics of the room, and the general characteristics of the driving system. It is rarely entirely predictable. For those intending to spend a fair amount of money, it is not unreasonable to expect the luxury of a home demonstration, and/or the option to return and change a pair which do not suit after a day or two.

The shop demonstration will suffice in most instances of choosing a loudspeaker or system, but the real value of a skilled specialist dealer is his ability to create in the home an experience similar to that which impressed in the shop, even within the inevitable constraints of the domestic environment. Experienced set-up advice can (or should) be worth a great deal, and certainly the normal retail markup.

Big Ones or Little Ones

For any given budget there is an obvious choice between large or small loudspeakers. One instinctive reaction is to favour the big one, particularly if it has lots of drive units, but others will plump for a miniature or compact on aesthetic grounds. In fact the differences and trade-offs are much more subtle and far-reaching.

Fundamentally, the larger the box the more extended the bass is for the same specific loudness. Ultimately a good big 'un is going to beat a good littl 'un on loudness and bass extension, hands down. But it is also going to cost a great deal more. The large enclosed volume remains the route to extended bass, and this in turn adds 'weight' and 'scale' to the sound. But it can also reveal the low frequency inadequacies of the sources, be they the equipment or the recordings themselves. Meanwhile most of the important musical information can be handled at adequate domestic levels by even the smaller enclosures.

Big speakers suffer from several innate disadvantages. Large box enclosures are expensive to build and ship, and represent an undesirably large surface area of unwanted radiation, which can colour the sound and blur stereo precision. Extra drive units do increase power handling, but bring problems of crossover complexity and unit integration.

Little speakers can prove more fragile if used for the occasional party, and are certainly not at their best when trying to recreate the power and drama of rock music or a full concert hall acoustic. Their appearance is bound to be more discrete, but they will nearly always need a special stand to produce the best results.

Modus Operandi

Given the excessive number of different models competing for attention, manufactuers are inclined to make much of the uniqueness of their particular brew. Indeed many will consciously aim towards some form of USP (unique selling point), or alternatively rush into incorporating that of a successful competitor. The result is that the industry has become riddled with buzz words to describe any single type of engineering solution, and this leads to the sort of stereotyping which entirely misses the point of loudspeaker engineering.

Examples are legion, from the Bextrene bass/midrange cones of the early 'seventies through to the latest metal dome tweeters which are currently springing up everywhere. The result is that people talk of a 'metal dome sound' as something desirable (or not) *per se*, whereas in fact there will be a whole range of different metal dome sounds, in all probability some distinctly more 'equal' than others.

The underlying axiom is that great loudspeakers are not created by adopting a quick technological 'fix'. Indeed, history has often shown that the 'radical innovation' is a mere flash in the pan, with benefits in one area more than offset by unforseen penalties elsewhere.

Technology has steadily improved the performance of loudspeakers over the years, and some innovations have proved decidedly worthwhile. But the whole is much greater than the apparent sum of the parts, and the buyer would do well to bear this in mind.

Paul Messenger

Magneplanar

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ENTER THE SONY/HI-FI CHOICE

Pictured above are Sony's *CDP 502ES* CD player and *TA-F444ESII* amplifier, *TC-K444ES* cassette deck, *ST-S444ESII* tuner and *APM22ESII* speakers — all five items comprise the top end of Sony's specially designed 'ES' Hi-Fi range, which can be won in a three part competition brought to you by *Sony* and *Hi-Fi Choice*. Part one of the competition appeared in 'Compact Disc Players' (June), part three appears in the 'Cassette Players' (October). (See opposite page for 'Digital Ready' question Number Two).

Sony are following up the success of their CD players with the introduction of a full range of separates called 'ES', of which the following models are offered as main prize:

— Sony *CDP 502ES* — this sophisticated, integrated player offers superb sound and a host of features including a shuffle play and a fully programmable remote commander.
— Sony *TA-F444ESII* amplifier — combining solid performance with a high power output, featuring 120 watts RMS (6 ohms) and using linear crystal oxygen-free copper.
— Sony *TC-K444ESII* — a high performance cassette deck with three laser-amorphous magnetic alloy head systems and two pairs of capstan shafts.
— Sony *ST-S444ESII* tuner — with high precision direct comparator technology allowing a comparison frequency of up to 50kHz, dual-gate MOS FET RF amplifier and ten pre-sets.
— Sony *APM22ESII* loudspeakers — *Hi-Fi Choice* 'Recommended' — specially designed to cope with digital audio sources, featuring a two-way speaker system, they can handle a maximum power rating of 160 watts.

The above separates retail for approximately £1,700.00.

In this issue, *Hi-Fi Choice* is offering you the chance to win either Sony's 'Recommended' *APM 22ES* loudspeakers — with a two-way speaker system offering clean, detailed sound, they are ideal partners for both Sony's 'ES' amplifiers. Or, Sony's *APM* 'Best Buy' *20ESMKII* loudspeakers, capable of handling 60/120 watts, they are extremely efficient and suitable for use with low power output amplifiers. To win either of these excellent speakers, pictured right, answer the questions opposite — retaining the 'Digital Ready' question for the main prize. (You should already have the 'Digital Ready' question from the June issue).

DIGITAL READY COMPETITION

'DIGITAL READY' QUESTION?

The theoretical resolution of the 16-bit CD system is (A) 90dB, (B) 96dB, (C) 100dB?

'ES' LOUDSPEAKERS ENTRY FORM

Choose A, B or C

1 Sony's smaller hi-fi loudspeakers have been specially developed to please European as well as Japanese ears. Is the Sony factory which builds them in (A) Japan, (B) USA, (C) Germany?

2 The *APM 20ES* uses an unusual tweeter. Is the diaphragm (A) Lightweight aluminium honeycomb, (B) metal dome, (C) vapour-deposited graphite?

3 The large Sony *APM66ES* is considered capable of achieving high sound levels from a stereo pair in a typical room, estimated around (A) 103 dBA, (B) 107dBA, (C) 112 dBA?

Sony 'ES' is a natural choice of high quality hi-fi, because_____

_____

_____ (not more than 20 words)

Name _____

Address _____

Postcode _____

Closing Date For Entries 6th October 1986

Send your entry to Hi-Fi Choice/Sony Competition, Freepost 7, London W1E 4EZ

RULES

The competition is open to anyone except employees of Hi-Fi Choice (and subsidiary companies) and Sony. All entries must be submitted on the above entry form. No cash alternatives to the prizes shown will be offered. The publishers reserve the right to publish any entry submitted and entries become the property of Hi-Fi Choice. The winners will be notified by post. In the event of more than one correct entry, the winner will be decided by the 'Sony ES' tiebreaker above.

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TECHNICAL INTRODUCTION

The rationale and background to the Hi-Fi Choice Loudspeakers test programme.

Reviewing loudspeakers — or indeed any item of hi-fi equipment — is a desperately difficult undertaking. Carefully conducted listening tests can be impressively consistent internally, but results inevitably vary somewhat according to the room and ancillary equipment. And despite some international measurement standardisation, the results taken from different test programmes usually show substantial discrepancies.

While it will always be possible to pick the occasional nit in a particular test programme, the unique strengths of the *Hi-Fi Choice Loudspeakers* series are the consistency in methodology that has evolved over many years, and the breadth of perspective afforded by the large number of models which have been covered.

This is now author *Martin Colloms'* seventh *Loudspeakers* project, and represents the distillation from an accumulated data base on some 400 past and present models. Each successive project sees careful refinement in both measurement and listening test techniques. But similarly strenuous efforts are made to compare the results from previous reviews with those of the latest tests, rescaling the former where necessary to take account of the steadily rising standards of fidelity.

A number of long-lived models have helped maintain a secure perspective, aided by more recent exceptional performers. These references include the Quad *ESL 63*, Spendor *SP1* and *SP2*, B&W *DM100*, BBC-spec *LS3/5A*, Celestion *SL600*, Apogee *Scintilla*, and Magneplanar *MG3 II*.

The context of a test programme is an essential part of the interpretation of the results. For the lay reader much of this has been incorporated within the reviews, but the experienced enthusiast will welcome the full and detailed explanation of the test conditions described in this introduction.

LISTENING TESTS

The Listening Room

The diagram on page 19 shows the layout and dimensions of the listening room in some detail, with listening positions shown.

The room reverberation has been analysed, and found to correspond closely to the IEC standard. The Rt curve aligns closely to 0.3s above 100Hz, indicating an even, balanced and uncoloured character. There was some inevitable irregularity below 100Hz, but this was well-damped, for example, Rt did not exceed 0.51s at 50Hz.

Auditioning procedure

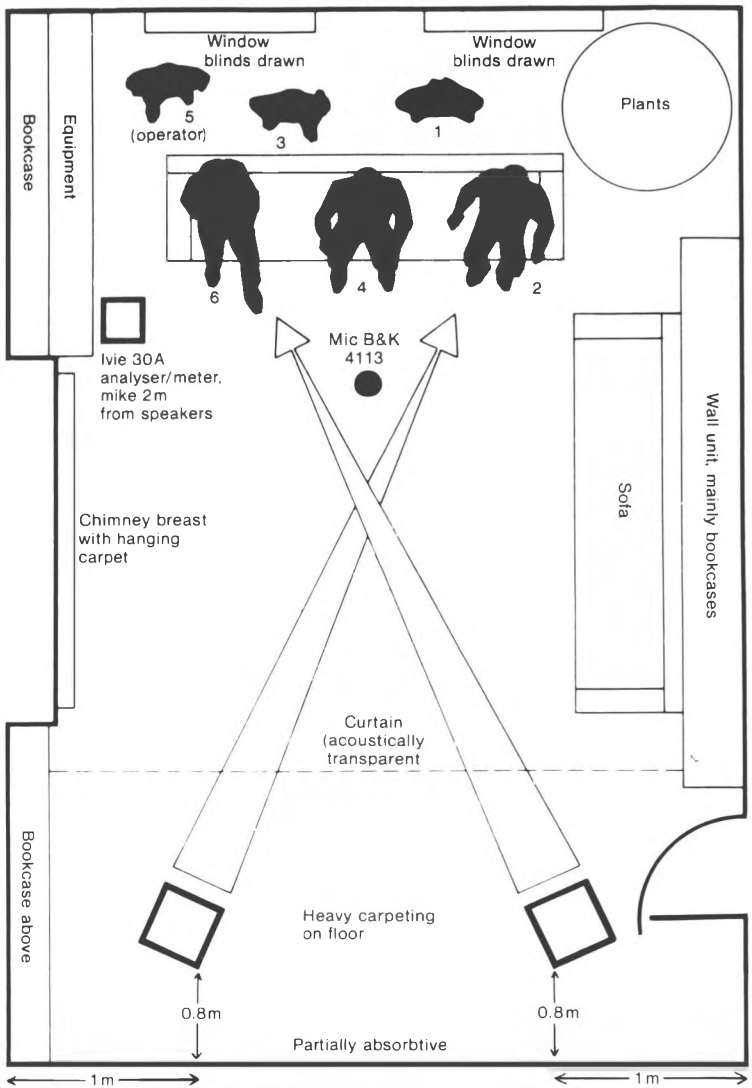
Each pair of loudspeakers is presented sequentially and in isolation, and is hidden from the panel behind an acoustically transparent curtain. Care is taken to ensure optimum mounting conditions — height, angle and position relative to reflecting surfaces.

Each presentation lasts for approximately 25 minutes, the programme is reproduced at a realistic 93-95dBA maximum spl (2m), an average level in the 80-90dBA range. The panelists are required to provide a considerable amount of information, both as descriptive comments, and as numerical judgement on five parameters: subjective frequency response flatness; clarity and detail; coloration; precision and depth of stereo image.

A number of repeat presentations of review and reference samples were incorporated into the sessions, to check on consistency of panel judgements and to try and ascertain the effect of any extraneous influences, such as time of day.

Choosing source material

Much of the recorded material used in the tests is of master quality, while the arrival of Compact Discs has brought a new level of consistency to the undeniably high quality obtainable from analogue LP and tape. Covering a broad range of tastes, the programme consists of excerpts ▷



Listening room data
Actual dimensions: 9′6″H×13′9″W×18′4″L. **(IEC mean recommended dimensions:** 9′H×13′9″W×22′L).
Actual reverberation time: 0.3 seconds ±20%. 100Hz; less than 0.6 seconds at 50Hz.
(IEC recommended reverberation time: between 0.3 and 0.65 seconds, mean 0.45).
Substantial Victorian house; suspended floor and ceiling (the latter heavily loaded by speaker loan stock above), heavy carpeting (3 ply). Over 50% of surface area of walls lined with book shelves; wall adjacent to loudspeakers reflecting, wall behind listening panel mainly absorbtive. Dominant absorbtive furniture, two large Chesterfield sofas.

from a wide range of music, from those which are both natural in origin and naturally recorded, to those which are essentially electronically derived.

Program material
For the latest series of tests, the program was taken from the following:
Schumann: Fantasy Op 12, Brendel (PH411 042-2, CD)
Debussy: Quartet in G Minor, Orlando quartet (PH411 050-2, CD)
Respighi: Feste Romana, Dutoit (PH410 145-2, CD)
'Flesh and Blood' by Roxy Music (800 019-2, CD)
'Hello, I must be Going' by Phil Collins (V2252, CD)
'Walk Across the Rooftops' by Blue Nile (Linn LHK 1)
'Easy Money' by Ricki Lee Jones (03296-2, CD)
'This is Makewicz' with Phil Woods (Sheffield Lab 21, direct cut)
Drum test: *Hi-Fi News* Test Disc (out of print) HFN 003, CD)
Loussier: Best of Bach (SCD 1, CD)
Joe Cocker: Civilised Man (CDP 7 46038-2)
Falla: Three Cornered Hat (Decca 410 00 82)
Vivaldi: Four Seasons, Marriner (Argo ZRG 654)

Data analysis
The panel results were analysed both for the response to specific program items, and the judgement on particular performance parameters independent of the excerpt. Statistical analysis established the mean and standard deviation of the panel's numerical value judgements, enabling a basic ranking order to be established before decoding the identity of the speakers concerned.

The panel
For earlier editions the panelists included the author, John Atkinson, Dave Collingworth, Paul Crook, Steve Harris, David Prakel, Neil Whiteley-Bolton, Tony Faulkner, Ivor Humphries, Ken Kessler, and Noel Keywood.

For this new edition, David Prakel returned for more punishment, aided by the author, Paul Crook, David Inman (KEF), Robin Marshall (Epos), Richard Ross (Rogers), Chris Breunig, and Steve Harris.

Listening test equipment
The first entry shows the prime component for the latest test, equipment used in previous editions is shown in brackets.
Power amplifiers: ARC *M100* (ARC *D115 II*, Krell *KSA 50*, Magnum *A100*.
Pre-amplifiers: ARC *SPII* (Sugden *C128*, Audio Lab 8000C.)
Cables: Single strand 0.9mm × 3m massed crystal, Siltech and Hitachi microphone grade balanced cable (Monster *Reference*, Randall, Absolute Wire).
Stands: Cliff Stone π, *Foundation* and Stand & Delivery *Lab 1*, Linn *Kan*, Heybrook *HBS1*, floor-keyed and levelled.
CD: Cambridge Audio *CD1*, (Sony *CDP552/702es*, Yamaha *CDX1*).
Vinyl: Linn *LP12*, SMEV, vd.Hul-*EMT MCB1*. (Aux *PD300*, Alphason *HR100s*, *MC1B*, Linn *LP12*, *Ittok*, Koetsu *Black MK1*.)
Tape: (Revox *B77 HS*, Dolby *A361*, Sony *PCMF1/SL7UB*).

LAB TEST PROGRAMME

For the third successive edition the Cambridge Electroacoustics anechoic chamber was used. Despite the comparatively large size of this facility, a degree of low frequency correction is still desirable to approximate true anechoic conditions. Such correction has been added to both the 1m (reference) and 2m (forward characteristic) response traces.

Naturally enough, the computer-averaged in-room ⅓-octave analysis was conducted in the listening room.

The Characteristic Forward Response (2m)
This primary measurement presents visually the forward radiating character of the loudspeaker, over a sensible forward solid angle and throughout the audible frequency range. The fundamental response is normally that taken nominally on-axis, usually between the mid and HF unit. In certain circumstances it is measured on the axis corresponding to the level of the listener's ear when the speakers are correctly sited and mounted.

The uniformity of response traces taken on and around the main axis represent a crucial aspect of speaker performance, which determines whether good stereo imaging is possible, and whether the speaker will sound markedly ▷

◁ different on- and off-axis.

The ⅓-octave noise measurements are taken at a realistic 2 metres distance from the loudspeakers. The Characteristic Response set comprises: axial; 15° above in the vertical plane (below if relevant, eg in the case of a tall floor standing model); 30° in the lateral plane (both clockwise and anticlockwise if the speaker is laterally asymmetric); 45° lateral.

Recent research indicates that the perceived spectral balance of a loudspeaker is the result of a complex integration of the first group of sounds arriving within some 10-20mS, a period which is in fact long enough to include reflected energy from adjacent boundaries — floor, rear and side walls. The character of these partly attenuated and decayed reflections are a product of the off-axis energy and add to the direct sound from the loudspeaker.

The low frequency portion of the main characteristic response has been derived from an accurate sine wave analysis at 1m, frequencies above 200Hz representing the ⅓-octave analysed portion.

A good performance on this test will include the following characteristics:

1. A wide, even and balanced axial response, fitting comfortably within +/−3dB amplitude limits from 80Hz-15kHz.
2. A 15° vertical off-axis curve deviating by less than 3-4dB from the axial curve up to 15kHz.
3. A 30° lateral off-axis curve deviating less than 3-4dB from the axial response up to 15kHz.
4. Good lateral response symmetry.
5. A 45° lateral off-axis curve showing a smoothly falling characteristic with increasing frequency.

A speaker whose frequency response varies strongly with axis variations is classed as inconsistent, and will give different results for each listener position. It cannot therefore be subjectively assessed with any degree of accuracy or reliability.

Reference curve

All loudspeakers (both left- and right-hand models) were measured using sine wave excitation at 1 metre. This provides an accurate representation of the low frequency response. Pair matching can be checked by over-laying the curves of left- and right-handed speakers, and the measurement also sets a reference level against which the distortion can be scaled and the quoted lab sensitivity established.

The standard one watt input was established by a voltage of 2.83V RMS on the speaker terminals. For this purpose the impedance was assumed to be a nominal 8ohms.

Listening room responses

Naturally specific to the room used during the listening test, the computer-averaged in-room response has evolved into one of the most powerful predictions of subjective performance. The intention is to create a plot of the average forward sound energy arriving at the listening area.

Due to the 'comb filter' effect, this test cannot be conducted with a stereo pair of speakers energised simultaneously; instead, taking a sensible number of averages, the speakers were evaluated one at a time for responses corresponding to three listener positions (centre, left and right) for the left and right channel speaker positions. Pink noise excitation was used, and each of the six responses is the result of four averages. The whole was algebraically summed and averaged using a powerful computing ⅓-octave spectrum analyser driving a suitable plotter to produce the published responses.

These curves should *not* be expected to give perfectly flat responses. At low frequencies there are some inevitable irregularities corresponding to resonances peculiar to the particular room; the characteristic hump at 60Hz is the main feature here. (It is, however, fascinating to see how different sizes and positions of speakers change the apparent severity of this room res- ▷

ponse effect.) The near ideal speaker may be expected to run more or less flat up to 5kHz; beyond this the response should gradually fall away. Sharper changes in slope will correspond to irregularities in response or directivity, and are therefore suspicious.

Taken at about two metres with the speakers mounted on stands well into the room (unless stated otherwise), the averaged response will contain a reasonable proportion of direct to reverberant or reflected sound, and is a fairly good indication of the tonal and spectral balance perceived by the listening panel.

Certain more directional speakers change the direct-to-reverberant ratio considerably and complicate the interpretation of these graphs. For example, the Quad 63 shows apparently severe room interactions at low frequencies, more so than theory would predict, but the subjective bass quality was nonetheless comparatively uniform and extended.

Distortion

Using a swept tracking filter, second and third harmonic distortions were plotted at 96dB and 86dB. With average sensitivity above 86dB/watt, typically less than 1 watt was required for the lower level; since most HF units in such systems are attenuated, blown drivers are nowadays a rare occurrence. However, at 96dB miniature speakers are generally in gross overload at low frequencies, so an 86dB test level is more relevant to their limited application.

It is generally accepted that third harmonic distortion is more aurally obtrusive than second, so we pay particular attention to the level of third order effects in the midband, where the value should be significantly below 1%. Higher figures are permissible below 100Hz — say 2%, with up to 5% satisfactory at levels under 50Hz. Third harmonic distortion is an indicator of magnetic non-linearity — for example in crossover inductors — and is also related to the incidence of intermodulation distortion products. Second harmonic distortion values of perhaps double the level of third may be considered acceptable. A decibel (dB) scale is given on the graphs, referenced to midband 0dB only, so this will require rescaling if a chosen frequency is materially different from that reference level.

Impedance

The impedance curves were plotted for all loudspeakers, while the phase angle was monitored and 'worst case' combinations of phase and impedance have been recorded. For space reasons the curves themselves are no longer published.

Constructional quality

The enclosures were inspected both inside and out to assess their construction quality, the grade of components used, and the general standard of engineering. During all tests, any buzzes or rattles were noted and where possible their source identified.

Sensitivity and power rating

From the reference curve, a mean midband sensitivity figure was recorded, corresponding to the sound pressure at 1 metre from the enclosure when energised by 2.83V (sine). A nominal 8ohms draws 1 watt from this voltage, and lower impedance draws more power, on a *pro rata* basis. Since amplifiers (within their limits) are theoretically voltage sources, this method of specifying voltage sensitivity is a sensible one. Likewise, as no loudspeaker presents a constant impedance value, a power input sensitivity rating is a rather pointless one.

From the power handling, sensitivity and impedance data, a recommendation can thus be made concerning the loudspeaker's minimum and maximum amplifier power rating (per channel, 8ohms). It should be appreciated that this is only a recommendation, and will be modified in practice by individual taste; *ie* a requirement for low or high listening levels as ▷

▷ well as by the size and acoustics of the particular listening room involved. The minimum amplifier power that is quoted relates to a typical maximum sound pressure level of 96dBA (2 metres) from a stereo pair of speakers in an average room of volume 80 cubic metres.

It is almost impossible to specify a maximum power rating, as a complex relationship exists between the type of programme, the maximum power input (peak and average) and how long this maximum level is maintained. In this test we found most of even the smallest speakers could sustain a 500W peak, 250W mean power input on solo intruments in the midband provided that its duration did not exceed 15 to 20 seconds. On highly transient signals a 500W peak could apparently be indefinitely tolerated if the mean power was low.

There is a strange contradiction regarding amplifier size, larger models appearing to be safer than smaller ones! Take for example the case of the Spendor *BC1*. It incorporates a Celestion *HF 1300* treble driver which is rated at not more than a few watts, and yet the system as a whole survived the high level test at a full 250 watts for over a minute, and easily tolerated 500W peaks. However, partner this system with a smaller 35-50W amp, drive the latter beyond its limits into clipping, and there is a good chance that the treble unit will blow, as many *BC1* owners will testify, having tried to use the speakers at a party! This example clearly illustrates the difficulty of defining power ratings.

Notes on frequency response testing

The repeatability of response measurements from one test facility to another is surprisingly poor. This obviously matters little for models whose response profiles resemble mountain ranges, but when a carefully calibrated model with tightly specified response limits is involved, it is only too easy for an unfortunate combination of circumstances to result in a measured response that is apparently 'out of spec.'

Careful consideration of the factors involved does however enable sources of error to be identified and accounted for. They include:

1. Slight but significant differences in microphone frequency response, particularly if 500Hz is chosen as a reference point with which to correlate subjective spectral balance judgements. This is unfortunately true of even the best 'lab reference' condenser microphones.
2. Proximity effects, whereby the range below 500Hz is elevated by 0.5dB or so at 1m relative to the speaker's previously calibrated response at 2 m.
3. Non-anechoic environment effects.
4. Choice of axis is also critical, since the response naturally varies somewhat with mike position on the frontal axis.
5. Whether or not the grille is in position during measurement can also effect the results; some manufacturers quote specs. with the grille removed.

In one case a combination of these factors resulted in a response curve that differed in balance and character from the manufacturer's own claimed tight limits, although it still met a +/−2.0dB spec. (but only just) right up to 17kHz. This example illustrates that the tester must be aware of such effects in order to maintain a good level of accuracy in published responses and the interpretation thereof.

Lab test equipment

B&K 2010 generator/analyser
B&K 1901 harmonic controller
Nicolet 100kHz FET analyser
B&K 4133, 4165 precision 12.5mm condenser microphones
B&K 1623 tracking ⅓ octave analyser
B&K 2307 high speed level recorder
B&K phase meter
Ivie 30A real time ⅓ octave analyser
Rion LR04 level recorder
Hitachi 550 oscilloscope
Baxendall sweep oscillator
Shackman scope camera
Hewlett-Packard HP8703 audio analyser
Hewlett-Packard HP3561A and HP3582A Fourier analysers
Hewlett-Packard HP200 and 8926A computers
A&R Cambridge SA200 and Mission 777BU power amplifiers

Acknowledgements

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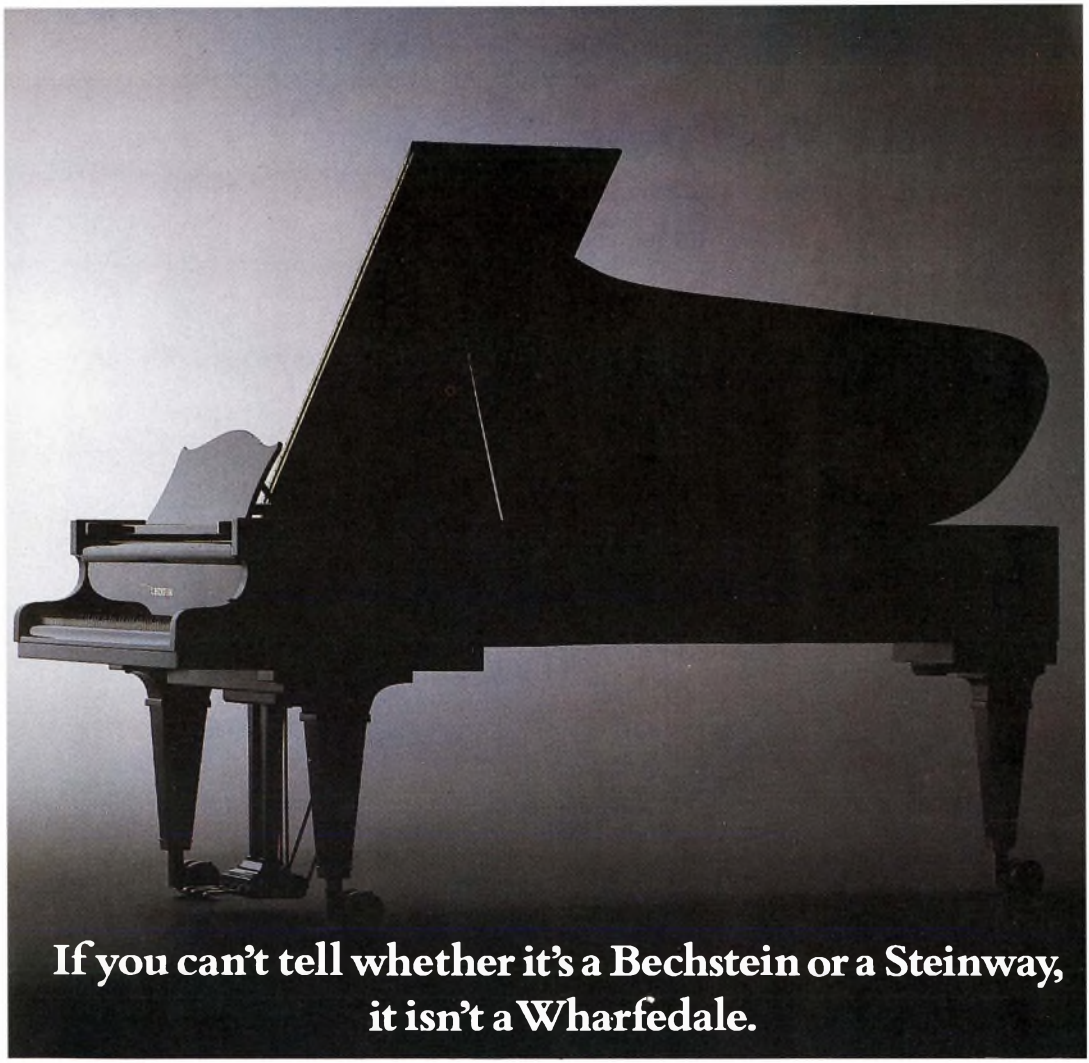

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STANDS AND CABLES

Today's loudspeaker purchaser entering a specialist hi-fi shop with £150 to spend is quite likely to end up with £100 loudspeakers sitting on £50 stands, a situation that would have been unheard of five years ago. And as often as not he will have made the decision himself, based on a demonstration which has left little doubt of the vital role that the stands play in the overall sound. Indeed it is becoming increasingly clear that the stand should be regarded as an integral part of the loudspeakers. Proper support is as important as proper siting, and both are nearly as important as the loudspeaker itself.

Connecting cables demonstrably also benefit from more than a passing nod. And although decent quality cables are not excessively expensive, it is possible to spend a great deal of money on some of the more outrageous pure silver confections. However, this level of obsession tends to be restricted to the well-heeled audiophile with exotic equipment, who probably pays more attention to the various low-level interconnects than to the speaker wire itself.

How much value can good or bad choices add or subtract from the performance of a loudspeaker? Strictly 'guesstimating', poor siting and inadequate support can knock a third off the typical value of a loudspeaker, while the best carefully matched stands can be worth half as much again in performance terms. Cable choice is more likely to add or subtract 10 to 15 per cent of performance, with the greater potential gains associated with the more exotic amplification.

The physical reasons why these particular accessories should have assumed such subjective significance, and should only have done so quite recently remain somewhat obscure, though not beyond conjecture. The bottom line is that loudspeaker stands and connecting cables both have an important influence upon the overall sound quality that a system can produce, and the fact that this was barely identified five years ago is perhaps evidence of the steadily improving quality of the sources.

Conflicting theories of various kinds have been touted, but most attempts to carry out objective measurements have failed to explain causes and effects convincingly. Certain fairly general ground rules have been established for both stands and cables, but in the final analysis 'suck it and see' is still part of the overall recipe, and the end result may well depend as much upon the skills and resources of the dealer in creating the best cocktail of price and performance, and in carrying out the setup and installation with care.

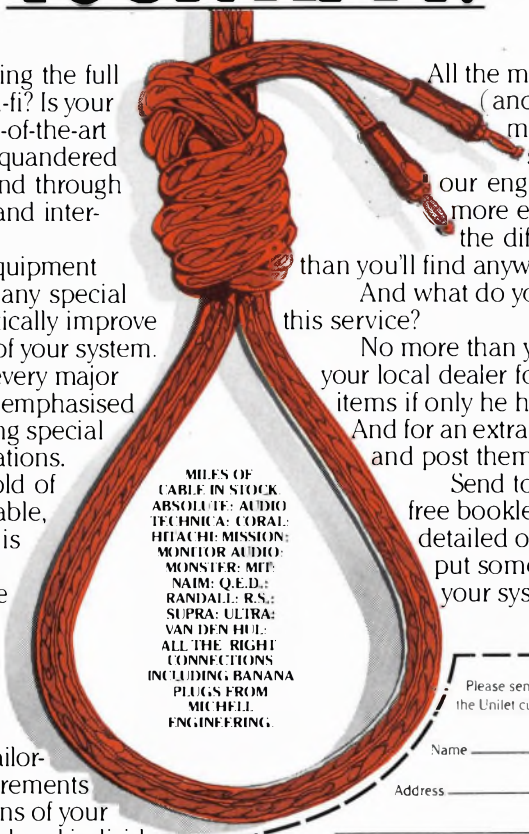
Hi-fi engineering is usually explicable in terms of conventional science and engineering, at any rate up to a certain level of refinement. Similarly the *Hi-Fi Choice* review projects examine the success of the various manufacturers in meeting these basic criteria. But objective measurements only go so far, and actual listening must be the fundamental criterion. Put another way, a loudspeaker which measures poorly is unlikely to sound particularly good — and least in certain respects. Conversely, however, excellent measurements by no means necessarily guarantee similarly excellent sound quality.

It is these grey areas, between merely competant and the nearly great, where attention to the little details really pays off, and the optimisation of the whole system assumes real importance. Accessories such as speaker stands and cables, not to mention the siting of the loudspeaker in the room, can be as vital as the components themselves.

STANDS AND SUPPORTS

Loudspeaker stands first started appearing about 15 years ago. Their purpose was to partner the BBC-influenced monitor loudspeakers like the Spendor *BC1*, Rogers *LS5/6*, KEF *104AB* and their successors. These designs have unusually low inherent midrange colorations, and the stands helped avoid additional coloration from ▷

ARE YOUR CABLES THROTTLING YOUR HI-FI?



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◁ room reflections, first by raising the loudspeaker up from the floor, and also by allowing the speaker to be rolled out easily into free space away from walls when in use.

In this they were undoubtedly successful, but at the time no-one seemed conscious of the other influences that the stand had on the sound. Paradoxically, whereas the search for low coloration had originally spawned the stand, the search for increased dynamic contrast and liveliness — often at higher levels of coloration with wall-mounted designs — led to the second generation of rigid stands with floor- and cabinet-spiking. Almost simultaneously a third variation has appeared, adding substantial mass to an inherently rigid design.

Sacrificing the convenience of castors means that the loudspeaker is now fixed more or less permanently to its site in the room — this is certainly one reason for the rise in popularity of wall-mount over free-space designs of late. However, the improvement in sound quality from adopting rigid stands is so dramatic that one can no longer seriously consider older castor type stands for hi-fi applications. Rigid mounting improves dynamic contrasts and impact, stereo width and depth, and also the subjectively perceived bandwidth; it will also affect and may improve the coloration of the loudspeaker.

To believe this, you have to hear it for yourself, and the writer can still vividly recollect the incredulous faces of a pair of hard-bitten and cynical BBC engineers when they first heard the effect of spiking stands. To understand why this should be important is rather easier, and one merely has to look afresh at what a stereo pair of loudspeakers is trying to do. More objectively, Martin Colloms recently substituted a **Cliff Stone π** stand in place of a *Foundation*, and noted that for the same volume control setting the bass/mid cone now 'bottomed' on a specific bass transient. The obvious inference is that the enclosure was now being held more rigidly so that the cone excursion was increased.

THE ROLE OF THE STAND

The loudspeaker has to create vibrations in the air which correspond to the signals with which it is fed, simultaneously covering a wide range of frequencies from around 20Hz up to 20kHz, and collosal differences in dynamic range. This is done by vibrating diaphragms mounted on the front plate or baffle, but the ideal signal transfer can only be achieved if the mounting plates are absolutely rigid with respect to the room. And it is easy to see why large movements of a comparatively heavy bass cone inevitably cause considerable vibration in the enclosure and baffle. This can shake the drivers and modify the wanted signal, and can be transmitted into adjacent surfaces such as tables or shelves. Non-rigid supports will allow the whole enclosure to move around to a sufficient degree to upset dynamics and stereo, while rigid supports effectively couple some of the mass of wall or floor to the enclosure and at least gives the pair of speakers a chance to create a coherent stereo soundfield.

Beyond the question of rigidity which is now generally accepted, there is the question of the energy transfer between the enclosure and the stand (and the floor), and the complex effects which this can have. Here we start to get into rather murkier and more controversial waters. Different types of enclosure deal with vibration in different ways; different types of stands interact in different ways to the various forms of vibration which the enclosures produce; and further variations are created by the spike, 'tiptoe' or 'Blutack' contact between enclosure and stand.

Generally speaking — and there are bound to be a number of exceptions — the heavier loudspeakers do tend to prefer the lighter stands, and the lighter loudspeakers respond better to the heavyweight stand. Heavyweight proponents point out — quite correctly — that lighter stands produce more vibration and hence coloration, while lightweight fans note that the heavier stands are apt to store and return the ▷

◁ energy over a longer timespan. And then there is a further element of debate on the uses of different types of stands and floor-keying methods according to whether the floor is wooden, concrete, or some combination or alternative.

Wall brackets provide an interesting alternative to floor stands, where the loudspeaker in question has been balanced to cope with the bass and lower midrange augmentation that such siting provides, and where the compromise that results is considered acceptable. Rigid and spiked wall brackets are available from a number of suppliers, and are much neater and cheaper than stands. They allow the enclosures to be mounted significantly higher than usual, which further reduces floor reflection effects and is apt to enhance the subjective 'sense of scale' conveyed by a system. However, walls tend to be more easily excited than floors, and some speakers may interact badly with stand and wall. In this respect outside and load-bearing walls are likely to work much better than partition or stud types.

It is arguments like these that keep hi-fi so fascinating! Ultimately it will come down to choosing on demonstration or approval, and hopefully achieving a result which enhances the strengths of the rest of the system.

THE STAND MARKETPLACE

Stands are sourced and marketed by three different groups in the industry, the accessory or stand specialists, the loudspeaker manufacturers themselves, and a number of creative and enthusiastic dealers. The stands themselves may be specific and unique to a particular loudspeaker, may also suit wider applications, or may be near universal designs suited to almost any loudspeaker.

It is fair to say that the specialised stand is likely to work best of all for a specific loudspeaker, while the universal stand, produced in greater numbers, is likely to be cheaper and may offer better value for money. Companies such as **AVF, Target, QED** and **Partington** produce a wide range of general models to suit most applications, and at competitive prices, while several have been adding expensive high performance models recently. **Cliff Stone**'s *Foundation* and π stands have successively broken fresh ground with high mass and high price tailored to different models, though the Atlas is a popular cheaper alternative. **Stand & Deliver** produce useful stands specifically for Spendor/Rogers and Quad loudspeakers. Amongst speaker manufacturers, **Linn** and **Heybrook** have enjoyed considerable success in the middle market, particularly for close-to-wall applications. Dealers have taken a number of initiatives in stand development, notably **The Sound Organisation, Sound Advice, The Audio File,** and **The Cornflake Shop,** the latter with an outrageous-looking creation that costs half as much again as, but sonically transforms, the popular Wharfedale *Diamond*.

Ultimately we are moving steadily towards the integrated loudspeaker and stand, but with the opportunity for stand specialists to improve upon and offer greater variety than the loudspeaker manufacturer, while the user has some opportunity to choose stands which help enhance the overall balance of the rest of a system.

CABLES

While stand and location can have as dramatic effect upon the sound as the choice of loudspeaker itself, the cabling can also have a significant influence. However, where even the cheapest loudspeakers can benefit substantially from a stand which may cost half as much again, decent cabling can be comparatively inexpensive, while the more exotic types only really seem to come into their own with similarly exotic systems.

The reasons why cables should influence sound quality are rather less easily identified than those which justify stands, so the industry has been forced to rely almost entirely upon

subjective judgements. Why does the sound depend upon the metallic crystal structure of the conductor? Why can one also hear the differences between different types of insulator, or indeed no insulator at all? The observations are repeatable and undeniable, but theories are on or over the edge of conventionally accepted science, dealing with obscure areas of metallurgy and theories of electrical transmission. The problem as ever comes down to the extraordinarily broad spectrum of signals which comprise high quality audio, covering three decades of frequency and a huge dynamic range: where the difference of scale between a loud bass fundamental and a high frequency violin overtone is so collosal, it becomes easier to imagine that oddities like information loss within conductors can take place.

Because this is such a subjective area, there are inevitable controversies and disagreements. The soundest advice is probably that cables ought to be taken seriously, at least to the point of automatically using really hi-fi cables. The exotics will only start to come into their own in systems costing over £1000. However, cable experimentation can prove cheap and worthwhile.

The marketplace consists of several high quality and widely used brands at quite modest prices, notably **QED, Naim, Mission** and **Supra.** The middle market consists of what might be termed 'semi-exotics', such as the long-crystal oxygen free copper (LC-OFC) types from **Hitachi** and **Audio Technica,** the cleverly marketed **Monster Cables, The Absolute Wire,** and the cheaper **van den Hul.** Upmarket we find even more exotic stuff, with pure silver wiring and unusual insultators, from such names as **Siltech** and **van den Hul**.

It is also worth mentioning New Malden dealer **Unilet,** who offer a specialist custom cable service based on a wide range of different connectors and cables. Their price list alone will be informative, and this is undoubtedly the UK Mecca for the cable fanatic. Once again those seeking cable improvements should not necessarily automatically choose the 'best' cable for a particular application. The overall balance of a system is probably more important, and in this area manufacturer recommendations are often reliable guides, while some experimentation can produce very worthwhile results.

BEST BUY

ACOUSTIC RESEARCH 18

ACOUSTIC RESEARCH, HIGH STREET, HOUGHTON REGIS, BEDS LU5 5QJ.
TEL: (0582) 867777

Last year the Acoustic Research budget speakers did not fare too well in *Choice*, as a hurried changeover from pulp cone systems to inadequately developed plastic cones gave unimpressive end results. Since then AR have completed an extensive development programme, resulting in a new set of budget models. The *18* is the middle-sized system, selling at a typical £115 a pair.

This compact two-way design uses a 210mm frame, 165mm cone bass/mid unit, plus 19mm cone dome tweeter. Both radiating elements are plastic, graphite-loaded polypropylene for the larger driver and polycarbonate for the ferrofluid-cooled tweeter.

During development it was discovered that the bass/mid unit possessed a naturally flat response with a convenient rolloff near the intended crossover point. Experiment confirmed that the system could work without an electrical crossover to this unit, and that a single capacitor feeding the tweeter would complete the design. The overall acoustic slopes approximate to 12dB/octave, with the ferrofluid damping helping to establish a defined tweeter bandpass. One outcome of the simple crossover design is that the amplifier is directly wired to the bass/mid unit. Past experience suggests that if such a system can be made to work correctly, this may confer benefits in terms of clarity and definition.

Built largely from 17mm chipboard, the vinyl-clad enclosure has a sealed-box volume of 15.4 litres, loading the bass unit to system resonance at 85Hz. The grille is satisfactorily shallow and rebated. Electrical connection is by 4mm socket/binders. Placement on stands is recommended, fairly close to the rear wall — 0.4 — 0.6m should be a good starting point.

SOUND QUALITY

Improving on its predecessors, the *AR18* scored an average rating while being priced well below. In terms of tonal balance it did sound 'small' for example with a lack of body on piano, but this was not too serious. The bass was nicely articulate, if too dry in the lower register. The midrange seemed somewhat forward, but balanced quite well through to the treble. Stereo imaging gained an overall 'average' rating, but more dynamic clarity was apparent than is usually found in speakers of this price. Again of average quality, the treble was fortunately unobtrusive. Quite good power handling was shown at the higher test levels.

LAB REPORT

In anechoic free space the *'18* provided a really good axial response, albeit one which showed some treble improvement when the grille was detached. The reference sensitivity was a high 90dB/W, with the associated −6dB bass rolloff at 60Hz. Fair bass should be available down to 50Hz, if somewhat attenuated. The general trends are best seen at the 2 metre measuring distance, in particular a rising output through the midrange with a moderate variation in output.

The off-axis curves were poorer than usual, partly because the high crossover frequency

operates the bass/mid unit in its more directional region. The above-axis result was also unpromising, so the loudspeaker should be at or directed towards head height. The overall indications were of a 'light', 'forward' balance with some 'lumpiness'.

With a power handling of 60W, up to 103dBA will be possible from a stereo pair. Amplifiers down to 10W per channel will provide sensible sound levels provided party use is not envisaged. Rated 'good' in terms of amplifier loading, the impedance characteristic was fairly even, dipping to a minimum of 5 and averaging 6.5ohms. Most amplifiers will not find this speaker any problem to drive.

Measured in the listening room (without the benefit of wall augmentation), the response showed some mid dominance around 1kHz, but the overall balance was tolerable and the energy reasonably uniform through the crossover region.

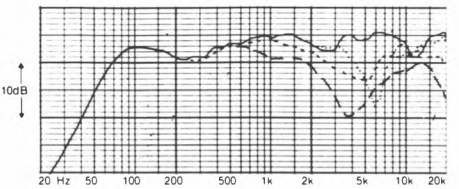
Distortion performance was more than competant at the higher 96dB sound level, particularly in the bass. At higher frequencies the third harmonic was held to below 1%, averaging 0.7%. At the reduced 86dB level a proportional improvement was obtained across the range.

Conclusions

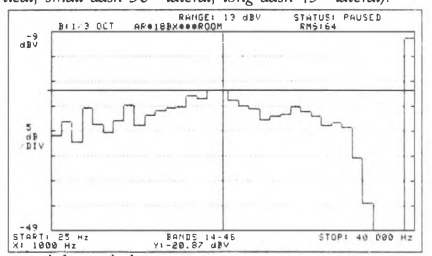
While the '18 was not particularly tidy in response terms, it passed the lab tests in quite good form. Subjectively it proved better balanced than anticipated, with moderate coloration, a pleasing dynamic quality, and above average programme detail. The good sensitivity and amplifier loading ensures a Best Buy value for money rating.

General Data

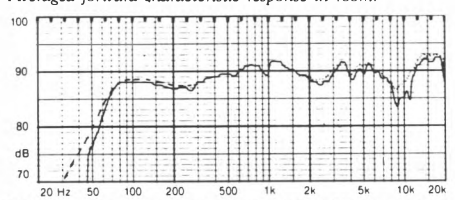
Size (height × width × depth)	45.5 × 27.5 × 21cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) – 60W
Recommended placement	on stand, near wall (0.5m)
Frequency response, within ± 3dB, at 2 metres	65Hz to 20kHz
Low frequency rolloff (– 6dB point) at 1 metre	60Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	90dB/W
Approximate maximum sound level (pair) at 2 metres	103dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	average
Typical price per pair, inc VAT	£115



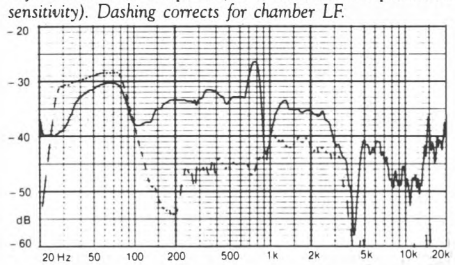
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

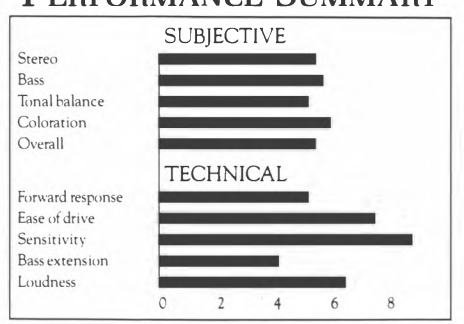


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

ACOUSITC RESEARCH 22

ACOUSTIC RESEARCH, HIGH STREET, HOUGHTON REGIS, BEDS LU5 5QJ.
TEL: (0582) 867777

Closely related to the *AR 18*, the *'22* shares a similarly-sized enclosure and the same 230mm frame bass/mid unit. In the *'18* this driver is 'let rip', with no crossover for the low frequency section. Some additional crossover elements are used in the *'22*, to help define a more even response and more precisely integrate a different, wider range tweeter.

The *'22* is a sealed-box model with an internal volume of around 16 litres, resulting in a system resonance close to 60Hz. The carcass is vinyl-clad 17mm stock, and the front baffle is 17mm MDF. The back is recessed and the enclosure is quite rigid despite the lack of additional bracing, and shows above average resonance properties. A loose filling of polyester wadding provides some absorption for internal standing waves.

The bass unit has a shallow, flared polypropylene cone of 165mm effective radiating diameter, the cone plastic reinforced by a graphite loading. The treble is handled by a 25mm soft plastic dome tweeter, ferrofluid-cooled. The crossover is of normal commercial quality and conforms to 12dB/octave rates. Internal connections use clip-on terminals, while combined 4mm socket/binding posts making the external links to the amplifier.

The grille is a quite slim 9mm moulding, with a rebate to reduce diffraction in the treble. Location on rigid stands is advised, spaced possibly 0.5m from a back wall, though this dimension may be varied to suit local acoustic conditions.

Sound Quality

While the *'22* was a little better balanced tonally than the *18* — naturalness on singing voice and the like — it nonetheless scored slightly below its less expensive brother. Some listeners remarked on a higher perceived level of coloration with some 'spikey' sounds in the upper treble. Some of the dynamic 'life' of the *'18* was missing in the *'22*, though in certain areas the latter was more accurate. It scored about average on other subjective parameters, and is therefore quite a competent performance in view of its modest price.

Lab Report

The sensitivity was close to average at 88.5dB/W, some 1.5dB less than the *18*. Consequently the maximum sound level was less, the system reaching 101dBA for a maximum input of 75W program. (Some differences in frequency response shape accounts for an extra dB loss in the peak dBA reading.) Set against the reference sensitivity, the bass extended to 60Hz, −6dB, and realistic output down to 50Hz can be expected under room conditions.

The reference response was smoother than for the *'18*, except in the treble where a 5dB plateau appeared from 14-19kHz. The output showed little change when the grille was detached (dotted line). The speaker performed well on the 2 metre set of characteristic forward responses, exceptionally so in the lateral phase at 30° and 45°. In fact the high treble peak was almost gone

by 20°, suggesting that a 'straight ahead' orientation for the enclosures in the listening room, listening off-axis, should give the best results. Some mid dominance may be seen, while the bass appears to be mildly underdamped. A small dip on the 15° vertical axis indicates that the speakers should be located at a sensible height, and not too low compared with a seated listener's head.

In-room, the '22 demonstrated a well balanced response, though with noticeable uneveness. The central midrange was satisfactory, but the treble peaked at 5kHz and showed an undesirable 'corner' at 16kHz (the axial peak). Surprisingly the output peaked at 150-200Hz, while the lower bass was somewhat depressed.

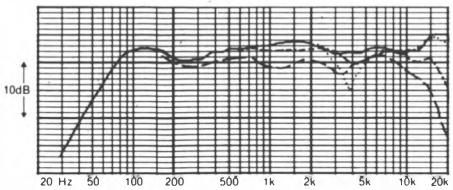
The impedance characteristic suggests that the '22 is a good amplifier load; although below the 8ohm standard, it should not present any problems. The distortion characteristics were fine at 86dB, averaging 0.4% third harmonic and 0.7% second, and although there was naturally an increase at the higher 96dB level, distortion remained well controlled.

Conclusions

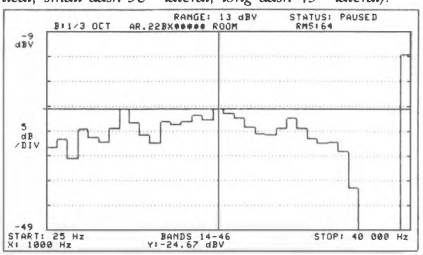
The '22 should be better than the *18*, but in practice was not. The general characteristics were similar, but it proved harder to forgive the high treble 'sting' of the '22 than the response untidiness of the *18*, particularly as the '22 is more expensive. However, in context the value for money is still good, so the system qualifies for recommendation.

General Data

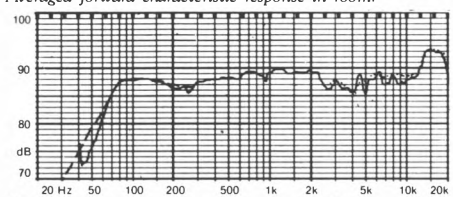
Size (height×width×depth)	44×27.5×21cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) –75W
Recommended placement	on stands near wall (0.5m)
Frequency response, within ±3dB, at 2 metres	70Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	60Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	88.5dB/W
Approximate maximum sound level (pair) at 2 metres	101dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good
Typical price per pair, inc VAT	£149



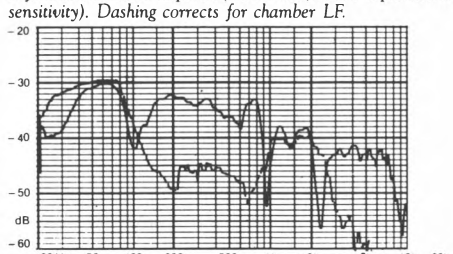
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

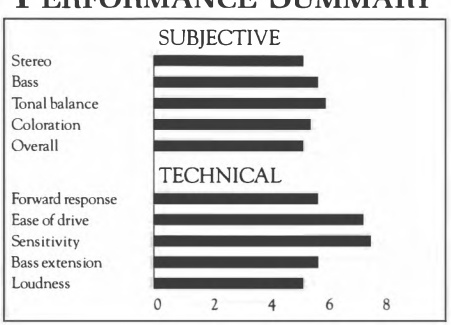


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

ACOUSTIC RESEARCH 44

ACOUSTIC RESEARCH, HIGH STREET, HOUGHTON REGIS, BEDS, LU5 5QJ.
TEL: (0582) 867777

For 1986 Acoustic Research (UK) have forged a new range of budget speakers, and these have been helping to lift their ratings in *Choice*. The 44BX is currently the largest, comprising a classic three-way sealed-box design. The well-proportioned cabinet encloses 52 litres, most of which is allotted to the 250mm long-throw bass driver, though a decent sized rear chamber isolates the midrange unit from the bass pressure.

The system resonance lies at 50Hz, resulting in good bass extension. Free space mounting on rigid 35-45cm stands is advised. The diaphragms of both the bass and midrange drivers are graphite loaded polypropylene, with a flared profile; the surrounds are of foamed polyurethane, with a damping sealent. Above 4kHz, the treble range is delivered by a 25mm soft plastic dome tweeter; all drivers are custom made for AR in Japan.

The substantial chipboard enclosure is built mainly of 17mm panels with circumferential and side bracing, the net result being quite low in resonance effects. We understand that the enclosure has recently been further improved since our review, with additional reinforcement. The 11mm thick grille is rebated, and the exterior finish is 'walnut' vinyl. Internal damping is handled by a fill of polyester fibre, and the good commercial quality crossover is essentially to 12dB/octave, second-order characteristics. Cable connection is by 4mm socket/binding posts.

SOUND QUALITY

Scoring above average in the listening sessions, the results were appropriate to the price. The '44 gave a solid, powerful impression with quite good dynamic 'attack', and a pleasing level of instrumental detail. Mild 'boxiness' and 'nasality' were noted, with a touch of overhang in the bass, and some 'edge' and 'grain' in the treble.

Stereo images were satisfactorily focused, and some measure of ambience and depth was reproduced. Several listeners correctly guessed that this was a three-way design, so the drivers cannot be all that well integrated. Overall the sound seemed quite well balanced, with the slightly emphasised midrange adding to the vocal clarity. The system handled high powers with great competence.

LAB REPORT

The sensitivity was an above average 88.5dBW, though this was achieved at the expense of a lower than usual load impedance, which dipped to 3.3ohms at 100Hz, and averaged 5ohms over the range. Tougher 4ohm rated amplifiers are to be preferred, with a 10W suggested minimum power, while maximum drive of up to 150W can be used, giving good sound levels of 104dBA in-room. Backing this power capability, the distortion traces at 96dBA showed an average 1% over most of the frequency range, though the third harmonic 1-4kHz was probably higher than desirable; by 86dB, the important distortions averaged a comfortable 0.3%.

The smooth reference response curve fitted quite close limits despite a suggestion of mid 'forwardness' and some treble lift at 15kHz. The

bass was mildly underdamped, but well extended to 43Hz, −6dB. The grille did not significantly upset the response, but can be seen to act as a treble attenuator. At 2 metres the speaker showed some improvement in driver integration, and the lateral off-axis responses are notably well controlled, but the 15° above-axis response in the vertical plane shows a 6-8dB dip around the upper crossover. This suggested that the stands used should be sufficiently high to bring the point between the mid and treble units up to or above ear height. Placement on the floor is asking for trouble, never mind the consequent coloration increase in the bass and low midrange.

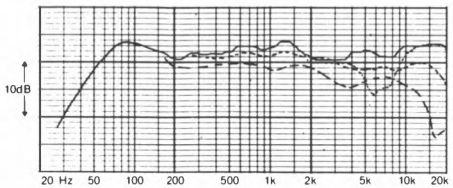
Measured in the listening room, the bass holds up well down to 30Hz without serious imbalance, though the lower midrange, 200-500Hz, shows a mild depression, while the range just above this was a mite forward, and is responsible for a trace of mid dominance. Integration is most satisfactory across the mid-treble, while a slight 'corner' can be seen just before the treble finally rolls away. The balance overall is good.

Conclusions

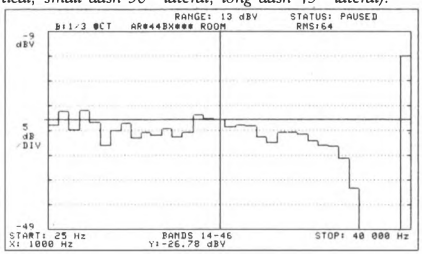
This is a powerful, well designed three-way system. The amplifier loading characteristics are tougher than usual, but sensitivity is healthy and the bass well extended. Tonal balance is pretty good, stereo detail and clarity were both well above average, so the system represents good value and is clearly recommended.

General Data

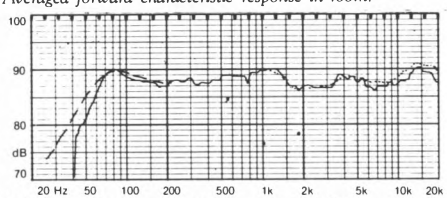
Size (height × width × depth)	70 × 32 × 34.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −150W
Recommended placement	open 35cm stands
Frequency response, within ±3dB, at 2 metres	50Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	43Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	88.5dB/W
Approximate maximum sound level (pair) at 2 metres	104dBA
Impedance characteristic (ease of drive)	below average
Forward response uniformity	good
Typical price per pair, inc VAT	£339



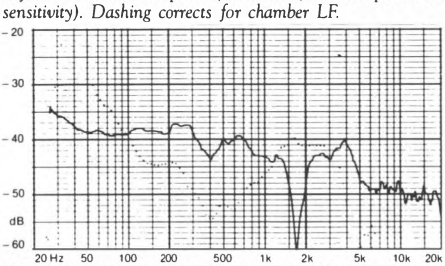
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

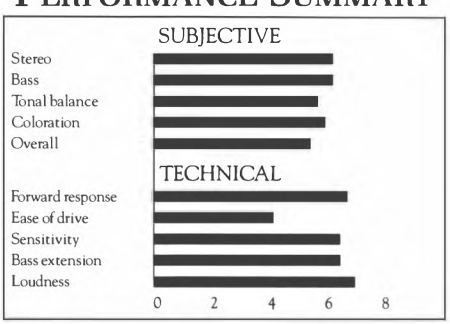


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



CASTLE
ACOUSTICS

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Stereophile Magazine Vol. 9 No. 1

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. . . Frequency response at the bottom end was impressively extended for a box of this size . . .

. . . Without exception, these are the nicest looking hi-fi speakers I have ever seen."

George Entwistel,
New Hi-Fi Sound, June 86

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ARCAM TWO

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

A&R's Arcam *Two* is the middle of three models from this manufacturer. Like the *One*, this compact design is a two-unit reflex loaded system and carries the same unusual feature of an optional open-cell porous plug in the reflex port.

The two drive units are mounted vertically-in-line and comprise a 19mm soft plastic dome by VIFA and a 170mm Kobex PVC-coned bass/mid unit, built for A&R by Elac. The latter driver has a steel frame, with an appropriate magnet. Using high quality components the crossover is nominally 12dB/octave, 2nd order. Inside, the chipboard panels are damped by a bituminous lining and the interior air volume by a small amount of foam and fibre wadding. The thick MDF front panel is braced in the area between the drivers. The overall construction is very good, the exterior is finished in real wood veneer, and the foam grille has good acoustic properties.

With a 13 litre internal volume, the enclosure is tuned by a large 5.7cm diameter port, 15.5cm long, fitted to the rear panel. Electrical connection is *via* projecting 4mm socket/binding posts.

Matching platform stands were provided, but the recommendation is for near-to-wall positioning, adjusted to suit room acoustics and taste.

SOUND QUALITY

The *Two* scored a direct hit at the 'average' mark in the listening tests for this edition. Its price is also virtually at the group average and so the listening result is considered worthy, but unexceptional. The panel agreed closely on marks, suggesting a consistent, well balanced output with good forward distribution.

Stereo focus was to a good standard, with fair representation of depth but also some central concentration, reducing soundstage width. Tonally the sound tended to be a little 'thin' and bright, with a hint of mid hardness. Violin tone was rated well but piano lacked 'body'. The bass was average in definition while low bass was muted; with the port open, more low bass was available at the expense of mild 'boominess'. Coloration was judged a little better than average overall, with reasonable power handling on heavy rock programme.

LAB REPORT

The reference sensitivity measured 87dB/W which was about average, suggesting a minimum amplifier power of 15 watts per channel. It coped with up to 75W peak programme (undistorted) and could thus provide up to 101dBA sound levels in a typical room. The distortion results at a continuous sound level of 96dB at one metre gave decent average readings of 1% through the bass-mid region. At the lower 86dB sound level distortion improved, with typical midband results of 0.3% (−50dB) falling still further at high frequencies.

The axial reference curve showed a rising trend up to 500Hz, confirming the optimum position as close proximity to a back wall. Port open, the −6dB rolloff was average at 52Hz, and with the port plugged this rose to 65Hz, though with a slower rate of bass rolloff.

Turning to the forward response set, the output can be seen to be well integrated in the lateral plane but showed a mild trough at 15° above axis, suggesting the preferred use of fairly high stands such as Arcam's own.

In the room the speaker response showed some mid forwardness, together with excess treble and a shy bass at the lowest extreme.

CONCLUSIONS

The Arcam *Two* is a nicely finished, well engineered compact system, suited to near wall mounting on stands. Its competent performance in both subjective and objective terms has ensured that it has not fallen behind, but its achievement was too close to the average for recommendation. Nevertheless, it has sufficient merit to be well worth consideration, particularly as part of a complete A&R system.

Reassessed. First reviewed 1985. Current typical price £200.

General Data — see pages 180-184.

ARCAM ONE

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

Following the success of the *Arcam One*, A&R have introduced an upgraded version for 1986, which has been re-auditioned and partly re-measured. In many respects is identical with its predecessor, the bulk of the review has been retained and only updated where necessary.

This is a medium-sized two-way bass reflex system aimed at the higher quality end of the market. The recipe is straightforward enough — a 200mm bass/mid unit plus 25mm soft fabric dome tweeter, but A&R's approach shows considerable care and attention to detail.

The tweeter is a modified Peerless design, mounted above an A&R-designed Elac-built bass/mid unit. Constructed on a strong damped steel frame, the latter uses a generous motor system driving a synthetic flared cone formed from Kobex (a PVC material). The crossover is a high-quality, high power design with 12dB/octave slopes, and may be disconnected by the user via a terminal patch panel on the enclosure rear. Direct active connection to the two drivers is then possible, using matching A&R electronics.

Built from 19mm chipboard, the substantial enclosure is internally braced and loaded by a thin bituminous cladding. A 120mm deep ducted port is located on the rear and is fitted with a user-removable damping plug to allow fine adjustment of the lower bass output.

Externally, the system was well finished in a high-quality walnut veneer on all surfaces. The 12mm-thick grille panel has a step effect although this is partly ameliorated by a foam strip around the tweeter. Against A&R's recommendation, we felt the grille was better removed, and it could do with some modification.

SOUND QUALITY

Auditioned for 1986, the Arcam One did less well than its predecessor, scoring only average despite its above average price.

Bass was a trace boomy with the port plug removed (as suggested by A&R), while some mild boxiness was heard in the lower mid and the upper treble occasionally hinted at fizziness.

Conversely, this speaker produced lively, open, balanced and transparent stereo images. Ambience, air and depth were well portrayed while natural perspectives and musical detail were also evident over the whole frequency range. Stereo images were stable and well focused, and transients were convincingly reproduced.

LAB REPORT

The reference 1 metre response was re-measured for the new version, and showed a similar character to its predecessor, albeit with treble irregularities occuring at different frequencies. Once again the overall result was smooth.

Sensitivity was above average at 88dB/W with a typical bass rolloff at 55Hz (porous plug in). A minimum amplifier power of 15W per channel is suggested, and the general performance indicated a capacity of up to 150W of unclipped music programme, generating respectable 104dBA maximum sound levels.

At 2 metres a well ordered and integrated forward response output was demonstrated 15° above and below axis. Responses dipped mildly at the 2.7kHz crossover frequency and the speaker median axis should aim accurately at the listener for the best results. The lateral responses were particularly good.

At a 96dB sound level, one metre, the second and third harmonic distortion levels were typically around 0.8% to 1.5%, which was a good result. At 86dB the second harmonic improved but third did not, and here the system is possibly somewhat worse than average, the cause probably being magnet pole linearity. The impedance curve showed an easy, well controlled 8ohm amplifier load.

Room averaged, (port open) the Arcam gave a fine result. The response showed slight bass excess with quite good integration and depth, while the middle register was surprisingly

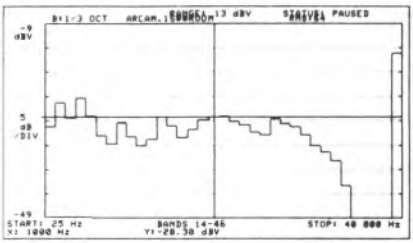
smooth, with a textbook rolloff at higher frequencies.

Conclusions

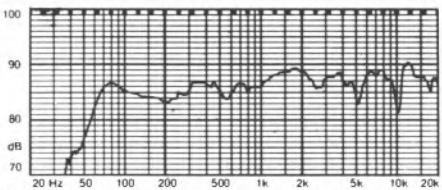
Very similar to the its successful predecessor in many respects, Arcam's *One* regrettably did not fare quite as well in the listening tests. While the solid, well balanced design remains worth considering, the new *One* version has failed to achieve the scores necessary for recommendation, as the competition has intensified in recent years.

Re-auditioned. First reviewed 1983. Current typical price £330.

General Data — see pages 180-184.



Averaged forward characteristic response in room.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.

RECOMMENDED

AKROYD A25

ROYD LOUDSPEAKER CO, UNIT A6, STAFFORD PARK 15, TELFORD, SHROPSHIRE TF3 3PB.
TEL: (0952) 617511

Akroyd have been building loudspeaker systems for a number of years, and although we had unpromising results with one of their earlier models a few years ago, we received the recent *A25* model, said to be a relative of the *Coniston*, for 1986. This fair-sized compact system costs a competitive £100 a pair considering that the vinyl-covered sealed-box chipboard enclosure contains a volume of 25 litres, and that this is a three-driver system.

The 220mm frame, bass driver has a quite lightweight 160mm cone resulting in a speaker system resonance of 72Hz. Underdamped at low frequencies, output was actually well maintained down to 40Hz. The main midrange driver employs a coated pulp cone with classic flared profile, an inverted half-roll polyurethane foam surround, and a pressed-steel chassis, the latter strangely showing premature signs of rust — perhaps it had been stored in a damp environment? The treble is handled by the popular Danish VIFA 19mm soft plastic dome, a variation of the long-established SEAS equivalent.

The enclosure is built from 11mm stock and is devoid of bracing. It is acoustically damped by a couple of layers of polyester fibre, but the walls are untreated, leaving the panels a touch resonant. The grille is a plus feature, being cunningly located in a concealed groove in the picture frame front of the enclosure, and formed of 25mm thick acoustically transparent foam. We found a steel disc cemented to the inside of the rear panel, but could not discover its purpose.

Electrical connection is *via* the usual combination 4mm socket/binding posts. The high quality hard-wired crossover uses air-cored inductors and Mullard film capacitors. The crossover slopes are electrically 12dB/octave, but will be higher order in practice due to the drive unit characteristics.

Sound Quality

The *A25* scored below average on blind listening, but not disastrously so. Somewhat inconsistent with different program, the panel showed noticeable divergence of opinion as to its merits. Coloration altered piano tone, adding some 'nasal' and 'boxy' emphasis. Taken overall the sound seemed fairly well balanced, yet the treble drew attention to itself, occasionally sounding isolated or exaggerating background hiss in the program. The bass was well controlled with even extension to the lower frequencies.

Stereo imaging was interesting — not particularly well focused, but showing good 'attack' and some resolution of the space and ambience in recordings. Depth was weak, but the system showed some life and dynamic impact.

Lab Report

The *A25* has an average sensitivity of 87dB/W, indicating a minimum power of 12 watts. A practical maximum of 75W will provide peak

sound levels of 100dBA in a typical room, and the bass was more extended than average reaching down to 52Hz, −6dB.

The alignment was close to ideal, as the room response shows. An attenuated but extended output was obtained down to 30Hz, while some mid prominence is associated with a notch at 1kHz (the marker position). At higher frequencies the treble looks nicely even, if overextended in the high range.

The Akroyd looked rather primitive on the axial reference response at 1 metre. A valley may be seen at 1kHz, apparently due to a drive unit resonance mode, while beyond this point the output recovered, but showed some uneveness coupled with a slight treble lift. With smoothing at 2 metres these features still persisted, and were in fact more clearly defined. Within the obvious irregularities the off-axis traces were actually very well controlled, proving that the 'lumps' were not crossover related.

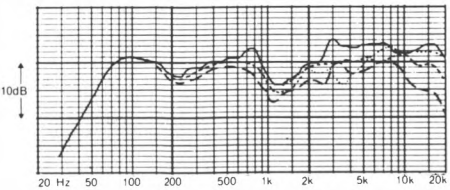
Just touching the 6.4ohm baseline, this speaker proved easy to drive, with an average impedance value of 10ohms. Distortion levels were poorer than average particularly at 96dB, but improved at the lower 86dB level.

Conclusions

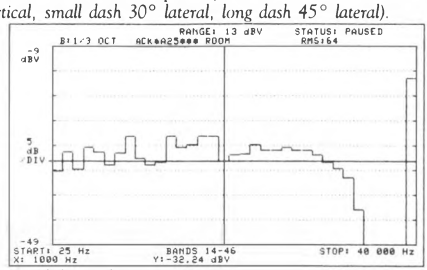
The results for this speaker were rather mixed, both for the lab tests and the auditioning. The indications are that it may not be to everybody's taste, but that it is still worth sampling. Decently sized for the price and with fair bass performance, it has done enough to achieve recommendation, but a personal audition is strongly advised.

General Data

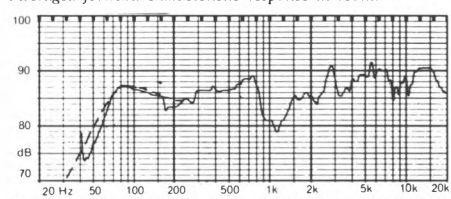
Size (height×width×depth)	51×29.5×24cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(12) −75W
Recommended placement	on stand near wall
Frequency response, within ±3dB, at 2 metres	see graph
Low frequency rolloff (−6dB point) at 1 metre	52Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	87dB/W
Approximate maximum sound level (pair) at 2 metres	100dBA
Impedance characteristic (ease of drive)	good+
Forward response uniformity	below average
Typical price per pair, inc VAT	£100



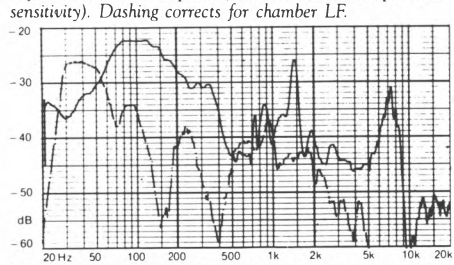
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

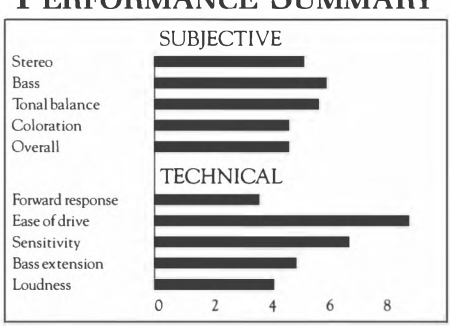


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

APOGEE SCINTILLA

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

Arguably the most technically interesting speaker, the *Scintilla* is certainly one of the most expensive on the market at £4,950 a pair. However, there are certain special problems. First, the impedance of this speaker 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 this can be satisfied by another line imported by the *Scintilla* UK agents, the Krell *KSA100*, and 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 produced really effortless high sound levels. Originally obtainable in either 1ohm or 4ohm form, the *Scintilla* now comes in 1ohm form only, so many amplifiers are ruled out.

A second problem concerns the open panel design. While this is a great strength in terms of freedom from box colorations, 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 do not work well at all in some rooms. 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/midrange 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 'super-tweeter' ribbons, two at the front and two at the rear.

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 de-couple 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.

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/midrange 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 with excellent transparency. Furthermore this vital 'high end' quality was held through the midrange right down into the mid-bass. Low frequency localisation was heard 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.

The bass performance was very powerful 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 than my 19ft 6in room, and its correct low frequency balance was confirmed subsequently in rooms 26 to 36ft long.

Tonally, the speaker's character was marginally 'rich', with an audible presence depression that is kind to matching solid state amplifiers and helps to produce a pleasing overall balance. Properly set up, this speaker was capable of a supremely musical and authoritative performance.

Lab Report

Due to the difficulties in visiting any anechoic chamber with such a weighty example, some tests were carried out in my listening room. Sensitivity was rather low at 79dB/W, and the watt referred to here is a nominal 8ohms reference, so in truth the *Scintilla's* efficiency is very low indeed.

Measured close up, the bass panel showed a pretty uniform response which extended 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, corresponding with the wide driver bandwidths.

The computed listening area in-room 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 low at around 1%. At higher frequencies, 0.05% to 0.1% distortion was typical; these are excellent results.

Conclusions

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. 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 coloration is very low and although it is a beast to drive well, the reward is 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.

Reassessed. First reviewed 1986. Current typical price £5000.

General Data — see pages 180-184.

AUDIOSTATIC ES200

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

This Dutch panel electrostatic speaker is a little larger than the Quad 63, but whereas the latter uses most of its area as a 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 lower frequencies.

The effective width of the source reduces with increasing frequency, maintaining a good lateral off-axis response.

Heavy and stable enough for floor mounting, these speakers benefit from low rigid frames, around 10-15cm high, and the agent also recommends the use of floor spikes.

As with all open-back systems, the *ES200* should be used well away from the rear room wall, and in fact large rooms are preferable. Overall constructional quality and finish are excellent, and Audiostatic also produce compatible sub woofer systems.

SOUND QUALITY

There was a definite limitation in the bass power handling, and over 50 watts was ruled out on several rock tracks. The speaker sounded unbalanced with a forward midrange plus a lack of richness and 'scale' in the upper bass/lower mid. However, this response complemented some sources to a surprising 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 the depth effect was also substantial given appropriate material.

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, the speaker is 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 be on axis.

Distortion at 96dB/1m was very good above 200Hz, particularly as regards third harmonic. Below 200Hz, the speaker was clearly working hard, distortion rising to 3% third harmonic. At 86dB, distortion fell below 0.1% above 150Hz; even at 50Hz neither second or third exceeded 1.5%, which is an excellent result. At moderate levels it 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.

CONCLUSIONS

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.

Reassessed. First reviewed 1985. Current typical price £1,400.

General Data — see pages 180-184.

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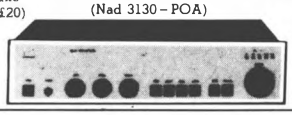

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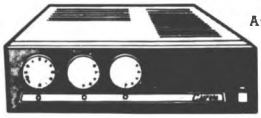

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AUDIOSTATIC ES300

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

Audiostatic is a Dutch company devoted to the design and manufacture of electrostatic panel loudspeakers. The '300 uses a large area electrostatic element mounted in a 44cm wide open-back baffle. The considerable 93cm height compares with the Magneplanar MG3, and gives the '300 a line-source characteristic, driving a cylindrical rather than spherical wavefront towards the listener, the sound quality changing little with head height. However, all such designs show strong dependance on room height and acoustics, so home demonstration is strongly advised.

Audiostatic designer Ben Peters employs an open array of insulated wires for the fixed electrodes, while the ultra-lightweight film diaphragm operates under the usual constant charge principle. This sort of two-way system uses a unique high quality, double transformer system to reduce radiating width at higher frequencies and maintain a reasonably wide beam.

Connection is made *via* gold-plated socket/binding posts, and additional mains is required for polarising the system to several thousand static volts. Needless to say, this is well protected from the user!

SOUND QUALITY

Some aspects of this speaker were quite superb. It excelled in the upper-mid-treble range, where it was pure, articulate, seamless, transparent, and full of natural detail. Stereo focus was very stable, and in the upper range coloration was low. However, in my view this is insufficient recompense for a 'lumpy' low bass, easily overloaded, and with a distinct lack of upper bass power and 'slam'. This energy depression apparently extended into the lower mid, lending a 'lightened', 'thinned', and 'pinched' quality to the broad midband tonality. In addition, a noted loss of energy in the high treble resulted in a lack of 'air' and 'sparkle'. On some program material it was convincing, while on many other sections the sound was clearly unusual and idiosyncratic.

LAB REPORT

Used at a normal listening distance, open panel speakers tend to sound 3dB louder than their anechoic measured 1 metre sensitivity would suggest. The *ES300* returned a low 82.5dB/W sensitivity, but this is perhaps closer to 85dB subjectively in-room. It soaked up amplifier power, requiring a minimum of 50W per channel, but could also be easily overloaded with strong bass program, suggesting a sensible maximum limit of 75W. Modest peak sound levels of 95 to 97dBA will be possible in a typical room.

The axial reference response will not fully represent this loudspeaker's true response due to proximity effects, but it does indicate a bass 'boom' at a low 38Hz , a response broken into two rising slopes, and a premature rolloff in the treble. The picture improves through the upper midrange at 2 metres, but the early rising trend in the lower mid is still present. The off-axis curves are presentable, but the system is more directional than most.

The lift at low frequencies ensures that the

system gives a good measured bass extension, to 30Hz, −6dB. But in my room the speaker sounded much as the computer analysis measured it (though it will vary from room to room). It looked very tidy above 400Hz, though it must be conceded that the treble rolloff was both premature and excessive. The upper bass loss was exaggerated in this computed presentation, but the 30Hz isolated 'boom' was plain to see, as was the severe deficiency in the upper-bass/lower-mid area.

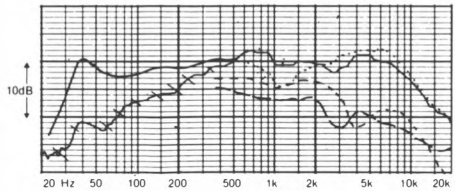
The test for distortion at 96dB had to be halted below 60Hz, due to overload, and in any case third harmonic had climbed through the roof below 120Hz. At the 86dB sound level (1 metre anechoic, achieved with just a few watts input) the distortion was considered excellent above 100Hz and tolerable below. Averaging 8ohms, this loudspeaker's impedance fell to a rather low 2.6ohms at 12kHz, making it more than usually sensitive to the quality of the partnering amplifier.

Conclusions

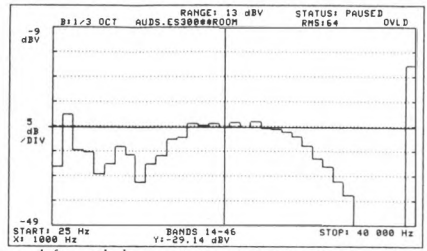
Much as I admire the working principle behind this speaker, appreciating that it has inherent good points, I feel that the *ES300* is seriously flawed in tonal balance terms. Aside from the high cost, this design offers limited bass power handling, just satisfactory sensitivity, and poorer than average amplifier loading. The measurements broadly back the subjective opinion, so although this unusual loudspeaker is worth considering, it cannot be recommended for general applications without careful qualification.

General Data

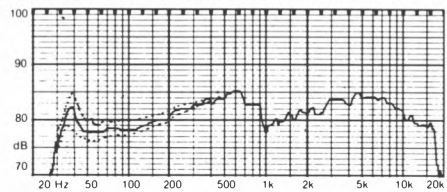
Size (height × width × depth)	44 × 5 × 93cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(50) −75W
Recommended placement	freespace
Frequency response, within ±3dB, at 2 metres	35Hz to 14kHz
Low frequency rolloff (−6dB point) at 1 metre	30Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	82.5dB/W
Approximate maximum sound level (pair) at 2 metres	95dBA
Impedance characteristic (ease of drive)	difficult
Forward response uniformity	average+
Typical price per pair, inc VAT	£2,300



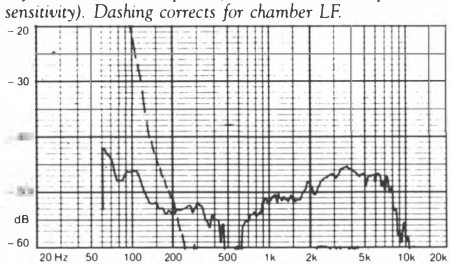
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

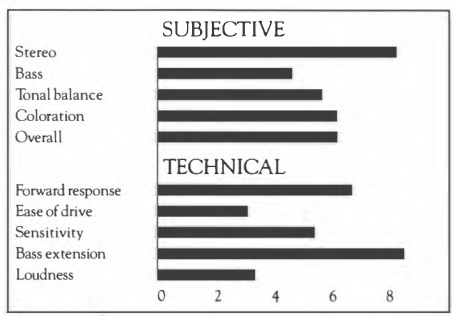


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



BEST BUY

B&W DM100

B&W Loudspeakers Ltd, Marlborough Road, Churchill Iindustrial Estate, Lancing, West Sussex. Tel: (0903) 750750

The *'100* is the smaller brother of the successful *DM110*, and follows many of its sibling's good engineering features. For example, the 190mm bass driver chassis is a die-casting, the 145mm flared pulp cone has surface damping treatment and a generous magnet provides the energy.

Our samples were finished in a good quality 'black ash' vinyl. The enclosures are built from plain 15mm chipboard, with an internal volume of 11 litres. A sealed-box design, system resonance was a rather high 100Hz.

Crossing over at around 3kHz, the network is essentially third order, 18dB/octave and uses five elements plus an attenuating resistor. The 25mm soft plastic dome tweeter (made by B&W) is protected by a user-replaceable fuse.

The grille baffle is made from 15mm stock, unrebated, and is best detached for serious listening. Free space or shelf mounting is possible. Electrical connection is made *via* 4mm socket/binding posts.

Sound Quality

The *'100* romped through the listening tests with a substantially 'good' score, which is very good for the class. Sounding a trifle 'loud' and light-weight in tonal balance, it provided an even, well-integrated sound, with consistently high levels of both detail and clarity.

Stereo focus was good, with quite good representation of depth and recorded ambience. Perspectives were nicely handled, while the coloration was fairly low throughout the range. It proved a bit shy in the low bass but the upper bass was both clean and tuneful. Good power handling was shown up to 75W above which point some detail was lost.

Lab Report

On axis at the reference 1 metre distance, this speaker proved its pedigree by providing a ±2dB output from 80Hz to 20kHz. The grille was acoustically poor, as the solid line (grille on) showed. The reference sensitivity was 89dB/W, above average, and the −6dB rolloff occurred at 75Hz, a higher than usual frequency.

Pair matching was very good. Maximum sound levels of 103dBA are possible and a minimum amplifier power of 10 watts per channel is indicated.

At 2 metres microphone distance, a well integrated set of curves is seen, with only minor variations over the various axes. The overall balance was pretty good.

The fine sensitivity was not compromised by the impedance, which did not fall below 6ohms and averaged 8ohms. Driven to a 96dB sound level the distortion results were good, averaging 0.3% above 300Hz and well balanced below that frequency. By 86dB, a general improvement has occurred with second harmonic falling to negligible levels above 300Hz.

While the low frequency range showed some attenuation, the room response illustrated the finely balanced midrange and the integrated treble of this well engineered performer.

Conclusions

A fitting companion to the *'110*, the *'100* managed to establish a fine performance in its own right, despite its competitive pricing. It sailed through both the lab and the listening tests, proving to be sensitive, clean sounding, and offering good stereo. It suits shelf or stand mounting and offers very good value. A Best Buy classification is mandatory.

Reassessed. First reviewed 1985. Current typical price £100.

General Data — see pages 180-184.

BEST BUY

B&W DM110

B&W Loudspeakers Ltd, Marlborough Road, Churchill Industrial Estate, Lancing, West Sussex. Tel: (0903) 750750

Available for some years now, the *'110* has been a highly successful loudspeaker. Built to a tried and tested formula, this success seems due to a skilful balance of performance, engineering and fine value. A two-way model of some 22 litres internal volume, it is reflex-loaded by a 5cm diameter port, backed by a 7cm tube.

Bass and midrange frequencies are handled by a 220mm flared pulp cone unit, built on a substantial diecast frame with six hole fixing. A B&W-built unit is also used for the treble, a 25mm soft dome plastic foil unit with cast plate.

The enclosure is well finished in a 'walnut' vinyl material, while the grille and its thick non-rebated frame can be detached. 4mm socket/binding posts are fitted at the rear. The crossover is said to be 4th order acoustic Butterworth, achieved by a good quality 2nd order internal network in conjunction with the drivers' acoustic responses. Acoustic foam is used to provide internal absorption.

Sound Quality

Despite its budget price the *'110* scored 'above average'. A good midrange was solidly backed by a lively, articulate quality, and the speaker showed a pleasing transparency with good rendition of fine detail.

Tonally it was well balanced, with just a hint of untidiness at the response extremes; in the extreme treble, a touch of 'tizz' was evident while the bass extreme sounded a little underdamped. Some box coloration was present despite the fine overall effect, and this occasionally made itself apparent. Stereo images were well focused, particularly with the grille detached, and the *'110* made a surprisingly good attempt to recreate depth of image. High powers were also handled very well.

Lab Report

An excellent pair match was shown, certainly within ±0.5dB limits over the whole range. The reference response was very good indeed, marred by a ripple at 5kHz to 8kHz which was removed by detaching the grille. Sensitivity was a high 89.5dB/W with the remarkable response of ±2dB, 65Hz to 19kHz. The −6dB LF point was typical for the type at 56Hz, and the system is well tuned.

A 350W peak programme signal was handled without damage but 100W peak would be a fairer rating, allowing a generous maximum sound level of around 104dBA for a stereo pair, near disco levels! Out at 2m the forward response family of curves was very good, bar the 15° vertical off-axis response. This suggests that fairly high stands should be used, with the treble units close to ear level. Good driver integration was shown here particularly in the lateral axis.

Even at 96dB sound pressure level, the speaker produced only moderate distortion levels of under 0.3% midband, and this was mainly the less harmful 2nd harmonic. At 86dB and above 200Hz 3rd averaged 0.2%, and 2nd still less. These are very fine results.

The impedance curve gave no cause for concern and essentially represents an 8ohm system of typically good behaviour; no decent amplifier should find this speaker a problem.

In the listening room, the computer averaged response was impressive too. Good output can be seen down to 40Hz with a notably even and well matched midband, while the treble rolloff also conformed to an even axial output.

Conclusions

This well engineered loudspeaker provides good sensitivity with low distortion. The amplifier load is good, the responses even and the tonal balance most presentable. The sound quality is most competitive and the power handling exceptional, while its lively, transparent quality consistently pleases. Overall this is a clear candidate for Best Buy status.

Reassessed. First reviewed 1984. Current typical price £140.

General Data — see pages 180-184.

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Three manufacturers are currently licensed by the BBC to produce *LS3/5A*s, and all must stick to the Corporation's tight specifications. Designed as a miniature broadcast monitor for cramped spaces, by offering a fine sound quality in its own right it has stood up to much larger competition for more than 10 years. Mounting on high stands well clear of room walls at approximately ear level provides best results.

A sealed plywood box of 5½ litres volume, the *3/5A* is a two way system employing selected KEF drivers, a 110mm Bextrene cone bass/midrange and a 19mm plastic dome treble unit. An elaborate and costly crossover is employed to equalise the drivers to a strict specification.

SOUND QUALITY

The *LS3/5A* has consistently done well in previous live-versus-recorded sessions and fairly well on analogue programme sources. However, with digital material, problems which were only hinted by analogue material were now clearly apparent, making the design sound more dated. Several areas attracted criticism — the bass lacked extension and sounded 'boomy' in the upper bass register, while the mid had a noticeably 'hard', 'nasal' quality and the treble seemed forward with a grainy, 'zitty' effect at the extreme top end. Some 'tubby', wooden and boxy colorations were also evident, with only moderate rendition of stereo depth.

However, it continued however to provide good voice detail and articulation, with a reasonably accurate tonal balance. Comparison between the Goodmans and Spendor versions showed great similarity while a much older model from Audiomaster (no longer in production) sounded slightly dimmer by comparison, with less mid nasality. However the difference was small by speaker standards.

LAB REPORT

Sensitivity was low, measuring 81.5dB/W and necessitating a minimum amplifier power of 30W per channel. A 50W maximum is suggested although with care 100W amps may be used. The bass rolloff −6dB point measured 57Hz, quite good for the size, while pair matching was very good (all three current makes). The impedance curve never dipped below 7.5ohms, so the design qualifies as an easy 10ohm load. Modest 96dBA maximum sound levels are possible.

Reference curves were taken for the Goodmans and Spendor samples and showed good agreement with the reference unit, though the 1.2kHz prominence seems to have become more pronounced over the years. This perhaps reflects a change in the B110, although it is still within specification. By modern standards the response looks a trifle lumpy, though in its time this system was regarded as a very smooth performer.

CONCLUSIONS

At risk of offending the BBC, we feel that the *3/5A* is due for a revision; as a working broadcast tool it no doubt does its job, but as a piece of value engineering it is beginning to fall behind. Other speakers have shown a progressive reduction in price as well as an improvement in sound quality, but the *LS3/5A* has steadily increased in price more or less in line with inflation. Nevertheless, on the most recent listening tests the *LS3/5A* scores were sufficient to retain recommendation!

First reviewed: Rogers 1978, Goodmans and Spendor, 1983 (retested 1984, reassessed 1985/6.) Current typical price £220.

General Data — see pages 180-184.

BLQ1

BRITISH LOUDSPEAKERS, 23 GILMERTON COURT, CAMBRIDGE.
TEL: (0223) 840083

This true two-way miniature is similar in size to the *LS3/5a*, and for some might be regarded as the equivalent of a 'budget' Linn *Kan*. And like the *Kans* the *BLQ1* is rigidly constructed with glued-in drivers, so consequently we have not been able to examine all the interior; an obvious question is, what about servicing?

This sealed-box system has an air volume of a little over 5 litres, and the system resonance is located at a high 100Hz with the bass unit installed. The cabinet is strongly constructed from 12mm sides and a 17mm front, and a dense filling of acoustic foam counters internal standing waves. Electrical connection is *via* plain 4mm sockets, and judging by the off-axis responses the crossover is likely to be second-order type, with 12dB/octave rolloffs.

The bass/mid driver is built on a 130mm pressed-steel frame and fitted with a 105mm flared pulp cone with foam surround. The treble is handled by a 25mm soft plastic dome, in this instance the classic SEAS design. External finish is in fine quality veneer, and the 120mm thick grille baffle is rebated to reduce diffraction. In all, there is evidence of good attention to detail.

This loudspeaker works best on rigid stands about 50-60cm high, backed but not quite touching a rear wall. The tonal balance is insufficiently flat to survive free space location.

SOUND QUALITY

Rated somewhat below average, the *BLQ1* suffered from tonal balance flaws, which attracted criticism. Little low bass was evident, while the mid was 'thinned' and 'forward', even 'cuppy' in terms of perceived coloration. Some 'grain' and 'zit' were apparent in the treble, which in any case was set on the bright side. Piano and voice sections were projected with a 'lightweight' effect, and some sibilance was evident in the upper register, although it sounded fairly 'sharp' and 'quick' in dynamic terms, the sound never really impressed the panel.

LAB REPORT

Taking an average through the louder part of the axial 1 metre reference response, the sensitivity worked out around 87dB. Minimum power should be around 12 watts per channel, and a maximum of 50W will provide satisfactory peak levels of up to 101dBA in a typical room, with wall-mounting helping to bring up the power in the low midrange.

Despite the rebating, the grille strongly influenced the axial response. When it was removed, the presence range improved, but the overall treble level increased by 1dB, which is not necessarily an improvement. The low frequency range did not show much extension, rolling off at a high 90Hz, −6dB. The response stepped up abruptly by some 5dB at 800Hz, more than is required for accurate boundary compensation.

Out at 2 metres, the averaged output still looked lumpy in the upper range, with a mild loss centred on 3.5kHz. On a more positive note, the off-axis were notably well controlled, showing good uniformity with the axial output.

Considered an easy amplifier load, the *BLQ1*'s impedance fell only slightly below 6.4ohms at 200Hz, and measured a fairly smooth 8ohms thereafter. Distortion was quite good above 300Hz at 86dB, averaging 0.3%. Below 300Hz third harmonic was fine, while second was progressively poorer at the 96dB level; however, the speaker did remain in control of the situation.

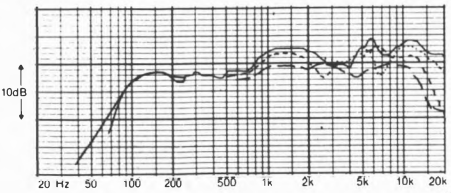
Assessed by the computed room averaging technique, this speaker shows a forward upper-mid, a 'lumpy' treble, some isolated bass around 100Hz, and a serious rolloff in bass power below 100Hz is evident. Wall-mounting cannot effect a complete rescue.

Conclusions

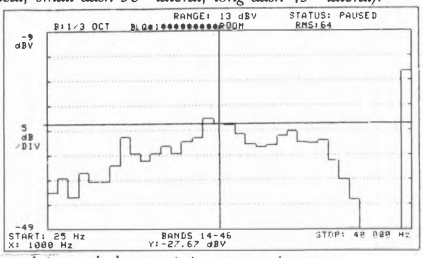
Bright and lively, this speaker might well appeal to *Kan* fans! However, judged by accurate references, it was seriously unbalanced in tonal quality. There were some plus points, including the strong, low-resonance construction and quality finish, so it could be worth trying, but does not qualify for recommendation.

General Data

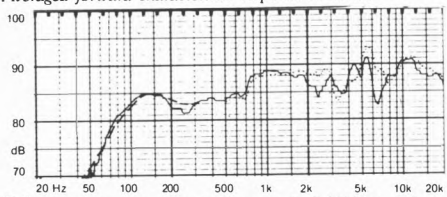
Size (height × width × depth)	29 × 18 × 20.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(12) – 50W
Recommended placement	against wall
Frequency response, within ±3dB, at 2 metres	see graph
Low frequency rolloff (–6dB point) at 1 metre	90Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	87dB/W
Approximate maximum sound level (pair) at 2 metres	101dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	average+
Typical price per pair, inc VAT	£120



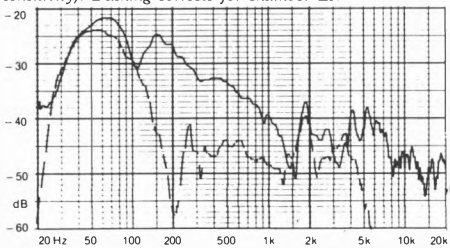
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

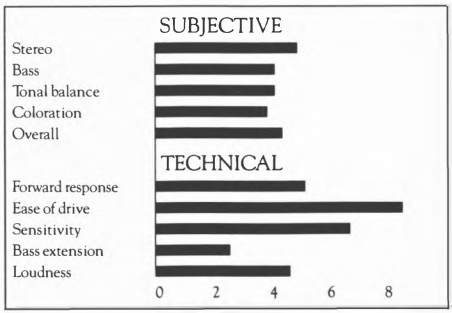


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



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The Audio Consultants
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London NW6 1SQ
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BOSTON A40 II

HI-FI MARKETS, COUSTEAU HOUSE, GREYCAINE ROAD, WATFORD WD2 4SB.
TEL: (0923) 26499

This compact speaker from Boston Acoustics of Massachusetts, USA, was first reviewed in the 1983 edition, but has subsequently been improved and reassessed. Highly successful on the US home market, these speakers suffer the usual shipping cost disadvantage when imported and sold in the UK, and consequently need to be highly competitive designs from the outset.

A two-way design, this sealed box miniature has an internal volume of just 8 litres, and is driven by a bass unit of 160mm frame size with a 120mm diameter radiating surface. Its paper pulp cone is mounted on a steel pressed chassis, with a moderate-sized magnet. The high frequency driver is the 19mm Audax plastic cone/dome with ferro-fluid damping.

Finished in vinyl, the enclosure is made of plain chipboard, with loose polyester fibre lagging inside. The simple crossover is 6dB/octave first-order type, using a two-element network plus attenuating resistor. Connection is made *via* spring clip terminals.

SOUND QUALITY

While scoring below average, the A40 did reasonably well for the price. The results showed some conflict between a lively fairly articulate nature with fair detail, and conversely a tendency to coarseness and brittleness in the upper mid/lower treble. Bass showed a muted effect at low frequencies, though the upper-range bass scored satisfactorily. In the mid it sounded a touch 'thin' in balance, with some 'boxy' and cone type colorations. Mid/treble integration was not its strong point, with some panelists finding the sound variable and phasey in the crossover region.

Stereo depth was not well portrayed, though the speaker sounded reasonably clear.

LAB REPORT

This current sample actually performed very similarly to the original model. Reference sensitivity was 88.5dB/W which if taken in conjunction with the 50 watt maximum power handling, will allow maximum sound levels of 101dBA in room from a stereo pair.

Low frequency rolloff was noted at 63Hz for −6dB, this agreeing with the measured system box resonance at 80Hz. Pair matching was poorer than average with imbalances of up to 2.5dB in the crossover range. The grille had only a small effect on the response, which rose up to 1kHz and then levelled out. At 2 metres, a general rising trend was apparent, with good uniformity in the lateral plane, but signs of a crossover dip at 4kHz when measured 15° vertically above axis.

At a 96dB sound level the distortion averaged 2% second, and 0.4% third harmonic, while at the lower 86dB test both harmonics were well controlled, settling at the 0.3% level over most of the range. With the simple crossover, the impedance curve was very smooth, but fell below 5ohms at 200Hz, an 'average' load rating.

On the room measurement the speaker was promising in the bass and midrange but peaked a little too much at 1.5kHz, before rolling off in the approved manner.

CONCLUSIONS

The Boston A40 performance was competent enough for the size and price, but was also generally below average relative to its UK competitors. However, despite the costs of importation, the A40 is still reasonably priced and is rated as worth considering.

Reassessed. A40 first reviewed 1983. A40II: 1985. Current typical price £110.

General Data — see pages 180-184.

RECOMMENDED

CASTLE CLYDE

CASTLE ACOUSTICS LTD, SHORTBANK ROAD, SKIPTON. N. YORKS BD23 2TT.
TEL: (0756) 5333

Possessing a 9.8 litres internal volume, the *Clyde* is reflex-loaded by a small ducted port, 28mm long by 37mm in diameter, which does more for the power handling than the bass extension. Both drivers are made by Castle; the lightweight pulp-cone bass/mid unit is built on a 130mm frame, and is partnered by a unique 30mm plastic cone/dome tweeter using a phase-corrected diaphragm. The undamped chipboard cabinet is also made by Castle themselves, having a fully finished teak veneered exterior with a well-designed, acoustically favourable foam grille. A 4-element crossover is fitted with fuses for each driver, accessible through the bass unit aperture.

Flush-mounted spring clip terminals are used for electrical connection, and an acoustic foam lining provides absorption within the enclosure.

SOUND QUALITY

The *Clyde* was felt to sound a little 'small' with a degree of 'forwardness' in the midband, but negligible accompanying 'loudness' or 'shout' was apparent, and the general effect was smooth and well integrated with good detail and natural tone colour. On occasion the treble could sound a little 'sibilant' and 'edgy', while some coloration was also identified, mainly of the 'boxy' kind.

The imaging was clearly defined with some depth and good lateral precision over a wide listening angle. Low bass notes were lacking in power, but the balance was surprisingly good if tending to be slightly 'light' and 'middy' in character.

LAB REPORT

The test samples showed a good pair match, measuring typically +/−1dB: a fine result for a speaker in this price category. Sensitivity was indeed high at 89.5dB/W, and was uncompromised by the impedance/amplifier loading, the latter rated as 'good' and averaging 9ohms. As expected the low frequency range was somewhat curtailed with a −6dB point at 64Hz, but the axial reference response was inspiring, meeting fine +/−2.5dB limits overall, and showing a promisingly even balance.

Under ⅓-octave analysis at a 2 metre measuring distance the output was excellently uniform and integrated; in this respect the system illustrated an almost textbook performance. However the tonal balance showed a gentle rise in output with increasing frequency, with a mild but discernible hump in the treble region centred on 15kHz.

The averaged room response in energy terms did suggest some mid prominence between 600Hz and 1.5kHz, but the overall trend above 1.5kHz was very good, and close to the theoretically ideal characteristic. While the low frequency range had some depression coupled with an early rolloff below 50Hz, it was otherwise fairly uniform.

With comfortable sound levels achieved on as little as 10W per channel, this speaker will happily accept 50W unclipped programme without blowing fuses, thus allowing up to 102dBA sound levels, which is quite loud considering the box size.

CONCLUSIONS

Now a well-established model, the *Clyde* is a tidy little performer which packs a surprising punch in terms of a clear, even and lively sound. It offers a high sensitivity and is an easy amplifier load, giving good dynamic range with moderate distortion, plus good finish and engineering.

Re-auditioning in 1986 with a current version suggests perhaps that the *Clyde* is at last beginning to show its age, with slightly below average results overall. Considering the low price this is still a good result, though our recommendation is now perhaps a little less enthusiastic in the light of increased competition.

Re-auditioned. First reviewed 1981 Current typical price £112

General Data — see pages 180-184.

CASTLE PEMBROKE

CASTLE ACOUSTICS LTD, SHORTBANK ROAD, SKIPTON, N. YORKS BD23 2TT.
TEL: (0756) 5333

RECOMMENDED

Although basically a compact design the *Pembroke* nonetheless encompasses a bass-reflex-loaded volume of some 32 litres. The enclosure had a shaded stain/varnish finish with the black foam grille flanked by horizontal veneered bars at the top and bottom of the cabinet.

A 200mm bass/mid unit is married in a vertical in-line arrangement to a 30mm plastic cone tweeter, both drivers of Castle's own manufacture. The bass unit is constructed on an aluminium cast frame, with a substantial magnet. The good quality crossover operates at approximately 3kHz and is of 12dB/octave basic order, although this is adjusted to 'fine tune' the driver responses.

The heavy enclosure is braced and damped, the interior lined with an acoustic absorbent. A conventional moulded rear connector panel is fitted with plain 4mm socket/binding posts more suited to 'special' cables. Internal fuses, accessible behind the bass driver, protect against sustained amplifier overload.

SOUND QUALITY

As we have come to expect from Castle, this speaker gave a good account of itself during the listening tests. Favoured by all the panelists, it produced a consistently smooth sound, free from fatiguing effects. Tending to mild 'richness' tonally, it was felt that the bass could have been a little drier while some 'boxiness' and 'plumminess' in the lower midrange was also noted, although this was not serious. The treble could also demonstrate a little 'breathiness' in the upper range.

Overall the sound was 'big', with good bass power and extension. Stereo images were quite well-focused although they showed some loss of depth and transparency; frontal detail was however good with a pretty natural tonal balance. In fact, the *Pembroke* sounded as smooth as the remarkable lab test results would indicate!

LAB REPORT

Pair matching was good except around the 14kHz area where significant 2dB errors were observed. The grille had no deleterious effect on the sound. Sensitivity was rated as above average at 88dB/W, providing maximum sound levels of up to 103dBA, and a 10-100W amplifier power range is considered appropriate.

Bass was quite extended at 44Hz, −6dB, and quite uniform in anechoic terms. Overall the response in the 70Hz to 12kHz range was quite remarkably smooth with only ±1dB ripples apparent. Out at 2 metres, a very good forward output was demonstrated showing great consistency, phase control and integration. Can you believe a ±1.5dB response from 60Hz to 20kHz here?

At 96dB, second harmonic distortion typically measured 1-1.5%, with third rather lower than that except at 2kHz. Third harmonic was little altered at the lower 86dB level, but second was much improved to 0.3% and better. With third harmonic often at the 0.15% level, the *Pembroke* essentially gave good results for distortion.

Impedance never fell below 6.4ohms, indicating that the loudspeaker will be very easy to drive with any reputable amplifier. The computer-averaged room response also appears very promising, with the low frequencies integrating well with the room, down to 40Hz. The mid register was also very smooth and while the lower treble seemed slightly depressed, the upper treble was in fact marginally too well extended, hinting at the upper 'edge' heard on audition. However, overall this is a fine result.

CONCLUSIONS

Comfortably 'recommended', this traditional-looking speaker offers a sweet, smooth sound with an excellent overall balance of engineering-based performance.

Reassessed. First reviewed 1983. Current typical price £240.

General Data — see pages 180-184.

RECOMMENDED

CASTLE DURHAM

CASTLE ACOUSTICS LTD, SHORTBANK ROAD, SKIPTON, N. YORKS BD23 2TT.
TEL: (0756) 5333

The *Durham* is a brand new design, selling for £150, and so sits at the higher quality end of the budget speaker sector. Such models typically use a larger 210mm frame for the main bass/midrange driver, but here the Castle designer employs a small, high power driver with 150mm pressed steel frame and 110mm active cone diameter. This flared pulp cone is suspended on a strong mechanical system designed for reflex-loading.

Castle themselves make both drivers, the treble range being handled by their established 30mm plastic cone, which is fitted with a large central phasing plug that results in an annular radiating element. The good quality crossover essentially conforms to 12dB/octave second-order form, and is distinguished by the use of film capacitors for the treble section. Hard-wiring is used internally, external system connection is made *via* combined 4mm socket/binding posts, and positor' overload protection is fitted.

The enclosure is robustly contructed from 19mm chipboard, finished in real walnut veneer, and the side panels are internally reinforced by a cross-brace. Bituminous pads further damp panel resonances, and an acoustic foam lining moderates internal standing waves. The 15 litre internal volume is reflex-tuned to 65Hz by a ducted port 40mm in diameter and 30mm long. A foam grille ensures good frontal dispersion characteristics. The standard of construction is as good as the finish, and a site fairly close to a rear wall mounted on a good quality stand, will take account of the slightly 'forward' frequency balance.

SOUND QUALITY

Handling realistic peak power levels without noticeable limiting, the *Durham* scored above the group average during the listening tests. It sounded quite clear, giving some resolution of the recorded acoustic. Depth was not particularly well constructed in the stereo image, though frontal plane focusing was more than satisfactory.

Coloration in the usual sense was low, but like so many recent speakers, the tonal balance tended to 'thinness' with a 'forward' upper-midrange. While the mid-treble balance was quite uniform, the upper treble hinted at brightness with some 'grain' or related imprecision. The bass was of an average standard — somewhat shy and lacking extension though fairly articulate and tuneful.

LAB REPORT

Assessed from the 1 metre response, the lab sensitivity is a fairly high 89dB/W, though the bass extension to 67Hz, −6dB is unexceptional in this price range. A minimum power of 10W per channel is suggested, while a sensible 50W maximum will provide peak sound levels of up to 102dBA, ample for all normal purposes.

Under anechoic conditions, the output rises smoothly by some 5dB from 80Hz to 1kHz. Some loss is seen in the presence range, while the treble shows mild uneveness. The impedance curve had an average value of 8ohms, and constitutes an easy amplifier load since it did not fall below 6.4ohms. The forward frequency response group at 2 metres proved uniform, with a fine consistency over the range of forward axes. The speaker's 'light' frequency balance is plain to see, and the output is notably uncritical of the precise listening axis.

In the listening room, the computer measurements showed a properly defined output through the mid and treble ranges, but with a loss of level in the upper bass to low midrange, 90-250Hz. The bass output was shy, did not match the mid level even with the help of wall lift, and fell off quickly at lower frequencies.

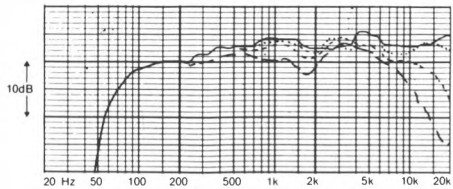
The distortion was judged about average at a sound level of 86dB at 1 metre, though the third harmonic appeared a bit high in the lower treble. By 96dB the range above 60Hz was nicely controlled, but signs of stress were apparent below 60Hz, for example 10% of third harmonic at 40Hz. The second harmonic peak at 20kHz is considered harmless.

Conclusions

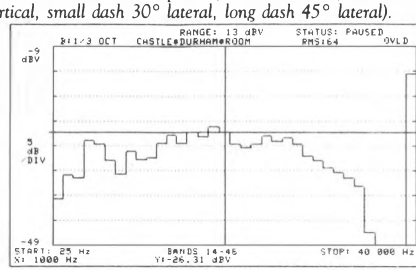
Though evolved from a smaller system, the *Durham* performed quite well in this issue. Despite a 'lean' midrange, the listening results were encouraging, and this system is clearly well engineered, sensitive and nicely finished. The bass is on the weak side, but does not prevent this model from meriting recommendation.

General Data

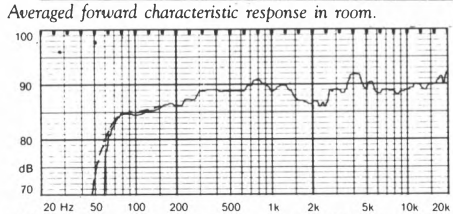
Size (height×width×depth)	40×21.5×25cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −50W
Recommended placement	near rear wall
Frequency response, within ±3dB, at 2 metres	100Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	67Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89dB/W
Approximate maximum sound level (pair) at 2 metres	102dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	very good
Typical price per pair, inc VAT	£150



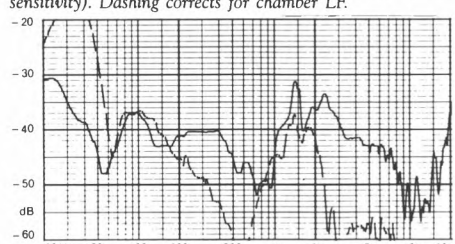
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

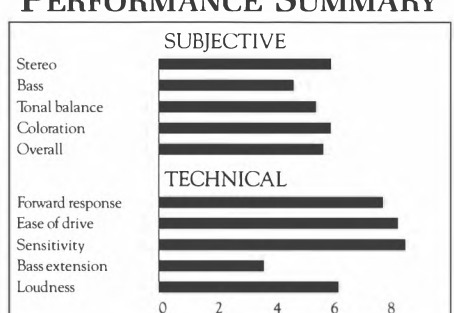


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



BEST BUY

CELESTION DL4

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
TEL: (0473) 73131

by David G. Prakel

The author of this volume, Martin Colloms, was called in as design consultant on the Celestion *DL* series. Consequently the review is written by DGP, based on the comparative measurement and blind listening data generated during the test programme.

Smallest of the three is the *DL4*. This 10 litre box is styled to capitalise on the association with the *SL6* while the 25mm soft plastic film tweeter has a front-plate ribbed in the manner of the *SL6/SL600* trim plates. The brown painted Medite baffle has been divided with painted lines to follow the *SL6* 'modular' appearance.

A 165mm paper-coned mid/bass driver has been chosen which, coupled with reflex loading, enables the system to achieve above average sensitivity.

The 12mm chipboard carcass has a recessed back panel for stiffness and is neatly chamfered around the front edge to give a smooth transition to the moulded plastic grille frame. Michell gold-plated binding posts have been used — an 'audiophile' touch unusual in a £100 speaker.

An eight-component crossover is hard-wired to the back of the moulded terminal block — the two drivers crossing over just below 3kHz. The highish sensitivity of the finished system allows even modestly powered amplifiers to produce fair levels with these speakers.

SOUND QUALITY

There was no disagreement about the considerable strengths and the few compromises in this speaker when presented in 'blind' conditions to the listening panel. All listeners, particularly those seated on-axis, commented positively on the stereo depth imaging ability, but no one was fooled into thinking this was a large speaker as extended bass simply wasn't there. However the bass was always described as tight and tuneful and the overall performance dynamic, exciting and informative.

The only real criticism of this design came from its top end performance which was variously described as 'shrill' or 'whistly'. Later listening tests confirmed that the speaker sounds best on tall stands with some reinforcement from a back wall, say within 0.5m.

LAB REPORT

The 1m on-axis plot showed a controlled bass rolloff with just a trace of upper bass prominence, the −6dB point at a high 85Hz suggesting that the speaker is best used fairly close to a room boundary. Around the crossover region there is some discontinuity in the response plot, and to some extent in the in-room analysis which also showed the limited bass energy of this system. Good dispersion characteristics were shown by the family of 2m curves, suggesting a strong stereo performance. However the 15 degree above axis plot has a 'treble-strong' balance which indicates that the speakers should be auditioned with the tweeter at least at ear height. Tall stands close to a wall are indicated.

At 96dB sound level, the major distortion peak is a relatively innocuous 2nd harmonic, rising to just over 3% at 200Hz. A tiny tweeter irregularity can be seen around 8-10kHz but the general distortion above the 200Hz centred peak is well below 0.3%.

The impedance plot shows an unremarkable dip to 6.5ohms between 5k and 10kHz.

CONCLUSIONS

Taking into account the fact that the *DL4* sells for just under £100 its performance in blind listening tests and in later sighted listening tests is a considerable achievement for the price. This is not a cheap 'audiophile' quality speaker but a design which will produce meaningful musical results when partnered with an inexpensive amplifier and a typically dull budget cartridge; brighter sources may sound 'spitty' and 'hard' however. The strong stereo performance and controlled bass would indicate Best Buy status at this price.

Reassessed. First reviewed 1985. Current typical price £100.

General Data — see pages 180-184

CELESTION DL6

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
TEL: (0473) 73131

by David Prakel

The author of this volume, Martin Colloms, was called in as design consultant on the Celestion *DL* series. Consequently the review is written by DGP, based on the comparative measurement and blind listening data generated during the test programme.

Though similar in principle to the *DL4*, the *DL6* has a considerably larger box. The same 25mm plastic dome tweeter has been used but this time it is crossed over to a 200mm paper mid/bass unit built in a substantial cast chassis and with an inverted PVC roll surround. Paper-pulp-coned drivers with large magnets keep sensitivity of both the models above average — Celestion quote 89dB/W/1m.

The *DL6* reflex-loaded with the port venting through the back panel of the speaker to maintain the visual consistency of the range. The same chamfered box front and tapered grille frame give the speaker a distinctive appearance and reduce the frontal area of the speaker to some extent. The carcass is produced in 16mm chipboard, again with a Medite baffle and fibre filling.

The eight-component crossover is to the same layout as the *DL4* (12dB slopes) again hard-wired and with the components glued to the back of the terminal block, which carries gold-plated Michell 4mm binding posts. Heavy gauge internal wiring is used.

SOUND QUALITY

In the panel listening tests the *DL6* rapidly established itself as a more extended and refined version of the *DL4*. The same strong imagery and lively informative sound was there but the bass was considerably more extended and a degree 'richer'. Treble was slightly 'whiskery', described as being slightly 'gritty' or 'scratchy'. Though on some programmes the speaker could sound a little 'whispy' or 'thin' it was not marked down for this.

The *DL6* gave considerable insight into the scale of music and produced a spacious sound retaining details of the ambience of the recording venue. However, off-axis listeners seemed less able to appreciate the speakers' imaging ability.

Bass was surprisingly controlled and extended for a speaker at this price. The *DL6*'s ability to produce a coherent sense of space with wide dynamic range, plenty of detail and good low end control helped it do well in both 'blind' and later 'sighted' listening tests.

LAB REPORT

The 1m axial plot showed evidence of the 3kHz crossover point and a slightly ragged treble output rising to peak at 10kHz (about 2dB up on the 1kHz level). The −6dB rolloff point in the bass comes at 60Hz and the upper bass peaks before rolling off into the midband trough. The twin peaks were shown also in the 2m plots. The off-axis curves indicated well controlled dispersion though again there is a 'glitch' in the 15° above-axis plot around the crossover point. As with the *DL4*, the '6 should be used on stands to aim the tweeter towards the listener's ear.

The in-room plots gave a very even smooth output with some evidence of the crossover notch but a well extended low-end.

CONCLUSIONS

The control and power embodied in this design sets it a way apart from the run-of-the-mill £120 speaker. Particularly good when pushed hard by a large amplifier, the *DL6* produced none of the listener fatigue generated by lesser designs at this price. Bass performance, stereo imagery and balance were all above average though the treble performance has been bettered in this price bracket. The balance of performance strengths, however, enables us confidently to recommend the *DL6*.

Reassessed. First reviewed 1985. Current typical price £130.

General Data — see pages 180-184.

BEST BUY

CELESTION DL8

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
TEL: (0473) 73131

by David Prakel

The author of this volume, Martin Colloms, was called in as design consultant on the Celestion *DL* series. Consequently this review is written by DGP, based on the comparative measurement and blind listening data generated during the test programme.

Where the Celestion *DL4* and *DL6* share a common tweeter, the *DL6* and *DL8* use the same mid/bass driver. However, in the *DL8* the 200mm paper-pulp-coned unit is used in a sealed box and crossed over to a derivative of the copper-deposition dome tweeter used in the *SL6*. This 32mm diameter unit achieves the necessary sensitivity by using a lightweight fabricated aluminium dome and an enormous magnet. The crossover network integrates the two drivers at around 2.5kHz with 12dB-slope tuned circuits, plus an additional capacitor in series with the bass driver.

The *DL8* carcass is built by wrapping a V-grooved 18mm chipboard plank around a recessed back and an 18mm Medite baffle. Finish is 'walnut' grained vinyl. The back panel terminal block is fitted with gold-plated Michell binding posts; inside the speaker, this block carries the hard-wired crossover. Fibre wadding is used in the cabinet while the drivers are wired with heavy gauge cable.

SOUND QUALITY

The gentle treble slope was noted by the listening panel, but the marks achieved were encouragingly high for a speaker selling at this mid-market price point. The metal dome tweeter gives the *DL8* an immediate ease and a treble clarity rarely heard in conventional tweeter designs. Again there was the hallmark of the *DL* range — a spaciousness and a controlled yet powerful sound.

Bass showed no trace of overhang while the purposeful tailoring of the low frequencies was just noted by one or two listeners who marked the speaker down as lacking the very deepest extension — which is not to criticise the precisely damped and tuneful bass of which the *DL8* is capable.

Listening tests outside the blind listening panel showed that the *DL8* lacked some of the sparkle and 'life' of the *DL6*, but equally well the treble never 'bit' in the same manner as the *DL6* when pushed too far.

LAB REPORT

The 1m axial plot showed the −6dB point of the system at 55Hz. The tweeter resonance lies outside the audio band being shown up by the rise in second harmonic distortion above 20kHz. General levels of distortion are commendably low, though the reflex-loaded *DL6* shows even lower bass distortion around 100Hz.

The 2m family of curves showed an excellent uniformity with a gradual slope falling from the mid through the treble. The 15 degree above-axis trace has a crossover notch which suggests that positioning with the tweeter on ear level would be appropriate. The in-room ⅓-octave measurements show an excellent smooth trend with a well sustained high end.

The 6.5ohm minimum impedence is of no real consequence. Sensitivity measured slightly under specification at 88dB/W.

CONCLUSIONS

The *DL8* has an easy relaxed quality with an imperturbable treble sound and a spaciousness and airiness that sets it apart from other loudspeakers in this price bracket. It offers an unusual blend of high power handling and above average sensitivity — attributes not normally associated with the smooth refined qualities of a metal dome tweeter. It is an easy speaker to live with and will not 'close up' when driven loud. A Best Buy rating is obviously in order for a speaker possessing these qualities while selling for £180.

Reassessed. First reviewed 1985. Current typical price £180.

General Data — see pages 180-184.

RECOMMENDED

CELESTION SL600

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
TEL: (0473) 73131

Developed from the original *SL6*, the *SL600* features a special alloy honeycomb enclosure and selected drivers. Both are of essentially identical performance, but price and sound quality differ greatly due to the advanced cabinet of the model 600.

A two-way miniature sealed box design of 12 litres internal volume, the design employs a die-cast, Kobex-coned 165mm bass/mid unit fitted with a generous magnet. The special 37mm copper-dome tweeter has an integral motor coil former and offers high power handling capacity. Both units are of excellent quality, having benefited from new design and constructional techniques plus laser analysis.

The high power 12dB/octave crossover uses separate bass and treble boards. Each crossover is matched to a specific tweeter to correctly align the 21kHz compensation network.

The cabinet is an ultra-light, ultra-rigid ally honeycomb box, with special multilayer graded acoustic absorption within. The very high material cost is in fact the main reason for the higher price. Plain 4mm sockets are provided for connection and the grille is omitted. External finish is a handsome charcoal coloured Nextel with gold legends.

SOUND QUALITY

The *SL600* showed a correct, brighter balance than the original *SL6*, and scored significantly better still, with a remarkable, almost 'holographic' stereo precision maintained over the entire spectrum. Coloration was very low, detail abundant, and the overall effect was one of airy transparency and subtlety. The bass was reasonably extended, 'quick' and well differentiated, and high scores were awarded. Clearly this speaker is an exceptional device, with transparency the keynote.

LAB REPORT

The tight balance and integration of the 600's selected components were apparent. Sensitivity was low at 82-83dB/W with maximum sound level of 96dBA and a 30-150W power capacity range. The −6dB rolloff point was at 55Hz, good for the size.

Forward responses for the 600 show excellent integration and good uniformity, with the 15° above-axis result particularly good. A slightly below ear-level listening position would be ideal. The balance was still slightly rich, with a full midrange.

Generally 8ohms, the impedance fell to 4.5 ohms at 15kHz but was still considered to be a fairly good amplifier load — low-resistance cable is recommended.

Room-averaged, the output showed a near perfect interface with the room at low frequencies, having a slight presence droop, a mildly rich treble balance and a smooth rolloff.

CONCLUSIONS

Arguably one of the finest speakers of its size ever produced, the *SL600* has also undergone manufacturing improvements, and despite a somewhat shaky start, the performance of production samples should now be fully up to standard. Compatible mass-loaded stands (Cliff Stone) are now available, and these enhance the performance, which is fully commensurate with the price!

GENERAL DATA

Size (height × width × depth)	37 × 20 × 25.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(30) – 150W
Recommended placement	open stands (Celestion)
Frequency response, within ±3dB, at 2 metres	60Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	55Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	82.5dB/W
Approximate maximum sound level (pair) at 2 metres	98dBA
Impedance characteristic (ease of drive)	fairly good
Forward response uniformity	very good
Typical price per pair, inc VAT	£700

Reassessed. First reviewed 1983.

RECOMMENDED

CELESTION SL6S

CELESTION INTERNATIONAL LTD, DITTON WORKS, FOXHALL ROAD, IPSWICH, SUFFOLK IP3 8JP.
TEL: (0473) 73131
David Prakel

A 'luxury compact' loudspeaker, the *SL6S* is a thoroughgoing redesign of the famous *SL6* primarily aiming to cure the sensitivity and bass limitations of the original design. The new 32mm aluminium dome tweeter offers both a higher frequency first bending mode and a lower mass, leading to higher sensitivity than the electroformed copper dome tweeter which it displaces. The closed-box cabinet is now made in medium density fibreboard (MDF), with thinner panels to reduce energy storage. A 'figure 8' brace and inset back panel help make the cabinet rigid; foam absorption is now used internally. It is available in black or walnut wood veneer finish, with optional high twin-pillar stands.

The 165mm Kobex-coned mid/bass driver is now built in a lugged die-cast chassis, which is bolted rather than clamped onto the cabinet. The unique two-part surround is effectively a mechanical crossover. The PVC originally used to terminate the *SL6* cone was good at reducing travelling waves in the cone, but was stiff and impaired bass impact. Laser velocimetric analysis showed that termination was already complete half-way through the roll surround, so Celestion have introduced a two-piece surround, the outer half in soft rubber giving a freer suspension at lower frequencies for improved bass articulation and 'speed'. The voice-coil inductance of this driver has also been reduced, to give better bass 'attack'.

The crossover is hard-wired and gives improved integration; a change of slope on the high pass leg has altered polar distribution, and stand height is now less criticial. Gold-plated binding posts are fitted.

SOUND QUALITY

The *SL6* has a generous, open sound with good stereo depth and separation — an altogether brighter, more out-of-the-box sound than its predecessor, it is also more capable of catching the impact and power of bass notes. *SL6* bass performance was marred by cabinet effects and the 'slowing' effect of the stiff mid/bass driver surround; the new speaker has a notably articulate bass, free from 'congestion' or 'drumming' coloration.

Furthermore, *SL6* delivers something of the exceptional stereo imagery achieved in the more expensive metal-cabinet *SL600* (still based on original *SL6* drivers and crossover).

A comparison of response traces shows the extra treble energy in the '6S which makes the speaker a little 'bright', and can produce a slight 'pinched' coloration, though otherwise the mid-band sounds unusually transparent.

LAB REPORT

For the 'S model sensitivity has improved by roughly 2dB, and the maximum sound level achievable by a pair in-room is now increased to just over 100dB, from the previous 98dB. The speakers showed good pair matching, and the grille and its frame had little effect on the anechoic measurements. The 2m forward response curves are particularly even, showing evidence of the increased treble energy.

The 96dB distortion plots showed some improvement in high frequency figures over the *SL6*, but at this level this compact speaker is nearing its limits. The 86dB traces showed a dramatic reduction in the 200Hz third harmonic cabinet problem, which was very clearly seen in traces taken on the earlier *SL6*. The distortion performance at this level is good.

The *SL6S* computer averaged in-room response shows much better driver integration than before. A uniform output with surprisingly extended low frequencies combines excellent room interfacing with an impressively smooth treble rolloff. The '6S crossover presents a better load than *SL6*, the one 6ohm minimum confirming a true 8ohm load.

Conclusions

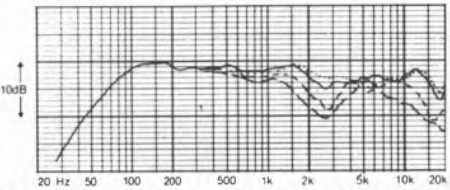
Retaining the strengths of the *SL6*, the *SL6S* loses none of that design's sweet treble and musical detail. Bass performance has been improved in both extension and clarity, and the redesign speaker is altogether more neutral, producing some of the excellent imaging properties of the *SL600* at under half the price.

Improved sensitivity and continued good drive characteristics make this an easy speaker to match; better treble dispersion allows greater freedom in room placement. The twin-pillar 40cm stands (L series) are recommended for the preferred free space location. *SL6S* rates as one of the very best compact speakers and carries a clear recommendation.

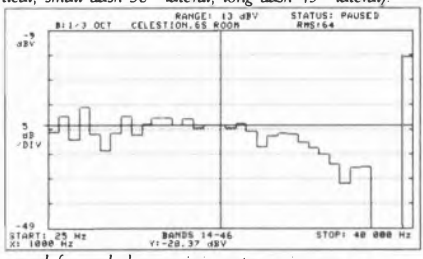
Author Martin Colloms' involvement as design consultant finds David Prakel writing this review, based on his own interpretation of the lab and listening data.

General Data

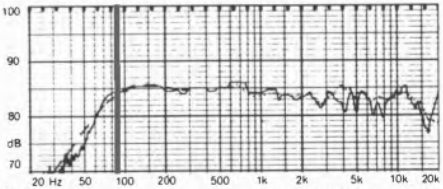
Size (height×width×depth)	37.5×20×27cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(20) – 150W
Recommended placement	free space, 40cm stand
Frequency response, within ±3dB, at 2 metres	60Hz to 16kHz
Low frequency rolloff (–6dB point) at 1 metre	50Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	84dB/W
Approximate maximum sound level (pair) at 2 metres	101dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good+
Typical price per pair, inc VAT	£350



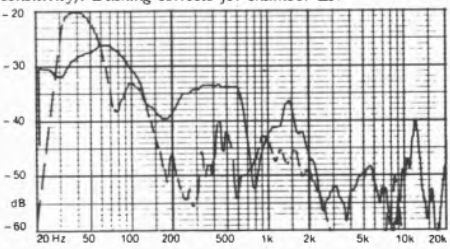
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Infinity's little miracle.

Britain regards itself as the home of the speaker and has been able to fight off the challenge from imported products in this market sector. However there is now a product from the USA which can meet and beat the UK product in many areas, including price.

The Infinity RS 2000 is the pathfinder product for a company known principally for its very expensive and esoteric units ranging in price up to £35,000 a pair.

It would be fair to say that the American 'sound' has been characterised by an over-emphasis in the mid range leading to severe colouration, although these type of speakers produce an extremely dynamic and exciting sound. Infinity have always ignored the rules and whilst their US competitors continued to produce high level coloured speakers. Infinity have preferred to look at the neutrality and musicality which hallmarks high quality products.

In particular, with the RS 2000, great attention has been paid to clarity without hardness, bass end extention without undue emphasis and precision of sound which is astonishing in speakers at £500, let alone these remarkable units at under £200. Truly miraculous performance from Infinitys little miracle.

At In Hi Fi we have an outstanding range of quality Hi Fi, enhanced by the ASC products we carry. Amplification is provided by Conrad Johnson and Copland from the US and Denmark, showing that valves still produce seductive sound quality Worldwide. Not to be outdone Burmester have produced some outstanding transistor designs, we especially enjoyed the 785 pre-amp. The initial extraction of information is vital so we stock the Well Tempered Arm and the van Den Hul MC10 cartridge. This combination is incredible. Potentially the most difficult choice is the loudspeakers. It has long been recognised that speaker boxes' induce unwanted colouration, but Infinity have a range of 'boxes' that make the most of the technology.

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We doubt if few speakers produced in England (the apparent home of the world's best speakers) can equate with these marvellous transatlantic units. There's not the space here to say what we thought about these remarkable speakers other than to say that as soon as we heard them we bought them, and this is a little miracle in itself!

If you think these are good however, why not lend an ear to the rest of the range which naturally is on demonstration at Subjective.

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2/4 Camden High Street, London. NW1 0JH
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Automation Sciences have been around for longer than you think, preferring to build our reputation slowly and carefully by selecting only the most imaginative, innovative products, in a particular market sector, rather than going for blanket coverage trying to back every available option.

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There is no such thing as the best loudspeaker in the world, however. If the audiophile world were to vote, then the winner would almost certainly be the Infinity Reference Series. Since few audiophiles can afford £35,000, Infinity introduced the RS IB which sacrificed the 'overkill' but retained the musically important features, admittedly at a still expensive £6,700. Below this model compromise inevitably creeps in but listeners can hear for themselves how the Infinity range all the way down to the RS 2000 compares with their competitors.

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The Music Room is often confronted with the task of evaluating new products on behalf of the manufacturer. In the case of the Infinity RS 4b loudspeaker it was the distributor, ASC, who asked us to try them adding that we might enjoy them. We listened bottom jaws fell ajar, sounds of 'Wow' and 'Hey' were gasped. How much are these babies we asked £1200.

ASC

Automation Sciences Company,
20, Little Gaddesden, Little Gaddesden
Berkhampsted, Herts. HP4 1PA
Tel: (044 284) 2786

£1300? No was the reply they're only £889 inc vat! You must audition these definitive loudspeakers, probably the finest you'll find under a grand.

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Tel: (061) 835 1366 Open 10am–6pm Tues–Sat
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'INFINITY'–suggestive of boundless scope. Apt, perhaps, with models ranging in price from a few tens to tens of thousands. Our own selection of speakers is comprehensive to say the least, including most of the leading makers in each price range.

Notwithstanding this, however, we have found the Infinity RS 4b to be a valuable addition, not too difficult to drive, producing a large sound stage and good value.

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RECOMMENDED

DIESIS SOLITAIRE

DIESIS LOUDSPEAKERS, 28 BARRAS LOCHMABEN, DUMFRIES, SCOTLAND
TEL: (05762) 3765

Diesis is a small British company with cabinet making experience, and this is reflected in the excellent natural wood finish of this product. A miniature design, the *Solitaire* is virtually hand made, and fits in the upper price bracket for the type. Measuring 35 by 20.2 by 26cm deep, the sealed box has an internal volume estimated at 12 litres. In this two-way design the treble is handled by an Elac 25mm polyamide dome, while the 165mm bass unit is made by SEAS, with a pulp cone that Diesis treat with a damping compound. The simple three-element crossover has three additional resistors for attenuation and damping.

Strongly constructed of double skinned chipboard, the front panel is a thicker grade of 20mm MDF. However, the 6mm grille panel is unrebated and stands slightly proud of the panel. The interior is lined with two grades of foam, and is hard-wired with good cable. Electrical connection is *via* 4mm socket/binding posts, and although this model is small enough for shelf mounting it will in fact perform best on open stands, probably not too far from a rear wall.

SOUND QUALITY

The *Solitaire* did well on test, proving to be a tidy and civilised performer. Despite its small size, it coped with the maximum 350W programme input despite beginning to sound a little ragged at this level; 100W is probably a sensible maximum.

If a touch 'lightweight', this speaker possessed a clean midrange, producing a well integrated sound with a natural tonal balance. No areas of the frequency range proved obtrusive and good stereo focus was evident with quite good depth. The only area of criticism, apart from the lack of really low bass, was a loss of the full dynamic impact of the material — at times it sounded just a little dry and over-controlled. Coloration appeared low on most program, except on solo piano, where some mild 'boxiness' was noted.

LAB REPORT

The reference response showed a 1 metre uniform characteristic with a modest 85dB/W sensitivity. Maximum level was of the order of 100dB for a stereo pair. Pair matching was good, except in the 5-12kHz range where tweeter sample differences amounted to 2dB, more than expected.

The grille was not beneficial to the response, imposing a dip at 3kHz as well as some upper range ripples; Bass rolloff was quite average, −6dB at 57Hz. At 2 metres, the forward response family showed some driver overlap at the crossover region, with the best sound obtained on axis. A mild peak was present above 15kHz while the midrange showed mild forwardness. But ±3dB limits sufficed for a 65Hz to 20kHz response.

At 96dB sound pressure level, the *Solitaire* was clearly working hard, giving a fair amount of second and third harmonic distortion. At the reduced 86dB spl, distortion fell below 1% over most of the range, which was a more satisfactory result. System resonance was 82 Hz, a bit high, but reflecting the small size. The impedance curve suggested a smooth 8ohm load, meeting the B.S. standard.

In the room the average response confirmed the lightweight balance, but only just. The mid was slightly prominent but the overall curve was quite well balanced.

CONCLUSIONS

This well-crafted miniature has a modest dynamic range. The sound is pleasantly neutral, with a generally good performance, if slightly lacking in bass power and extension. The quality control on tweeter matching needs watching but otherwise the performance of the *Solitaire*, the first Diesis model to appear in *Choice*, justifies a recommendation.

Reassessed. First reviewed 1984. Current typical price £220

General Data — see pages 180-184

RECOMMENDED

ENSEMBLE PA1

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

Swiss made and imported by Presence Audio, the Ensemble *FA1* loudspeaker represents an interesting approach to a high cost miniature. Selling at a cool £1,000, it is superbly finished in Brazilian rosewood, with alternatives including walnut, or black or white enamel colours. The front panel is slanted backwards to time-align the driver, and gave a distinctive appearance.

With the grille detached one is initially surprised by the paucity of drive units, and not least by the diminutive dimensions of the bass/mid unit. A 130mm pressed steel frame supports a 100mm cone of expanded polystyrene, straight-sided and laminated with aluminium foil. However one's impression improves upon seeing the rear panel, whose entire surface is occupied by a KEF auxiliary bass radiator (ABR) based on the large *B139* bass driver. This is a passive acoustic element which is roughly equivalent to a bass reflex port; if correctly designed it can provide lower distortion and reduced coloration. The treble is handled by a high quality 19mm soft-domed tweeter.

The internal volume is around 10 litres and the ABR is tuned to 50Hz, in principle extending the response down to 40Hz or so. A simple, first-order compensated crossover using selected film capacitors operates at 2.5kHz.

The enclosure is built with sandwich reinforced panels, and uses special joints to minimise resonances, resulting in a substantial 6.5kg for each system. Placement on rigid stands 40-45cm high is ideal, and reasonable proximity to the rear wall will help to optimise the balance. Electrical connection is made *via* 4mm sockets..

SOUND QUALITY

Though some comment will follow concerning the tonal balance, the *FA1* certainly did well in the auditioning. Strong points included a spacious, 'airy' stereo image with a mildly exaggerated impression of height. Musical detail was of a high order, while coloration was held to quite low levels. Stereo focusing was fine with good presentation of stage width, though the perspectives were a trifle close. Far space depth was well represented nonetheless.

The close perspectives seemed to be a function of the tonal balance, which tended to be 'lightweight', but without any apparent hardness. The bass was pretty good, reasonably damped but sounding a touch isolated from the mid-range. Some listeners felt that this aberration was attractive, in that the delicacy and speed appeared to be enhanced. Quite dynamic, it could also sustain surprisingly good sound levels.

LAB REPORT

Sensitivity was good, the *PA1* measuring 89dB/W, though this was to some extent comprised by a lower than average impedance, reflecting a significant amplifier loading 3.3ohms was recorded over the low frequency range making this a 4ohm nominal model rather than the 4-8ohm specified. A minimum power of 10W is suggested, while the 75W maximum will provide substantial 103dB peak levels.

The bass shelved down to a premature −6dB

point at 60Hz, while the limit in room was nearer 50Hz, the 38Hz figure proving to be rather optimistic. A rising on-axis response was evident through the midrange, but was followed by some loss in output through the crossover region. The grille had a negligible effect.

The family of responses at 2 metres were pretty well behaved though the graph confirmed the tendency to a 'forward' midband and a 'light' tonal balance. The treble was notably even. The in-room computer averaging defined a broad, smooth response characterised by some mid dominance, an isolated (ABR) bass lift plus a loss of energy on either side of the 50Hz resonance point.

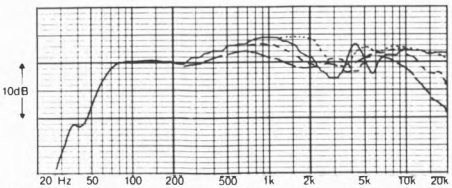
The high sensitivity helped to keep distortion levels within bounds at higher frequencies, though the range below 1kHz was none too promising. At 86dB (only 0.5W input) second harmonic averaged 2% up to 500Hz; third was rather better at 0.8%. At 96dB, a 5W input, the speaker overloaded below 50Hz, while distortion levels were generally around twice those at 86dB.

Conclusions

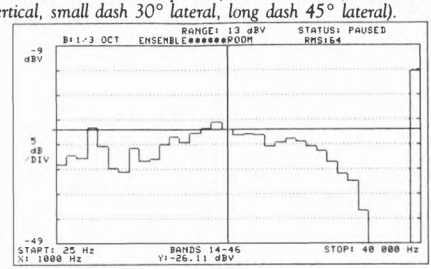
Although this loudspeaker produces a limited bass extension and needs to be used with some caution where larger amplifiers are concerned, depending on the programme bass content, hearing is believing, and there is much to commend in the *PA1*. While it does not represent very good value, and is too 'light' in balance to qualify as a true monitor, it nonetheless does qualify for recommendation, with the usual caveat to audition prior to purchase.

General Data

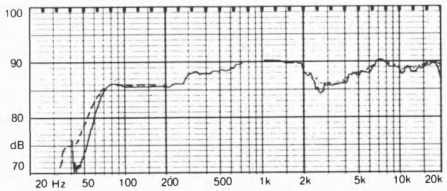
Size (height×width×depth)	35×23×22.5/17cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) –75W
Recommended placement	on stand (45cm) near wall (0.4m)
Frequency response, within ±3dB, at 2 metres	65Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	60Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89dB/W
Approximate maximum sound level (pair) at 2 metres	103dBA
Impedance characteristic (ease of drive)	average–
Forward response uniformity	fairly good
Typical price per pair, inc VAT	£1,000



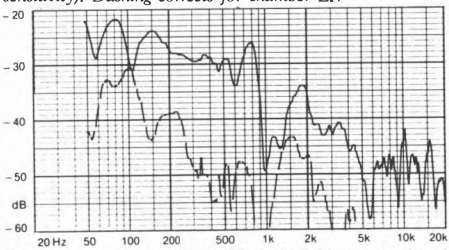
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

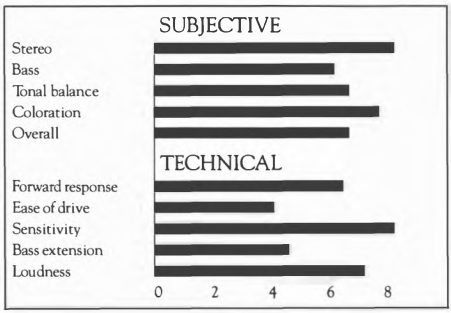


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



GALE 301

DW LABS, UNIT 2, STONEHILL, STUKELEY MEADOWS INDUSTRIAL ESTATE, HUNTINGDON, CAMBRIDGESHIRE PE18 6ED. TEL: (0480) 413277

This loudspeaker is the first medium sized model from Gale, and is intended to maintain the stylish image of the larger models. The distinctive looking enclosure sports an unusual grille — a flat sheet of perforated steel, available in black enamel or chrome to order. This grille is critically spaced with respect to the tweeter dome, and its acoustic effects have been accounted for in the design.

The two drive units comprise a 210mm framed, 170mm cone bass/mid unit plus a 19mm plastic dome tweeter, both of Danish manufacture. The bass/mid unit has a flared pulp diaphragm suspended on a foam surround in a pressed-steel chassis. The treble driver has been modified by Gale, punching out a small central portion of the dome, and placing some absorbent over the pole face.

Operating to 12dB/octave slopes, the second-order crossover uses a capacitor for the high frequency feed. Electrical connection is *via* 4mm socket/binding posts recessed into the rear panel. The chipboard enclosure is reinforced by internal bracing and finely finished in real black ash veneer. Combining the 23 litre sealed-box internal volume with a light moving mass bass unit results in a fairly high system resonance of 83Hz. The system is fairly well damped at low frequencies.

SOUND QUALITY

The panelists were somewhat divided over this speaker. While the overall scoring reflected a near average position, the stereo performance was rated rather higher. Subjectively open and 'lively', it favoured complex vocals, eliciting good depth and atmosphere from such recordings. The bass was somewhat reticent, but seemed both even and tuneful.

Tonally the midrange was lightweight, 'thinning' piano balances and favouring the right rather than left hand ranges of the keyboard. The treble was explicit, but slightly 'exposed' and perhaps too 'airy'.

LAB REPORT

The measured sensitivity was a little below average at 86.5dB/W. Up to 100W of input was accommodated comfortably, allowing peak sound levels of the order of 100dBA, sufficient for most purposes; a minimum 12W per channel is indicated.

Set against this reference sensitivity, the bass rolloff (−6dB) at 63Hz is unexceptional. In-room the bass extended below this somewhat arbitrary measuring point, but the computer averaged response confirmed that the overall level of bass was somewhat attenuated. The room curve shows a gently rising output through the midrange, followed by a significant depression through the presence region, coincident with the crossover point, leaving the main treble range exposed as a separate entity.

Two frequency responses are shown on-axis at

one metre, for the left- and right-hand speakers of the pair (the grille is essentially non-detachable). Interestingly, pair-matching was none too good, with significant 2dB variations at frequencies above 2kHz. An earlier pair reviewed previously had not suffered from this degree of channel imbalance. The response hints at upper mid lift, while the output appears to be deliberately decayed in the range 3-5kHz.

The output trends are very evident at 2 metres, namely a slightly prominent mid, a presence loss, and an isolated and somewhat lifted treble. However, a noteworthy feature is the excellent driver integration. The system is not too critical of listening position, and the set of three off-axis responses tally well with the main axial trace.

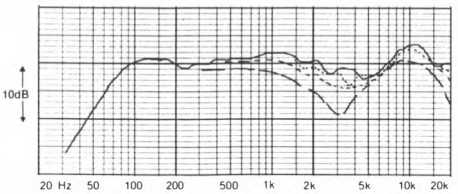
The sensitivity is not compromised by an impedance which rates an easy amplifier load, averaging 10-12ohms and not falling below 6.4ohms. The *301* gave above average distortion performance. At 86dB the results were good, while at the higher 96dB level the system remained well clear of overload even at the lowest frequencies.

Conclusions

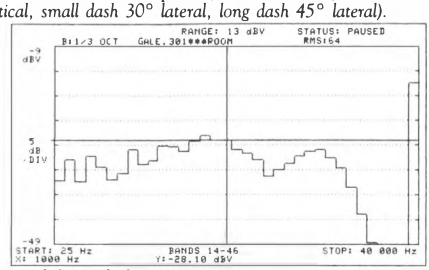
The Gale *301* produced a mixed response. Possessing good clarity and some strong subjective qualities, its frequency response nevertheless contains some perceptible variations from the neutrality. The value for money rating is not particularly good, but its particular merits make this model worth considering, particularly for those attracted by its refreshingly unusual appearance.

General Data

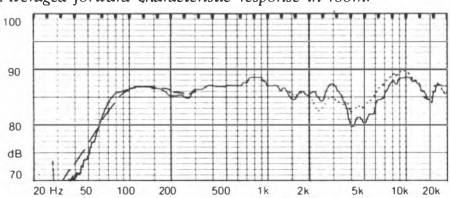
Size (height×width×depth)	44×23.5×22cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(12) –100W
Recommended placement	stands
Frequency response, within ±3dB, at 2 metres	75Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	63Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	86.5dB/W
Approximate maximum sound level (pair) at 2 metres	100dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	good+
Typical price per pair, inc VAT	£250



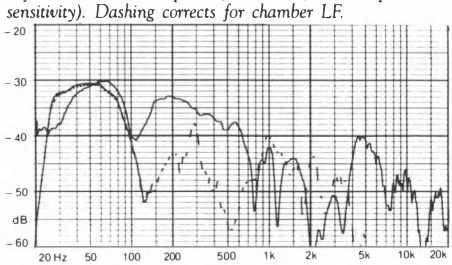
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

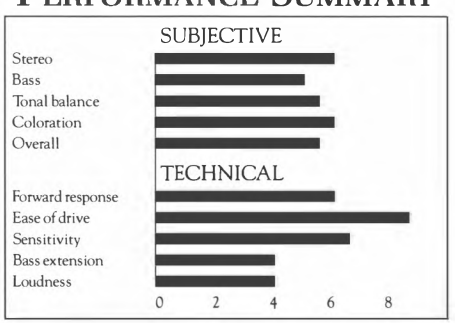


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



BEST BUY

GOODMANS MAXIM

GOODMANS LOUDSPEAKERS LTD, 2 MARPLES WAY, KINGSCROFT CENTRE, HAVANT, HANTS.
TEL: (0705) 486344

In recent years, the British loudspeaker company Goodmans has introduced new models nostalgically named after the classic M-series designs produced two decades ago. We have already seen the reincarnated *Mezzo* and the *Magnum* in recent years, and have now received perhaps the most famous of all. The *Maxim* was a true miniature of exceptional quality for its time, setting a pattern for many other commercial models leading up to the BBC *LS3/5a* design.

However, times change. While the new *Maxim* is certainly a true miniature, in real terms it is far less expensive than its predecessor. The veneered case of the original has been replaced by a vinyl-clad chipboard, and the drivers are not all of Goodmans manufacture. The new *Maxim* is actually one of the cheapest models to be included in this issue, with a typical retail price of around £70.

This speaker is intended for stand mounting, not too close to a rear wall. The bass reflex type enclosure has an internal volume of only 5 litres, and is tuned by a small ducted port 30mm in diameter and 50mm long, fitted to the rear panel and effective at around 70Hz. The panels are 12mm thick, and polyester fibre provides internal absorption.

A two-unit design, the bass/midrange driver has a 130mm steel frame and a 100mm flared pulp cone with vinyl half-roll surround, and uses a decent magnet. The treble range above 4kHz is covered by the familiar Audax 12mm plastic cone/dome unit which has ferrofluid cooling/damping.

The grille is 12mm thick and unrebated — better left off for more serious listening. The crossover has generous power handling capacity and provides nominal 12dB/octave slopes. Electrical connection is *via* combined 4mm socket/binding posts.

SOUND QUALITY

The *Maxim* scored well for its price in the blind listening tests. In contrast to many small inexpensive systems, which tend to have a 'loud' quality, almost 'shouting' at the listener, the panel found the *Maxim* was pleasantly balanced, with a broad, even midrange. Low bass was understandably absent, while upper bass was somewhat muted, but managed to appear articulate and tuneful. The treble was more than satisfactory, sounding nicely balanced, and showing pleasing detail without drawing excessive attention to itself.

Coloration was quite good and the mid detail was presented well. While clearly a small box, it made no excuses; it just got on with the job. Stereo images were well focused, with fine width and acceptable depth.

LAB REPORT

The sensitivity was only a little below average at 85.5dB/W, so the *Maxim* may be used with amplifiers from 20W per channel up to a sensible maximum of 50W. Acceptably loud 97dBA maximum in-room sound levels will be possible from a pair.

The reference response on axis at 1 metre was pretty good, measuring ±2.5dB 130Hz —

20kHz, though there was a hint of midrange excess and inevitable low frequency deficiencies with −6dB at a high 82Hz. The forward response group at 2 metres gives a better idea of the sound energy reaching a normally seated listener, and this showed very good characteristics, generally uniform with excellent integration. Uncritical of precise listening axes, this speaker offered a consistent response.

The impedance fell to just below the 8ohm limits at 350Hz, but typically held around 10ohms which is a relatively straightforward amplifier load.

This loudspeaker behaved well under power peaks of up to 75W, and achieved satisfactory swept distortion results at the 86dB test level. Overall, second harmonic held to about 0.8% while the more important third harmonic was typically 0.3%. The higher 96dB test level was hard on this miniature, but it coped pretty well even at low frequencies.

The computer-averaged room response confirmed the smooth broad midrange character of this model, neatly demonstrating the excellent mid/treble balance and the associated crossover integration.

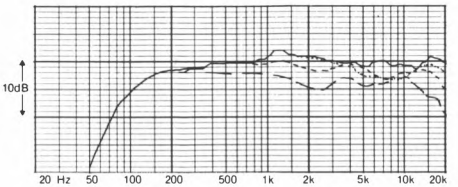
Conclusions

Perfect speakers cannot be had for this price, However the *Maxim* achieved much of the midrange and treble quality of more costly models. Nicely balanced, it performed competantly in the lab tests and scored well for its price on audition. A comfortable budget miniature, it gives sound value and achieves a Best Buy rating.

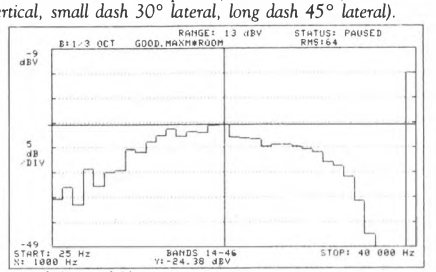
Note: The author provided a private opinion on an earlier version of this model for the manufacturer.

General Data

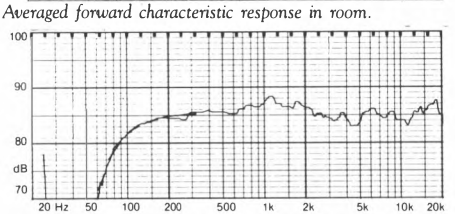
Size (height×width×depth)	26×17×21cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(20) −50W
Recommended placement	50cm stand, 0.5m from wall
Frequency response, within ±3dB, at 2 metres	120Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	82Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 metre)	85.5dB/W
Approximate maximum sound level (pair) at 2 metres	97dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	excellent
Typical price per pair, inc VAT	£70



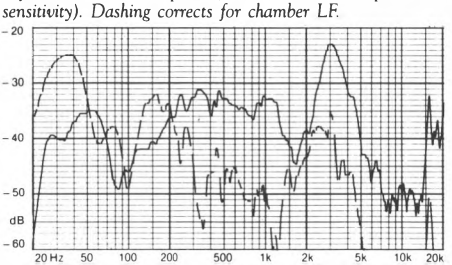
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

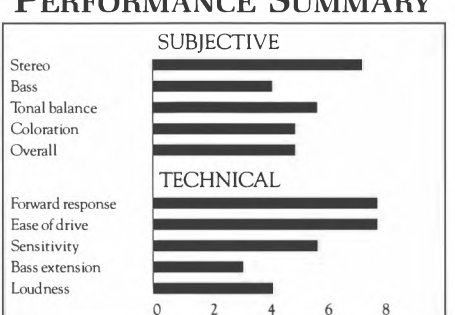


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

GOODMANS MEZZO

GOODMANS LOUDSPEAKERS LTD, 2 MARPLES WAY, KINGSCROFT CENTRE, HAVANT, HANTS.
TEL: (0705) 486344

The *Mezzo* is the middle sized model in the Goodmans 'M' series of moderately priced speakers, and revives the name of a model popular many years go. Since this review was originally carried out there have been some changes to the layout of the front baffle, removing the LED indicator lights and re-arranging the drive units vertically. Though we have not formally reassessed the model, such changes ought to have positively improved the level of performance.

The substantially built 37 litre bass-reflex enclosure has a three-way driver system. The 80mm cone midrange unit and the 25mm soft dome tweeter are now mounted vertically, and a larger-than-usual 250mm pulp-cone bass driver occupies the lower section of the enclosure.

Externally, the rigid chipboard enclosure is well finished in a synthetic vinyl print. The commercial-quality crossover is basically of 12dB/octave form, employing eight elements plus power resistors. Thick foam blocks provide acoustic absorption for the interior, whose panels are otherwise undamped.

SOUND QUALITY

The *Mezzo* acquitted itself well on the listening tests, comfortably achieving a score worthy of *Choice* recommendation. It was considered lively and well balanced, with good detail in some regions, while the bass was powerful with quite good extension, if a little 'plummy' in character. The treble was quite pleasant and free of obvious vices, and the midrange sounded open if a trace 'boxy', while 'cuppy' coloration was also audible.

Opinions about this speaker did, however, vary a little, though this is a factor that may have been improved — by the recent front baffle rearrangement. Only moderate depth was portrayed, the central focus seeming rather diffuse by comparison with the group average. Despite this, the *Mezzo* had a pleasant character not usually encountered at its price level.

LAB REPORT

Measured at 1 metre, the output looked unpromising, but the overall forward response was rather better. Mean sensitivity was above average at 88dB/W, with a quite extended −6dB/W bass rolloff point at 46Hz. In conjunction with a 100W peak power handling, substantial 104dBA sound levels were possible.

Fine distortion results were obtained at 96dB; around 1.5% second harmonic at low frequencies and just 0.3% for both second and third above 200Hz. At 86dB both showed a further reduction to very good levels.

At 2 metres, the off-axis responses were fairly well grouped apart from the 30° lateral, with the general characteristic slightly 'rich', possessing a gentle suckout at 3kHz. Assessed by computer room averaging, the output was rather more consistent than anticipated, and correlated well with the smooth impression gained on the subjective tests.

Failing to meet the 8ohms spec, the *Mezzo* showed an impedance dip to 5ohms, but its modest reactive content and average value of 7ohms it remains quite easy to drive.

CONCLUSIONS

This larger-than-average speaker is good value for money, offering a pleasant, uncritical 'big' sound. The bass extended deeper than usual while high sound levels with low distortion were possible. The already good performance should have been enhanced by the new front panel arrangements, particularly in terms of the stereo performance, so at its realistic price level, the *Mezzo* carries a firm *Choice* recommendation, with the provision that personal audition to confirm the results of the recent changes is advised.

Reassessed. First reviewed 1984. Current typical price £150.

General Data — see pages 180-184.

HARBETH HL1 IV

HARBETH ACOUSTICS, 1a BIRCHANGER ROAD, SOUTH NORWOOD, LONDON SE25 5BA.
TEL: 01-654 9549

RECOMMENDED

Since its introduction the *HL1* has been subject to small detailed improvements culminating in the current Mk IV version reviewed here. The 50 litre enclosure, reflex tuned by a large 62mm diameter tunnel port, has a cabinet of thin-wall high quality veneered plywood, with bituminous panel damping and extensive seam battening. Front and back panels are well screwed down and a sculptured foam grille assists the cabinet diffraction. An exclusive polypropylene 200mm driver covers the bass/midrange, and a 25mm Audax soft dome tweeter the high frequencies, with a good quality crossover dividing the input at approximately 2kHz. Provision has been made for sensible matching of mid and high frequencies using an auto transformer to aid consistent frequency balance.

SOUND QUALITY

The original *HL1* proved to be of monitor quality, and survived comparison with live sounds very well. On complex recorded programme in stereo it was a little weaker with some sibilant and chesty effects on vocal.

Fully reauditioned in Mk IV form (this arrived too late for new measurements except a room curve, not shown), the *HL1* bettered its earlier result by offering a clearer, more dynamic sound. Improvements in mid clarity were heard leading to still greater transparency as well as more precise transient definition.

Our first samples were slightly bright, which Harbeth acknowledged, stating that the treble level would be reset in production. Subsequent auditioning in 1986 confirmed that this had been done, and that the mid/treble integration was now first class. Overall the balance remained very good while the bass was somewhat underdamped in the reflexed area, more suited to classical than rock programme in this respect.

LAB REPORT

A useful above average sensitivity of 87.5dB was recorded, which is on target and not compromised by the impedance; this was judged to be a good amplifier load, typically of the order of 8ohms with a 6.6ohm minimum. While some high phase angles were apparent (for example, 70° at 2kHz), the impedance here was substantial enough to avoid censure. The −6dB rolloff point was noted at 46Hz, and with a 100W per channel amplifier limit, a good maximum sound level of 102dBA should be possible in a typical room.

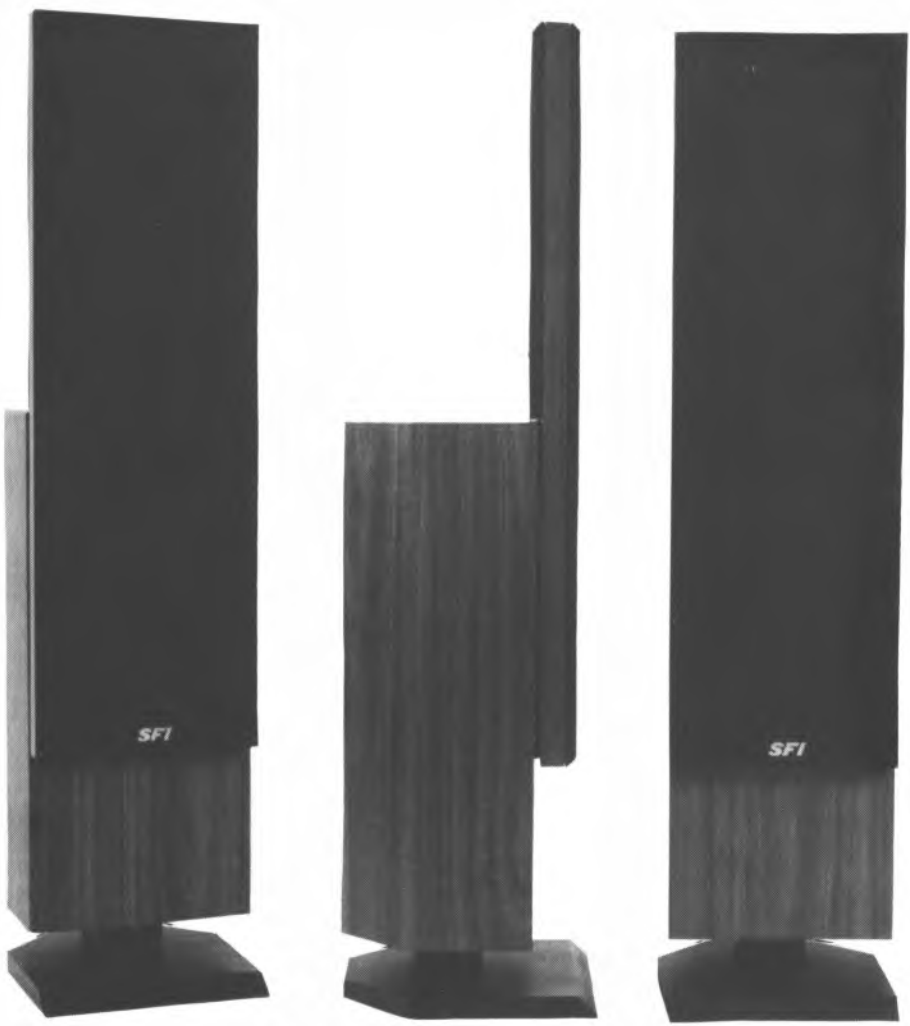
The axial response at 1m was fairly uniform, and ignoring a 5kHz notch met ±3dB limits, 55Hz-18kHz. Third harmonic distortion levels were also very well controlled at 96dB, typically measuring 0.5% or better above 150Hz. The less annoying second harmonic content peaked at 8% around 100Hz, and this might be audible on sustained bass notes. The system fared less well on a diet of 100W pulses despite the low 2Hz repetition rate: although perfect at 500Hz, a +0.3dB expansion occurred at 5kHz generating 5% of second and 1.8% of third harmonic distortion. Crossover saturation is the probable cause at this equivalent 100W programme level.

CONCLUSIONS

Reassessed, the *HL1 IV* was technically very similar to the *III*, except for the revised bass mid unit, this custom built by Audax on a cast frame, using the advanced TPX cone polymer. With notably improved midrange and fine overall mid/treble balance and integration, the design continues to stand the test of time, and carries a strong *Choice* recommendation.

Reassessed. First reviewed 1985. Current typical price £348.

General Data — see pages 180-184.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HEYBROOK HB1

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

For 1986, the *HB1* has been slightly revised. We have re-auditioned and partly re-measured a current sample, but the basic physical data in the review still refers to the original.

This low-cost speaker is rather better made than usual. The exterior of its rigid chipboard cabinet is vinyl 'walnut', while internally it is damped by bituminous cladding plus acoustic foam absorption. A superior reticulated foam grille is fitted and electrical connection is via binding posts/4mm sockets of good quality.

Internal volume is 22 litres, and two drivers are used, both of Danish VIFA' origin. The 200mm doped-pulp-cone bass/midrange driver is fitted with a decent magnet and a superior frame, and the high frequencies are handled by a 25mm soft-plastic-dome tweeter, whose chassis is reinforced inside the cabinet, this also serving to brace the front panel. A 12dB/octave crossover of superior quality integrates the two units at 3.7kHz.

Appearances response-wise suggested a character which might suit shelf mounting against the wall, and in fact the *HB1* did work quite well in this position, but for the listening tests the cleanest results were felt to come from positioning on rigid open stands.

SOUND QUALITY

Whereas the original *HB1* had showed a generally 'bright' overall balance, this was not considered particularly detrimental by the panel. However, this characteristic was found to be even more exaggerated, and seriously downgraded the overall scores of the new version.

Good qualities included a highly revealing transparency which was truthful to the programme character. Stereo images showed quite good depth with a realistic acoustic and decent frontal focus; in fact it sounded almost too 'clean' in the 'open' sense, as opposed to 'shut-in' or enclosed. The bass was articulate, with fair extension if a mite too 'dry', although this helped on percussion.

On the minus side, the sound showed some boxy colorations plus significant 'tizz' and hiss emphasis in the upper treble. The mid could also appear somewhat hard and forward. Using first-rate program, these effects were somewhat less serious than when juxtaposed with the more distorted output of a brighter and less expensive analogue disc player. Tonally speaking, the *HB1* was balanced well on the bright side, even when used on Heybrook's own stand.

LAB REPORT

Excellent pair matching was demonstrated with a high 90dB/W snsitivity, despite which the bass was reasonably extended to 55Hz, −6dB on the anechoic response, and was also free of overshoot.

In view of the 80W maximum power handling, decently loud 104dBA sound levels were possible, while as little as a 10W input raised pretty good levels of around 95dB in a typical room.

Out at 2 metres the general trends can be seen and the speaker only just scraped into the nominal ±3dB response limits for axial output. The upper mid was indeed forward by 2-3dB while an energy suckout occurred at 7kHz, high enough not to be felt subjectively as a loss of presence or 'air'. The treble recovered soon after, with a broad hump centred on 14kHz. Both plus and minus 15° vertical off-axis responses were run, showing the *HB1* was axis-critical and should be directed straight at the listener. Crossing the axes in front of the listener for 10°15° lateral angle also improved the tonal balance.

Measured at 96dB the distortion was moderate at 0.8% to 1.5%, with a further improvement noted on reducing the signal level to 86dB.

Occasionally the *HB1* impedance almost approached 5ohms, but it represents a simple amplifier load reactively and should prove fairly easy to drive. System resonance was noted at 65Hz.

Room averaged, the bass was smooth but somewhat deficient. Consequently, the mid remained forward although the integrated treble works better than the axial responses might otherwise suggest.

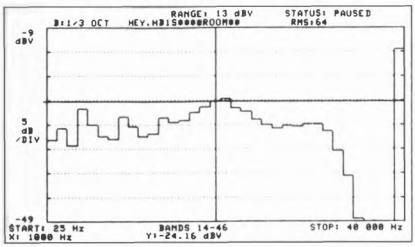
A new 1 metre axial reference response was taken for the 1986 *HB1* samples. This showed close correspondence with that of the earlier *HB1*, but with the undesirable characteristics somewhat exaggerated. In particular the treble is now more 'exposed', its peak some 2dB higher and the preceding trough 3dB deeper.

Conclusions

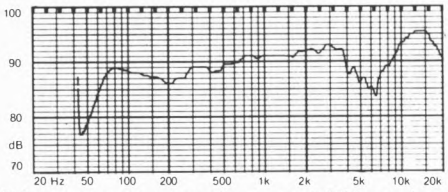
The *HB1* offers a distinctly bright character plus an above average build quality. Moderate distortion levels, high sensitivity as well as good maximum acoustic power are also all apparent, while the sound is strikingly clear with a fine transient performance. However, in the opinion of the listeners the current version has gone too far in terms of tonal brightness, to the point where prior audition by prospective purchasers is essential. Still an impressive design in many respects, the *HB1* is now rated worth considering, rather than the Best Buy classification enjoyed by its predecessor.

Re-auditioned. First reviewed 1983. Current typical price £149.

General Data — see pages 180-184.



Averaged forward characteristic response in room.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.

HEYBROOK HB2R

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

Similar in appearance to the *HB2*, and including desirable features like the real wood veneer and open-cell foam grille, the price of the *HB2R* has been increased to the £250 category. Several innovations are apparent; for example, the systems are supplied with a 'tab' — a wood strip to be attached to the enclosure underside. Under normal stand-mounted conditions this tilts the cabinet backwards, to more or less time-align the tweeter with the bass/mid unit.

The latter now uses a higher efficiency doped pulp cone in place of the earlier, heavier Bextrene unit. Built on a cast 165mm frame, the effective radiating area is some 130mm. The treble is covered by a 19mm SEAS soft plastic dome, replacing the older Audax *HD25*. The crossover is essentially first-order, using a ferrite inductor and some plastic film capacitors. The assembly is internally hard-wired to high standards, and the external electrical connection is made *via* 4mm sockets.

Reflex-tuned to 47Hz, the two rear mounted ports are 36mm in diameter and 160mm long, with the exit apertures airflow-smoothed and foam-damped. The 12 litre chipboard enclosure is massively braced, the panels are damped by bituminous pads, and acoustic foam absorbs standing wave modes. Rigid stands are recommended, with the systems located close to a rear wall.

SOUND QUALITY

The listening test results suggest that this new model has fared less well than its predecessor, the marks indicating a below average rating. Piano sounded 'ringing' and 'hard', while several panelists commented on a 'cardboard' quality to voice reproduction. The stereo image was projected rather forward, with crisp detail, but on a wide range of program a number of spectral imbalances were heard and commented upon.

The treble drew attention to itself, not by an excess of level but due to some sort of isolation effect, while the midrange was excessively dominant. The upper bass seemed 'thinned', but overall the bass was quite well-damped, with promising clarity, 'speed' and articulation: here at least it was certainly better than the old *HB2*. Dynamics were well reproduced, though not without the mid exaggeration noted.

LAB REPORT

The sensitivity measures 88dB/W, well up with the modern average, while for this reference level the bass was moderately extended to 61Hz, −6dB. The sensitivity was partly compromised by a poorer than average load impedance, dipping to 4ohms in the main music power range. In theory this is a 5ohm rated load, and this may influence the selection of an accompanying amplifier.

Power handling is above average and a 10W minimum input power is suggested. Using a sensible 100W maximum, a stereo pair will produce healthy in-room peak sound levels of 103dBA. The reference response graph shows two traces, the solid line being the normal result while the dotted line shows the effect of fitting the 'tab' tilt bar. The prime response was not very even, showing the increasingly widespread rising of midrange, here reaching a maximum

at 900Hz. The extreme treble was elevated relative to the main portion, and this effect was exaggerated by the 'tab'.

The set of off-axis responses were better than anticipated out at 2 metres, and the system proved to be quite well integrated. Though the result is still significantly unbalanced in terms of frequency response, ±3dB limits serve to contain an 80Hz to 20kHz range.

In the listening room, some bass was developed in the lower registers, but with a noticeable power loss at 100Hz. The mid was 'thin', humped up around 800Hz, and wall mounting was judged not able to effect a complete cure. Second and third harmonic distortions were generally satisfactory at both of the tested pressure levels, averaging 0.3-0.6%.

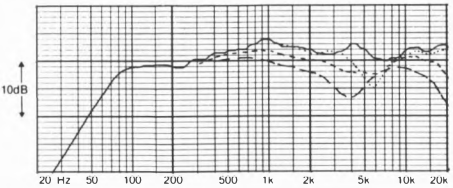
Conclusions

The old *HB2* was ready for replacement, but it was well regarded in its day as a broadband, compact system with a tendency to an overbright extreme treble. The new *HB2* is less well balanced in the midrange, and has sought to provide higher sound levels with more dynamic impact. This has been achieved, but not in a way which makes for a consistently musical whole. Taken overall, the performance was unimpressive for the price, and the system does not merit recommendation.

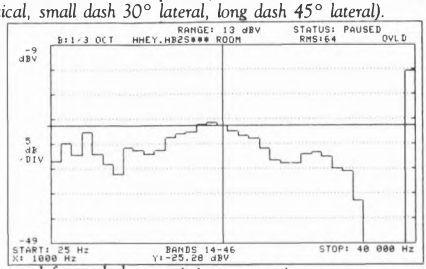
Following the disappointing panel auditioning and discussions with the manufacturers, Heybrook's own stands were substituted for the Linn stands originally used. While these provided some improvement, this was not considered sufficient to counter the criticism of the mid and treble balance.

General Data

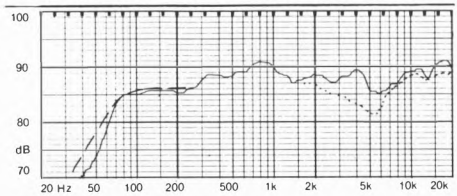
Size (height×width×depth)	41×23×23cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) –100W
Recommended placement	on stands, correct tilt angle, near wall
Frequency response, within ±3dB, at 2 metres	80Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	61Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	88dB/W
Approximate maximum sound level (pair) at 2 metres	103dBA
Impedance characteristic (ease of drive)	average–
Forward response uniformity	good+
Typical price per pair, inc VAT	£240



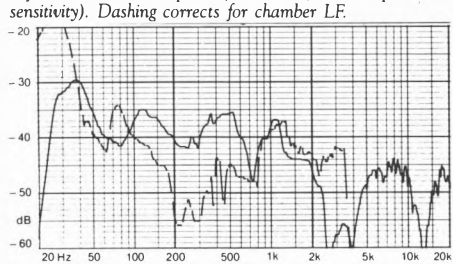
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

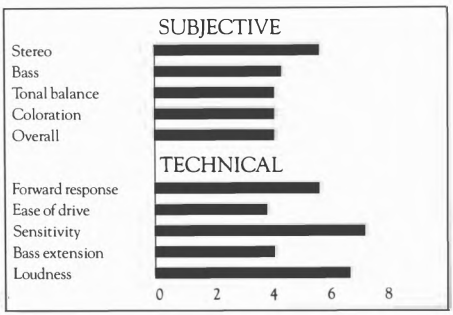


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



INFINITY REFERENCE STANDARD IIB

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

Infinity's giant *Reference Standard* loudspeaker system, now in *Series III* form, has a 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.

There are two smaller models in the series, the *IB*, and the *IIB* which is the subject of this review. As I write, I am sitting in front of a large area of natural mid-tone oak veneer, rising some 1.6 metres from the floor. The breadth of each is 57cm, which is enhanced both acoustically and visually by a convex curvature to the front panel. Including plugs and grille, the system is however quite shallow, measuring some 30cm deep. The systems come right- and left-handed, and a distinguishing feature of the range is Infinity's own drivers, the planar foil EMIM mid units and the EMIT high frequency drivers. Infinity also build their own polypropylene-coned woofers.

In the *IIB* three mid units are mounted in a vertical line, and come into operation above 150Hz, a favourably low crossover point. As a group the mid array continues to 800Hz, while the central module continues 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 ensuring 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. The vertical slot of each tweeter has a radiating aperture of 50×15mm, and an additional 15×22mm 'super-tweeter' 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 drivers.

The lower five-eighths of each baffle is a rigid sealed-box enclosure driven by a pair of high power 250mm bass drivers, employing BBC-style flared polypropylene diaphragms. These well-damped units would normally present a relatively limited bass extension, but in the *IIB* they are designed to work with a matching low frequency equaliser. This suppresses the natural system resonance and results in a range claimed to extend to 29Hz, ±2dB; without such a technique a 60Hz rolloff 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 so 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.

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. On test, we used an ARC *D115 II* for the bass and a C-J *Premier Four* for the mid-treble.

SOUND QUALITY

Once set up and properly in phase, the system as a whole provided five pre-set level control, so 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 proved so easy to live with sonically (if not visually for me!) that one became adjusted 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 drivers did have their own distinctive quality.

While the sound could be adjusted to give good tonal balance and a smooth overall result quite free from hardness or compressive effects, at times there was a feeling of separate units, not quite achieving 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.

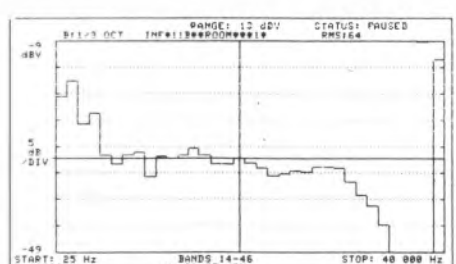
Given the complications of bi-amplification, the basic sensitivity was estimated at around 90dB, which is high, making the most of smaller amplifiers and providing high sound levels with large ones, for example up to 110dBA in-room for a stereo pair. This is a genuinely large-scale system, with low distortion 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 mike position, indicating broad driver overlaps. The *IIB* 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, though this is not as subjectively damaging as one might expect; in larger spaces the performance will probably be close to correct.

Conclusions

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.



Averaged forward characteristic response in room.

Reassessed. First reviewed 'The Collection'. Current typical price £3,500. General Data — see pages 180-184.

JBL TLX-3 GI

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

Last year we examined two new budget systems from JBL, the *TLX2* and *TLX4*, and this year we have the even more recent *TLX3*. This compact speaker verges on the miniature, with a modest internal volume of 12 litres. The system is quite strongly bass reflex-loaded, with the enclosure tuned to a high 58Hz by a substantial 47mm diameter port 75mm long. A sensibly stiff suspension on the bass driver provides surprisingly high power handling at low frequencies.

The two drive units comprise a bass/mid with a 165mm pressed steel frame and 125mm doped, flared, pulp cone, and a 25mm fabric dome tweeter whose surface radiating area is reinforced by a silver-coloured coating of vapour-deposited titanium. The crossover comprises three electrical elements with the electrolytic capacitors augmented by small value film capacitor 'improvers'. Fast-on connectors are used internally, and the external connection is made *via* spring clip terminals, which are, incidentally, large enough to take a 4mm plug directly.

The enclosure is robustly made in 15mm and 19mm grades of vinyl finished chipboard, matt black in colour; not surprisingly, internal treatment is limited to a thick fibreglass mat. The grille panel is thick, 18mm deep, essentially unrebated, and likely to produce diffraction effects in the treble. The system will probably sound — and measure — better with the grille removed.

Sound Quality

Scoring a little below average, the *TLX3* sounded lively and cheerful, with a 'directness' which helped to offset a degree of aural coloration and some associated response uneveness. At times sounding somewhat old-fashioned, the bass lacked real extension and the upper bass could be too lively at times. The mid was projected and 'lightened', 'thinning' piano tone, while the treble could occasionally sound somewhat rough and 'spikey'.

Stereo focus was satisfactory, but the full width and depth of the sound stage were not fully explored. However, some of the innate character of the recordings was portrayed, and the panelists quite liked it, despite noting specific criticisms. The mixed reactions indicate that an intending purchaser should insist on an audition.

Lab Report

At the standard 1 metre microphone distance, this speaker measured an average 87dB/watt sensitivity. Although small, the bass unit has a high power motor, and the *TLX3* accepted power inputs of up to 100W peak, resulting in maximum sound levels of 120dBA for a stereo pair in a typical room; a minimum power input of 10 watts is suggested. Considering the reference sensitivity, the bass is quite well extended to 55Hz, −6dB, though the rolloff is pretty steep at lower frequencies. The sensitivity is uncompromised by the amplifier load rating, the impedance values meeting the 8ohm specification.

A characteristic 'three-humped' effect is seen

in the reference response, elevated at 130Hz, 1kHz and 12kHz. The grille added a number of smaller ripples to the output but did not affect the general trend, which was again apparent at the 2 metre measuring distance. Some of the output loss in the 2-4kHz region may be seen to be due to crossover effects; this region of the response was rather dependant on the speaker height, and the angle of measurement in the vertical plane. Interestingly, the response became nearly flat with increasing lateral angle, so the best sound will be obtained with the speaker directly facing ahead, not angled inwards towards the listener as is usually the case.

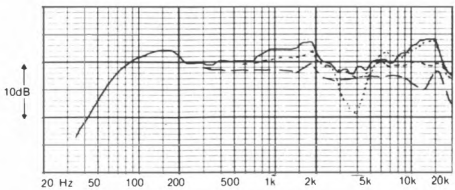
The computer averaged room response confirmed the mid prominence centred at 1kHz. The bass is 'lumpier' than usual, with noticeably restricted extension, while the treble rolloff curve lacks uniformity. The distortion sweep results were unexceptional though well clear of overload at both 86 and 96dB. The rise in second harmonic above 12kHz is probably inaudible.

Conclusions

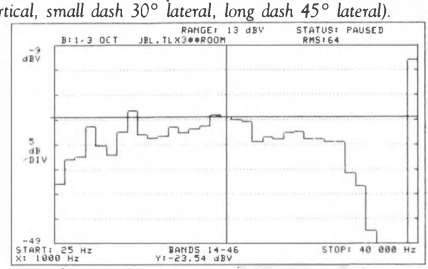
While this speaker was untidy in some respects — for example, the forward response — it did not sound as bad as this might suggest. Lively and 'punchy', with above average dynamics and detail, this little speaker may have deviated significantly from the hi-fi standard, but cannot be summarily dismissed. It has some 'fun' in it, and the final scores placed it only a little below recommendation, so we are left with a 'worth considering' verdict.

General Data

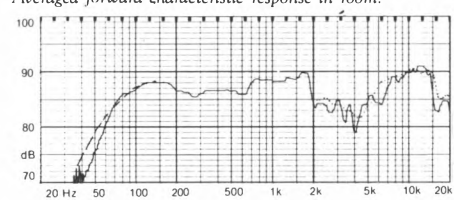
Size (height × width × depth)	38 × 25.5 × 22cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(10) – 100W
Recommended placement	on stands, free space
Frequency response, within ±3dB, at 2 metres	75Hz to 18kHz
Low frequency rolloff (–6dB point) at 1 metre	55Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 metre)	87dB/W
Approximate maximum sound level (pair) at 2 metres	102dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	average
Typical price per pair, inc VAT	£130



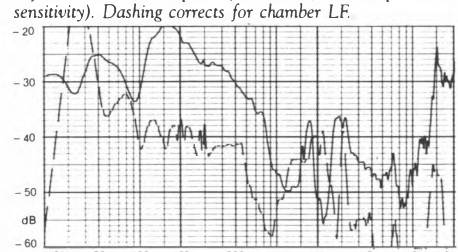
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

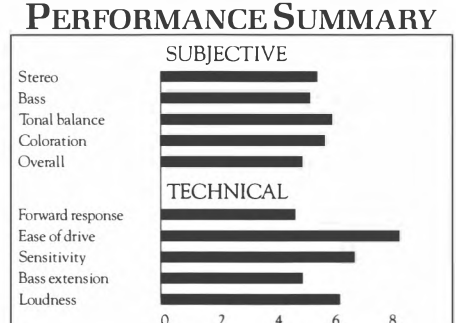


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

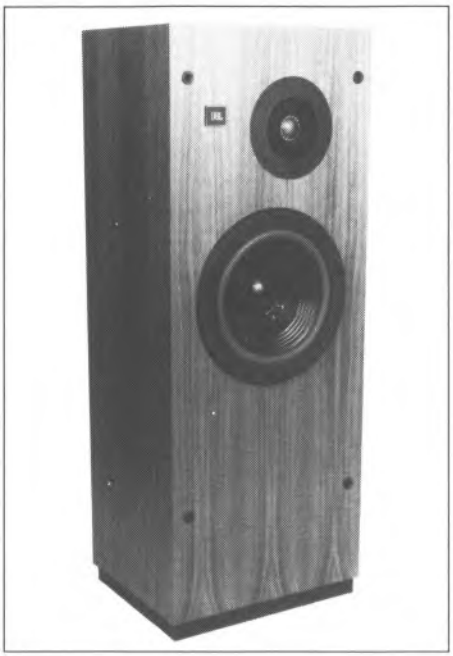
Performance Summary



RECOMMENDED

JBL 60T

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



Placed at the quality end of the compact loudspeaker market, the *L60* is a quite substantial loudspeaker — at a quite substantial price tag of £370 a pair. For a start, this is a floor-standing design, which has its own particular appeal, to the many people conscious of the visual obtrusiveness of hi-fi. It must, however, be said that for perfectionists a better performance will be obtained by elevating the speaker on rigid low stands, designed with a floor-keying feature. Standing 78cm high, the *L60* is a two-way reflex-loaded system of some 35 litres. It is tuned to a low 26Hz, which promises good bass extension.

The bass/mid unit has a die-cast frame fitted with a light pulp cone with foam surround. The frame measures 230mm overall, while the actual diaphragm diameter is 160mm. The generous motor system has an oversize high-power 50mm voice-coil. Crossing over at around 2.5kHz, the treble range is handled by a version of JBL's 25mm titanium dome tweeter with its integral 'diamond pleat' surround. The high quality 12dB/octave four-element crossover includes two polypropylene capacitors, and uses internal push-on connectors; combination 4mm socket/binding-posts are used for external connection.

The main enclosure construction material is 19mm chipboard, finished in natural walnut veneer. There is no internal bracing, but a 20mm fibreglass lining helps absorb internal standing waves. The port is reasonably sized, 48cm in diameter and 128mm long. An assembly fault on our sample left one bass unit mounting nut loose inside the enclosure.

Sound Quality

The *60T* scored above average for the listening tests, which is an appropriate rating for the price, and was impressive in several respects. While the bass was somewhat rich and a little too powerful, it was also fairly clean and well extended. Futhermore the upper-bass to mid-treble balance sounded agreeably uniform, in contrast to many modern systems. This helped to give a good sense of scale to a wide variety of program material.

Some moderate 'boxy' colorations were present in the midband, and the treble could sound a little 'wiry' and 'brash' on strings and brass. Stereo focus was quite good, with a fair representation of depth. Dynamics were also above average.

Lab Report

The average 88dB/W sensitivity was mildly compromised by a load impedance below the 8ohm standard tolerance; in fact the lowest value was a touch over the 4ohm level, and was not considered too severe in amplifier loading terms. A minimum input power of 10 watts per channel is suggested, while the system showed fine power handling to 150W peak program, so

good peak sound levels of 104dBA are possible in a typical room.

The bass was well extended to 40Hz, −6dB, and as the room curve testifies, the response was well maintained down to 25Hz, albeit with some excess below 60Hz. Above 100Hz the computed room response shows fine balance and most even output, bar some mild abberation in the mid treble.

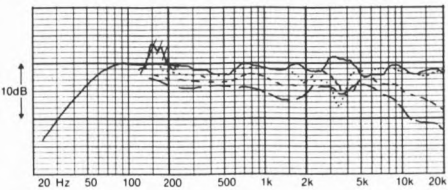
This speaker measured pretty good on axis at 1 metre, bar a degree of crossover interaction around 3kHz. Removing the grille effected a small improvement (dotted line). The 2m set of forward responses indicated fine driver output integration except in the 3kHz area, and the lateral off-axis curve was particularly good. Reflecting JBL's experience in this area, the audibly significant third harmonic distortion at 86dB was held to low levels. The second harmonic trace rose somewhat at the higher 96dB sound level, but the general trend showed good control right down to 20Hz.

Conclusions

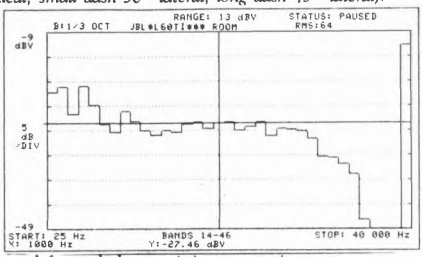
This speaker possesses many positive qualities including a fine treble, an extended and powerful bass suited to larger rooms, moderate distortion levels, and the capability for high sound levels. Stereo performance was rather above average, and the 60*T* sounded pretty well balanced in musical terms. It offers realistic value for money, and thus merits *Choice* Recommendation.

General Data

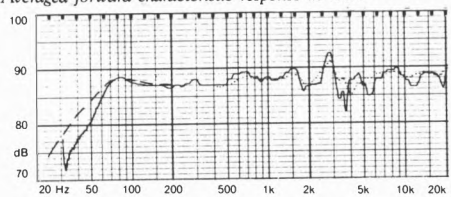
Size (height × width × depth)	78 × 30.5 × 26.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −150W
Recommended placement	floor or low stand (15cm)
Frequency response, within ±3dB, at 2 metres	45Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	40Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	88dB/W
Approximate maximum sound level (pair) at 2 metres	104dBA
Impedance characteristic (ease of drive)	average (not 8ohm)
Forward response uniformity	very good
Typical price per pair, inc VAT	£370



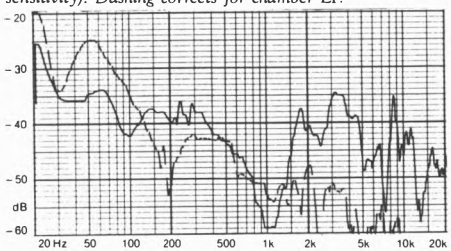
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

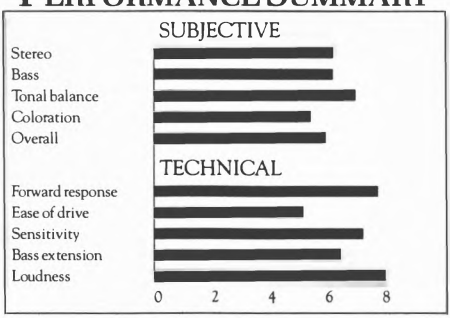


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

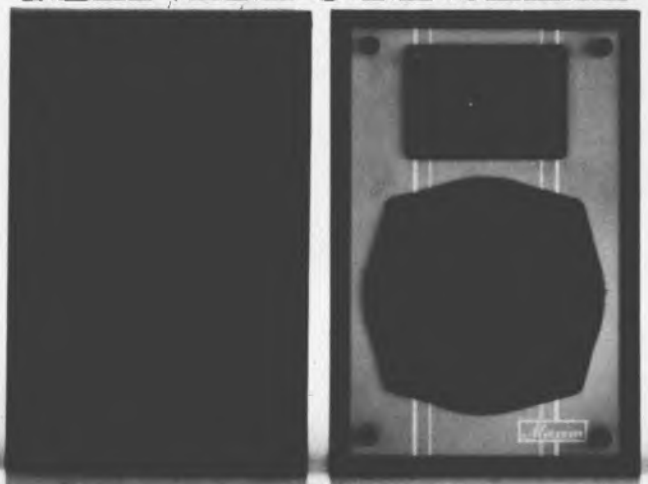
Performance Summary



Maximum

PERFORMANCE

MINIMUM SIZE



MAXIM

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JBL 18Ti

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

This costly loudspeaker comes as a surprise from JBL since it is a similar size to the earlier *L15*, but is double the price! But in fact, the *18Ti* is a completely new system, incorporating advanced technology drivers.

The *18Ti* is rigidly constructed in 20mm thick chipboard, double veneered in real wood. Its 10 litre volume is reflex-tuned to 59Hz by a generous 45mm diameter tube 100mm long.

Bass and midrange frequencies are allocated to a high power 180mm cast frame driver with a 44mm motor coil and a rigid flared polypropylene cone, this critically terminated by a plastic surround.

The treble is covered by the latest JBL tweeter, a profiled titanium dome with integral diamond pleat surround. Generous magnets energise both devices.

A high quality crossover network divides the input power at 12dB/octave at around 3kHz. The speaker is hardwired internally with Monster Cable and 4mm socket/binding posts are provided for rear connection.

SOUND QUALITY

The panel's scores were a somewhat disappointing 'above average' rating, which is not commensurate with the price. Their comments described a generally well balanced system, well integrated and controlled, with good detail and attack in the frontal planes. Fair depth was produced, but it lacked full resolution of space and ambience. The sound was smooth, but some colorations were noted: in the mid there was a 'woody' effect, plus some 'hardness' and 'wiriness' in the upper ranges; ringing tones and woodblock sounds were over-emphasised.

Stereo focus remained good, while power handling was quite exceptional. Some loss of low bass was noted.

LAB REPORT

Despite the *18Ti*'s compact size, sound levels of up to 104dBA should be possible for a stereo pair, with up to 150W per channel of undistorted peak programme power. The near 86dB/W reference sensitivity indicates a minimum amplifier power requirement of 20W. From the reference response the speaker offered a −6dB rolloff at 53Hz, an average result for the size of speaker; the bass was step-tapered to improve room boundary matching.

Out at 2 metres, the set of forward responses was very tidy, with a nicely balanced trend and fine integration. A small notch developed above-axis, indicating the need for decently high stands, perhaps 50cm. Frequency response limits of ±3dB were easily met at 55Hz-20kHz.

Driven to a 96dB sound level, distortion remained low above 300Hz, averaging 0.3%. At 86dB very good results were obtained particularly for the more critical third harmonic; the peak at 22kHz probably related to the dome resonance, estimated to be at a high 44kHz. Even at low frequencies, the 86dB distortion averaged 0.5%, a fine result.

Failing to 5.5ohms at 200Hz, the impedance still suggests a 'good' amplifier load, the speaker presenting a relatively straightforward load.

In the listening room the bass showed an isolated prominence at 60Hz, suggesting that the tuning is not ideal. Elsewhere the balance was basically good although some excess in the mid treble range was visible, this associated with subjective comments of mild hardness.

CONCLUSIONS

This well finished miniature was beautifully engineered, and should give a long life. Its power handling was high while distortion was low. Essentially neutral, with sharp stereo focus, it will be hard to beat for high level rock reproduction in confined spaces. Overall the performance was unexceptional for the money, but it is certainly worth considering.

Reassessed. First reviewed 1985. Current typical price £550.

General Data — see pages 180-184.

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. A key feature is the development of a new dome tweeter. Made from a thin foil of titanium (chemical symbol Ti), no significant resonances or break-ups occur within the working audio range, its performance closely approaching the fabled acoustic piston with perfectly defined behaviour.

The *250 Ti* is a large floor-standing enclosure, superbly finished in natural oiled veneer, with nicely rounded front edges and a tweeter mount executed in solid hardwood. Built as mirror image pairs, these substantial monoliths include a prominent inwards taper from the base to the top, slightly tilting the line drawn between the drive units, and a 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 but JBL have avoided the worst effects by lifting the grille 15mm away from the front panel.

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 pulp 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 stiffness and extend its operating range; JBL's curves suggest a response good to 6kHz.

The tweeter is a 25mm dome made in one piece from 25 micron titanium foil, including the surround which uses JBL's proprietory Diamond Pleat pattern to provide the necessary compliance. 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 re-arranged as desired, to provide tonal balance control via attenuation of the upper three drivers. Listening tests early on found the most accurate sound in the test system and room was with the mid at 0, and the two upper units both wired for −1dB.

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, so a light plug of polyester wadding was placed in the duct. In general this was preferred and room responses taken for both conditions

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, and could also handle big inputs in the bass, delivering a massive floor-shaking 'slam', rather excessively with the undamped reflex ports. 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 hardness or aggression.

However, 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.

Tonally 'even' with the optimised attenuator settings, the voice range was a touch '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

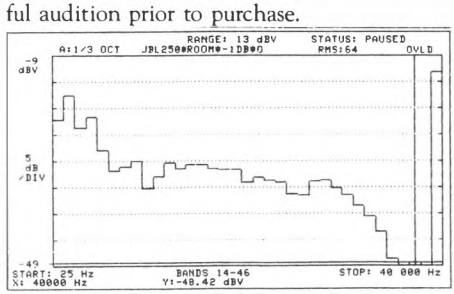
The impedance characteristic showed a fine 8ohm result, making this an easy-to-drive design. The sensitivity was on target at a high 89dB/W, providing high sound levels of up to 109dBA in-room. Amplifiers from 50W to 300W per channel would be sensible, chosen according to room size, sound level required, 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.

Conclusions

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, it 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 careful audition prior to purchase.



Averaged forward characteristic response in room.

Reassessed. First reviewed 'The Collection. Current typical price £3,300.

General Data — see pages 180-184.

RECOMMENDED

JPW P1

JPW LOUDSPEAKERS LTD, PO BOX 31, PLYMOUTH, DEVON PL1 1YH.
TEL: (0752) 784284

Least expensive of a range of speakers designed and produced by a small UK company, the *P1* is a standard-formula budget two-way design. Selling for a modest £115, it is distinguished by a real wood veneer in a price category where most are vinyl coated. The cabinet is a 19 litre sealed-box, solidly constructed from 19mm chipboard, its interior lined with acoustic fibre. The 9mm thick grille panel is unrebated.

Bass is covered by a 200mm VIFA unit with a modest magnet and a straight-sided pulp cone. Treble is allotted to a second VIFA unit, a 19mm polyamide soft dome. A standard four-element 12dB/octave crossover divides the signal electrically.

SOUND QUALITY

The original *P1* scored below average on the tests, but not seriously so in view of the modest price. Panel comments were mixed. Over and above a basically satisfactory sound, criticisms of a 'boxy' and 'thickened' effect were made, and while the bass was respectable it lacked real extension. The tonal balance was lightweight and the upper range showed some uneveness, varying in effect according to programme. Both a sharpness and a 'wiry' coloration were evident, and the upper treble was sometimes rather prominent. Stereo images were quite well focused, but again the depth effect was variable with different program. Sometimes it sounded OK, but on occasion the sound was described as rather two dimensional.

Subsequent 1985 & 1986 audition of later samples showed significant improvements in midrange 'sweetness' and mid/treble integration, though the 'bright' balance was still noted.

LAB REPORT

Pair matching was very good, within ±0.3dB over the whole range. Reference sensitivity was high at a mean 90dB/W, and with a 100W power handling, a pair will be capable of 105dBA; even 15W amps will give quite decent sound levels. The −6dB bass rolloff came in at a typical 60Hz and despite the grille rebating, a significantly smoother response was obtainable with grille removed.

Out at 2 metres, the smoothed output still showed some tendency to 'lumpiness', with a plateau around 1kHz and minor peaks at 15kHz. Nevertheless ±2dB limits sufficed for an 80Hz to 20kHz response. Driven to the 96dB sound level, requiring only a modest 4W input, the JPW distortion was about average at around 1% over most of the range. At 86dB, third harmonic distortion was lower at 0.3%, while second remained much the same. Compression measured −1.4dB, poorer than average, but intermodulation was rather better, at −44dB.

From the impedance graph, the system resonance was seen at 88Hz. The impedance variation was small, averaging 7ohms, with a small dip to 6 at 15kHz, which is pretty harmless. In view of the high sensitivity, this loudspeaker should not present any problems for any modern amplifiers.

The room-integrated response illustrated the 'lumpy' nature more clearly, with an almost three-humped response along with a forward midrange. The treble 'bites' a little at 5kHz, and while the bass was fairly extended, it rolled away a little too soon. Realignment to 88dB plus better driver integration at the crossover would help matters a lot here.

CONCLUSIONS

Despite the above discussion of its various character quirks, the *P1* remains a well-crafted, well-finished speaker offering a good general performance. The subjective ratings, enhanced by the improvements of subsequent samples also suggest good value. It is both sensitive and easy to drive, while progressive refinement has maintained its competitiveness by 1986 standards, though a personal audition is advisable, to see whether its tonal quality appeals to you.

Reassesed. First reviewed 1984. Current typical price £115

General data — see pages 180-184

RECOMMENDED

JPW AP3

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

A relative of the *API*, the '3 is a larger version with some refinements including the option for bi-amplified use in conjunction with an active cross-over such as the custom packages produced by Nytech or A&R.

Sturdily built from 20mm thick chipboard, this two way design is reflex-loaded, the 25 litre internal volume giving a system resonance of 73Hz. The grille baffle is rebated to improve acoustic performance, while the external finish was in our case an excellent walnut veneer. The panels are damped internally by a bituminous layer, and volume absorption within the enclosure is effected by a polyester fibre wad.

The bass/midrange main driver is from VIFA, with a 200mm diecast chassis and a doped pulp cone. For the treble at 19mm plastic dome unit (VIFA again) takes over. A simple 3-element crossover is used to provide nominally 12dB/octave acoustic rolloff slopes, but in active mode the electronic crossover takes over, the drive units barely requiring equalisation.

SOUND QUALITY

Achieving a 'good' rating on the listening test, the *AP3* did well in spite of comments concerning a mild excess in the upper bass, a mild tonal 'thinness' in the midrange, and a forward, bright treble. Somehow the speaker remained well enough balanced overall, as well as sufficiently controlled, to allow its other qualities to show. Stereo was pretty good in terms of both width and focus, with fair depth. The voice band was liked, and sounded articulate and well differentiated. Low bass was somewhat muted but was present in the room, and compensated for by an upper bass richness.

Coloration in the general sense was fairly low, bar some 'graininess' in the upper treble.

LAB REPORT

Set to a 1 metre measuring distance in the anechoic chamber, this speaker demonstrated a good sensitivity of 90dB/W, uncompromised by the impedance characteristic. The latter rated as a very good amplifier load with an average value of 9ohms and a lowest of 6ohms.

The reference response showed slight bass underdamping with a −6dB rolloff at 57Hz. A rising output with increasing frequency was also shown, amounting to 5dB over the 200Hz to 15kHz range. With the grille removed some improvement was seen in the treble smoothness.

A minimum of 10 watts was indicated for satisfactory sound levels, while 100W maximum input was possible on undistorted programme (not continuous tones). Good sound levels of up to 105dBA were possible in a typical room, and for active operation, amplifiers in the 25-50W range will be entirely suitable.

At 2 metres, the forward response set was quite good, particularly in the lateral plane. Vertically the response was less regular, and the speakers should therefore be placed with some care, for example on a stand 40-50cm high and set straight ahead. The rising trend was again noticeable on the smoothed responses.

Low distortion levels were obtained at 96dB, typically 0.3 to 0.4%, at 86dB with further improvement to a very good 0.2% average.

In the listening room the *AP3* did show a generally good balance, though with a touch of treble excess and the beginnings of a 'humped' energy response.

CONCLUSIONS

This nicely finished and well built loudspeaker had a touch of its own 'character', but this did not detract from the listening results which were good for the price. Other aspects were also nicely balanced and the facility for active operation is an interesting option, providing the opportunity for a subsequent upgrading of the performance in power, clarity and balance. Offering reasonable value, the AP3 carries our recommendation.

Reassesed. First reviewed 1985. Current typical price £195.

General data — see pages 180-184.

KEF C10

KEF Electronics Ltd, Tovil, Maidstone, Kent ME15 6QP.
Tel: (0622) 672261

While this is the smallest and cheapest speaker of KEF's new C series, it makes the same use of up-to-date polypropylene cone technology as its larger brothers. The *C10* is a relatively sensitive design intended for siting close to or almost touching a rear wall, a position which was adopted for the blind listening tests. This true miniature model encloses an internal volume of 6.2 litres and not unexpectedly uses sealed-box loading. However, the bass alignment corresponds to third- rather than the second-order of a simple sealed-box, with a large capacitor in series with the bass unit becoming active in the range below 70Hz. The upper system resonance is at 100Hz. KEF quote a quite healthy 80 watt power handling, with an 8ohm impedance.

The bass/mid unit has a 180mm steel chassis fitted with a 128mm active diameter flared cone, while the treble is handled by a 25mm soft dome unit. Acoustically the crossover approaches fourth-order, as defined by electrical slopes approximately third-order. The seven-element crossover of normal commercial quality is built on a small printed circuit board and external electrical connection is made *via* 4mm socket/binding posts.

The simple vinyl-covered cabinet is made from quite substantial 14mm chipboard, with internal absorption provided by two polyester fibre wads; bracing and or damping is uneconomic at this price, and largely unnecessary with such a small design. The unrebated grille is 17mm thick and likely to disturb the treble response; the more critical will probably prefer to leave the grille off.

Sound Quality

The *C10* scored significantly below average on the listening tests, but it proved difficult to summarise the results. The criticisms were of a general nature, relating to stereo imaging, balance and coloration, but in the main were not sufficiently specific to pin down a definitive description of the sound.

There was little extension to low frequencies in the bass, while the sound was not very tuneful in the upper bass. Mild 'boxy' and 'hard' colorations were noted through the midrange, though these were no worse than the average.

The tonal balance was somewhat 'lightweight', with strong 'presence' — perhaps it was too 'open' in this respect. The treble was unexceptional, lacking obvious irregularities but sounding a little 'bright'. Stereo imaging was evidently constrained by the wall position and did not show much depth. Some panelists approved the stereo focus.

Lab Report

This speaker recorded an average sensitivity of 87.5dB/W, so quite reasonable maximum sound levels of 101dBA will be possible under typical room conditions, given its 75 watt power handling, while 10-15W will be sufficient to give satisfactory results. The sensitivity rating was not too severely compromised by an impedance characteristic which was typically 6.5 rather

than 8ohms, and which fell to 4.5ohms at 11kHz; a 'good' amplifier load rating is indicated.

The reference response was commendably uniform — especially with the grille detached, as shown by the dotted line. The bass rolled off early, −6dB at 75Hz, while the general trend was upwards with frequency, not necessarily the ideal characteristics for a small box system.

This trend was confirmed at 2 metres (grille on). Above 300Hz the output rose smoothly, reaching 2dB above reference from 1.5-12kHz. The set of forward responses were nicely controlled, and with the system directed towards the listener (so avoiding the small crossover notch when the microphone is 15° above axis), the best output was obtained at 20-30° off-axis. Directing the speakers straight ahead from the wall will come fairly close to this condition.

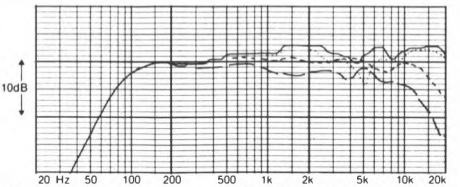
The response in the listening room (measured without wall gain) was slightly 'bright', and also 'lumpier' than usual in the mid bass, where it was also down in level, −6dB at 50-80Hz. The broad mid treble was quite smooth. The measured distortion was fine for the size, with the more critical third harmonic well within bounds. Distortion at low frequencies was kept within sensible bounds even at 96dB.

Conclusions

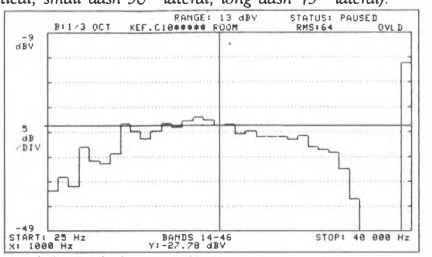
This system was notably well engineered, had some good features (and was, incidentally, preferred to the C20, not reviewed here.) However, the listening test results were unexceptional for the money, the system basically sounding too 'small'. Nevertheless, it is a fair effort for a wall-mounted loudspeaker, and is therefore worth considering.

General Data

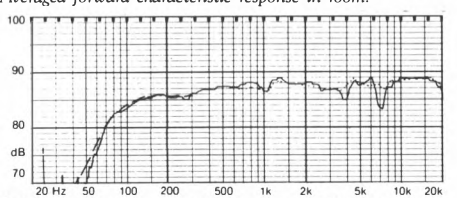
Size (height × width × depth)	30 × 20.5 × 17.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −75W
Recommended placement	stand, near rear wall (0.1m)
Frequency response, within ±3dB, at 2 metres	90Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	75Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	87.5dB/W
Approximate maximum sound level (pair) at 2 metres	101dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	excellent
Typical price per pair, inc VAT	£90



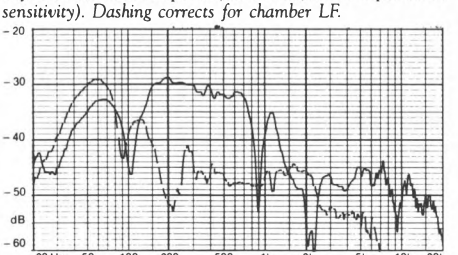
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

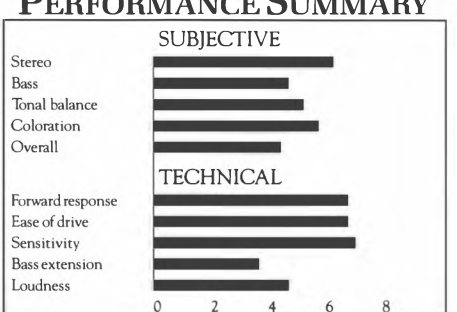


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



KEF C40

KEF ELECTRONICS LTD, TOVIL, MAIDSTONE, KENT ME15 6QP.
TEL: (0622) 672261

When a compact two-way design is a success, there is temptation to make a larger loudspeaker based on the smaller model, while avoiding the major difficulties of a true three-way design. Generally the 200mm bass/mid driver and tweeter two-way has its box size increased to take a second bass/mid unit. These two similar drivers work in tandem at low frequencies, their lower unit is gently rolled-off through the midband leaving the upper unit to complete the transition to the tweeter.

The KEF C40 is one such design, following in the tradition of the *Concord* and others. The tweeter is moved back to the top of the cabinet, and is combined with two new series bass drivers. Built on 220mm pressed-steel frames, the 170mm flared polypropylene cone has a vinyl half-roll surround and normal motor assembly. Treble is handled by a 25mm soft dome unit. The series-type crossover network blends the two bass units and gives effective final rolloff rates corresponding to 18dB/octave third-order, using a total of 7 elements.

An additional 450μF series capacitor aligns the bass response to third-order, adding a further 6dB of slope to the inherent 12dB/octave rolloff of this sealed-box enclosure.

Despite the use of two bass drivers the enclosure is a pretty compact 28 litres, built mainly of 14mm chipboard with a vinyl 'walnut' exterior. No bracing is used but the interior is well fitted with polyester wadding. The 11mm grille is rebated to reduce diffraction, and electrical connection is *via* 4mm socket/binding posts.

SOUND QUALITY

Scoring a little below average, the panel found the C40 unexceptional, though basically competent, with a tidy subjective frequency characteristic. The comments concerned a lack of fine detail, a loss of transparency and depth, plus a noticeable lack of dynamic 'attack', both in the bass and midrange. The latter suffered from some 'boxy' coloration, especially apparent on piano and associated with some blurring of fast fingerwork.

Stereo focusing was about average with stage width a little below average. Tonally this speaker appeared well balanced, but with some degree of mid 'thickening' and forwardness' which detracted from the impression of perspective in the stereo image.

LAB REPORT

The high 90dB/W sensitivity was uncompromised by an impedance characteristic which is rated as a very good amplifier load, the curve barely falling below 6.4ohms and averaging 8ohms. With generous 200W peak power handling, this system can generate exceptional sound levels of up to 108dBA in a typical listening room, while decent levels are available with as

little as 10 watts per channel. The −6dB bass rolloff was a fairly typical 58Hz, the output falling quite steeply below that frequency at a rate of 18dB/octave.

The grille had little effect on the output, and the reference response indicated quite promising uniformity. Some degree of mid isolation was apparent at 2 metres, though the system demonstrated fine integration of the three drivers with very good off-axis curves.

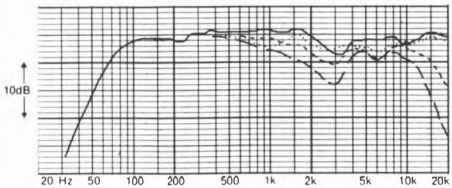
The system revealed its inner nature to the computer analysis in the listening room. The midrange was indeed dominent as the panelists had noted, while the bass was 'shy', though beneficially free from 'boom'. The C40 proved to be very competant as regards distortion, both at 86 and 96dB sound pressure levels — indeed, the low frequency distortion actually improved at the higher 96dB level!

Conclusions

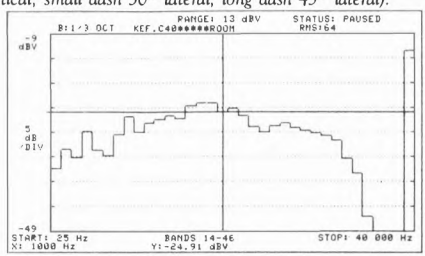
This well engineered and sensitive loudspeaker was capable of excitingly high sound levels with high power handling capacity. The distortion was moderate and the amplifier load easy. While tonally it was judged to be mid forward, the overall frequency balance was decent enough. Sound quality was admittedly unexceptional, even a little below average, but the C40 is certainly worth serious consideration at £200 a pair.

General Data

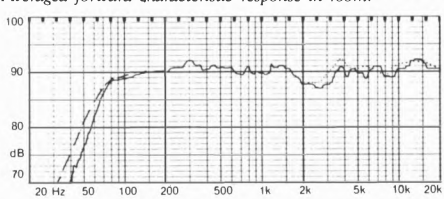
Size (height × width × depth)	65 × 24.5 × 26.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −200W
Recommended placement	free space, stands (25cm)
Frequency response, within ±3dB, at 2 metres	70Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	58Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	90dB/W
Approximate maximum sound level (pair) at 2 metres	108dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	good+
Typical price per pair, inc VAT	£200



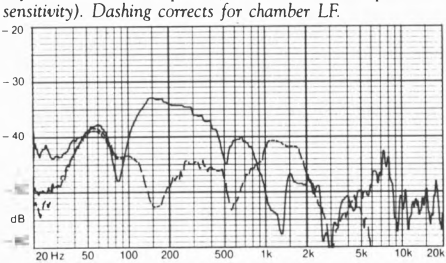
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

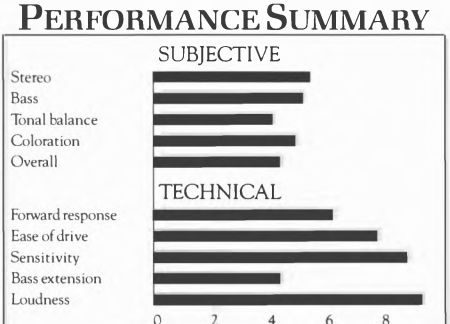


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

KEF 104.2

KEF ELECTRONICS LTD, TOVIL, MAIDSTONE, KENT ME15 6QP.
TEL: (0622) 672261

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, vertically mounted facing each other and back loaded by sealed chambers above and below. Their 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, mounted above and below the 25mm soft-dome ferro-fluid damped treble unit.

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 total system presents a flat 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 the 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.

Production models have overcome most of these points of earlier criticism. 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.

LAB REPORT

Pair matching was very good at better than ±0.75dB while the reference midband 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.

CONCLUSIONS

Our original samples were premature, and revisions made to subsequent UK production have resulted in significant improvements.

The *104.2* 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 recommendation.

Reassessed. First reviewed 1984, retested 1985. Current typical price £750.

General Data — see pages 180-184.

LINN INDEX

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

The *Index* is a sealed-box two-way system of conventional design. The bass is handled by the decade-and-a-half-old KEF *B200* Bextrene-coned drive in standard form, married to a treble range provided by a 25mm soft fabric dome tweeter by Tonegen (Japan). Crossover is by second order low-pass, and third order high-pass filter, with damping and attenuating resistors. Good quality components are used.

Constructed from plain chipboard, this 15 litre enclosure is acoustically damped by a light polyester filling. Connection is *via* plain 4mm sockets. The grille is a plain 15mm thick panel, cloth covered and of poor acoustic quality. Our samples came with a good grade of 'black ash' vinyl finish. Linn produce optional budget stands for this model, these medium weight tripod affairs with spikes.

SOUND QUALITY

On blind testing the *Index* was found wanting, with its below average rating reflecting consistent scoring throughout the panel.

Low bass had a 'rolling' power, but the upper bass was not too well differentiated. Some coloration remains, but rather less than before, while the midrange is still 'forward'. The treble quality is now average.

Stereo focus was satisfactory while depth was restricted.

LAB REPORT

The axial reference response shows a rising output into the midrange. The grille also affected the response.

At 2 metres the situation was little improved. The 'lumpy' trends remained whilst the off-axis responses were poorer than average both in the lateral and vertical planes. The usual ±3dB response limits could not be met.

Assessed at 86dB/W, sensitivity was fairly high, and in conjunction with its 100W peak programme power handling will allow good sound levels of up to 104dBA to be obtained, although in practice it will sound louder still when judged subjectively. Bass rolloff was average at 57Hz, −6dB, and free of excess overhang. A minimum amplifier power of 12W was indicated.

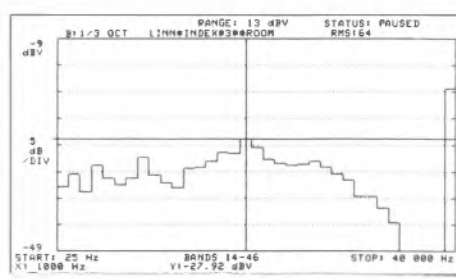
Driven to 96dB sound levels, distortion was about average at 0.3 to 1% midband, and well controlled in the bass. By the 86dB sound level, good results were obtained.

System resonance occurred at 80Hz and the impedance curve was fairly even, only falling to 5ohms at 20kHz. The result was pretty harmless so in this case the amplifier load rating was good.

The computed room response told the final story, confirming the extended bass but clearly pointing to the unnecessarily excessive upper midrange output. Linn must like it this way; otherwise I cannot explain it.

CONCLUSIONS/UPDATE

A current Index sample was partly reassessed for 1986, and found to have a much improved tonal balance. This is now sufficiently civilised to be worth considering, and represents a major improvement over earlier versions. The room curve relates to this latest sample.



Averaged characteristic response in room.

Re-auditioned. First reviewed 1985. Current typical price £150.

General Data — see pages 180-184.

LINN KAN

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

Externally similar to an *LS3/5a*, the *Kan* differs by its use of a damped, loaded and fully sealed chipboard enclosure — even the grille is more or less permanently attached. The bass/mid unit is the same KEF *B110* as used in the *3/5a*, loaded here by the 5 litre volume of the sealed box. The driver's steel frame has damping pads, and is carefully sealed *in situ*. It uses an 80mm Bextrene cone with a long-throw rubber surround. A complex high quality cross-over divides the frequency range at around 5kHz, with the new version of the soft 19mm dome tweeter, now made by Hiquphon of Denmark, operating over the higher frequencies. Amplifier connection is *via* plain 4mm sockets, and Linn make a pair of top quality stands for the *Kan*. These are an optional extra and were used for our reviews with the speakers backed on to a plain wall.

SOUND QUALITY

The *Kan* did not score well in the listening tests. Rated as rather below average, the treble range was not excessive in balance terms but nonetheless drew attention to itself. 'Tizzy' and 'sibilant' effects were heard which negated depth perspectives. In the mid a forced 'cuppy' quality was noted, with a 'thin', 'pinched' tonal balance. The speaker did provide open, 'sharp' transient definition with respectable bass, but when driven hard we found that it quickly overloaded at low frequencies.

Stereo focus was average but depth rather poorer than average. However musical detail was presented quite well if in a rather 'upfront' manner.

LAB REPORT

On axis at 1 metre the measured response was disappointingly rough. Output climbed steeply to a peak at 1kHz, some 10dB above the 100Hz reference line, before falling some 8dB into the following trough. By 5kHz the output recovered, to follow a moderately ragged treble extension. The response would not meet the usual ±3dB limits.

Sensitivity was assessed at 85dB/W which was below average, with a −6dB rolloff at a high 90Hz. A minimum amplifier power of 25 watts was indicated, while a practical 50W per channel maximum restricted the maximum sound level to 98dBA.

At 2 metres, the hoped for improvement in uniformity did not occur with the 1kHz peak still dominant. Broad irregularities were evident in the vertical plane, indicating unwanted driver passband overlap, and the overall trend was rather unbalanced.

At 96dB sound level this little speaker was working hard, and midband second harmonic averaged 2% while third was rather better. At the 86dB sound level the improvement was not as great as usual.

The impedance curve showed the system resonance at 78Hz and the remaining trend was smoother than usual, not falling below 7ohms and classed as an easy amplifier load.

The *Kan*'s true colours were revealed by the computed room response. The bass was quite good but was set at low a level relative to the forward and peaky midrange; wall mounting alone cannot sufficiently redeem this.

CONCLUSIONS

In its latest form the *Kan* remains, in my view, an idosyncratic, off-beat creation. The build quality and finish were very good, while the sound was sufficiently unusual as to be strongly criticised on blind listening — surely the acid test of any speaker? However, as many Linn owners hold the *Kans* in high esteem, our advice is to try the loudspeaker for yourselves.

Reassessed. First reviewed 1985. Current typical price £260.

General Data — see pages 180-184.

MAGNEPLANAR SMGa

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

This 'small' Magneplanar model 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, so no power supplies or matching transformers are required.

Rated at an almost uniform 4ohms impedance, this speaker uses two radiator elements arranged as vertical strips, the 200mm wide bass section operating below 550Hz while the 20mm wide mid/treble unit takes the upper range. Element height is 1 metre, so there is substantial radiating area.

Designed for floor standing, with rear supports which are adjustable for listening angle, this speaker needs to be very carefully sited to get the best results. Almost by definition the results of blind listening tests will be compromised by the difficulty of arranging the optimum position for all panelists.

SOUND QUALITY

Despite the above reservations the *SMGa* performed pretty well on blind auditioning, though the results did vary according to the panelist 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', 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 the *SMGa* 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.

LAB REPORT

The reference sensitivity at 1 metre was a quite low 85dB/W, and compromised to some degree by the low but almost purely resistive impedance. As with other large panel models, the 1 metre sensitivity wasn't that helpful in determining actual loudness, and in practice good sound levels up to 103dB can be obtained, with up to 150W per channel of drive; 25W would be a sensible minimum. The low frequency roll-off was at 56Hz, which is not very extended but can be enhanced by some optional perspex rear 'wings'.

The response varied with angle, and was optimised for around 15° inwards laterally (speakers are in mirror pairs). Hence the axial reference response looked lumpy but the picture was smoother on the lateral 'off-axis' set. As expected from such vertical elements, the vertical response changed rapidly with angle, so the speaker must be angled so the median axis arrives at head height for the listener.

CONCLUSIONS

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 *MGIII*. Purely on test results this speaker merits a 'worth considering' — though some would give a recommendation on its other merits. A carefully set-up home trial is suggested prior to purchase.

Reassessed. First reviewed 1985. Current typical price £700.

General Data — see pages 180-184.

MAGNEPLANAR MGIIIa

RECOMMENDED

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

Still one of the largest and most expensive models in this survey, the *MGIII* is one of the US-made Magneplanar range of open-back planar speakers. One distinction is a line source tweeter almost the full height of the speaker, nearly two metres. Current versions of the *III*, now entitled the *IIIa* feature changes in diaphragm mounting and damping, though we have not yet had the opportunity to assess any improvement.

In this three-way model, the mid is handled by a high definition film element covering approximately 300Hz to 6kHz. Below 300Hz, the bass radiator takes over, a more robust film element occupying more than 50% of the considerable radiating area. Being bi-directional, like panel electrostatics, it is also very sensitive to room acoustics and will benefit from a large room, standing well clear of the rear wall — 1.5 to 2.0 metres is a starting point.

During the tests 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 *MGIII* excelled. 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 outstanding.

Stereo focus was surprisingly good for a large panel and the loudspeaker 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 a touch 'heavy' in the upper bass, it remained very tuneful even here, and was consistently faithful to a wide variety of source.

LAB REPORT

The *MGIIIa*, like other large panel speakers, does not obey the inverse square law and hence the 1 metre sensitivity, averaging around 85dB, was not too helpful. At 3 metres it sounds more like an average 88dB/W sensitivity. Power handling was up to 300W program allowing levels for a stereo pair up to a substantial 107dB. Pair matching was very good, and the −6dB point was 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. Response limits of ±2.5dB sufficed for 80Hz to 18kHz, a pretty smooth result. The 2 metres 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. Treble dispersion was particularly good from the narrow ribbon tweeter.

Moderate distortion was evident at low frequencies, but distortion was particularly good above 150Hz, especially third harmonic, and was quite exceptional at the 86dB level. Compression measured a very low 0.03dB, with negligible intermodulation. The impedance was uniformly low and did not fall below 4ohms with 1.8ohms added in place of the treble fuses, averaging 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 reflections. The treble rolloff was smooth and gradual, as it should be.

CONCLUSIONS

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. It must be recommended.

Reassessed. First reviewed 1984. Current typical price £2,880.
General Data — see pages 180-184

MERIDIAN M30

BOOTHROYD-STUART, 13 CLIFTON ROAD, HUNTINGDON, CAMBRIDGESHIRE PE18 7EJ.
TEL: (0480) 57339

Meridian are very experienced in active loudspeakers, and the new M30 is the latest in a long line of such systems. This model is intended as a replacement for the previous M3, while an M20 has already been released to supplant the old M2.

The M30 is actually a miniature, enclosing an acoustic volume of just 9 litres, but sturdy construction and the inbuilt power amplifiers makes it very heavy. It is reflex-tuned at low frequencies by a pair of multi-duct, resistively-damped ports, 30mm in diameter. The active approach gives the system designer almost complete freedom in the low frequency alignment, and this small system uses pre-equalisation to provide unusually good bass extension.

The cabinet is strongly built from 20mm MDF board, and veneered in real wood. The grille is unrebated and 15mm thick, but its reflective tendencies are ameliorated by a foam layer around the tweeter. The bass/mid unit of this two-way system has a 180mm steel frame with a 120mm flared, doped-pulp cone. The 25mm soft-fabric dome tweeter is a recent KEF design with a shallow horn section, and is widely used in top range KEF systems.

All the electronics are concealed beneath an alloy heatsink/cover plate on the rear panel. Using an electronic low level crossover, each drive unit has a separate power amplifier. Signal input is *via* a phono socket, and balanced input connection may be selected according to the pre-amp used. Mains connection is *via* an IEC socket, and the speaker may either be left on for extended periods of listening or set to 'music sense' for automatic switch-on. A row of tiny switches allows the user (probably with dealer guidance) to select a variety of small adjustments, to treble rolloff to account for local acoustics, and to bass alignment suitable for shelf- or wall-mounting. We tested the system in free space, using the recommended 'normal' alignment, but some subsidiary listening was also carried out with the system set to 'flat'.

SOUND QUALITY

The M30 gave little hint of its small dimensions on blind listening, showing good subjective bass extension, though with some 'plump' excess in the mid-bass (50-60Hz). The scores were higher than those of the earlier M3, judged from an earlier presentation; whereas the latter had been considered too 'bright', the panel found the M30 too 'rich', in fact tending to a 'syrupy', 'blanketed' effect. Vocal articulation was lost and dynamics appeared to be compressed. Tonal balance was pretty good through the midrange.

Backup tests undertaken using the 'flat' response setting showed some improvement, and we preferred the M30 on this alignment. The whole sound was more lively and better focused, yet remained musically balanced. However, throughout our tests this speaker did not produce much depth or hall acoustic.

LAB REPORT

Measured on the 'normal' setting, the axial reference response did show a downtilting of response with rising frequency. Some 'lumpiness'

can be seen in the upper midrange — and in the treble, due partly to the chunky grilles whose removal improved matters (dotted line.) At low frequencies, the output extended to a generous 40Hz, −6dB, but there was little sign of room-match tailoring.

The overall trends at 2 metres show the mean treble output depressed by 3-4dB, though this was improved on the 'flat' setting. While not exceptional for a small system, the off-axis curves show fine conformity with the axial trend.

Depending on individual distortion standards and the spectral content of the programme, the maximum sound level is estimated at 102dBA, which is quite substantial for the size. But the distortion at 96dB was high below 150Hz, and overload occurred below 70Hz. At the reduced 86dB sound level, the distortion was considerably improved.

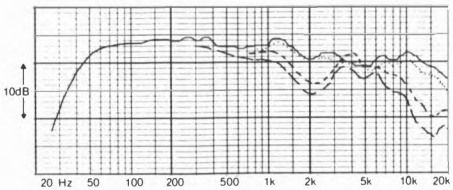
The computed room response confirmed the depressed treble, some mid dominance, and an excess at 50Hz, though with good accompanying extension to 30Hz. The overall response was a trifle lumpy.

Conclusions

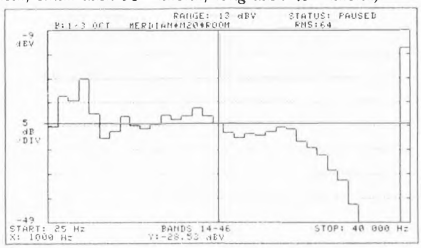
The M30 has done quite well and offers exceptional bass extension for its size, though other theoretical advantages offered by active operation have not been exploited to give a particularly good response or improved room matching. The M30 sits a little above average in sound quality terms, but value ratings are difficult with the inbuilt power amps. Easy on the ears, it is certainly worth considering, particularly where space is at a premium.

General Data

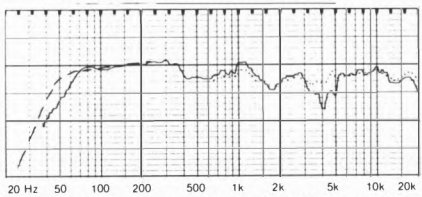
Size (height×width×depth)	38.5×18×32cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	not applicable
Recommended placement	free space on stand (wall adaptable)
Frequency response, within ±3dB, at 2 metres	42Hz to 15kHz
Low frequency rolloff (−6dB point) at 1 metre	40Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	n/a
Approximate maximum sound level (pair) at 2 metres	102dBA
Impedance characteristic (ease of drive)	n/a
Forward response uniformity	good
Typical price per pair, inc VAT	£725



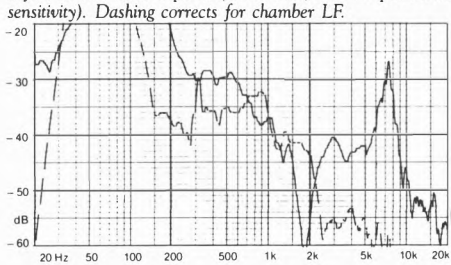
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged in room response M20 (M30 v. similar).

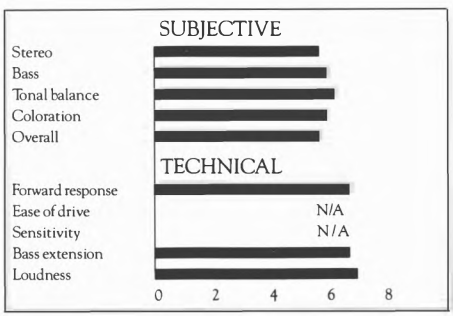


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



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MISSION 70 II

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

BEST BUY

Now officially in *Mark II* form, the '70 is Mission's least expensive speaker, whose performance in some areas threatens several of its larger brothers in the Mission speaker range.

A two-way miniature, the '70 has a sealed-box volume of 13 litres, which loads the custom 170mm pulp cone bass/mid unit. Both this and the tweeter are Danish, the latter comprising a 19mm polyamide dome, ferro-fluid damped and built by VIFA. The crossover is of good quality, 12dB/octave acoustic, and uses three electrical elements.

The cabinet is nicely finished in vinyl 'black ash', with a deep grille which is integral with the enclosure. In fact the cabinet comes apart as two shells, locked together by four capped screws at the rear. A fibre wad provides for the internal absorption, while electrical connection is made by sturdy 4mm socket-binding posts. The overall contruction quality is fairly good.

SOUND QUALITY

While use on a shelf or bookcase is likely, this speaker actually gave a good account of itself on 42cm high stands, not too far from the rear wall. The mark was a strong 'average plus', great for the price.

There are however several criticisms. The sound could show some 'sibilance' and 'edge', with a mildly 'thin' tonal balance, some 'boxiness' and a rather 'dry' bass.

Conversely it was favoured for its lively, 'quick' nature, revealing detail throughout the frequency range, and preserving the excitement of the performances. The bass was articulate and tuneful while the stereo focus was good, with a fair reproduction of the natural recorded acoustic around the performer.

LAB REPORT

The axial reference response showed a smooth, slightly uptilted character, on spec at a sensitivity of 89dB/W. The bass −6dB point was a modest 84Hz which is average for the type, with a system resonance at 97Hz. Pair matching was very good, to within ±0.5dB, and at 1 metre the speaker met fine ±2dB limits from 95Hz to 17kHz.

Out at two metres the forward response family showed an exemplary set of responses. The variation over the 15° vertical axis from straight in front was minimal, and the blending was very good in the lateral plane. The forward yet uniform nature of this design was clear enough.

Working hard at 96dB, the speaker nevertheless showed well controlled distortion, generally less than 1%. down at 86dB, still a fair level, the distortions had improved to the 0.4% level, with the low frequency range rather better than average. Compression measured an average 1.9dB while the bass-mid intermodulation was fine at −42dB.

At low frequencies the impedance dipped to just under 5ohms, and a fair rating would be 6ohms, although most amplifiers should have no problems.

Computer averaged in the listening room, the *70 II* response was less even than expected. The mid was clearly forward (noted on audition), while the bass was rather 'shy', and the upper treble a trifle 'exposed'.

CONCLUSIONS

Despite the measured and auditioned tonal imbalance in the energy response, the panel liked the *70 II* for its lively, transparent quality, and here its subjective appeal served to outweigh its problems. The ratings suggest Best Buy status, but I nonetheless feel that it should be carefully auditioned before purchase.

Reassessed. First reviewed in Mark II form 1984. Current typical price £100.

General Data — see pages 180-184.

RECOMMENDED

MISSION 700LE

MISSION ELECTRONICS, STONEHILL, HUNTINGDOM, CAMBS PE18 6ED.
TEL: (0480) 57477

Mission have laid out in their instruction manual a well specified set of conditions for obtaining optimum sound from their loudspeakers. While many of the suggestions are sensible, their injunctions against the use of tone controls, which potentially contravene the guarantee conditions, do seem a little strange. These speakers are intended to be used almost touching a back wall, and arranged to direct the forward sound straight ahead. The resultant mildly off-axis delivery to the centrally seated listener has been compensated by the designer by adjusting the axial response.

The *700LE* is a compact two-way system that has evolved from the *70* series. The sealed-box volume of 9.5 litres produces a system resonance at 88Hz. On a normal stand, the enclosure is a little below head level for the seated listener, resulting in a time delay between the arrival of sounds from the bass and the treble units. Mission exploit this by inverting the usual arrangement and placing the tweeter below the bass unit. The system is therefore inherently approximately time aligned, which allows the use of a 12dB/octave crossover while still maintaining good drive unit integration. The bass unit is fed *via* a large ferrite core inductor, and the 19mm soft plastic dome tweeter receives frequencies above 3.5kHz by an LC combination plus attenuating resistor. Hard-wiring is used for the crossover itself, but only clip terminals for the drivers. Spring terminals are provided for the speaker cables and 4mm plugs can (just) be used! The bass/midrange is handled by a 135mm flared, doped pulp-cone unit with a foam surround in a 165mm pressed steel frame.

The main cabinet carcass is 12mm vinyl-coated chipboard, and the driver baffle is made from moulded reinforced plastic. A single layer of polyester wadding damps the interior, and the well made, rebated grille is another moulding. The system is well made and finished, and can be obtained with matching spiked stands.

SOUND QUALITY

Scoring an average mark on the listening test, this is a respectable result for the price level. Furthermore, wall-mounted systems tend to suffer from some disadvantage on test due to the altered stereo image presentation, but the *700LE* coped well here. Coloration was moderate and the sound was quite well balanced.

The treble was quite good with only moderate 'grain' at the frequency extremes. The general impression was pleasing and articulate, though some listeners felt that there would have been more transient 'attack' and 'air'. The bass was quite tuneful, while the midrange was a touch forward, though not so much so that it dominated the sound.

LAB REPORT

The sensitivity was on the high side at 89.5dB/W, helping to provide substantial room sound levels of up to 104dBA for a pair. A minimum power of 10W is suggested, while the speaker happily sustained peak inputs of up to 100W. The sensitivity was mildly compromised

by the poorer than average amplifier loading, but any good 4 to 8ohm amplifier will have no difficulties here.

On axis at 1 metre, the reference response showed a bass rolloff at 73Hz, some lift in the 130Hz range due to underdamping, plus a mildly rising midrange. As the dotted trace shows, the grille was responsible for most of the treble response anomalies. At 2 metres, with the benefit of some response smoothing, the *700LE* met an 85Hz to 20kHz range within ±3dB limits. Good integraton was shown in the off-axis responses, with the output approaching virtual flatness at the designed 20° lateral angle. Distortion results were about average, typically 0.3 to 0.4% at 86dB, while second harmonic approached 2% at the 96dB sound level. Distortion was well controlled at low frequencies, considering its size and price.

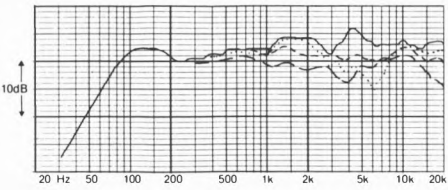
The room curve was obtained on an open stand position for the sake of consistency and did not show the mid-bass lift which would be achieved by wall mounting. The mid-treble balance and integration was pretty good, though the low bass could benefit from more power relative to the midrange level.

Conclusions

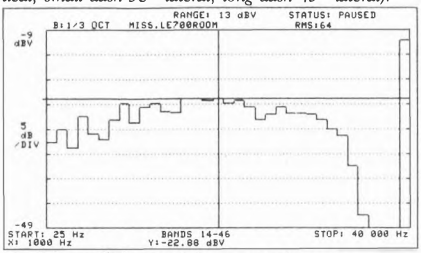
This speaker was well balanced for a close to the wall position. A consistent subjective performance was obtained with a complementary set of lab results. It handled power well and the good sensitivity allowed for high sound levels if so desired. The cleanest treble was obtained with the grille detached. Taken overall the value rating was respectable, and the *700LE* qualifies for recommendation.

General Data

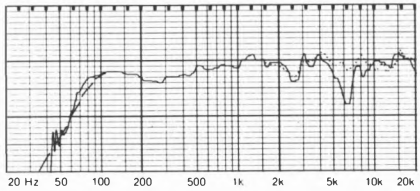
Size (height×width×depth)	38×21×21cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −100W
Recommended placement	on stand near wall
Frequency response, within ±3dB, at 2 metres	85Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	73Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89.5dB/W
Approximate maximum sound level (pair) at 2 metres	104dBA
Impedance characteristic (ease of drive)	average
Forward response uniformity	good
Typical price per pair, inc VAT	£125



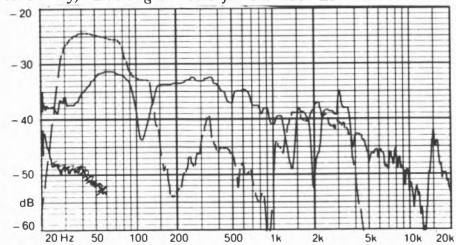
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

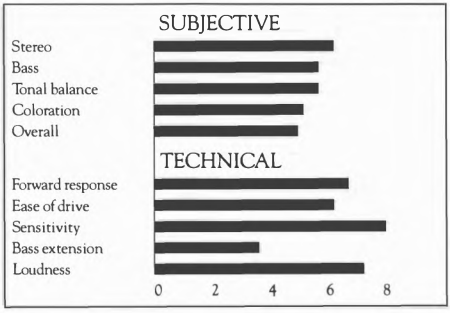


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



MISSION 737

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

Similar in superficial design and appearance to its predecessor, the current *737* uses the transluscent polypropylene-coned driver originally designed for Mission's *770* and custom made for Mission by SEAS. The large voice coil provides fine power handling, while the 220mm frame is a magnesium die-casting fitted with a generous magnet. The simple three-element crossover of modest quality, leads to the 19mm soft plastic dome VIFA tweeter.

The carcase is of chipboard with some flat block bracing, and is externally finished in vinyl. The heavy front panel is made from 25mm MDF, finished in a silver grey hammer enamel. Reflex tuned by a multi-aperture port of 50mm effective diameter, the duct length is a short 25mm, tuning the 25 litre enclosure to a damped 55Hz resonance. The cleverly-designed moulded grille frame has a low acoustic profile and fits nicely over the projecting driver baffle. As to location, stand mounting near to the rear wall is advised.

SOUND QUALITY

The panel were in good agreement on this one and gave the *737* a fractionally above average mark. It did have some fine qualities: for example, a good level of detail and transparency was fighting to get out of the mix. The sound was generally articulate, fairly smooth and well integrated.

On the debit side the low bass was muted while the general tonal balance was 'thin' and 'forward', tending to excessive brightness in the treble. Coloration seemed well controlled, while stereo images failed to leave the plane set by the enclosure positions properly, and depth impressions were curtailed. On occasion it could sound a trifle loud and 'hard'.

LAB REPORT

The reference 1 metre response showed a good characteristic up to 2kHz, attaining a nominal sensitivity of 89.5dB/W. An average low frequency cutoff of 58Hz, −6dB, was obtained.

The response rose gently up the range before reaching a peaky area in the mid treble. Having a good power capacity of 100W, good sound levels of 104dBA can be expected, while 10W was actually sufficient for satisfactory loudness.

At the 2 metres measuring distance with smoothing, the set of lateral off-axis curves were well integrated while the general trend confirmed the 'bright' tonal balance. At 15° above axis, the output 'notched' at the crossover, 3.5kHz, so the speaker should be placed so that the median vertical axis was directed at seated head height. A straight ahead position providing some lateral angling to the listener is probably ideal. From 70Hz to 20kHz, ±3dB limits were met.

At 96dB sound pressure level distortion was well controlled, averaging 0.3% above 300Hz and around 1.5% at low frequencies. Third harmonic was particularly good. At 86dB, the distortion results were excellent, confirming Mission's known interest in this particular parameter.

The impedance characteristic was generally very good, though it touched 5ohms at 10kHz. In room, the low bass rolloff noted on audition was evident, as was the smooth but 'lean' energy balance. reference to other curves will show that the treble level was too high on this room-averaged response.

CONCLUSIONS

A lively and in some respects exciting design, suited to near-wall positioning, the *737* did not however really inspire the panel on blind listening tests. However, it is worth considering for those who favour a dry' forward balance, has low distortion, and comes into its own when driven hard on rock material.

Reassessed. First reviewed 1983. Retested 1985. Current typical price £230.

General Data — see pages 180-184.

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MONITOR AUDIO R100

MONITOR AUDIO LTD, 34 CLIFTON ROAD, CAMBRIDGE CB1 4ZW.
TEL: (0223) 246344

Monitor's *R100* could be regarded as a smaller version of the *R252*. It is very compact, with an internal volume of 11 litres, and stand or shelf mounting is envisaged. The review samples used a chipboard box, with a real veneer exterior. Internally the sealed volume has a foam absorption pad, while side panel resonances are moderated by thin braces in the vertical axis. The grille baffle is partially rebated to help reduce its acoustic profile.

The 210mm pressed steel framed mid/bass unit has a light flared pulp cone which tunes to a high 100Hz system resonance. Treble frequencies are allocated to a 19mm soft plastic dome tweeter, the dividing crossover essentially to 12dB/octave acoustic slopes, using three reactive elements. Good quality components are used and the drivers are hard-wired using Monitor Audio cable. Rear connection to the amplifier is *via* 4mm socket/binding posts.

SOUND QUALITY

Scoring a little below average, the *R100* performed satisfactorily at its rather below average price.

Some 'boxiness' and cone coloration was noted but this seemed quite well controlled. Tonally it was quite neutral, while low bass was rather muted. Generally the sound was fairly detailed and articulate with firm upper bass and a crisp if slightly hardened midrange.

Stereo focusing was good over the frontal plane, but depth and ambience effects were weakly reproduced; at times, its 'small box' character was identified by the panel. The power handling was good for the price, with no audible breakup noted on test.

LAB REPORT

At 1 metre, the reference sensitivity was set at 87.5dB/W, an average value. Despite the rebate the grille still exerted a significant effect on the response. Intrinsically close amplitude tolerance limits were met. The −6dB low frequency point was fairly high at 70Hz.

With a nominal 75W power handling, sound levels of up to 103dBA will be possible from a stereo pair while amplifier ratings as low as 15W/channel will give a good basic in room 96dB.

Out at 2 metres, the general character may be seen, slightly lumpy but essentially well balanced. Some sensitivity to vertical axis was seen, but taken overall the off-axis responses were very good.

Good results were also obtained for distortion at 96dB, averaging 0.3% midband and a moderate 1% at lower frequencies. Third harmonic was well controlled. By 86dB the reduced input power provided stilll better results and here the distortion level was classed as very good.

The average impedance was close to 10ohms and never fell below 6.5ohms, so this loudspeaker was classed as a very good amplifier load.

Computer averaged in the listening room, this speaker's projected power was not very even, with the low bass rather restricted. Although the upper bass balanced the midrange, both were somewhat isolated. Likewise, an energy gap was present between the mid and treble.

CONCLUSIONS

This presentable, compact system was well finished and basically well built. It also offered low distortion and a reasonable tonal balance, but despite this it remained uneven. Low bass was rather deficient. The panel felt it was quite satisfactory although not a front runner, but given the reasonable price, this system might specifically suit some systems and rooms and is worth considering.

Reassessed. First reviewed 1985. Current typical price £130.

General Data — see pages 180-184.

RECOMMENDED

MONITOR AUDIO R252

MONITOR AUDIO LTD, 34 CLIFTON ROAD, CAMBRIDGE CB1 4ZW.
TEL: (0223) 246344

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

Unusually for this price level, the solid enclosure is finished to a high standard in real wood veneer, the panels built of 12 and 15mm board. The grille is a low profile component, made from fully-rebated plywood.

No box panel damping is used, but the interior has been lined with acoustic foam to suppress internal resonances, while electrical connection is by means of 4mm socket binding posts.

SOUND QUALITY

Initially the *R252* sounded rather below average on audition, appearing aggressively forward as well as brash. However, a bass/mid unit revision provided a significant improvement in tonal balance as well as general character, sufficient to move it up to an average score, which is good for the price.

Some colorations did remain, notably a residual upper-mid 'hardness', some lower-mid 'boxiness' and a rather 'dry' character to the sound. Low bass was rather curtailed, though upper bass was quite detailed, and the treble was also much better than before, due to the improved balance. However the treble was still felt to be mildly 'rough' and 'forward'.

Stereo images were quite well focused with moderate depth and quite clear spatial effects, and the speaker also showed a good level of instrumental detail.

LAB REPORT

Sensitivity was an above average 89dB/W, and in conjunction with a 10 to 75W power range, sound levels of up to 102dBA were possible. Pair matching was very good, while the bass register was very uniform and well damped, measuring 62Hz, −6dB, but rolling off quickly below this point. Note that this and other measurements here are for the original loudspeaker.

At 2 metres the axial response was fairly smooth meeting ±3dB limits from 80Hz to 30kHz, and dispersion was excellent in the lateral plane. However 15° above-axis a noticeable 4kHz notch appeared and we recommend using this speaker directed at ear level. In fact Monitor Audio's matching stands are designed for exactly that purpose. The forward responses were good for the type.

Room-integrated response evidenced the 'dry' nature of this speaker, with a fairly extended but shallow bass plus a slightly prominent midrange. However, the overall effect was pretty smooth.

Distortion at 96dB sound level was moderate at around 1% second and third harmonic even at low frequencies, while higher in the range third harmonic was particularly good. Further improvement was apparent at an 86dB level, with an average of 0.3% recorded here.

Bar a mild dip to 5.5ohms at 10kHz the impedance was well behaved over the range, and the *R252* was classed as a good amplifier load.

CONCLUSIONS

This powerful two-way design is well constructed for the price. Reviewed originally in 1983 it comfortably won recommendation, with low distortion, high sensitivity and a good rating for sound quality. Some minor changes in the 1984 samples were viewed less favourably, the main points of criticism being a hard and bright quality, with insufficient output in the bass. However, a new version auditioned for 1985 had improvements to the cabinet and the tonal balance. The sound quality now shows less 'boxiness' and a smoother overall effect, and this model can now be recommended once again.

Reassessed. First reviewed 1983. Current typical price £150.

General Data — see pages 180-184.

RECOMMENDED

MONITOR AUDIO R352

MONITOR AUDIO LTD, 34 CLIFTON ROAD, CAMBRIDGE CB1 4ZW.
TEL: (0223) 246344

This speaker is larger than usual for its price range and consists of an excellently-veneered 36 litre enclosure that has been rigidly constructed from 18mm-thick heavy chipboard. Internal bracing has been used to raise the frequency and also to moderate the amplitude of the panel resonances. A fine rebated grille is also fitted. Foam absorbent blocks line the interior, and the bass-reflex system is tuned to 50Hz by a substantial tunnel port.

The interesting 200mm flared pulp cone bass unit uses a special magnet system which provides a better flux distribution at the pole tip, while the controlled local pole saturation should also reduce second harmonic distortion due to improved motor coil flux modulation.

A 20mm soft plastic dome tweeter crosses over at around 3kHz, a high-power hard-wired crossover, heavy duty wiring, and 4mm socket/binding posts for rear connection complete the lineup.

SOUND QUALITY

The *352* scored well up the field, achieving a good overall rating which was impressive for its price category. It was liked for its well controlled, smooth and yet lively character, the bass appearing articulate but gutsy and demonstrating reasonable extension. The mid sounded clear and showed less 'boxiness' than usual, while the slightly bright treble was even and well detailed.

Stereo images were sharply focused, with presentable depth effects where appropriate, and the speaker also proved itself capable of revealing the different ambience and acoustics present on a variety of recordings.

Rock programme was reproduced with a lively, tuneful beat and some panelists remarked that the sound 'grew on them' as the tests proceeded.

A slight muddiness and graininess was however present in the reproduction, as well as a touch of fundamental bass overhang, but none of these effects were at all serious.

LAB REPORT

Pair matching was good, as judged by the 1 metre responses. A narrow notch was present at 5kHz but did not appear to affect the results, and overall the response was pretty flat with a well tuned bass extending to 50Hz, −6dB, which is average for the type but with a well damped and slow rolloff. Sensitivity was high at 90dB/W, providing good levels from as little as 10W and a rather loud 105dBA from the 100W per channel maximum input power. Grille effects were negligible.

At 2 metres the lateral off-axis responses were fine but the speaker was clearly a mite critical in the vertical plane. Dips were recorded at 15° above and below so accurate beaming to the listener would be important with this mode; ±3dB limits comfortably covered the 50Hz to 15kHz range.

Room averaged, the speaker's fine overall balance could be appreciated. The bass was uniform to 45Hz and well integrated while the treble showed a correct and gentle rolloff towards the extreme frequencies.

At the 96dB sound level distortion was quite low, particularly above 500Hz, and at 86dB the results were especially good. Impedance averaged 12ohms and possessed no low levels at any frequency, so the *352* should be particularly easy to drive, and as such presents a 'kind' amplifier load.

CONCLUSIONS

This well-finished and constructed speaker is sensitive, low in distortion, accurate in balance, more reasonably faithful to the programme fed it, and will also provide good stereo effects. It is tonally well balanced and can provide high sound levels, being easy to drive and capable of extracting good results from any decent amplifier. Reauditioned in 1985, the *352* continued to set a decent standard, and despite increasing competition retains recommendation for 1986.

Reassessed. First reviewed 1983. Current typical price £200.

General Data — see pages 180-184.

MONITOR AUDIO R652

MONITOR AUDIO LTD, 34 CLIFTON ROAD, CAMBRIDGE.
TEL: (0223) 246344

This beautifully finished two-way loudspeaker may be obtained with stands in a matching real wood veneer. A larger brother of the *R700MD*, both speakers share the new 25mm aluminium dome tweeter developed jointly by SEAS and Monitor Audio, whose rather fragile diaphragm is protected by a self-locating steel mesh grille. Slimly proportioned, and vaguely reminiscent of a Meridian *M2*, the oak-veneered cabinet encloses an air volume of around 18.5 litres, which is reflex-tuned at low frequencies by a large ducted port, 60mm in diameter and 100mm long; the box resonance appears at 55Hz.

The enclosure is made from 11mm chipboard to reduce mass, while the sides are braced to increase rigidity. The panels are damped by bituminous panels glued to the interior surfaces, and anechoic-grade polyurethane foam provides internal absorption.

The bass/mid Monitor Audio driver has a 180mm die-cast frame with a 130mm flared polypropylene cone and synthetic modified-rubber surround. The metal dome tweeter is cooled and damped by ferro-fluid. The *'652* uses a minimal crossover of normal commercial quality, electrically to 6dB/octave, using just 2 elements plus an attenuating resistor. Electrical connection to the system is *via* the usual combination 4mm socket/binding posts, and internal wiring and connections are made to a high standard. These loudspeakers should be stand-mounted moderately close to a rear wall.

SOUND QUALITY

Though the technical performance was superior to the *'700*, the listening panel marked that less expensive model above the *'652*. While the mid-to-treble seemed quite well balanced, the lower mid lacked some power and 'drive', while an odd, confused, even 'defocusing' effect occurred in the midrange, associated with some coloration. The bass seemed well balanced but of a 'reflexed', almost one-note quality, while low bass was weak.

Within the overall balance some irregularities could be heard — a hint of 'nasality' and an uneven if controlled quality in the treble. The sound was quite lively, and musical dynamics were quite well presented, bit it did not portray much stereo depth in the midrange.

LAB REPORT

The 86dB/W sensitivity was a little below average, so a minimum amplifier rating of 15W per channel is advisable. Power handling of up to 100W peak programme will give maximum sound levels of 103dBA in-room.

The 1 metre reference response was not flat, though it did have some uniform sections. The 'glitch' at 400Hz was probably a cabinet or internal mode, preceeding the slightly elevated midrange. The nicely rebated grille baffle had little effect on the response, while the treble showed a mild cancellation at 6.5kHz, disturbing the otherwise smooth effect. Moderate bass extension was shown, to 54Hz, −6dB, but reference to the computed room response shows the bass is underdamped at 50Hz, rising 3dB above

the mid level at this frequency.

In-room the bass fell away below 50Hz but was also deficient in the main power band from 80Hz to 150Hz, robbing the midrange of an adequate foundation. When room averaged the mid to treble characteristic appeared very tidy; however, the 2 metre forward response family shows that the loudspeaker's output was rather variable in the vertical plane, over a range from 1.5kHz to 8kHz, was due to the wide driver overlap in the crossover region. The off-axis outputs in the lateral plane were tidy enough.

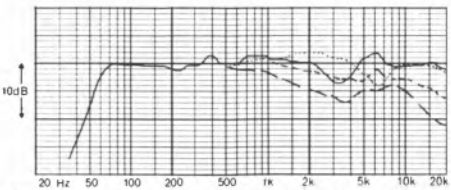
The treble range did show distortion peaks corresponding to the relatively energetic dome response at 23kHz. This amplified the residual distortions, but at an inaudible frequency, and the peaks below 10kHz relate to these amplified harmonics. The distortion results were otherwise good, especially so at high powers in the bass, where the low frequency driver remained in good control. A good amplifier load was indicated, only falling a little below the 8ohms specification.

Conclusions

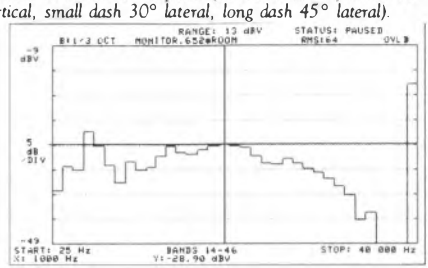
Curiously the '652 was better balanced than the more expensive 700, but did not sound as 'lively', a loss of midband clarity was one factor, the 'odd' bass another. The standard was nonetheless pretty competent, with the sound rating a straight 'average', so the '652 is worth considering.

General Data

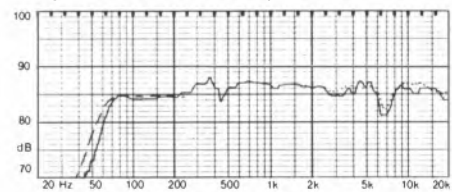
Size (height × width × depth)	51×20×27cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(15) – 100W
Recommended placement	open stands 0.6m from wall
Frequency response, within ±3dB, at 2 metres	56Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	54Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	86dB/W
Approximate maximum sound level (pair) at 2 metres	103dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	good
Typical price per pair, inc VAT	£300



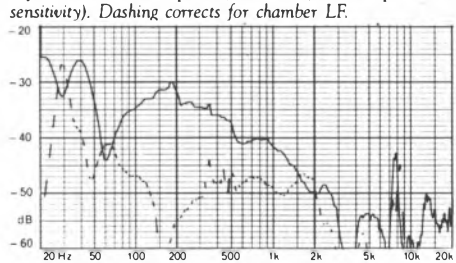
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

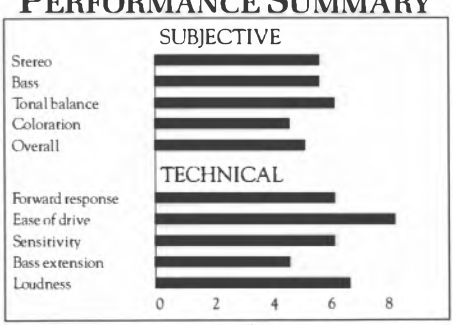


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

MONITOR AUDIO R700MD

MONITOR AUDIO LTD, 34 CLIFTON ROAD, CAMBRIDGE.
TEL: (0223) 246344

Hi-Fi Choice reviewed an earlier *R700* in a previous edition, but the model was withdrawn shortly before publication with the consequent removal of the prepared review. (It still appeared in the comparison chart, however.) Extensively revised since, the latest *R700* comes with an *MD* (metal dome) suffix stressing the inclusion of a new 25mm hard dome tweeter, an aluminium unit specially made by SEAS for Monitor Audio. Sensitive to handling damage, a steel mesh grille protects the fragile diaphragm.

This is a compact two-way system with an enclosure volume of 11.5 litres, tuned to 60Hz by a rear-mounted ducted port of sensible size, 50mm in diameter and 75mm long. The bass/mid unit has a 190mm diecast frame and a 130mm flared polypropylene cone with an inverted half-roll synthetic surround. This is integrated electrically with the 25mm dome treble unit by a simple two-element crossover network, an electrolytic capacitor to the tweeter and a ferrite-cored inductor to the bass. Ultimate rolloff slopes will approach 12dB/octave, second order, but considerable overlap of driver outputs will occur in the crossover region.

The enclosure has a chipboard shell, with front and back panels in 17mm *MDF*, and the review samples came finely finished in a real black ash veneer. The grille frame is made of 11mm *MDF*, rebated to reduce unwanted diffraction effects. Internal absorption is handled by a polyurethane foam lining. Hard-wired internally, the *700MD* combines 4mm socket/binding posts for electrical connection. Custom stands are made for the system, and the loudspeakers will probably sound best sited fairly near to a rear wall, though this will depend to some extent on personal taste and room acoustics.

SOUND QUALITY

Scoring above average in the blind listening sessions, the *R700MD* was commended for its 'lively' detailed nature. While not particularly low in perceived coloration, showing some 'boxiness' and 'forwardness' through the midrange, the speaker proved capable of conveying some of the 'life' and 'drama' in the test programme.

The bass tended towards 'dryness', and lacked real extension to low frequencies. But in recompense it was quite 'punchy'. Stereo images were quite well staged, with good focus and a good sense of space and atmosphere. The treble reached a notably good standard, showing an 'open', clear quality, free from 'grain' and well extended to the limit of audibility. However, in balance terms the *700MD* did show some upper mid-range 'forwardness'.

LAB REPORT

Measured at 1 metre, the *R700MD* showed a good sensitivity of close to 88dB/W, and consequently its power handling of up to 75W per channel means satisfactory sound levels will be produced with as little as 12 watts per channel. Maximum sound levels of 102dBA are possible from a pair in a typical room at full wick.

The reference response shows several alternatives. The solid line gives the axial output with

the grille fitted; the fine dotted line shows the effect of detaching the grille; the dashed response shows the output when the microphone was lowered to the bass/mid axis. Taken overall a rising trend may be seen through the midrange, 200Hz to 1kHz, with output falling to −6dB at 62Hz in the bass.

At a 2 metres microphone distance with response averaging, the significant driver output overlap resulted in an erratic set of off-axis curves. However, taken overall the trend was not so bad, and reference to the computed room curve showed that the forward energy was quite well controlled above 1kHz, confirming the listening test result. Note that the tweeter peaked some 12dB around 26kHz, but this should be inconsequential. On the room curve the bass was fairly well maintained down to 50Hz, but was mildly deficient in general terms.

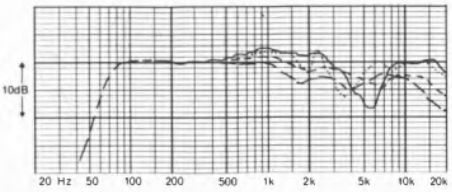
Never falling below 6.4ohms, the *700MD* represents an easy amplifier load. As regards distortion it was unimpressive below 500Hz at 96dB, but was excellent at higher frequencies. By 86dB the results were fine throughout the range, averaging 0.3% overall.

Conclusions

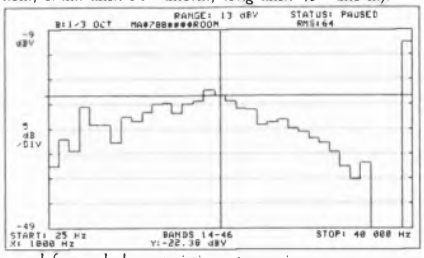
Representing a considerable improvement over last year's withdrawn model, this lively and communicative loudspeaker was well represented and features a fine treble range. Bass extension was limited, having been traded for good sensitivity. Despite an untidy set of off-axis responses, this speaker did pretty well on audition, and as such justifies recommendation.

General Data

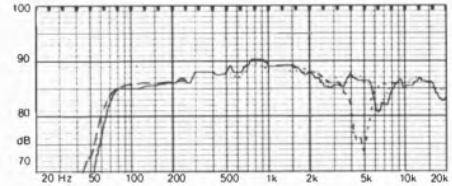
Size (height × width × depth)	35 × 21.5 × 25cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(12) −750W
Recommended placement	stands 0.4m from wall
Frequency response, within ±3dB, at 2 metres	see graph
Low frequency rolloff (−6dB point) at 1 metre	62Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	87.5dB/W
Approximate maximum sound level (pair) at 2 metres	102dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	fairly good
Typical price per pair, inc VAT	£250



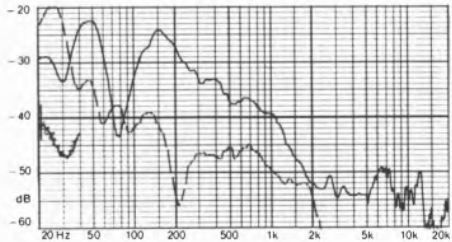
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

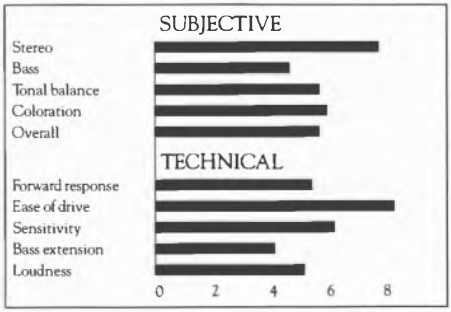


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



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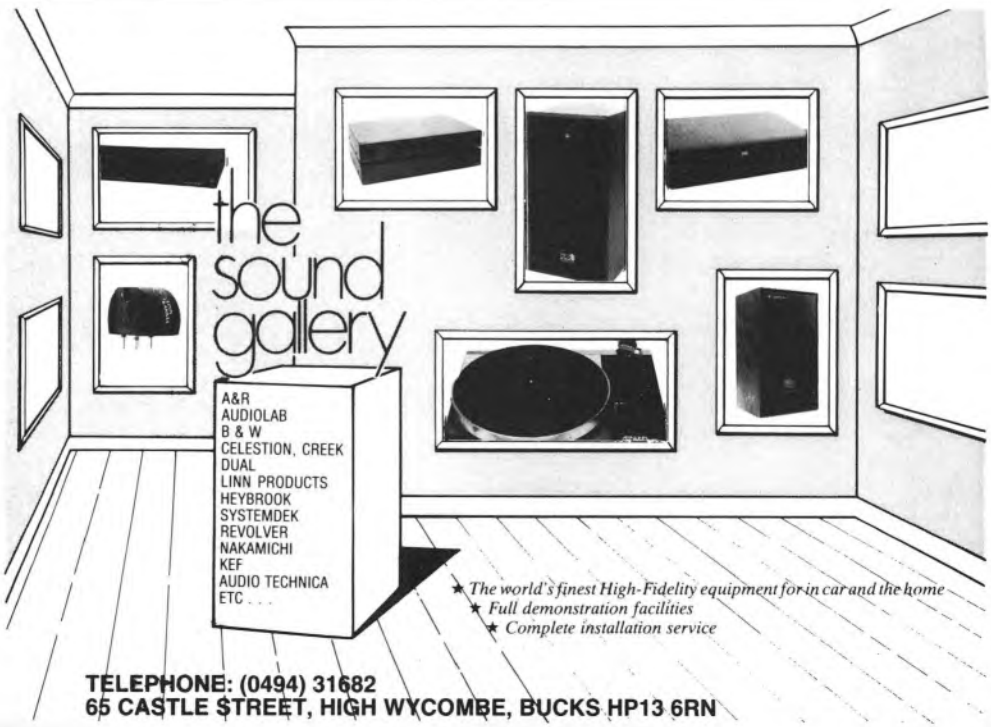

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MORDAUNT SHORT MS10

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RECOMMENDED

Rising costs are now weighing heavily on the shoulders of the quality system producers, who have been compelled to seek unusual solutions to the problems of producing speakers at the £80 a pair level. Here Mordaunt Short have made use of a small bass/mid driver with a cone just 90mm across, with a pressed steel frame to support it. This two-way system is completed by a 19mm plastic cone/dome tweeter, both units manufactured by Audax.

The diminutive enclosure has a 5.2 litre internal volume, reflex-tuned to a high 68Hz by a 30mm diameter tuned port, 65cm long, located on the rear panel. Built in plain chipboard the cabinet was well finished in 'black ash' vinyl, but the grille baffle was unrebated, with an acoustically poor profile.

A three-element crossover network aims at nominal 12dB/octave acoustic slopes, with push-on tags used for the internal wiring. 'Positec' protection against overload is included, a most uncommon and welcome feature at this price level. Electrical connection to the amplifier is made *via* 4mm socket/binding posts.

Sound Quality

The panel were very consistent in their judgments, scoring the *MS10* below average but not seriously so, and in fact this is a commendable result given the group context.

On 'blind' testing, it was identified as a small box, the weak bass and 'thin' 'forward' character were noted, and particularly a blend of 'metallic brashness' in the upper midrange. Some 'boxiness' was also evident. On the other hand, it did have some appealing qualities — stereo focusing was particularly good and the sound was detailed as well as subjectively transparent. It also managed to convey some measure of the recorded acoustic.

Lab Report

Measured on axis at 1 metre, sensitivity was below average at 85dB, though this is good for the size. An amplifier range of 20 to 50W is appropriate, giving a maximum sound level of 98dB, sufficient for all but 'disco' domestic use. Set against the reference sensitivity, the low frequency rolloff was high at 80Hz, −6dB. Conversely, the impedance characteristic was excellent, not falling below 8.5ohms and rated as a very easy amplifier load.

The reference response was encouragingly uniform, and with the grille removed 100Hz to 20kHz limits (±3dB) were easily met, though the trend shown at 2 metres suggested some brightness as well as a shyness in the bass. Bar a small notch in the vertical axis, the forward response set looked very tidy and the drive units can be seen to integrate well.

Driven to 96dB sound level, the speaker was working near its practical limit with distortion rising to 4% at 300Hz; at higher frequencies it was more satisfactory. A useful reduction in distortion was recorded at the lower 86dB sound level with the overall result averaging 0.4%, though this was still higher than usual. Conversely, the figures at low frequencies were quite good for such a small box.

In the listening room the *MS10* provided a relatively uniform mid/treble response, but the bass was lumpy at 50Hz and lacked extension, as well as being rather deficient. A thin tonal quality was only to be expected from this.

Conclusions

Well worth considering, this recommended minature would perform well in a bookcase location and a system fitted with a sweet-sounding cartridge. It produced a 'lightweight' sound, but this was redeemed by the low levels of subjective coloration as well as the fine clarity. The treble was also somewhat better than average for its class.

Reassessed. First reviewed 1985. Current typical price £80.

General Data — see pages 180-184.

MORDAUNT SHORT MS15

MORDAUNT SHORT LTD, DURFORD MILL, PETERSFIELD, HANTS GU31 5AZ.
TEL: (0730) 80721

In production for almost a year now, the *MS15* just missed the 1985 issue of *Choice*, this compact system more or less replacing the popular and long established *MS20*. The *'15* comprises an 8 litre sealed-box system fitted with two drivers. The 125mm diaphragm bass/mid unit compares with the 170mm radiator used for the slightly larger *'20*, so both power handling and sensitivity are likely to be somewhat compromised as a result. Both speakers share the same Audax 19mm plastic cone/dome ferrofluid-damped tweeter.

Derived from the 'direct-coupled' *MS100*, the *'15* seeks a better tonal compromise by using some inductive equalisation in series with the bass unit. Utilising the latter's natural second-order rolloff, the crossover point is set at a higher than usual 5-6kHz, while the small radiating area helps in maintaining good distribution characteristics. The bass unit employs a lossy cone of thick paper-pulp fitted with an absorbtive synthetic surround termination. Nominally 12dB/octave, the second-order crossover uses good quality components. M-S' Positec position overload protection system is fitted, and this has so far proved to be foolproof, reliable and apparently inaudible.

The vinyl-coated enclosure is rigidly constructed in 14mm chipboard, and the review samples were finished in a high quality simulated black ash. The unrebated grille is constructed from 14mm thick material, and should be removed for critical listening. Electrical connection is *via* plain 4mm sockets.

SOUND QUALITY

Despite placement close to the rear wall, the *MS15* scored below average in the listening tests, suffering from a mid-dominant tonal balance coupled with some noticeable 'boxiness' in the lower mid. Piano tone was 'thinned' and 'hardened', though the treble range was by no means 'bright'. The bass was quite dynamic and showed some extension, but viewed as a whole was not strong enough in proportion to the mid-range level.

Stereo focusing was fine. Some measure of recorded acoustic was conveyed, but the panel found depth restricted. Though this aspect improved when the speaker was positioned away from the wall, conversely the tonal balance suffered. The sound was interesting, but did not fully convince the panel.

LAB REPORT

The sensitivity was a little below average measuring 86.5dB/W with an associated bass extension to a modest 60Hz, −6dB. The system resonance was noted at 79Hz. The *MS15* represents a very good amplifier load, with impedance typically at the 8ohm level. A minimum amplifier power of 15W is indicated, while a maximum of 75W will allow realistic peak sound levels of 101dBA.

The reference response measured on axis at

1 metre showed a relatively uniform characteristic, an upper-mid 'forwardness' followed by a mild presence loss before the treble output recovered. The response was better with the grille removed. The trends were confirmed at 2 metres in the family of forward axial and off-axis responses. Integration between the drivers was impressive, though this loudspeaker should be positioned ideally at or near head height for a seated listener to give optimum sound quality.

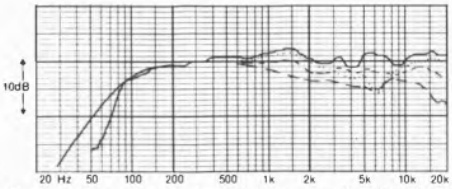
In the listening room, a mild peak was evident at 800Hz, surrounded by a 'forward' mid region. The treble was desirably uniform, but probably a little too attenuated, while the bass, though extended, was not powerful enough. This loudspeaker delivered a satisfactory distortion performance, handling the combination of low frequencies and higher powers well.

Conclusions

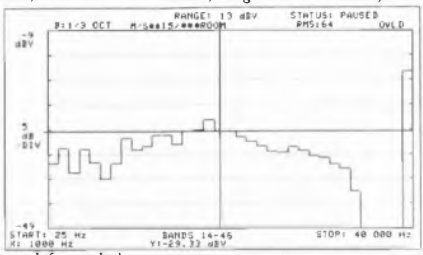
Carefully set up in a well matched system, the *MS15* can give a good account of itself. However, in a test sequence such as ours, significant defects of balance and coloration were easily noticed, and the *MS15* emerged weaker than average. It did have some subjective good points, was well engineered and finished, and the value for money aspect is also promising. A 'worth considering' verdict is appropriate, and auditioning commended.

General Data

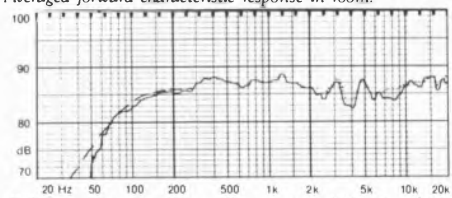
Size (height × width × depth)	32.5 × 22.5 × 17.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(15) – 75W
Recommended placement	on stand near wall
Frequency response, within ± 3dB, at 2 metres	85Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	60Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	86.5dB/W
Approximate maximum sound level (pair) at 2 metres	101dBA
Impedance characteristic (ease of drive)	very good
Forward response uniformity	very good
Typical price per pair, inc VAT	£100



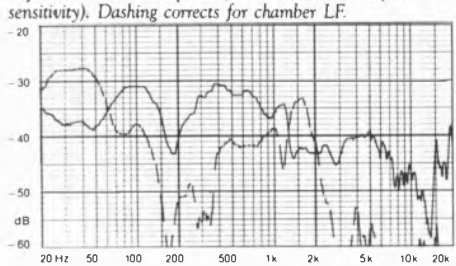
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

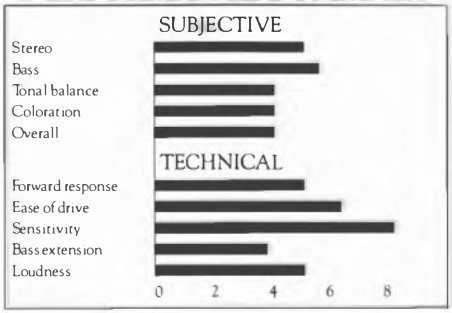


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



MORDAUNT SHORT MS25Ti

MORDAUNT SHORT LTD, DURFORD MILL, PETERSFIELD, HANTS GU31 5AZ.
TEL: (0730) 80721

Mordaunt-Short's *MS20* has done well in *Choice* for several years, but has now bowed out to the new *MS25Ti*, a larger model, with more costly tweeter, using a pure metal-foil diaphragm made from titanium. Mordaunt-Short have also responded to the market forces demanding higher sensitivity speakers, and a new bass/mid unit with a lower mass cone has been designed. The price has now unfortunately risen to £120 a pair, but given the intervening inflation this is little more than the cost of the *MS20* when it originally appeared.

The *25Ti* is a two-way sealed-box system, with a vinyl-clad enclosure rigidly built from 14mm chipboard and reinforced by a circumferential brace located between the two drive units. The interior is tightly packed with polyester fibre to control internal standing waves. The enclosure volume is aproximately 14 litres resulting in a system resonance at 78Hz.

Built on a 220mm steel frame, the bass/mid driver uses a 165mm flared pulp cone driven by a fair sized motor assembly. For the treble, the unusual titanium cone/dome type tweeter is sourced from MBE and manufactured in West Germany. It uses a 19mm pole motor, is ferrofluid damped, and has a phase plate which also provides protection against prying fingers. The crossover has five elements plus one attenuating resistor, and essentially conforms to 18dB/octave, third-order alignment. Spring clips connect the drivers internally, while external connection is *via* plain 4mm sockets. 'Positec' driver overload protection is included.

Sound Quality

The 'blind' panel scores suggested some disappointment with the *MS25Ti*, and if the truth be told, it was ranked lower than its predecessor had been in earlier tests. Standards have improved since, but I am inclined to believe that the *MS20* would have comfortably survived reaudition this time around.

The '25 was described as sounding as though the energy was 'humped up' in the midrange. Vocals were exaggerated but 'thinned', while the bass was excessively crisp but lacking in weight and extension. Though quite even, there simply was not enough bass. This mid 'forwardness' lent a 'boxy', 'hardened' effect to the balance which proved destructive of stereo depth. Stereo focus was considered good, but some central concentration tended to limit the subjective impression of stage width. The treble was felt to be tidy enough and attracted little adverse comment, which is obviously a plus point.

Lab Report

A high 89dB/W sensitivity was recorded, to some degree achieved at the expense of a flat midband tonal balance. The impedance curve suggested a basically 'good' amplifier load rating, the impedance falling to 5ohms in the treble range. The axial reference response was uniform

to 300Hz, beyond which it rose some 3.5dB by 700Hz, remaining at this level to 1.4kHz before dropping back to the average reference level. Some power loss was evident through the presence range, 1.5 — 5kHz, leaving the treble somewhat exposed.

The inherent trends of this system were exposed at the 2 metre measuring distance. The family of forward responses showed a 'double humped' pattern, dominant at 1kHz and 6kHz. Within this overall trend the integration was pretty good, while the system on-axis scraped through from 85Hz to 20kHz with ±3dB limits.

The bass rolloff measured −6dB at 65Hz while reference to the computed room response showed that although there was bass extension, it was attenuated relative to the midband. The output reached a peak at 800Hz, and an energy dip was also evident in the presence range.

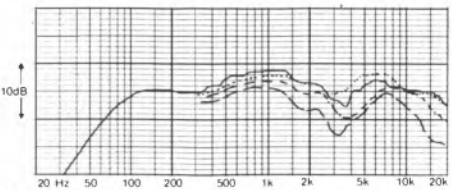
The *'25Ti* had decently low levels of second and third harmonic distortion at 86dB, while we measured a moderate increase at 96dB, in fair proportion with the increased power level. The low frequency range remained under control, and the maximum power handling was around 100W, which will produce sound levels of up to 104dBA from a stereo pair in-room.

Conclusions

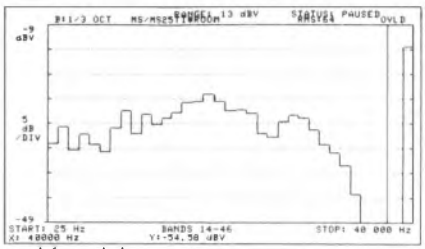
The *MS25Ti* had the makings of a fine speaker, with a number of promising aspects including high sensitivity, good loading and low distortion. The accurate build was reflected in the close pair matching, but the frequency response was too 'forward' in the mid and not sufficiently well integrated with the treble to merit recommendation. However, it represents fair value and is well worth considering.

General Data

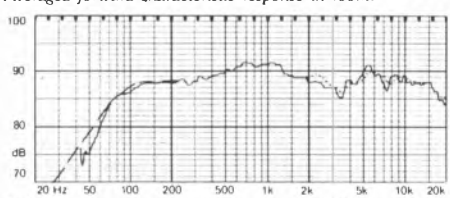
Size (height × width × depth)	40×26×23.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) – 100W
Recommended placement	on stand near wall (0.3m)
Frequency response, within ±3dB, at 2 metres	85Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	65Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89dB/W
Approximate maximum sound level (pair) at 2 metres	104dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good
Typical price per pair, inc VAT	£120



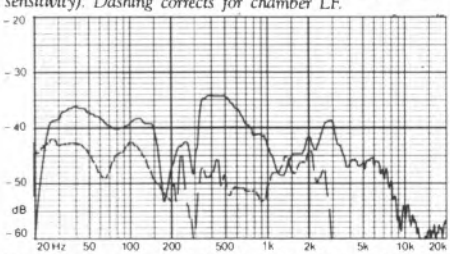
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

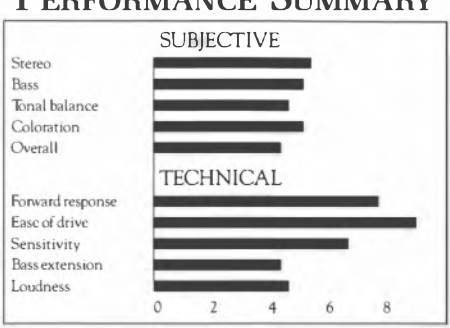


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

MORDAUNT SHORT MS100

MORDAUNT SHORT LTD, DURFORD MILL, PETERSFIELD, HANTS GU31 5AZ.
TEL: (0730) 80721

The *MS100* is an upmarket miniature in real wood veneer. The finish is excellent and the box rigidly constructed, but the grille baffle is a thick unrebated structure, which, as M-S themselves admit, is best detached for serious listening. The speaker can be supplied with optional matching stands, which bolt securely to the underside, and optimum placement is said to be close to the rear wall of a room.

This speaker is unusual in its use of a custom-made 170mm frame size bass unit using a 120mm rigid pulp cone, which is designed to operate without a crossover network. In this sense everything up to 5kHz is fed direct and unobstructed to the bass/mid unit. A simple crossover network allocates a sensible proportion of the remaining 1½ octaves to the 19mm Audax plastic cone/dome tweeter.

Damped by a dense fibre filling, the sealed box volume of 8½ litres tunes the system resonance to 75Hz. Positec overload protection is fitted, a self-resetting system using special positive temperature coefficient links which change from a very low to a high resistance once a continuous averaged current is exceeded; fast transients are unimpaired.

SOUND QUALITY

In the past I have favoured the use of a small passive equaliser with this system to help correct a degree of forwardness in the midrange. Conversely other listeners both here and in their own homes, have decided to leave it 'untouched'.

In this unaltered state the *MS100* performed quite well on the subjective tests.

The mid was clearly prominent with some associated 'shout' but it proved possible to adjust to this provided that it was not played too loud. It offered in return a high level of transparency and detail throughout the frequency range, an aspect which, despite its near-to-wall location, gave considerable depth to the stereo image, while recorded ambience was also read well. The overall balance was tidy, with fair bass extension and low coloration (mid area excepted here) while stereo images were well focused.

LAB REPORT

At 1 metre under anechoic conditions, the reference response showed a well damped low frequency range while the output gently climbed to 800Hz. Above this range the output was uniform, levelling out at 88dB/W, an average sensitivity. The −6dB low frequency point was at 80Hz but the rolloff rate was desireably shallow.

Out at 2 metres, the forward response family confirmed the broad mid forwardness, and showed excellent responses laterally off axis. In the vertical plane the loss at '15° above' was more serious than usual suggesting the use of fairly high stands, which indeed M-S can supply.

At 96dB sound level, the distortion was about average at 1% second harmonic, and rather less third harmonic. By 86dB both had settled at the 0.3% level over most of the range except above 14kHz where some minor high frequency resonances disturbed the results.

The suggested amplifier power range is 15 to 50 watts, the latter providing reasonable sound levels of up to 100dBA for a stereo pair in a typical room. The *MS100* was rated as an easy amplifier load with a non-reactive trend and an average impedance value.

CONCLUSIONS

The 'official' rating based on the test results would indicate a 'worth considering' verdict, but I feel that this loudspeaker's particular strengths in terms of immediacy, stereo focus and depth, all outweigh its tonal balance weakness. While I must suggest a careful audition prior to purchase, I also feel that this well made speaker deserves recommendation.

Reassessed. First reviewed 1985. Current typical price £160.

General Data — see pages 180-184.

MORDAUNT SHORT MS300

MORDAUNT SHORT LTD, DURFORD MILL, PETERSFIELD, HANTS GU31 5AZ.
TEL: (0730) 80721

Selling at a little under £300, the MS300 is a larger version of the *MS100*, similar in concept but extended in height to allow the addition of a second 160mm base unit. The result is a 54cm tall enclosure with a sealed-box volume of 19 litres, this tuning the pair of bass drivers to 80Hz. One of these drivers receives input direct from the amplifier (as in the *MS100*) and so covers the bass and midrange; the other is fed a tapered signal so that its main contribution is in the lower frequency range. In this way the system becomes self-balancing in a way the *MS100* is not.

The *MS300* bass units are made by the British firm Elac, to Mordaunt Short design; located between them on the front panel is the 19mm Audax tweeter, the same as that used in the *MS100* model.

Nicely veneered in walnut, the cabinet is of 15mm thick chipboard, reinforced by effective circumferential bracing in the vertical plane. The grille baffle is of unrebated thick MDF, and should be detached for critical listening. As with the *MS100* electrical connection is made in plain 4mm sockets while the speaker is fully protected against any possible damage from overload by the Positec system.

Sound Quality

The '300 scored a straight 'average' in the listening tests, a fair result but not really up to the price level. It did not sound as well integrated as the *MS100* nor did it really manage to avoid that thinned mid 'forwardness'.

Some richness was present lower in the range, but the bass extension was just average and the treble was also judged to be of average smoothness.

Some 'boxiness' was evident though the 'direct coupled' sound did break through. As with the *'100* it proved to be nicely transparent with good stereo focus and depth. Recorded acoustics were well portrayed while a good power handling was also evident.

Lab Report

The axial response was lumpier than that of the *'100* and the supplied grille could be seen to exert an adverse effect on the performance. Well damped, the bass rolloff was slow with a −6dB point at 65Hz, which is higher than average for this price group. Sensitivity was good, and at 89dB/W was sufficient, along with the 100W peak programme power capacity, to generate substantial 104dBA sound levels. A minimum power input of 10W is indicated. The sensitivity was not compromised by the impedance characteristic, which met the 8ohm standard and rated as a very good amplifier load.

Measured at 2 metres with smoothing, the response was fairly stable in the lateral plane, but the speaker clearly showed poorer drive unit integration in the vertical plane. The listening height must be carefully judged to get the optimum performance. On axis, ±3dB amplitude limits were met from 90Hz to 20kHz.

At 96dB sound level, distortion was well controlled, averaging 0.4% above 200Hz save for a harmless peak of second harmonic, inaudible at 20kHz. At the lower sound pressure level of 86dB, distortion showed a general improvement to a 'very good' level.

Room averaged, the overall characteristic was better than expected, since the upper midrange sounded more prominent than this curve suggested. From this response I would judge the system to be quite well balanced with good low frequency extremes.

Conclusions

While in a general sense the MS300 is better balanced than the *'100*, and also has greater power handling as well as lower distortion into the bargain, it also sounded less 'direct' and more coloured. Overall this speaker is rated as 'worth considering'; I consider it to have some promising qualities, and feel it is worthy of audition.

Reassessed. First reviewed 1985. Current typical price £300.

General Data — see pages 180-184.

NAD 20

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

This medium priced loudspeaker is unusual in that it is designed for free space floor mounting without the need for a stand. A slim structure, it measures 75cm high, and is fitted with a neat plinth. The complete system, including drive units, is built for NAD by Braun in West Germany.

With an internal voume of 25 litres, this sealed box enclosure is tuned to 62Hz. Coverage of the bass and midrange is allocated to a steel-framed driver of 220mm diameter, fitted with a straight-sided pulp cone of 170mm radiating diameter.

The crossover is of commercial quality, 12dB/octave electrical slope, using four elements. Above 3kHz the treble is handled by the well established Braun 25mm soft fabric dome driver, in production for over a decade now. On our pair as delivered, one of these had an off-centre voice coil but this was reset without difficulty.

Clip terminals are fitted on the underside of the enclosure, leaving all visible panels finished in black grained vinyl. At 15mm thick the acoustically poor grille frame is unrebated, and the enclosure is built of plain, unbraced chipboard. The interior does however have a fibreglass filling for volume absorption; but when tested for resonance by knocking, the panels did seem louder than usual.

Sound Quality

Sight unseen, the speaker scored rather below average, which is disappointing for the price. The panel criticised it for a mild bass softness and excessive fullness; for a muddled lower mid; a thinned, forward upper mid and a lifted, almost edgy treble.

Depth was poorly represented in the stereo image, which in addition showed less focus sharpness than usual. Basically quite lively with reasonable levels of musical detail the sound did not fully 'gel', leaving the panelists somewhat uninspired.

Lab Report

At 1 metre, the axial sinewave reference response showed a high 90dB/W sensitivity. With good power handling of up to 100W peak programme, high sound levels of 105dBA are possible from a stereo pair. Bass extension was quite good, −6dB at 50Hz, but underdamped with an overhang of 2dB. Pair matching was rated average while the grille added quite an obvious ripple to the otherwise smooth impedance response. The overall response roughly corresponds to a breed of speaker which generally tends to be crudely condemned as the 'boom and tizz' brigade.

At 2 metres this speaker's rising response trend was obvious, some 3dB from 200Hz to 10kHz. Above axis, the vertical response was noticeably notched out in the crossover region, so the median driver axis should aim at head height. Overall the forward response set looked fairly good.

In room, the mild mid bass excess noted by the panel is confirmed, likewise the treble range which was too 'flat' on this graph — a level 3dB less would be nearer the mark. The 'thin' midrange was associated more with coloration than energy balance.

Distortion was average at 96dB sound level and did not improve greatly at the lower 86dB level. A 'below average' amplifier load, the impedance dipped to just below 4ohms at three points and might need some care in the choice of amplifier, which should preferably be a model which is rated for 4ohms use.

Conclusions

Both listening and laboratory tests showed weaknesses in this otherwise promising design. The concept is a good one, but the execution does not attain a high enough standard, in our view, for UK success.

Reassessed. First reviewed 1985. Current typical price £160

General Data — see pages 180-184.

PROAC TABLETTE EBT SUPER

PROAC LOUDSPEAKERS, 130-132 THIRSK ROAD, BOREHAMWOOD, HERTS.
TEL: 01-953 8933

This ProAc is the latest model in the *Tablette* series, with the *EBT* designation related to the extended bass afforded by the use of two bass/mid drivers as opposed to the single bass unit of the standard *Tablette*. The *Super* suffix indicates cabinet and component improvements, which now apply to both *EBT* and standard *Tablettes*. Our samples were purchased, not supplied by the manufacturer for this review.

A very slim enclosure for vertical orientation, the *EBT* measures just 15.5cm wide. A 19mm soft fabric dome tweeter, the Scan *D2008*, is fitted in the middle, while above and below it are placed the miniature 110mm bass units from SEAS. Built on a cast housing and fitted with good magnets, the pulp cones are heavily damped 80mm radiators.

With an 8 litres internal volume, the system is reflex tuned at 61Hz by a small multi-aperture damped port 45cm diameter by 100mm long, located on the rear panel. Superbly finished in a choice of fine veneers, the carcass is built of damped MDF. A fine quality seven element crossover is used with electrical connection made *via* 4mm socket binding posts. Matching low-resonance 'Foundation' stands are available.

SOUND QUALITY

Scoring close to average, the *Tablette* did quite well for its size but not for its price. On blind listening and irrespective of either cost or dimensions, the panel liked this speaker for its open sound and explicit detail. Comments on stereo were mixed with some panelists finding good depth and focus while others were somewhat confused. The tonal balance was lightweight, with clearly more treble than average while low bass was virtually absent. Overall the coloration was fairly low.

LAB REPORT

Pair matching was excellent with this system, pointing to tight tolerances in production. At 1 metre on axis, the response was very uniform, particularly with the grille detached. A rising trend was apparent, some 10dB from 75Hz to 20kHz; this characteristic was the opposite to that of many other small speakers which are balanced on the richer side to disguise their size.

Bass was well damped with a −6dB point at a high 75Hz, which is poor for the price. Sensitivity was close to average, and taking into account the good 75W power handling, sound levels of up to 100dBA will be possible. Sensitivity was not compromised by the impedance characteristic, which rated as a very good amplifier load; it did not fall below 6.4ohms and thus met the 8ohm standard nicely.

At 2 metres, with some averaging, the response was clearly uplifted with excellent dispersion off-axis in the lateral plane, probably one of the best ever. In the vertical plane, it proved axis-sensitive and at 15° above, a broad area of crossover loss was noted. Care should be taken to align the tweeter at head height.

At 96dB sound level distortion was higher than average but certainly quite satisfactory, while at 86dB the results were quite good, averaging over 0.2% over most of the range.

CONCLUSIONS

While the speaker's light balance clearly upset the listening panel, it proved to be a well engineered design of considerable merit. If a wide dispersion miniature of good overall control, low coloration and good power handling is required, the *Tablette EBT Super* should be high on your list — its clarity and detail demand an audition but only personal trial can settle the matter. As regards bass extension and straight value for money, it fared less well.

Reassessed. First reviewed 1985. Current typical price £340.

General Data — see pages 180-184.

HI-FI CHOICE
1986 SERIES

FEBRUARY

AMPLIFIERS & TUNERS

At the heart of any system is the amplifier, and its performance is critical. But only a combination of carefully-controlled listening and lab tests can give the true picture of amp performance, and in some cases prove that the best low-cost amplifiers can sound better than many at several times the price.

APRIL

THE COLLECTION

'State of the art' means the best we can do with available technology. This special large format edition covers hi-fi equipment which aims at true excellence — with no expense spared. As well as the truly esoteric, this guide covers the very best that is to be found at (fairly) reasonable prices.

JUNE

COMPACT DISC PLAYERS

Digital audio has come of age, with a wide range of players to choose from and even some mini-size portables. We've tested every player under consistent conditions to give a true picture of the often perplexing differences between models. Programming facilities, features and software are also covered.

AUGUST

LOUDSPEAKERS

Progress brings better-value speakers every year. Hi-Fi Choice puts the important new models through its unique 'blind' listening comparisons to find out which really do represent a step forward. Combined with full lab analysis, they provide a comprehensive guide to speaker sound quality.

SEPTEMBER

BEST BUY GUIDE

Hi-Fi Choice give a 'Recommended' rating to models which perform well — and the coveted 'Best Buy' accolade to those found to be outstanding value for money. Amplifiers, CD, speakers, cassette and record decks — all are fully covered in this bumper volume with around 200 complete reviews.

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RECOMMENDED

QUAD ESL-63

QUAD ELECTROACOUSTICS LTD, 30 ST PETERS ROAD, HUNTINGDON PE18 7DB.
TEL: (0480) 52561

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 is electrostatically energised to operate as a phased array of eight concentric elements, so 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 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 distribution from 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 panelists could be in the optimum zone, and when used as suggested on the floor at our typical 3-3.5m listening distance, the main axial treble response was directed nearer to chests than ears. Accordingly, the speakers were elevated by about 20cm on open stands and tilted marginally 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 that are suppressed in the sideways directions. This results in a rather different room drive and reverberation compared with considerably more omni-directional small box speakers. So 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. Furthermore, the different manner of 'throw' into the room produces a more even spread of intensity compared with dynamic loudspeakers.

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 listening 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, the '63 at first appears to lack detail and transparency. But prolonged listening showed that this was due to the misleading frequency balance, and that superb image depth as well as detail were apparent off-axis.

LAB REPORT

The sensitivity reading was not comparable with

a normal speaker due to the doublet directivity. 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, though as with all panel speakers intensity is maintained well at a distance from the speakers. The reference response met ±2dB limits between 50Hz and 9kHz, outside of which some irregularities were charted which could not be wholly blamed on proximity, as 2m and 3m response checks verified.

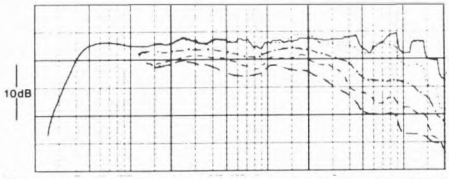
Averaged in ⅓-octave bands at 2m, the speaker demonstrated a superbly even mid and low range response, with some mild 'lumpiness' above 5kHz. The response sensitivity to axis was shown by a measurement just 7.5° off-axis vertically, which revealed a more than 5dB loss above 12kHz. The output decayed 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, with dips to 3.5ohms recorded at 50Hz and 10 kHz, the speaker should not cause amplifiers too much trouble. But when the speaker is heavily overloaded it protects by a short-circuit 'crowbar' which may damage some amplifiers. 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 compression occurred at a 100W peak input, due to the speaker's protection circuit; however, at 50W, just 3dB less, the pulse reproduction was simply too perfect to register measurements.

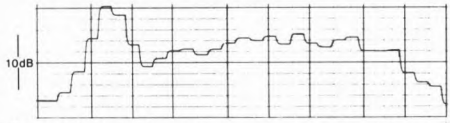
Conclusions

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.

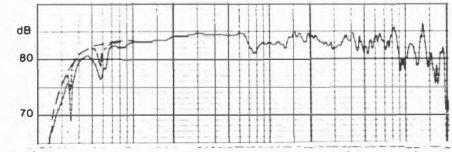
The Quad has uniquely musical qualities through the vital mid registers, and deserves auditioning on high quality material if its blend of strengths and weaknesses are to be fairly assessed by the intending purchaser. The results continue to justify a *Choice* recommendation despite the elevated price.



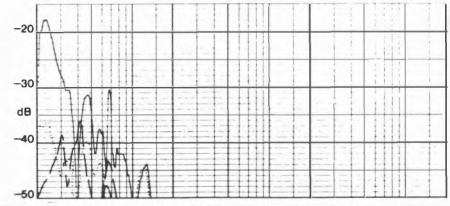
Forward characteristic response (1/3 octave at 2m, dotted 15° vert., small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room at listening position.



Reference sinewave response (1m on axis, 2.83V input shows sensitivity) (dashing corrects for chamber LF, dotting shows response without grille).



Harmonic distortions: solid 3rd 96dB, dotted 2nd 96dB, dashed 3rd 90dB, chain-dashed 2nd 90dB, shows stop point at 96dB).

Reassessed. First reviewed 1981. Current typical price £1,340.

General Data — see pages 180-184.

QED L234

QED AUDIO PRODUCTS LTD, UNIT 12, ASHFORD INDUSTRIAL ESTATE, ASHFORD, MIDDLESEX.
TEL: ASHFORD 46236

QED began as an accessory manufacturer, but are now making a name for themselves with audio separates and systems. A miniature loudspeaker now joins these ranks, this a custom made system built for QED by Castle Acoustics, based on their evergreen *Clyde*. Whereas the *Clyde* normally comes with a real veneer finish, QED have opted for a grey matt-textured enamel for their model. The measured results for the two systems are similar, but examination shows that QED have changed a number of details. The reflex tuning now uses a 35mm by 30mm duct, and the internal filling has been altered to long-fibre wool. The crossover has also been beefed up and enhanced by hard-wiring and the substitution of Ashcroft film capacitors for two of the treble section electrolytics.

Electrical connection is *via* plain 4mm sockets, and the crossover slopes acoustically approximate to 18dB/octave. The front and back of the cabinet are made from 14mm MDF, while the shell is in chipboard. No bracing is used, though this would be an unlikely feature in such a small box.

The pulp-cone bass unit, built on a pressed-steel frame, has an active cone diameter of 105mm, so bass reflex loading is essential to achieve respectable sensitivity and power handling. The treble unit is Castle's unique plastic annular cone, some 30mm in effective diameter and crossing over at around 4kHz. Aligned for good sensitivity, this system benefits from stand-mounting moderately close (0.2-0.4m) to a rear wall, but it could also be shelf mounted at a pinch.

SOUND QUALITY

The QED had a mixed reception, though both wall and free space positions were tried. The treble was generally average, but sounded forced and nasal in the lower register. Tonally the mid appeared 'loud', with a lightweight balance, but managed to avoid a 'humped' midrange effect. Piano was too 'small', and some voices were too forward. The bass was 'fast' and 'dry', with reasonable detail but lacking extension to the lowest frequencies; some power loss was evident in the low midrange.

However, stereo focus was quite good. And while this speaker did not manage to convey much depth, many panelists commented on its unusual transparency and clarity, presumably the payoff for the extra work put in by QED. Dynamics were also felt to be above average.

LAB REPORT

The '234 achieved a decent 89dB/W sensitivity at the cost of a marginally impaired amplifier load characteristic and a 'lightweight' frequency response. One clear indication is the limited bass extension, measuring −6dB at 80Hz with a fairly rapid rolloff thereafter; the bass had already begun to fall by 120Hz under anechoic conditions. A minimum of 10 watts per channel will get the system going, and a maximum sensible power handling of 50 watts will give peak sound levels of up to 101dB for a stereo pair in-room, a generous level for the size of box.

The reference 1 metre response was commendably unform, showing just a hint of excess in the 2.5-5.5kHz range. One might not suspect much from this, but at 2 metres the forward response set showed more clearly that the output was too strong in the presence range. Despite such criticism, the '234 displayed excellent uniformity and consistency over the range of axes measured.

Turning to the room response, the presence range was clearly set brighter than usual (compare with other graph). Basically this speaker balanced well down to 120Hz, and then the bass rolled off too quickly to give any impression of weight or scale.

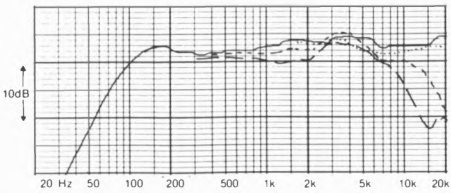
The '234 was classed as a good amplifier load, with a minimum impedance of 4.8ohms. However, the distortion results were poorer than average: at 86dB, unwanted products were high below 100Hz and averaged 0.6% through the mid and treble; at 96dB, the midband situation was similar but the distortion rose at lower frequencies to 5% of second harmonic at 200Hz, for example.

Conclusions

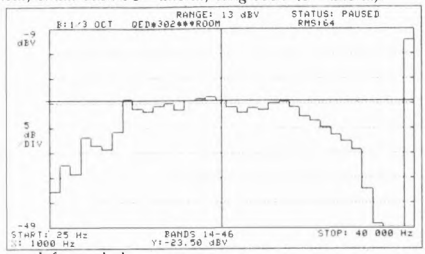
In attempting to get a quart out of a pint pot, the '234 has failed to create a complete, balanced impression. It had little bass and sounded less 'even' than its fine response traces tend to suggest. However, it is reasonably priced and has some merits, notably a high level of clarity, so it certainly merits auditioning by prospective purchasers.

General Data

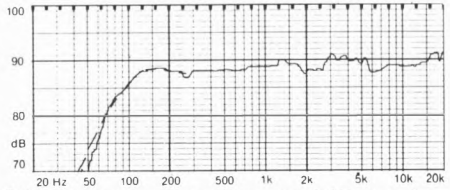
Size (height × width × depth)	30.5 × 20 × 18.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) – 50W
Recommended placement	on 50-60cm stands near wall
Frequency response, within ±3dB, at 2 metres	90Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	80Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89dB/W
Approximate maximum sound level (pair) at 2 metres	101dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	excellent
Typical price per pair, inc VAT	£120



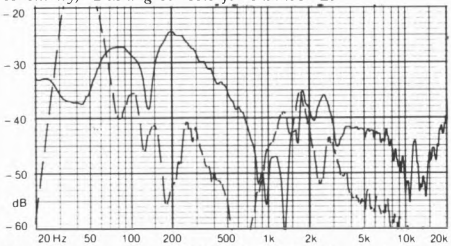
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

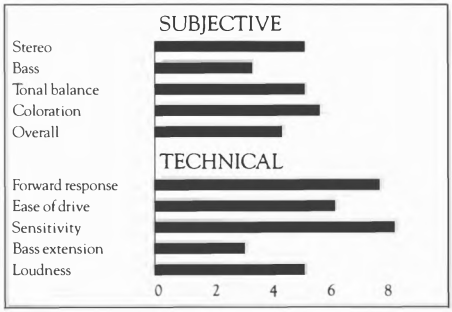


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

ROGERS LS2

SWISSTONE ELECTRONICS LTD, 310 COMMONSIDE EAST, MITCHAM, SURREY.
TEL: 01-640 2172

This very compact loudspeaker may be considered as having grown out of the little *LS1*, which it now replaces. With a 10.5 litre internal volume, the proportions are improved, and this should reduce box coloration. The cabinet is nicely veneered in real walnut, and has a decent chamfered grille baffle with an MDF board front panel. Plain chipboard is used for the rest of the carcass. Reflex-loaded, the box is tuned to 60Hz by a decently sized port, 50mm diameter by 110mm long.

In this two-way system, bass and midrange are handled by a Rogers-built polypropylene-coned unit, constructed on a 110mm pressed steel frame. High thermal power handling is obtained *via* a Kapton motor coil former. A five-element crossover of nominally 18dB/octave slopes is used to divide the frequency range at around 3.5kHz, with the treble register handled by a 19mm soft plastic dome unit of good dispersion.

The enclosure is undamped, but the bass unit is partially decoupled to reduce the transmission of driver frame vibrations to the cabinet panels. Electrical connection is made *via* 4mm socket binding posts and the overall constructional quality is very good.

SOUND QUALITY

Scoring well above average on the panel test, the *LS2* has improved on the earlier *LS1* result. Some panel variation was noticed in the results, however, suggesting a mildly biased speaker 'character'. It was weaker on rock material and lacked full dynamic power, but nonetheless sounded tidy and coherent throughout the frequency range.

Coloration was fairly low, though the bass did not achieve a clean 'slam', the mid could show mild upper range hardness, and the treble a hint of 'sizzle'.

On the plus side, it sounded well balanced with good detail, fair clarity, reasonable depth, and good stereo focus. Bass was tidy but low bass was rather muted.

LAB REPORT

A low sensitivity of 86.5dB/W was recorded, which suggests a minimum power input of 25-30W per channel; 150W is a sensible maximum power input, though it survived much higher levels without complaint. Maximum sound levels of 100dBA will be possible from a stereo pair.

With the grille removed the response was smoother in the upper range. The curve was somewhat unbalanced, the trends suggesting the extraction of all that was available from the main driver. Well tuned, the bass extended to a respectable rolloff at −6dB, 51Hz.

Measured out at 2 metres, the speaker showed a respectable set of forward and off-axis responses which confirmed its generally balanced and well integrated nature. A 60Hz to 20kHz frequency range was easily met for the quoted ±3dB limits.

A 96dB sound level was some task for this system, yet good distortion results were obtained, averaging 1% second and 0.3% third right down to 50Hz. At 86dB the results improved to a surprisingly good level. Just dipping to 6.4ohms amplifier load, rated very good.

With the forward response computer averaged in the listening room, this speaker's pedigree was confirmed. Low bass did rolloff quickly below 50Hz and the treble was a touch forward, but the overall result was distinguished by its notably even nature.

CONCLUSIONS

Another finely crafted design from the hand of Richard Ross at Rogers, the *LS2* stands as a neutral miniature offering good power handling, fine stereo and encouraging sound quality. Best suited to classical programme, this design is confidently recommended.

Reassessed. First reviewed 1985. Current typical price £165.

General Data — see pages 180-184.

BEST BUY

ROGERS LS6

SWISSTONE ELECTRONICS LTD, 310 COMMONSIDE EAST, MITCHAM, SURREY.
TEL: 01-640 2172

The *LS6* slots in below the *LS7*, and offers a similar basic package in terms of size but at a lower price. A newly developed polypropylene cone is used for the bass/midrange unit, built on steel frame and fitted with a generous magnet. The treble is handled by 19mm soft plastic SEAS dome unit, crossing over at around 3.5kHz.

Standing 51cm high, this speaker is suited to free space mounting on solid stands, like the *LS7*. The 23 litre enclosure is reflex-tuned to 50Hz by a 50mm diameter port; the internal section is slant-cut to an approximately 110mm length. Reflexing gives a fourth order bass response but in fact this system is fifth order, achieved *via* a 440μF series capacitor.

The high quality crossover network is essentially to a third order pattern and is built using excellent components.

Built from plain chipboard, the enclosure has an MDF driver baffle with a chamfered port opening and grille baffle.

The constructional quality and standard of finish is high. Electrical connection is *via* 4mm socket/binding posts.

SOUND QUALITY

Scored with great consistency by the panel, the *LS6* achieved a very similar rating to the *LS2*, though with superior bass extension and power handling. The '6 was found to be very well balanced with a transparent, informative mid, and an open, 'airy' nature. Stereo depth was quite well developed, with good width and image focus.

Quite lively and dynamic, coloration was generally low. While the upper treble could sound 'grainy' on occasion, when re-auditioned for 1986 the overall midrange balance and the bass tuning were both significantly improved. It handled high powers well, showing a convincing superiority here over the *LS2*, but not quite reaching the standard set by the *LS7*.

LAB REPORT

At the reference 1 metre microphone distance, set on the median driver axis, this speaker provided a very uniform, well controlled response. There was no difficulty in establishing a sensitivity at a solid 87.5dB/W. With the grille off the response met ±2dB limits from 55Hz to 16kHz, very creditable with a −6dB low frequency limit at 50Hz, about average for the price and size.

Out at 2 metres, this speaker's fine driver outputs are excellently integrated, producing a first class set of off-axis responses.

In the listening room the forward energy was finely balanced above 80Hz but bass was also up a few dB at the 50Hz system resonance, falling quickly at lower frequencies. A lower system tuning frequency could improve matters here.

Driven to 96dB sound pressure, the speaker offered moderate distortion levels, averaging a good 0.3 to 0.4%. At the 86dB level, the frequency range above 100Hz averaged a fine 0.25%.

With a 150W maximum power handling, this speaker will provide generous sound levels up to 104dBA in a typical room. Conversely, as little as 15W will produce enough volume for normal purposes. The sensitivity was not compromised by the impedance characteristic, which showed an easy 8ohm amplifier load.

CONCLUSIONS

This honestly built loudspeaker has achieved sufficiently high standards in both laboratory and listening tests to qualify for strong recommendation. With its neutral balance, smooth response, fine stereo and a consistent off-axis uniformity, it also provided low distortion as well as good power handling into the bargain and merits a Best Buy rating.

Reassessed. First reviewed 1985. Current typical price £230.

General Data — see pages 180-184.

ROGERS LS7

SWISSTONE ELECTRONICS LTD, 310 COMMONSIDE EAST, MITCHAM, SURREY.
TEL: 01-640 2172

Rogers' *LS7* is a fairly compact stand-mounted system, with an internal volume of 30 litres.

The excellently finished enclosure is constructed of 12mm bituminous damped MDF with a reinforced 19mm-thick MDF front baffle. None of the panels are removable, internal access being gained *via* the bass unit aperture.

The bass/midrange unit has a nominal diameter of 200mm, and uses a generous magnet, a high-power voice coil, and a patented polypropylene cone possessing the classic BBC profile. A selected version of the Celestion HF1000 soft-dome 25mm tweeter covers the remaining frequency range, integrated *via* the excellent-quality 13-element 3kHz crossover. External connection is by 4mm socket/binding posts and the internal wiring is to a high standard.

SOUND QUALITY

The panel were highly impressed by the *LS7*. It was felt to be tonally accurate and well balanced, with an extended and uniform frequency response. Good instrumental detail was preserved throughout the frequency range, while coloration was held to a consistently low level.

Stereo images were spacious, focused and full of the intended recorded-acoustic detail. Depth was impressive, with an almost 'crystalline' transparency.

The *LS7* provided good bass extension and despite seeming slightly 'leaden-footed' here, powerful and clean articulation were in evidence. The sound was consistently clean and free of 'boxy' effects.

Very mild criticisms concerned a slight 'edgy' and 'sibilant' treble, with a mild vocal 'chestiness, but neither was of much consequence. The speaker gave fine results on analogue sections but clearly excelled on the digital programme.

LAB REPORT

The *LS7* showed fine pair matching when measured at 1 metre, the axial response disfigured by a notch at 7kHz partly caused by the grille. The well-damped bass response was uniform and well balanced in character, extending to 48Hz, −6dB, which is fine for the size of enclosure.

Sensitivity was above average at 88dB/W, and an impressive 200W power handling was established. Maximum sound levels of 106dBA were possible from a stereo pair, while as little as 10W would give interesting results. The sensitivity was not compromised by the impedance, which showed only a minor dip at 8kHz, with a mean value of 10ohms, thus making the *LS7* a very good amplifier load.

A fine set of off-axis responses were demonstrated at 2 metres. At 15° above a mild 4kHz dip occurred (still affected by the grille), so the speaker should be directed or elevated to face the listener. Panelists' observations that the balance was slighly 'rich' were confirmed by the 2 metre trend.

When room-averaged, very good correlation with the subjective findings was established. The bass was only marginally 'rich' and showed a well-integrated response extension in the room. The mid was quite uniform and married correctly with the treble register which smoothly decayed above 8kHz.

Measured at 96dB, low frequency distortion held to below 3% second harmonic and 1% third, and was very fine above 300Hz, which is the more critical range in this respect. At 86dB distortion improved greatly.

CONCLUSIONS

The *LS7* provides a remarkably well-balanced subjective and objective performance. All aspects of sound quality such as extension, balance, stereo clarity and coloration were very good, while technically speaking it was easy to drive, low in distortion, sensitive, and consistent as regards frequency balance.

It it remains a strongly Recommended loudspeaker.

Reassessed. First reviewed 1983. Current typical price £335.

General Data — see pages 180-184.

ROTEL RL850

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

BEST BUY

A standard two-way sealed box system, this 20 litre speaker is built in the UK. Though Rotel is a Japanese-based company, the design is UK-inspired and uses a British Elac 220mm pulp-cone bass/midrange fitted with a modest magnet and built on a strong pressed-steel frame. The treble is handled by a Peerless 25mm soft fabric dome, and the connections are hard-wired in oxygen-free copper cable, using a simple three-element crossover network, with an additional resistor to provide attenuation for the treble. Built from 15mm thick chipboard, the enclosure is finished in black ash, and well filled with acoustic absorption. The grille panel is unrebated and 15mm thick — it probably should be discarded to get the best sound.

SOUND QUALITY

Scoring 'above average' on listening tests, the *RL850* did well in its category, and costs less than half the group average.

Some coloration was evident, namely a softening in the bass and a touch of 'boxiness' in the mid, plus a muted 'fizz' in the treble. The frequency response sounded quite even, if slightly dulled, while the upper-mid and treble lacked detail, with an inconsistency here depending on the type of programme played.

Stereo images were good, in terms of width, but central focus was not particularly strong, and depth was constrained. Despite the latter characteristic, the speaker sounded fairly 'big hearted', and could convey some of the weight and ambience present in the programme. Voice quality was quite good, and the speaker also handled high power inputs gracefully, proving quite happy up to 220W peak programme.

LAB REPORT

Pair matching was found to be very good — to within ±0.5dB, which is a great achievement for such an inexpensive speaker. The grille has some effect on the treble response and is better left off. The reference sensitivity measured an average 87dB/W; in conjunction with the generous power handling, this means that levels of up to 105dB are possible from a stereo pair, assuming that you have a large enough amplifier. Fairly smooth and well balanced, the response met ±2.5dB limits from 66Hz to 20kHz, while the −6dB bass rolloff came in at 52Hz, which is about average.

Out at 2 metres, the forward response family was fairly well integrated. A dip at 4kHz occurred above axis suggesting that this speaker ought to be at, or alternatively directed towards, ear level. The lateral responses were good.

Driven to 96dB spl, the distortion measured 1% for second harmonic, and rather less for third. Below 100Hz the usual increase to 3% or so was seen. When sound level was reduced to 86dB, distortion improved significantly to a good level, typically 0.4%. Compression was poorer than average at 2.7dB, but the bass-mid intermodulation figure was very good at −48dB.

The impedance curve indicated a normal 8ohm load, typically measuring 10ohms at higher frequencies, and posing no problem at all for a modern amplifier. Driving the listening room, the speaker produced a well balanced and extended response. Within that general trend however, the mid showed some prominence at 800Hz, while a forward energy notch was clearly present at 2.8kHz, indicating poor phase control through the crossover, leaving the treble somewhat isolated as well as uneven.

CONCLUSIONS

While some quirks have been unearthed in the performance of this speaker, the fact remains that it nonetheless offers very good value. A powerful, competent two-way system with a 200mm driver, when most in this category have 110mm, the 850 achieves Best Buy status, current production showing additional refinement.

Reassessed. First reviewed 1984. Current typical price £110.

General Data — see pages 180-184.

BEST BUY

SONY APM20ES MKII

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.
TEL: STAINES (0784) 61688
David Prakel

Sony first applied its Accurate Pistonic Motion (APM) drivers in the upmarket Esprit speaker range. The *APM22ES* then made this planar driver technology available at the £200-£250 area. The *APM20ES* reviewed here is a hybrid, marrying a true APM mid/bass driver with a metal dome tweeter dressed to look like the 25mm square tweeter of the '22, and entering the UK market at a very competitive £130.

The Japanese built 140mm square mid/bass driver is a remarkable piece of engineering in a speaker at this price. Rather than a conventional cone, an inverted 'quadropod' thin aluminium pressing moves a diaphragm made in exceptionally light aluminium honeycomb material. The die-cast chassis seen in the *APM22* is not used here, but the pressed-steel basket has been damped with mastic panels. The tweeter is a 25mm aluminium dome with a doped fabric suspension.

The cabinet is built throughout in 18mm chipboard, and finished in good quality woodgrain vinyl. The front vertical edges are rounded. The mid/bass driver, somewhat unusually, is reflex-loaded by a rectangular port equivalent to an ample 57mm diameter, backed by an angled 95mm duct.

The speakers are built — or as Sony would have it 'tailored' — to impressively high standards in Sony's German Wega factory. A good quality crossover gives second-order slopes and some driver equalisation. Binding posts which will accept 4mm plugs complete the picture.

SOUND QUALITY

The *APM20ES* immediately impresses with its confident reproduction of space and acoustic, providing good stereo despite its rather 'positive' perceived balance. The low end of this speaker is 'rich' and a little forward but always tuneful. Bass is not oppressive leaving the sound with plenty of air.

Good midrange definition is spoiled by a touch of sibilance, which hardens into stridency when the speaker is pushed hard. Played very loud the speaker can be a little 'shouty', but this is not a great problem considering the price being asked.

Overall this loudspeaker strikes the listener as a very smooth, well-integrated performer setting a standard at this price point which equals, if not betters, many of the competing specialist UK designs. Stand mounting in free space suited it best; positions close to room boundaries tended to emphasise the already generous bass. The grille frames are cleverly designed to stand off from the baffle and the grilles had surprisingly little effect on the sound — if anything, smoothing the top end somewhat.

LAB REPORT

Reflex loaded and tuned to 62Hz, sensitivity was rated marginally below average at 86dB/W. Good pair matching was noted to within ±0.5dB. The −6dB low frequency cutoff was measured at 50Hz, respectably low for such a compact design.

The anechoic forward response curves showed a slight 'hole' between the drivers at 2.8kHz,

though this seems to be of little subjective importance, unless lending a certain detached brightness to the treble.; The off-axis anechoic traces showed excellent dispersion, confirming the ability to produce a generous and stable stereo 'fill'.

At 96dB sound pressure levels the expected second harmonic port distortion was noted with a second hump based on 200-300Hz, no doubt adding that 'generosity' and 'forwardness' to the upper bass. A 1kHz distortion peak was little reduced at the lower 86dB level — this could well be evidence of the 'shouty' quality noted at high levels. The impedance curve dipped to 5ohms at 150-200Hz but was otherwise well controlled, the load being rated as average.

The computer-averaged in-room plot shows excellent integration and a smooth rolloff with perhaps some detachment of the mid/bass region though room effects could well predominate here. An excellent high end response however.

Conclusions

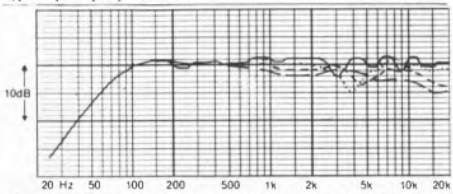
With design input from the UK, Sony has produced a much improved second series *APM20ES* with a forthright sound possesing lively bass, excellent treble clarity, easy driving, and surprisingly good stereo performance.

A thoroughly attractive compact speaker, widely available, with no serious shortcomings and many strengths, the *APM20ES* clearly deserves a Best Buy rating.

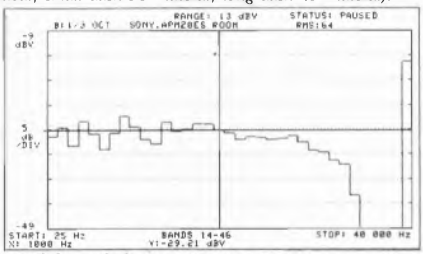
Author Martin Colloms' involvement as design consultant finds David Prakel writing this review, based on his own interpretation of the lab and listening data.

General Data

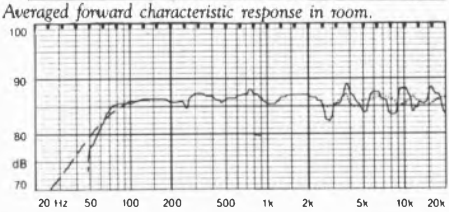
Size (height × width × depth)	43 × 25 × 29cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(15) – 75W
Recommended placement	40cm stand, free space
Frequency response, within ±3dB, at 2 metres	50Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	50Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	86dB/W
Approximate maximum sound level (pair) at 2 metres	100dBA
Impedance characteristic (ease of drive)	average
Forward response uniformity	excellent
Typical price per pair, inc VAT	£130



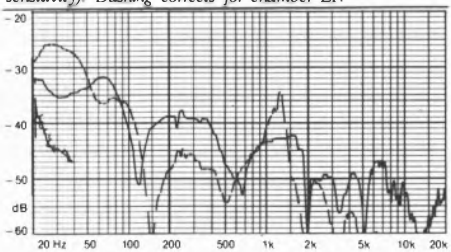
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

RECOMMENDED

SONY APM22ES

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.
TEL: STAINES 61688

The *APM22* is built in Germany at Sony's Wega plant, using two Japanese drivers, a 220mm square bass/mid and a 25mm square treble, both with extra light, strong aluminium honeycomb diaphragms. The bass driver is built on a fine die-cast frame and is fitted with a generous magnet, and a high quality five-element crossover is used. The 30 litre enclosure is reflex tuned by a rectangular port 75mm deep, its 44 square centimetre area equivalent to a generous 7.5cm diameter aperture.

Finished in vinyl laminate, the solid enclosure has some bracing, and is built from high density chipboard. Sensible 4mm socket/binding posts are provided for electrical connection, and this system will give its best on rigid stands, well clear of room boundaries.

SOUND QUALITY

Scoring well on the 1984 panel tests, the *APM22* achieved a 'good plus'. This has been downgraded to a 'good' by the improved 1986 standards, but is an impressive result nonetheless. The panel actually found little to criticise. The bass was powerful and tuneful, with a hint of excess, while the mid was a mite 'thin' and 'forward', showing mild 'boxiness' as well. The treble was judged to be slightly bright but of very good quality.

The *APM22* sounded notably clear and clean with very good dynamics, an 'open' explicit presentation, and a pleasing transparency. Stereo images focused well, and both depth and the recorded acoustic were well presented. The system handled high powers well, surviving 300W programme with no limiting, producing really high sound levels.

Coloration, particularly of the 'cone' variety, was found to be quite low, which was appropriate in view of the absence of cone diaphragms.

LAB REPORT

Reflex-tuned to 55Hz, the sensitivity was about average at 88.5dB/W. Pair matching was excellent, to within ±0.5dB, and the −6dB low frequency cutoff was a respectable 46Hz — good for the size. The grille did not unduly affect the treble response, though its removal still gave an improvement.

The 2 metres axial response was exemplary, meeting fine ±1dB limits from 60Hz to 20Hz. The off-axis family of responses looked tidy but the 3kHz crossover dip in the vertical plane suggests that the speaker should be near or directed towards ear level.

At 96dB sound pressure level, distortion was pretty good, though rising to normal values below 200Hz; it was much improved at 86dB, though a mild peak in third harmonic was evident at 1kHz. Compression was poorer than expected at 2.5dB but the intermodulation product was an excellent −51dB.

Dipping just below 6ohms at 170Hz, the impedance curve was otherwise well controlled, and will present no good amplifier with any problems.

In the listening room, the computer-averaged response confirmed the listening test results. The curve showed a well balanced output, with good integration and some moderate bass excess at 50Hz. The treble was particularly good.

CONCLUSIONS

The *APM22ES* is well engineered, offers an essentially neutral, open, transparent sound, and is full of detail and life. The response is wide, the stereo good and the distortion moderate, while sensitivity is above average. Furthermore it is easy to drive and usefully compact, interfacing well with our listening room. High sound levels of up to 105dB were also possible.

Achieving Best Buy status in both 1984 and 1985 editions, gradually improving overall standards since have resulted in regrading to a Recommendation for 1986, though it is clearly still a major contender at its price point.

Note: The author provided a private opinion on an earlier version of this model for the manufacturer.

Reassessed. First reviewed 1984. Current typical price £200.
General Data — see pages 180-184.

"Spendor now have their compact 30 litre monitor. Offering great consistency and accuracy, it slots in neatly below the SP1, conceding little to that respected larger model. With its natural extended response, low colouration wide dynamic range, easy amplifier loading and very fine stereo, the SP2 is a classwinner and is strongly recommended."

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HIFi News April 1985

spendor audio systems

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SONY APM 66ES

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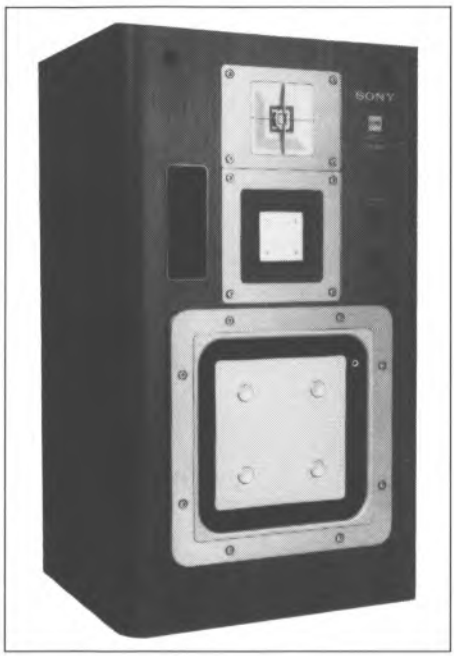
TEL: STAINES 61688



The *APM 66ES* is a recent Sony large three-way design which has already been well received on the home market. *APM* is a rather awkward acronym for 'Accurate Pistonic Motion', the three drivers having flat diaphragms made from a lightweight high rigidity aluminium honeycomb, surfaced with aluminium skins. The surface of the treble unit is further reinforced by a layer of deposited diamond! (Vapourised graphite can be deposited as a diamond film structure *in vacuo*.)

The bass unit is equivalent to a 10-inch model, built on a cast alloy frame 280mm square. A conventional voice-coil assembly drives the ideal diaphragm nodal points *via* an 'Eiffel Tower'-like construction with the 'feet' planted on the back of the diaphragm. The mid unit has a 65mm square piston, while the treble range is handled by a miniature version with 22mm square diaphragm. All the drivers are flush-mounted and therefore naturally time-aligned, so one can expect text book frequency responses if the designer has done his homework.

Intended for free space location, this 51 litre enclosure is reflex-tuned to 36Hz by a generous port. The enclosure is rigidly made from 25mm stock, finished in walnut vinyl, and with several internal braces to control panel resonances. The second-order 12dB/octave crossover uses high quality components, though level controls are fitted to the mid and treble drivers. Internal driver connections are made by clip-on terminals, while connection to the amplifier is *via* large binding posts.

SOUND QUALITY

Scoring in the 'good' class, with a fine standard of stereo imaging, the '66 sounded extended in response, and 'open' in character. The mid-treble range appeared 'seamless', detailed but delicate and unforced at the same time. Good transparency and depth was present through the mid and treble ranges, and orchestral layering was nicely defined. Stereo focus was well above average.

On the debit side, the bass was judged somewhat excessive, lending a 'fattened', 'slow' quality to this region. However, the bass was nevertheless quite 'tuneful', and showing a solid 'slam' and 'weight', coupled with fine extension. Coloration was quite low, with no obvious resonances or tonal imbalances.

LAB REPORT

The '66 showed good sensitivity, close to 90dB/W. With a peak power handling of up to 200W of undistorted programme, generous 107dBA maximum sound levels can be attained from a stereo pair. The bass was unusually extended, reaching down to 35Hz, −6dB, though the reference response suggested that this was achieved at the cost of some lift in the 50-110Hz range.

With the grille removed, the reference curve showed a well behaved characteristic, slightly downtilted to 10kHz and rising thereafter. The 2 metre forward response set was impressive, the off-axis curves showing very good correspondance with the axial trend, though some mild loss can be seen in the output taken 15° vertically above. A listener axis near the midrange axis should give the best compromise.

Rated poorer than average for loading, this speaker's impedance dipped to 4ohms at low frequencies, and averaged 6ohms overall. More powerful 4-8ohm rated amplifiers should not, however, find this a problem. Second and third harmonic distortions were well controlled at 96dB, averaging 0.6% and 0.3% respectively above 100Hz. These values were achieved down below 50Hz at 86dB, while upper range distortion was proportionately reduced.

The in-room response indicated a fine mid/treble balance and integration, with some energy loss in the low midrange. It still operated satisfactorily down to 80Hz, but below this the bass was up by an audibly excessive average of 6dB.

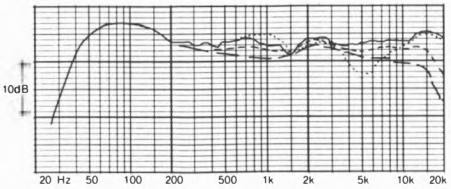
Conclusions

This is a well engineered, wide-range loudspeaker of surprisingly good clarity and pretty low coloration. The listening test results were good, though not exceptional in view of the price. Additional bass damping would be an advantage, though some listeners might find the bass correct in larger rooms. As it stands, this interesting model is worth considering.

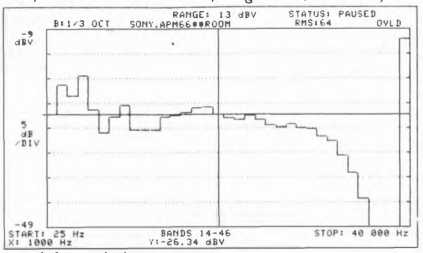
Note: The author provided a private opinion on an earlier version of this model for the manufacturer.

General Data

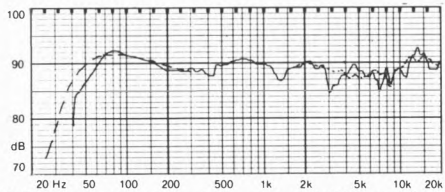
Size (height × width × depth)	66 × 38 × 36cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	10-200W
Recommended placement	40cm stands, free space
Frequency response, within ±3dB, at 2 metres	40Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	35Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89.5dB/W
Approximate maximum sound level (pair) at 2 metres	107dBA
Impedance characteristic (ease of drive)	average
Forward response uniformity	very good
Typical price per pair, inc VAT	£700



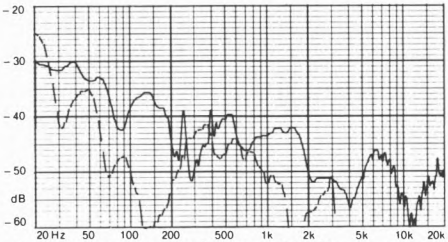
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

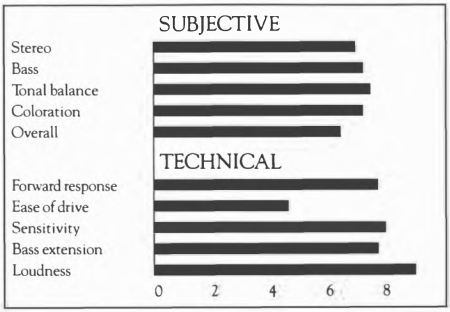


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



BEST BUY

SPENDOR PRELUDE

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Spendor's *Prelude* has now superseded the more expensive *SA2* from which it was developed. A vinyl-wrapped chipboard cabinet replaces the veneered multi-ply of the *SA2*, allowing a cost saving of some 30%, but with overall performance very little changed. For completeness, this review includes comparison to the *SA2*.

The 28 litre internal volume is reflex-tuned by a large ducted port, 75mm in diameter. The interior of the thinwall enclosures is damped by a bituminous cladding plus an acoustic foam lining. While the *SA2* had a superior foam grille, the *Prelude* is fitted with an attractive wooden framed construction.

The Spendor-designed high-power Bextrene-coned bass/mid unit uses a 40mm pole and massive magnet, and is built on a strong die-cast frame. The tweeter is a selected version of the once ubiquitous Audax 25mm soft dome.

A close-tolerance 8-element crossover marries the units at around 3kHz, with electrical connection made by 4mm socket binding posts in the *SA2*, but the less worthy spring connections in the *Prelude*. Both systems are intended for free space positioning on open stands.

SOUND QUALITY

The *Prelude* listening panel scores were very promising, placing it in the 'good plus' category which is a fine result at the price. As with the other Spendor models, the midrange tonal quality and balance was a strong point, with voice and piano reproduced well. Overall frequency balance seemed accurate with a wide smooth response, while the bass was firm, and possessed quite good extension — if slightly 'bumpy' or 'heavy' at times, it nonetheless showed low distortion and high detail.

Good clarity and detail were evident everywhere, except in the lower mid where some cabinet 'boxiness' and 'muddiness' were observed. The *SA2* also suffered from this phenomenon though this time the result was an over-rich and almost chesty effect, and in this respect the *Prelude* was ultimately preferred to the *SA2*.

Both gave fine stereo images with good staging and focus, plus impressive depth. Mild sibilance as well as a little 'slurring' was however observed in the treble.

LAB REPORT

At 1 metre an above average 88dB/W sensitivity was recorded, and the bass was perfectly tuned to rolloff at 48Hz, −6dB. With a fine 200W maximum power handling a stereo pair is capable of a substantial 105dBA sound level in a room. Pair matching was very good.

At 2 metres the design demonstrated a very even, well-integrated forward characteristic, the overall trend being that of a gentle downtilt with increasing frequency. Limits of ±3dB were comfortably met from 55Hz to 20kHz.

Bass in the listening-room computer-averaged response was slightly uneven, and mildly prominent at 50Hz. The mid was broadly uniform, with a slight presence dip evident before the treble rolled gently away.

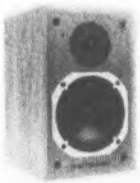
Driven to a 96dB sound level, fine distortion results were demonstrated, averaging 1% at low frequencies and reducing to 0.3% above 500Hz. At 86dB the distortion improved considerably. Averaging 13ohms, the impedance fell to a minimum of 6.7ohms in the treble, so the system may be classed as an easy amplifier load.

CONCLUSIONS

Good sensitivity, a smooth natural sound and fine stereo, have all been confirmed in recent (1986) auditioning. The extremely attractive price ensures that the *Prelude* merits a Best Buy rating.

Reassessed. First reviewed 1983. Current typical price £270.

General Data — see pages 180-184.



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HBS1 Loudspeaker stand of the year. **Federation of British Audio Awards 1984.**

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SPENDOR SP1

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While the *SP1* is built in the classic *BC1* tradition, it uses a new grade of polypropylene exclusive to Spendor for the bass/mid unit. It is built on a die-cast chassis and energised by a massive magnet assembly. The cone is doped by hand, and has its front pole cavity filled by an alloy plug attached to the pole face.

Spendor's traditional radiometal-cored inductors and plastic-film capacitors are used for the high-quality crossover. Above 3kHz Spendor's own carefully selected version of the Celestion HF1300 dome tweeter takes over, and the final half-octave is filled in by the Coles 19mm plastic dome unit.

The excellently veneered 44 litre enclosure is built of thinwall multiply, heavily bitumen damped and lined with acoustic foam. The system is reflex-tuned by a large, offset ducted port, and is intended for free space mounting on open stands.

SOUND QUALITY

The *SP1* did well on the *Choice* test programme, providing favourable results on analogue material and even better scores using digital masters. The balance was tonally accurate with very good reproduction of human voice, showing natural sibilants and character. The frequency response sounded wide and uniform, with good extension, albeit with a slight excess in output at the lowest frequencies.

Mid coloration was generally low, the treble 'sweet' and clear, and stereo perspectives well constructed. Frontal focus, width and depth were all well presented. High sound levels were possible with low apparent distortion. While some mild lower-mid 'plumminess' was observed, plus a touch of 'BBC nasality' this was not considered to be very important.

LAB REPORT

Measured at 1 metre on axis, the *SP1* delivered a smooth response except for a small 3.5kHz peak (improved on later production speakers). The bass was precisely tuned and well extended to 41Hz, −6dB. Sensitivity measured 87dB/W, about average and more than double that of the *BC1* (in decibel terms, an increase of more than 3dB). Pair matching was very close. The recommended power input range is 12-150W, and maximum levels of up to 103dB were possible, again rather higher than for the *BC1*.

The averaged response at 2 metres was very uniform, meeting ±2dB limits for 60Hz to 13kHz. The vertical dispersion was very satisfactory, and laterally was rather better than average. The integrated response in the listening room was very good indeed, only marred by the slight bass excess noted previously.

Fine distortion results were obtained at 96dB sound pressure level, measuring around 0.3% above 200Hz and holding to around 3% at lower frequencies. With the sound level reduced to 86dB, a substantial improvement to 0.8% or better was recorded at low frequencies, with negligible midrange second harmonic and an average of 0.2% third. These are fine results. The impedance curve averaged 14ohms, with a momentary and pretty harmless dip to 5.3ohms at 20kHz, so the *SP1* is therefore classed as a very good amplifier load.

CONCLUSIONS

The *SP1* has evolved into a subtle and musical sounding performer in the true Spendor tradition. It is expensive, but the good test results go quite some way towards justifying the price.

The *SP1* receives a warm recommendation and will probably slowly displace the *BC1* from its time-honoured position, especially where master-quality programme reproduction is concerned.

Reassessed. First reviewed 1983. Current typical price £600.

General Data — see pages 180-184.

RECOMMENDED

SPENDOR SP2

SPENDOR AUDIO SYSTEMS LTD, UNIT 47, STATION ROAD INDUSTRIAL ESTATE, HAILSHAM, SUSSEX BN27 2ER. TEL: (0323) 843474

With the original *BC1* and its virtual successor the *SP1* well established, Spendor has been researching a less expensive 30 litre alternative for a few years now. The *SA2* came first, to some degree then eclipsed by the superior and cheaper *Prelude*. Now, developed from the *SP1* and sharing that fine model's 200mm polypropylene coned bass-mid unit, we have the *SP2*. The treble is handled by a special version of the established Scan *D2008* tweeter, a 19mm soft dome offering a superior performance, and in this case, ferro-fluid damped. Optimum positioning is in free space, on 40-50cm high stands.

The finely veneered enclosure is critically balanced by an optimum choice of chipboard grade and thickness, the panels bitumen damped internally. This is a reflex loaded design, tuned to 33Hz, and the ducted port is internally damped by a foam lining absorbing the higher resonant modes in the duct.

SOUND QUALITY

On test the *SP2* achieved a very high ranking position, only a little behind that of the *SP1*.

Stereo images were well focused, and showed very good width and depth. Well balanced tonally, the response sounded very uniform, though with a touch of 'softness' in the low bass despite good extension. In the upper mid, a hint of 'hardness' was noted, plus slight 'wispiness' in the high treble.

In the Spendor tradition, the *SP2* offered a highly articulate, detailed midrange. Dynamics were presented well, the system sounding open and relatively uncoloured. Just a touch of 'boxiness' was present in the low midrange, but even this was much less than usual.

LAB REPORT

Reference sensitivity was about average at 87dB while the axial frequency response showed a highly uniform characteristic, ±2.5dB 50Hz to 15kHz. The bass was well extended, reaching 45Hz, −6dB.

A minimum power rating of 15W was indicated, while the *SP2* coped with up to 150W peak programme, generating decent sound levels of 104dBA from a pair in a typical room. The impedance curve showed an easy load.

At 2 metres, the ±3dB response was a wide 48Hz to 20kHz, with the set of forward responses showing quite excellent uniformity. The slightly down-tilted response is typical of subjectively well balanced compact box systems. In the listening room the speaker showed an even, well balanced characteristic with good power down to 30Hz. Integration was very good through the frequency range.

At the high 96dB sound level, the distortion above 150Hz held to a moderate 0.4%, bar some minor clutter above 100Hz. With level reduced to 86dB, third harmonic averaged 0.25%, second 0.1%, both fine results.

CONCLUSIONS

Spendor now have their compact 30 litre monitor. Offering great consistency and accuracy, it slots in neatly below the *SP1*, conceding little to that respected, larger model. With its natural, extended response, low coloration, wide dynamic range, easy amplifier loading and very fine stereo, the *SP2* is a class winner and may be strongly recommended.

Reassessed. First reviewed 1985. Current typical price £390.

General Data — see pages 180-184.

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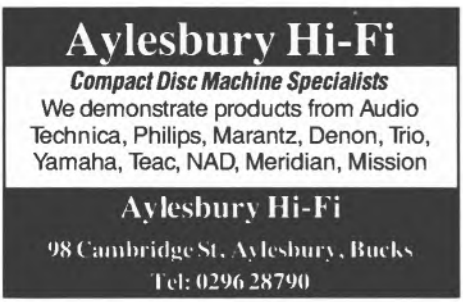
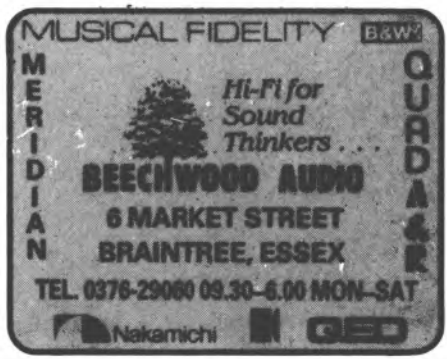
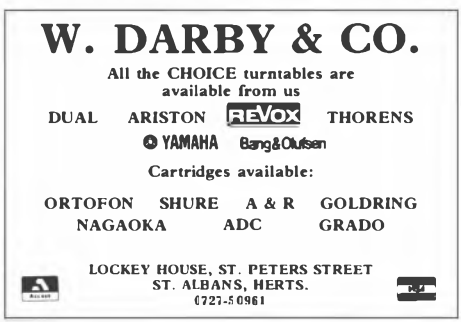
DEALER GUIDE







RECOMMENDED

TANNOY TITAN

TANNOY LTD, THE BILTON CENTRE, CORONATION ROAD, CRESSEX INDUSTRIAL ESTATE, HIGH WYCOMBE, BUCKS. TEL: (0494) 450606

An early *Titan* turned up rather late for the 1984 edition of *Loudspeakers*, and proved somewhat unpromising. However, since then it has been improved and was resubmitted in 1985 in full production form.

Built a little like the Mission *70*, the *Titan* uses rear mounting for its two drivers, with a fixed front grille; access is *via* the flimsy screwed-in rear panel. The sealed-box interior of 9.3 litres is damped by a loose fill of polyester fibre wadding.

The drive units originate from Japan, and include a soft dome treble, plus a 160mm steel frame bass/mid unit, the latter having a light pulp cone. In one sample the tweeter fixings were loose. The crossover has three elements plus a damping resistor and is aiming at 12dB/octave acoustic slopes. Push-on connectors are used, while the rear terminals are 4mm socket/binding posts.

Vinyl covered, the 15mm thick chipboard enclosure is grooved on the long sides to reduce panel resonance. Optimum placement is near a rear wall and the angled front means that this speaker may be left neatly in the 'straight ahead' position.

SOUND QUALITY

Scoring a straight average with little panel dissension, the *Titan* did well for its price group. The sound was described as somewhat 'boxy' with a 'forward' upper midrange plus a 'bright', moderately 'ragged' top end. On the plus side the speaker also showed a clear, open character with explicit detail, and a 'lively' nature. Low bass was absent, but upper bass was fairly 'quick' and clean.

LAB REPORT

A rising response trend was characteristic of the *Titan*, though this was not extreme at 4dB from 100Hz to 20kHz, a result expected from a design intended for wall mounting.

Pure sensitivity came out at 89dB/W, above average and uncompromised by the impedance characteristic; this happily met the 8ohm standard, so the *Titan* is rated as a very good amplifier load. System resonance was rather high at 90Hz, and from the axial response (nearfield converted at low frequencies) the −6dB bass rolloff was fairly high at 67Hz. With a power input range of 10 to a maximum of 50 watts, realistic maximum sound levels of up to 102dBA can be achieved.

Out at 2 metres this loudspeaker's forward response balance, seen in the pattern of the off-axis responses, looked well integrated with good uniformity. Pair matching was fairly good, though in the 3-4kHz crossover range up to 2dB difference was noted.

When driven to 96dB sound level, distortion was poorer than average, reaching 3% in the lower frequency range for (relatively innocuous) second harmonic. Third harmonic was variable with frequency, up to 0.8% in the midband. Reduced to a moderate 86dB sound level, third harmonic remained the same, while second showed a considerable reduction.

In the listening room the *Titan* gave a forward upper mid with some treble uneveness but a fair overall balance. The bass was smooth and well integrated even if it did decay gently in the lower range.

CONCLUSIONS

Apart from the loose tweeter on our sample, the *Titan* did quite well on both lab and listening tests, confirming its suitability for shelf mounting. It sounded much better than our early examples, and is now recommended.

Reassessed. First reviewed 1985. Current typical price £100.

General Data — see pages 180-184.

BEST BUY

TANNOY MERCURY II

TANNOY PRODUCTS LTD, THE BILTON CENTRE, CORONATION ROAD, CRESSEX IND ESTATE, HIGH WYCOMBE, BUCKS. TEL: (0494) 450606

Tannoy have enjoyed a very successful run with the *Mercury* and over the past year or so have produced an upmarket derivative called the *M20 Gold*. 1986 sees the introduction of a new *Mercury*, incorporating significant design stages. The cabinet has been reshaped and is now taller, while the Audax soft dome tweeter has been replaced by a Tannoy soft plastic dome design. The polypropylene-coned bass unit has undergone continued development, while other changes relate to the low frequency tuning and the crossover network. Essentially, this may be regarded as a new loudspeaker.

The new *Mercury II* is a compact two-way model with a 20 litre internal volume, reflex-tuned at low frequencies by a 50mm front port, 105mm long. The bass unit is energised by a generous magnet and has a 155mm flared cone on a 235mm pressed steel frame, whose central area has been reinforced to prevent flexure. Mounted on a specially cast asymmetric plate, the tweeter employs a 25mm polyamide dome. The high quality crossover is built for simplicity and clarity and designed to 12dB/octave slopes with good quality components. Though the crossover is hardwired, spring clips are used to connect the drivers. Connection to the system is by 4mm socket/binding posts.

Built mainly from vinyl walnut 14mm chipboard stock, the enclosure includes a circumferential brace between the two drivers, and a lining of acoustic fibre. On our sample the grille was unrebated, and for critical listening is better left off. Ideal placement is in free space, on open stands around 35-45cm high.

SOUND QUALITY

The *Mercury II* scored well in the listening tests, substantially beyond its price expectations and virtually repeating the success of the original *Mercury* in its day. The sound was well balanced, uniform, and well integrated. Coloration was moderate and generally well disguised; some mild 'boxiness' and 'thickening' on piano was noted, plus a touch of 'grain' and 'edge' in the treble.

The bass was very competant, showing fair extension and good control. Stereo images were well focused with a fair measure of depth and transparency. While no significant aberrations were detected in the subjective frequency response, a couple of panelists felt that this speaker was mildly 'soft' and undynamic, though their scoring did not appear unduly affected by this. Driven by clean source material, the *Mercury II* performed equally well on rock and classical sources, both CD and analogue.

LAB REPORT

A good sensitivity of 88 dB/W was easily established from the smooth axial response at 1 metre. The bass was quite well extended to 55Hz, −6dB, but the sensitivity was somewhat

compromised by the dip in load impedance at high frequencies, to 3.8ohms over a short stretch around 6kHz; elsewhere the impedance averaged an easy 8ohms. A 10 watt minimum amplifier power is suggested, while the speaker performed ably on inputs up to 150W, permitting peak sound levels of up to 103dBA.

The forward responses measured at 2 metres looked very tidy, with excellent integration seen in the forward axes. Frequency response limits of ±3dB were easily met from 55Hz to 20kHz. Some distortion rise was noticed around 200Hz, to 3% second harmonic at 96dB for example, with a similar anomaly on the third harmonic. Tuned to 40Hz, the system handled low frequency power well, only showing more serious distortion at high powers and below 30Hz.

The *Mercury* proved to be as well balanced as it sounded on the computer-averaged room measurement, right down to 30Hz in the bass. A mild prominence was evident at 1kHz, but otherwise the curve was most presentable.

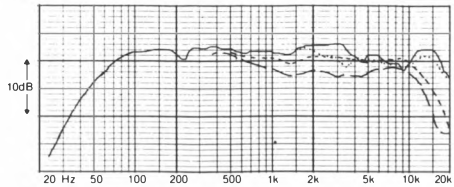
Conclusions

The original *Mercury* was notably well balanced, providing competant all round performance with a sensible blend of modern loudspeaker engineering. The new *Mercury* is even better balanced, has better response uniformity and lower distortion, while the price is barely greater than when the speaker was first introduced in real terms. This genuine allrounder represents an exceptionally accurate free-space system for the money, and merits a Best Buy classification.

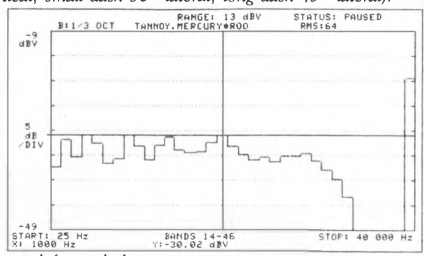
Note: The author provided a private opinion on an earlier version of this model for the manufacturer.

General Data

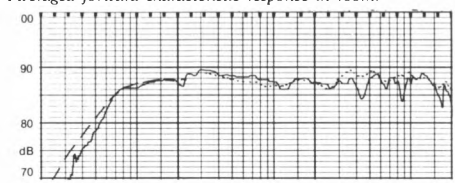
Size (height × width × depth)	50×25×23.5cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(10) –150W
Recommended placement	open stands, 45cm
Frequency response, within ±3dB, at 2 metres	55Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	55Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 metre)	88dB/W
Approximate maximum sound level (pair) at 2 metres	103dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	excellent
Typical price per pair, inc VAT	£150



Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



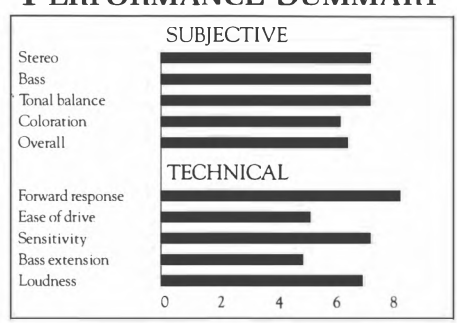
Averaged forward characteristic response in room.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.

Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

TANNOY VENUS

TANNOY PRODUCTS LTD, THE BILTON CENTRE, CORONATION ROAD, CRESSEX IND ESTATE, HIGH WYCOMBE, BUCKS. TEL: (0494) 450606

Tannoy's *Mercury* is an established 'Best Buy' speaker; in a higher price and quality category, the *Venus* is somewhat larger, with an internal volume of around 30 litres as against the *Mercury*'s 19 litres, and comes in a real walnut veneer finish. It has a substantial 6cm diameter and 6cm deep port, reflex tuning the enclosure to 48Hz.

Both drivers are made by Tannoy and comprise a 25mm plastic dome tweeter with a 210mm bass/midrange, the latter with a generous magnet, a steel frame and a critically flared polypropylene cone.

The sturdy enclosure is built of 19mm chipboard, bitumen damped and with interior absorbent. The drive units are 'time aligned', in that the treble signal passes through a time delay network to synchronise it with the midrange, while the crossover is a basic 12dB/octave type; including the time delay network, a total of 16 elements are employed. The 9mm thick grille panel is unrebated and is probably best left off to get the best results.

SOUND QUALITY

Scoring a substantial 'good plus' the *Venus* has done well on audition. It was felt to be well balanced, with an extended wide range response and a touch of bass excess. Coloration was comparatively low, while the sound was considered both 'open' and 'sweet'. A touch of 'grain' was occasionally noted in the treble.

The stereo imaging was fine, the speaker demonstrating good perspectives with fine depth and ambience as well as good focus and stage width. Coloration was comparatively low, with just a touch of 'plastic cone' and some mid 'boxiness'. It handled high sound levels well, surviving a respectable 300W peak programme and still sounding civilised and well controlled.

LAB REPORT

This speaker demonstrated an average sensitivity of 86.5dB/W. Low frequency rolloff was at 47Hz, good for the size and price, while pair matching was also good, with an absolute difference of just 1dB overall. The axial response was quite smooth, and better still with the grille detached. A mildly downtilted response was indicated, the overall trend meeting ±2.5dB limits from 50Hz to 20kHz, grille detached.

With 200W power handling capacity, maximum sound levels of 104dB should be possible from a stereo pair, particularly as the impedance does not fall below 6.4ohms, allowing an 8ohm rating for this well balanced design. Driven to 96dB, distortion was higher than expected, though mainly innocuous second harmonic. At a reduced 86dB level, it improved to a 'satisfactory' level.

Out at 2 metres, the off-axis response showed excellent integration, with the benefits of time alignment fully realised. This was as perfect a medium-sized two-way speaker as I have seen.

CONCLUSIONS

Smooth and sweet was the panel's impression of this well finished and carefully built loudspeaker. It does most things pretty well and is also easy to live with. Its subtlety and good stereo pleased the panel, whose scores suggested a firm recommendation.

Reassessed. First reviewed 1985. Current typical price £270.

General Data — see pages 180-184.

TECHNICS SBC 250EK

PANASONIC (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS SL1 6JB.
TEL: SLOUGH 34522

This modest system represents a major consumer electronics manufacturer's attempt to achieve some measure of respectability in a moderately priced loudspeaker, potentially suitable for accompanying those rack or stack audio systems which are often partnered by appalling 'orange box' speakers. This trim sealed-box two-way system has in internal volume of 10.6 litres. The 180mm steel-framed low resonance bass unit gives a system resonance at 73Hz, the 140mm diaphragm made of graphite reinforced polypropylene. A large centre dome suggests an oversize motor coil, though in fact the construction is rather more complex, involving a short pulp cone behind the centre dome which acts as a rigid coupling to a normal-sized motor coil. The result is none too stable, so Technics have resorted to a double suspension, one at each extremity of the inner 'sub cone'.

The treble range above 3kHz is handled by a 25mm soft fabric dome. Designed to 12dB/octave slopes, the crossover is of normal commercial quality with a medium power handling capacity; electrical connection is made *via* spring clip terminals. The enclosure is well finished in a grained 'walnut' vinyl, is constructed in 15mm chipboard, and the front baffle has been rounded to reduce diffraction. No bracing is fitted, and internal absorption is accomplished by a single piece of thick felt. The grille profile is sufficiently small to provide reasonably good distribution. The loudspeaker has been balanced to classical tastes, and will suit free space mounting.

SOUND QUALITY

The *SBC 250* scored below average in the listening tests, but this is not an unreasonable result considering the well below average price. Stereo focus was satisfactory, but the speaker failed to reproduce much depth; indeed the mid register was muddled, with a loss of fine musical detail.

The tonal balance was fair enough and attracted little comment. However, the sound suffered from moderate levels of coloration, seemingly distributed over large sections of the frequency range, including the treble, which was described as a touch 'spikey' and 'grainy'. The sound was bland and excessively moderated, lacking real dynamics or 'punch'. The bass was ordinary in quality, but with surprisingly fair extension to lower frequencies.

LAB REPORT

A below average 86dB/W sensitivity was recorded, with modest bass extension to 60Hz, −6dB. However, the bass rolloff was well damped, and fair energy was still available to well below this frequency.

Examining the room curve proved interesting. Relative to the mean midband power, the bass was level at 25Hz (not at great powers), and actually up somewhat at 30Hz. The output was then more restricted up to 100Hz, above which it rose gently through the midrange. A drop in energy occurred beyond 1.2kHz, followed by treble range recovery; the clearly non-uniform rolloff in the treble indicates lumps in the upper

treble energy characteristic.

It would be quite hard to predict such a room characteristic from the axial reference response taken at 1 metre, except for the obviously ragged treble above 6kHz. Some of the visible aberrations were due to the grille, the smoother dotted line response showed the effect of its removal. The '250 gave a 70Hz to 20kHz response range within the usual ±3dB limits at 2 metres, and the set of off-axis curves looked generally promising, indicating a good level of uniformity and integration.

Rated poorer than average with respect to amplifier loading the impedance dipped to almost 4ohms in the main music power range, 150 to 400Hz. Comfortable on a 12-15 watt minimum input, a safe maximum of 50 watts per channel would generate satisfactory 99dBA peak sound levels. The oddly designed bass/mid unit generated considerable distortion, typically 1% to 3% at 86 and 96dB.

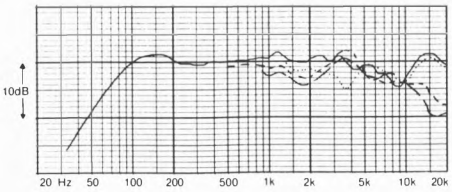
Conclusions

While the tonal balance was essentially OK, the rest was not. The panel found this speaker lacking in transparency, and were also not too keen on the treble either. In the lab it showed some good qualities, but the harmonic distortion was too high for comfort and might account for some of the midband 'muddle'. However, it was relatively inexpensive, and could be worth considering for some packages, though it did not attain sufficient to merit *Choice* recommendation.

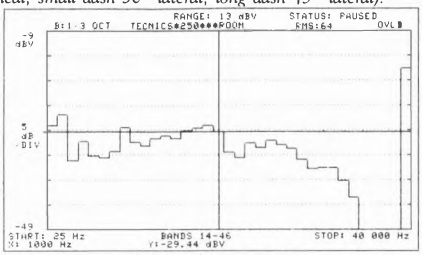
Note: The author assessed an earlier prototype sample for Technics.

General Data

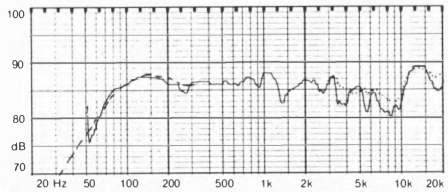
Size (height × width × depth)	36.5 × 23.5 × 20.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(12) −50W
Recommended placement	free space on stands 45cm
Frequency response, within ±3dB, at 2 metres	70Hz to 20kHz
Low frequency rolloff (−6dB point) at 1 metre	60Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	86dB/W
Approximate maximum sound level (pair) at 2 metres	99dBA
Impedance characteristic (ease of drive)	average−
Forward response uniformity	good
Typical price per pair, inc VAT	£130



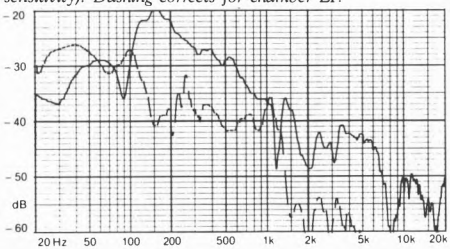
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

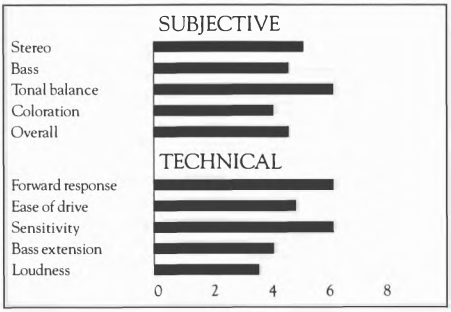


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



RECOMMENDED

TECHNICS RX50EK

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

This unusual loudspeaker sells for close on £500. Essentially a compact two-way system, the lineup is a 230mm bass/mid unit and a 25mm tweeter, in a bass reflex-loaded 23 litre box. The latter is not even finished in real wood — instead a well figured and coloured 'walnut' vinyl print is employed.

So just what is so special about this speaker, and where has the money gone? The key is its unique coaxial drive unit. Arranged to form a single unified plane, the central part consists of a flush-mounted 25mm planar piston tweeter, and this is surrounded by a larger, annular (ring-shaped) bass/midrange diaphragm, a flat, high strength, carbon-fibre-reinforced piston of 180mm effective radiating area, equivalent to a largish 8-inch driver. Both diaphragms use honeycomb cores, and the tweeter has an external laminate in mica — a natural material of exceptional tensile strength. Flush-mounted into an enclosure which is finished with radiused edges, a fine cabinet diffraction performance is virtually assured. Furthermore the drivers are naturally time-aligned, both on- and off-axis, so a simple crossover should give excellent driver integration and a superb set of axial and off-axis responses.

The system is tuned to a low 28Hz by a small 40mm port with a long 135mm alloy duct, mounted on the rear panel. Essentially to 12dB/octave slopes, the crossover uses good quality components, including polypropylene capacitors to the tweeter. The rigid enclosure is mainly of 25mm stock, reinforced by a circumferential brace.

SOUND QUALITY

Achieving good scores on the listening tests, the *RX50* (in its UK form) sounded well balanced with a fine standard of tonal accuracy. The bass range was generally good with fine articulation and dynamics, though occasionally some overhang could be heard in the low bass. Mid clarity was to a good standard, while the treble quality was in a still higher class — even, open, and extended. The sound was articulate and transparent, reading both depth and the recorded acoustic well.

Stereo images were well focused and proved stable over a wider than usual listening area. The sound was well integrated, and separate driver 'signatures' were not apparent. Lacking any forced 'forwardness', the relaxed subtlety of this speaker quietly impressed.

LAB REPORT

The sensitivity was a slightly below average 86dB/W, and was also compromised to some degree by a poorer than average load impedance, dipping to a 4ohm minimum at 200Hz. The response on axis at 1 metre was generally very smooth, and showed a stepped alignment in the bass. Extension was down to a low 40Hz, −6dB, but the room curve indicates that this was achieved at the expense of an excess of power at 30Hz.

We suggest a minimum amplifier power of 15 watts, while the relatively low distortion will allow peak inputs of up to 150W, with the

system attaining maximum sound levels of 103dBA for a stereo pair in a typical room. The room generated response shows a relatively uniform and well balanced output, a touch 'mid forward', but not sufficient to spoil the result. The system demonstrated an excellent set of off-axis responses at 2 metres: the 15° vertical (or lateral, as the system is symmetric) response was perfectly placed with respect to the axial result, and the remaining curves corresponded almost exactly to the theoretical dictates of source geometry.

The uniform acoustic output was held within close ±1.5dB limits over a 66Hz to 20kHz span; equally important, this general quality was maintained over a wide range of forward axes. The distortion results were better than average — in particular the third harmonic levels were low at typically 0.3% at 96dB, and 0.1% at 86dB pressure levels. At 96dB the system was clearly still in full control.

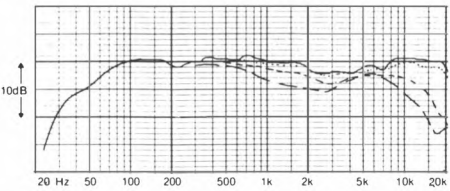
Conclusions

Said to have been balanced for the UK market, the results of our auditioning tend to bear this out. The *RX50* is a smooth well balanced performer, its minor weakness being a mild excess in the low bass — perhaps a touch of port damping would help? Low in distortion with fine engineering and finish, this model did well compared with classical standards, and the overall level of attainment indicates a recommendation.

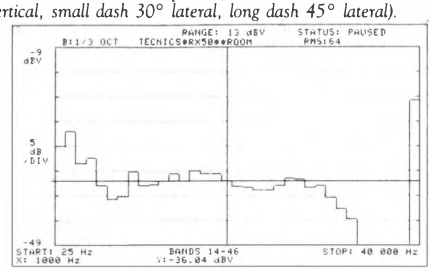
Note: The author was privately commissioned to give an opinion on an early prototype version of this model.

General Data

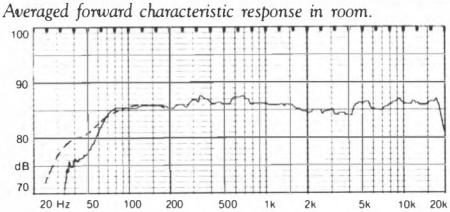
Size (height×width×depth)	48×30×26cm
Recommended amplifier power per channel	
(for 96dBA minimum per pair at 2 metres)	(15) –150W
Recommended placement	40cm stand, free space
Frequency response, within ±3dB, at 2 metres	45Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	40Hz
Voltage sensitivity	
(ref. 2.83V, or 1W into 8ohms at 1 metre)	86dB/W
Approximate maximum sound level (pair) at 2 metres	103dBA
Impedance characteristic (ease of drive)	average–
Forward response uniformity	excellent
Typical price per pair, inc VAT	£500



Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



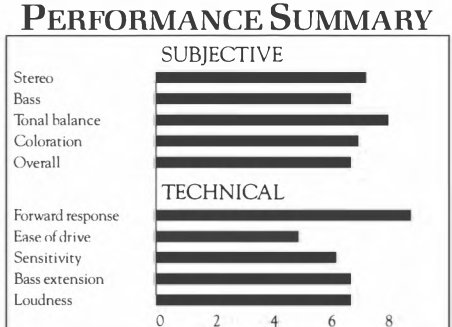
Averaged forward characteristic response in room.



Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.

Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



BEST BUY

TOSHIBA SS 33 MK II

TOSHIBA (UK) LTD, TOSHIBA HOUSE, FRIMLEY ROAD, CAMBERLEY, SURREY.
TEL: (0276) 62222

The original successful *SS 33* has undergone some refinement for 1986, with a slightly smaller and less resonant enclosure and revised performance in the crossover region. Our retesting has been confined to the listening sessions and the reference response, whose results are incorporated in the text.

Toshiba's British-designed *'33* is built and tested at the UK cabinet factory responsible for the enclosure, which makes for a useful saving in transport costs as well as one less mark-up to be taken into consideration.

A moderate sized 22 litre sealed box, the plain, 15mm thick chipboard enclosure is well finished on all frontal surfaces in a 'rosewood' vinyl. The grille baffle is 15mm thick, unrebated and is best left detached for more serious listening. Large enough for stand mounting, it suits a free space position in the room, not too close to the rear wall.

The 200mm steel-framed Elac bass-mid drive unit has a nicely flared, doped pulp cone. Treble is handled by a Tonegen 25mm soft dome with the crossover essentially to a third order 18dB/octave alignment. Connection is *via* spring clips and internal wiring uses push-on connectors. The cabinet panels are undamped while the interior has a loose lay of fibre wadding for internal standing wave absorption.

SOUND QUALITY

The original *'33* scored 'above average', which is excellent for the price. The midband was essentially good with quite good balance and above average detail. The same was true of the stereo depth effect and focus. The overall effect was quite well balanced though with a distant upper mid. By contrast, the bass was a bit slow and lacked dynamics, while the treble showed some isolated 'hiss', and was not perfectly integrated with the rest.

Some colorations were present, notably a 'boxy' 'thickening' in the low mid, but this was not too serious.

However, the 1986 version showed a distinct improvement in coloration, and the sound was more 'open', fully maintaining the fine value of the original.

LAB REPORT

Measured at the reference 1 metre on the median axis, the *'33* demonstrated an average 86db/W sensitivity. This was not compromised by the impedance, which rated as a very good amplifier load, and conformed to an 8ohm characteristic, the loading never falling below 6.2ohms.

System resonance was at 73Hz, typical for the type, while the bass response extended to a low 49Hz, −6dB. From a 15 watt programme minimum power input, this model proved quite happy up to 75 watts peak programme, and was capable of maximum sound levels of 100dBA.

A new reference response taken for 1986 showed a distinct improvement over the original. The broad sucked out mid region is almost filled, so the treble is no longer exposed. The crossover region shows better integration having a 4dB dip around 3kHz.

At 96dB sound level the distortion was satisfactory at low frequencies and improved above 200Hz, here averaging 0.3 — 0.4%. By 86dB, good distortion levels were established throughout the range.

CONCLUSIONS

This is a lot of speaker for the money. With a classic 'UK sound', the *'33* sits very comfortably in a highly competitive field and, in its latest guise fully maintains this competitiveness. Its performance was nicely balanced on both listening and lab tests, and offers Best Buy value for money.

Re-auditioned. First reviewed 1985. Current typical price £80.

General Data — see pages 180-184.

WHARFEDALE DIAMOND II

RECOMMENDED

WHARFEDALE LOUDSPEAKERS LTD, SANDLEAS WAY, CROSSGATES, LEEDS LS15 8AL.
TEL: (0532) 601222

The tiny Diamond has a 5.2 litre enclosure, reflex-loaded by an equally small ducted port 30mm in diameter by 65cm long, positioned on the rear panel. The bass alignment is in fact 5th order since a large series capacitor is also used.

The 120mm bass unit is built on a steel frame, with treble allocated to the 19mm Son Audax plastic dome/cone tweeter. The crossover is very simple, comprising just two elements plus an attenuating resistor for the treble.

Built from plain 12mm thick chipboard, vinyl coated, the cabinet has a 12mm thick unrebated grille, and spring clip terminals are provided on the rear panel for electrical connection.

SOUND QUALITY

For the price the *Diamond* did reasonably well, but its absolute rating on the listening tests was not too promising, with a well below average score. The panel results were confusing, some listeners liking this speaker fairly well while others considered it to be too weak for serious attention.

Almost all the panel recognised it as a small box, and it was criticised for 'boxy' coloration as well as a 'thinned' midrange, and an uneven treble which tended to emphasise background hiss. The bass was soft and weak though reasonably balanced and extended — in fact rather more so than one might expect. Positioned close to the wall it managed to produce a fairly big sound though depth effects were fairly muted. Left to right imaging was fairly good.

Some merit definitely lurked within, and once one had become accustomed to the sound, it began to make its own impression, which was quite respectable for the size and price.

LAB REPORT

Pair matching was fine to 2kHz, but poor thereafter with up to 4dB of mismatch. This could well account for the just passable stereo focus. Reference sensitivity averaged 86dBW taking into account normal wall mounting. The bass −6dB point was rather high at 74Hz.

Re-tested for 1986, the 1 metre axial reference response showed close similarity to the 1985 result, albeit with some improved smoothness and less prominence of the treble region. The 'grille-off' response showed that this optional item is best removed.

Out at 2 metres, these effects are smoothed out by the averaging, but the 'lumpy' quality remains. The 100Hz to 20kHz range required ±4dB limits, although the family of forward responses were quite good.

Driven to 96dB sound level, the distortion was unacceptable; typically 3% of second harmonic and 1% of third. At the reduced 86dB level, a moderate improvement occurred, though the third harmonic still did not improve much in the midrange. It survived the compression tests with a poor 3.5dB of loss and −19dB for the intermodulation product.

The impedance curve did not fall below 6ohms, and the *Diamond* can be regarded as a safe 8ohm type amplifier load. Out in the room the averaged forward response clearly showed the speaker for what it was, a seriously midrange-forward design. Bookcase mounting will help but will not entirely solve this aberration.

CONCLUSIONS

An interesting and inexpensive miniature, as originally tested the *Diamond* appealed to some panelists, but others were unable to get on with it. In the context of 1986 standards it is felt that a Recommended rating, noting the somewhat idiosyncratic nature of this loudspeaker, is appropriate.

Note: Wharfedale are planning a so-called 'active' Diamond with stereo power amplifiers to sell for a competitive £100, which should prove a popular add-on for use with personal stereos and television sets.

Reassessed. First reviewed 1984. Current typical price £85.

General Data — see pages 180-184.

RECOMMENDED

WHARFEDALE 504

WHARFEDALE LOUDSPEAKERS, SANDLEAS WAY, CROSS GATES, LEEDS LS15 8AL.
TEL: (0532) 601222

The success of the diminutive *Diamond* first led Wharfedale to produce a *MkII* model, and thence to create an up-market version, the 504, whose top performance is enhanced by Wharfedale's 19mm pure piston aluminium dome tweeter. This true miniature is just 29cm high with an enclosed volume of only 6 litres. Surprisingly for such a small box, it uses bass reflex loading, the small 30mm diameter rear panel port with 65mm duct tuning the system to a high 70Hz.

The bass/mid driver uses a flared-profile 90mm polypropylene cone in a 130mm housing which uses a new cabinet locking system. The two-way system has a minimal crossover of normal commercial quality, aimed to provide maximum musical transparency; essentially to 6dB/octave, the slopes are finally modified by the natural acoustic responses of the drive units. Electrical connection to the amplifier is made *via* 4mm combination socket/binding posts.

The 12mm chipboard enclosure is braced using the recessed back panel technique, with polyester fibre internal absorption, the 9mm grille has a half-rounded rebate on the inside edge. The bass unit is mounted above the tweeter, so that the drivers are brought partly into time-alignment with a normal stand (40-50cm); the 504 could be inverted if used on higher stands (60-80cm). Designed for placement almost touching a rear wall, up to 3dB of boundary lift will augment the measured response in the 80 to 700Hz range.

SOUND QUALITY

Despite wall mounting, the 504 made a good impression for its price and size, with a rating almost at the average position. While deep bass was absent it fooled several panelists by managing to give the impression of a much larger system. Stereo images showed good width with reasonable depth, while the treble was free from 'edge' or 'grain'. Focus was rated above average, with more than satisfactory mid detail, obtained at the expense of some 'forwardness'. Transients were clean and dynamic contrasts fair.

LAB REPORT

The sensitivity was a below average 85dB/W. The 'good' load impedance was typically 8ohms, falling to nearer 5ohms at 10kHz which should be pretty harmless. A minimum 15 watts per channel will be required, while the 504 proved fairly comfortable with up to 50W of music programme, resulting in a moderate peak sound level of 98dBA, for a stereo pair in-room. The bass rolloff was 75Hz, −6dB, with an internal series capacitor tuning the system to a fifth-order damped alignment.

The reference response was unpromisingly 'lumpy', broadly lifted in the upper midrange and poorly integrated with the treble, the latter peaking at 6-7kHz before falling away to a lower level in the range 8-20kHz. Despite the rela-

tively simple crossover, the family of forward responses was encouraging, the small enclosure helping to produce wide dispersion in the lateral plane. The 6kHz axial peak is revealed as a crossover problem, notably ameliorated above axis. Once installed, some experiment with system tilt may be worthwhile to achieve the best sound. The output was plotted without wall gain in the listening room, and this would amount to a lift of a few dB up to 600Hz for such a small system, which would help to fill in the lower mid and upper bass ranges though not to the degree necessary to flatten the room characteristic completely. The bass held up quite well down to 50Hz and was not confined to a single note. Above the mid region the treble was reasonably integrated, tending to a 'rich' balance and helping to give the impression of a larger model. Considering the small size, the swept distortion results were quite good; at 86dB third harmonic averaged 0.2%.

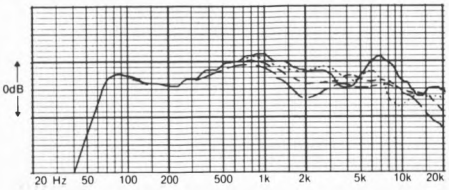
Conclusions

Wall-mounted this system gave a good account of itself, almost unbelievably unobstrusive and producing a clear, reasonably balanced sound with above average treble. The distortion was quite satisfactory and both the stereo and bass performance were better than expected. The value for money is quite good, so the 504 qualifies for recommendation, particularly for those seeking an up-to-date sound in a very compact package.

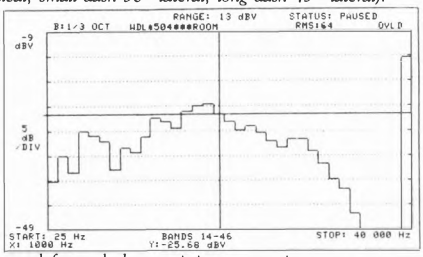
General Data

Size (height × width × depth)	21 × 18.5 × 20cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(15) – 50W
Recommended placement	60cm stand, near wall
Frequency response, within ±3dB, at 2 metres	70Hz to 12kHz*
Low frequency rolloff (−6dB point) at 1 metre	75Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	85dB/W
Approximate maximum sound level (pair) at 2 metres	98dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	good
Typical price per pair, inc VAT	£120

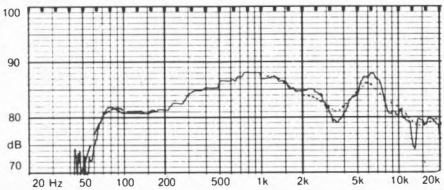
* *see text*



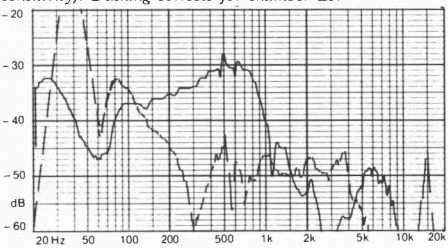
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

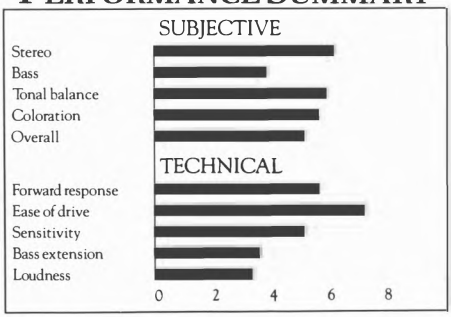


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



WHARFEDALE 507

WHARFEDALE LOUDSPEADERS, SANDLEAS WAY, CROSSGATES, LEEDS LS15 8AL.
TEL: (0532) 601222

This new compact loudspeaker has an internal volume of some 23 litres, and makes an interesting comparison with the 508, its near equivalent in the Wharfedale range reviewed last year. The latter was a medium sensitivity sealed-box of classical frequency balance, tending to a rich laid-back frequency response. The 507 has gone in the other direction, heading for maximum sensitivity with a 'forward' mid balance augmented by bass reflex loading to restore some of the balance. The rear mounted port is a generously sized 70mm in diameter by 200mm deep, tuning the system to 40Hz in a deliberately overdamped bass alignment. Whereas the 508 was best suited to a free space location, the 507 benefits from some proximity to the room walls, and 0.1-0.5m spacing was considered a good starting point.

The 507 bass unit has the new self-locking die-cast frame, 215mm in diameter, and is fitted with a flared polypropylene cone 160mm in effective diameter. The tweeter is Wharfedale's own and by now well established 19mm ferrofluid-cooled aluminium dome, operating above 3-5kHz. The crossover is of good commercial quality, essentially to 12dB/octave slopes. Electrical connection is *via* combination 4mm socket/binders.

The enclosure carcass is built from 15mm chipboard, reinforced by an interior brace and Wharfedale's customary recessed back panel. The finish is an attractive walnut vinyl, and the 9mm thick grille panel is partly rebated, covered in a black open-weave cloth.

SOUND QUALITY

The 507 did not do too well on the listening tests scoring significantly below average. We tried the speaker in several locations, and although a position close to a rear wall gave optimal tonal balance, stereo focus and depth both suffered in consequence. Dynamics were well presented, and the system was good at projecting detail.

The stereo image showed some false perspectives, with percussive midrange sounds (wood block, handclapping etc.) placed too forward for comfort. Piano tone was 'thinned' and 'hardened', while some 'boxiness' was associated with the midband. Despite the noted clarity, stereo depth was rather weak. The bass sounded somewhat isolated, but with quite good extension. The treble was a touch 'edgy', somehow not fully integrated with the rest of the sound. The tonal balance tended towards the lightweight, too 'thin' through the midband.

LAB REPORT

The high sensitivity target has been achieved, recording 89.5dB/W on test. A mild impedance dip was present at high frequencies, but the amplifier loading was barely compromised, still meriting a 'good' rating. A generous 150W peak programme power handling can provide substantial peak sound levels of 106dBA for a stereo pair under typical conditions, while a minimum input level of 10W per channel will still produce quite reasonable sound levels.

The axial frequency response appears satis-

factory at first sight but a closer examination reveals some oddities. The bass gently tapered away below 200Hz, while the mid was elevated in the 250Hz to 1kHz range. Some irregularities were also present above 10kHz, partly grille-induced as the dotted line (grille removed) confirms.

At 2 metres, even with response smoothing, ±3dB standard limits would only accommodate a 100Hz to 10kHz frequency response, mainly due to the height of the midrange lift at 800Hz. While the off-axis outputs were well integrated with commendable uniformity, the mid dominant trend was confirmed. The bass rolloff was normal at 56Hz, −6dB under anechoic conditions, but it proved in practice to be well extended down to 30Hz when assessed by computer-averaging techniques. The upper bass area was too dry, while the mid showed a characteristic rise to an isolated 800Hz which unbalanced the response.

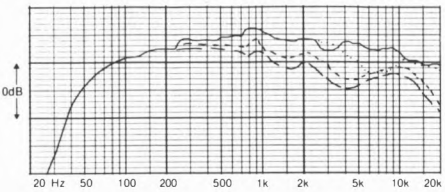
Third harmonic distortion was kept within sensible bounds, negligible above 500Hz and averaging 0.2% below at 86dB. Some second harmonic was measured in the lower treble, again around 0.3%, which is considered quite harmless. The distortion showed some increase at frequencies below 200Hz by 96dB, for example 6% of second at 100Hz.

Conclusions

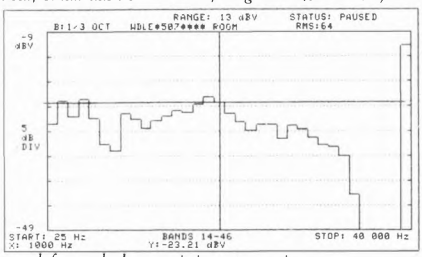
The 507 is intended for mounting close to the wall, but its midband forwardness has gone too far and wall augmentation cannot effect full correction for a box of this size. While they favoured other aspects of this well built system, the panel criticised the mid balance and the sonic rating was too low to justify recommendation at the price level.

General Data

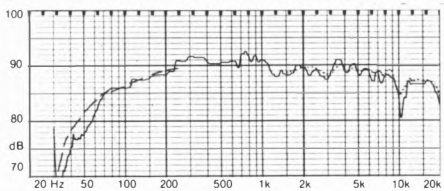
Size (height × width × depth)	49 × 25.5 × 28.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) −150W
Recommended placement	40cm stand 0.5m from wall
Frequency response, within ±3dB, at 2 metres	100Hz to 12kHz
Low frequency rolloff (−6dB point) at 1 metre	56Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	89.5dB/W
Approximate maximum sound level (pair) at 2 metres	106dBA
Impedance characteristic (ease of drive)	good
Forward response uniformity	very good
Typical price per pair, inc VAT	£170



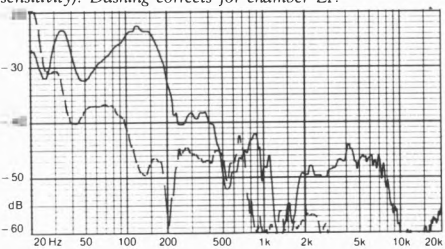
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

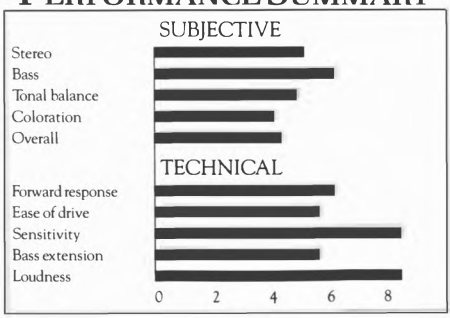


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



WHARFDALE 510

WHARFEDALE LOUDSPEAKERS, SANDLEAS WAY, CROSSGATES, LEEDS LS15 8AL.
TEL: (0532) 601222

It had been quietly hinted that this new three-way system would be one of the very few production loudspeakers to rival the better sound quality aspects of the classic Spendor *BC1*. No such direct claims were made, but despite some weaknesses the *510* emerged from the encounter with some honour. The drive units comprise the now well established 19mm alloy dome tweeter, below which a 100mm midrange unit operates in its own sealed chamber. This is based on the bass/mid driver of the *504*, but has been optimised for mid use in the *510*. Finally, the 220mm frame bass unit is again based on another Wharfedale driver, this time from the *708*. Mid and bass units have reinforced flared-profile polypropylene diaphragms, terminated by synthetic surrounds.

The 33 litre bass enclosure is reflex-tuned to 36Hz by a large rear panel port, 72mm in diameter with a long 208mm duct. Fireproof synthetic plastic foam provides internal absorption, and the enclosure is built from 18mm vinyl chipboard, reinforced by a full frame brace and the established recessed-back technique. The grille is an unrebated 12mm thick panel, and in the designer's opinion is better left off for more critical listening. The *510* can be used on stands 40cm high in a free space, moderately close to the rear wall. The normal commercial quality crossover is designed to 12dB/octave slopes throughout, operating at 1 and 5kHz. Electrical connection is made *via* 4mm socket/binding posts.

SOUND QUALITY

The listening panel scored this speaker at the 'average' level, not particularly impressive but fair enough for the price. Some uneveness was heard as a mild distortion of tonal balance on some sounds. There was a mild 'wiriness' on violin strings, and a touch of 'thinning' on piano and vocal passages. The bass was well extended, if a little on the 'rich' side low down. Thinning somewhat in the upper bass region, the system lacked some 'slam' and dynamic impact.

Stereo focus was quite good. The panel noted decent stage width, but not very much depth. The presentation was slightly 'forward' and perspectives appeared 'flattened', one panelist commenting that the sound had the makings of a good three-way but was not sufficiently interesting to merit a high score at this stage of development.

LAB REPORT

The system sensitivity was an average 88.5dB/W with a quite good measured bass extension to 52Hz, −6dB. The pair match was a fine ±0.8dB, and mild mid prominence is a key feature. In-room, the low end was augmented by room gain, the overall bass level being an excessive +5dB, 30Hz, seemingly at the expense of the main bass output from 60Hz to 120Hz. From the computed room characteristic, the mid

is slightly dominant and the treble range a little too subdued, though the overall balance is quite respectable.

At 2 metres the system looked quite well integrated except in the vertical plane at the upper crossover frequency of 5kHz. At 15° above-axis, the output rapidly dipped into a cancellation notch, 10dB deep and of considerable width. The system should be aimed or elevated so that the tweeter is directed towards the listeners head. Off-axis, the lateral dispersion was almost too good — viewed as a whole the output is too healthy in the midrange.

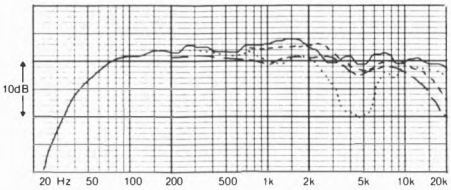
The sensitivity was somewhat compromised by a poorer than usual load impedance, the *510* approximating a 6ohm system with minima at 4ohms. The distortion levels were quite typical at 86dB, while at 96dB some low frequency increase was seen, with second harmonic rising to 6% at 120Hz, and third to 2% below 100Hz. However, the good peak power handling would allow decent maximum sound levels of up to 105dBA.

Conclusions

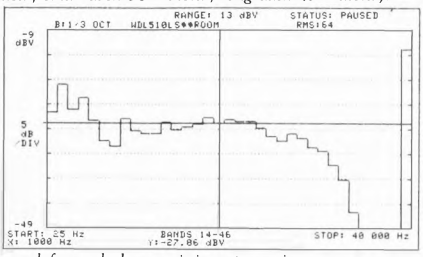
The listening test results were promising, suggesting a fairly accurate balance with well extended bass and sharp stereo focus. Aside from the lower than average impedance the lab results were uneventful. While the performance was not strong enough for a full recommendation, this is an interesting speaker, well worth considering and auditioning.

General Data

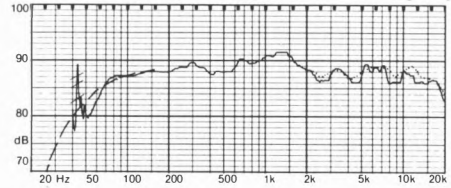
Size (height × width × depth)	61.5 × 28 × 28.5cm
Recommended amplifier power per channel (for 96dBA minimum per pair at 2 metres)	(10) – 150W
Recommended placement	30cm stand near wall (0.5m)
Frequency response, within ±3dB, at 2 metres	60Hz to 20kHz
Low frequency rolloff (–6dB point) at 1 metre	52Hz
Voltage sensitivity (ref. 2.83V, or 1W into 8ohms at 1 metre)	88.5dB/W
Approximate maximum sound level (pair) at 2 metres	105dBA
Impedance characteristic (ease of drive)	average
Forward response uniformity	good+
Typical price per pair, inc VAT	£250



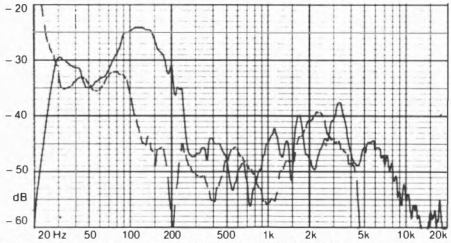
Forward characteristic response (⅓ octave at 2m, dotted 15° vertical, small dash 30° lateral, long dash 45° lateral).



Averaged forward characteristic response in room.

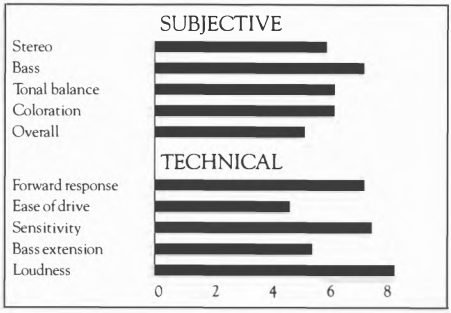


Reference sine wave response (1m on axis, 2.83V input shows sensitivity). Dashing corrects for chamber LF.



Harmonic distortions at 96dB SPL (solid 3rd harmonic, dotted 2nd harmonic).

Performance Summary



WHARFEDALE 708

WHARFEDALE LOUDSPEAKERS LTD, SANDLEAS WAY, CROSSGATE, LEEDS LS15 8AL.
TEL: (0532) 601222

This high-quality compact 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 cone, 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, and 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 indicated by this measurement.

CONCLUSIONS

Wharfedale's *708* is a respectable achievement. 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.

GENERAL DATA

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

Reassessed. First reviewed 1985. Current typical price £350.

YAMAHA NS1000M

YAMAHA ELECTRONICS (UK) LTD, YAMAHA HOUSE, 200 RICKMANSWORTH ROAD, WATFORD, HERTS WD1 7JS. TEL: (0923) 33166

This is a relatively compact, superbly-crafted three-way sealed-box speaker, of highly rigid and braced construction, and with an exterior black 'piano' surface 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 beryllium 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. However, the latest samples (1985), using mainly digital programme, the speaker appeared to 'come to life', and produced an impressive sound. The bass was quite exceptional, it appeared to produce good stop-start transients, and was also sufficiently transparent to reproduce the natural acoustic on many recordings. Stereo images were well focused giving a decent depth effect.

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, which is accentuated by distorted programme. On high-quality material, however, its 'monitor' label appeared justified by high sound levels with negligible subjective distortion.

LAB REPORT

The high 90dB/W sensitivity was slightly compromised by an 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, giving good bass extension to 40Hz, −6dB, with a desirably slow, damped 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.

On the computer-averaged room response, the clean extended bass was clearly evident, with the treble register well shaped; overall this is quite a well 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. Furthermore, the speaker had high peak power handling capacity of up to 200W, and high sound levels were possible from a stereo pair — up to 108dBA in a typical room!

CONCLUSIONS

The long-lived *NS1000* remains quite competitively priced. Satisfactory on analogue sources and really coming into its own on digital, the *NS1000* is a worthy contender, and well worth considering.

Reassessed. First reviewed 1976, retested 1978 and subsequently reassessed 1984, 1985. Current typical price £900.

General Data — see pages 180-184

SUMMARY REVIEWS

In this book we have given the full test reports on as many new models as possible but do not have space to print all our complete tests on current models. A number of these are summarised here.

Every model here has been subjected to the full *HFC* laboratory measurement and listening tests, results from which are quoted in as much detail as space allows. Sensitivity (the sound level the speaker will produce for 1W input) and suggested minimum and maximum amplifier powers are given at the end of each review.

With a continuing decline in the popularity of three-way loudspeakers, at least as far as the UK market is concerned, the great majority of the models covered here are two-way designs in which each enclosure contains a moderate-sized bass/mid unit and a small-diameter treble unit. Unless otherwise stated, all speakers in this section are two way 'infinite baffle' or 'sealed box' cabinet designs.

Audiostatic ES200 (£1,400)

A little larger than the Quad '63, this 143cm high panel electrostatic has a fairly narrow full-height electrostatic element, flanked by a large wooden baffle which helps to augment low frequencies in the room. Mid and treble performance was found superb, particularly on piano and chamber music; but the frequency balance was axis-sensitive and the bass was weak. Low sensitivity combines with modest power handling to make the speaker incapable of high sound levels, the maximum being typically 93dBA. A costly and idiosyncratic speaker but one worth considering at the price. (80.5dB W, around 100W)

B&W DM220 (£219 £245 with stand)

A double-size version of the *'110*, using two 220mm bass/mid units in each enclosure; the additional driver is electrically rolled-off in the lower midrange, to give a variant of three-way working. Compared with the *'110*, it added a smoother, slightly more extended bass, with a hint of added upper-mid detail. With exceptional power handling and dynamic range, the '220 cannot offer quite the value of the smaller models but is recommended. (90dB/W, 10-200W)

B&W LM1 (£199)

Intended for general purpose duty at home or in vehicles or boats, the very well engineered *LM1* has a 24cm high fully-styled die-cast enclosure finished in Nextel 'suede' paint in a choice of colours. With a tiny enclosure volume (5.5l), low bass was lacking and the balance a trifle thin and 'artificial', but it provided good frontal detail and stereo focus, if with restricted depth. By normal *HFC* criteria, it does not quality for recommendation, but is probably one of the best micros made, and is worth considering for special applications, including domestic use where unobtrusiveness is the primary consideration. (86.5dB/W, 15-100W)

B&W 1200 (£269)

Developed from the old *DM12* design, the 36cm high *'1200* retains the APOC driver protection, which makes the speaker nearly 'unburstable'. Panel test results showed an above average performance but indicated some mixed feelings about the speaker, which though generally open, could at times sound somewhat muddled and lacking in life. Stereo imagery was fine, the bass tidy and coloration low. Overall impression was that of a tidy, 'civilised' miniature which can be recommended, but a careful audition must be advised before purchase. (86dB/W, 15-100W)

B&W 1400 (£399)

Derived from the earlier *DM14*, and again featuring APOC protection, the *'1400* stands 60cm high and includes two 180mm bass/mid units in each enclosure, the additional driver adding to the bass power handling. On listening tests the panel liked it if anything less than the *'1200*. Clean and uncoloured in the normal sense, it was not considered to be very convincing when played loud, tending to sound a degree muddled and compressed. An otherwise fine treble was marred by a 'zing' at the extreme top end, while piano sounded somewhat 'thin' and boxy. The *DM1400* was rated 'worth considering'. (86.5dB, 20-200W)

Bose 301 (£260)

Each *301* has two tweeters, one facing the rear, with the intention of improving energy output into the room at high frequencies and to

encourage some rear-wall reflection. Standing 43cm high, the 15 litre enclosure, with a pulp-coned 200mm base/mid unit, is loaded by a 5cm diameter port. When reviewed in the 1984 edition the *301* produced very mixed reactions from the panel, some thinking very highly of it, others finding it not to their taste. With an open, lively, and 'gutsy' character, it nonetheless showed some 'boxy' coloration and a lack of stereo depth, while some critical listeners noted a 'phasey' effect. Rated as worth trying in its 1984 form, the 301 has since been revised as the *301 II*. (87dB, 15-100W)

Gale GS402 (£530)

Developed from the *401*, but featuring a new tweeter the *402* (available with '*401 style*' chrome ends, measures some 61cm high (or wide if the traditional Gale horizontal orientation is adopted) and has an internal volume of 40 litres. Two long-throw 200mm bass units are located towards the ends of the cabinet and work in parallel, while between these are a Peerless 100mm cone mid-range and a 25mm soft-dome Philips tweeter. Like its predecessors, the *402* scored well in listening tests, with a clean but rich and powerful bass (sometimes slightly excessive), good tonal balance and large-scale presentation, though stereo focus was not its strongest point. Despite an increased price and stronger competition, the Gale remains a good speaker, well worth considering. (88dB/W, 25-200W)

Kord Vulcan (£300)

Kord loudspeakers are a small company with limited distribution, and have been producing the medium sized and priced (£300) Vulcan for several years. The 23 litre sealed box enclosure combines a substantial Volt bass/mid driver with a version of the well regarded Scan tweeter. Auditioning resulted in an average rating, with good dynamics and musical detail marred by some coloration around the lower treble. The frequency responses backed this criticism, showing a major discontinuity of 10dB at 1-2kHz, though in other respects the measurements were quite positive. The favourable characteristics indicate a 'worth considering' rating which would undoubtedly be enhanced by further attention to the response anomaly. (87dB/W 15-150W)

Linn Sara (Teak, Walnut & Black £632).

Drive units in the 43cm high Sara are a 19mm Hiquphon domed tweeter, a modified KEF B200 200mm bass/mid unit plus a second B200 mounted internally behind the first and connected in parallel with it. This gives a low resonant frequency of 42Hz but makes the Sara a 4ohm speaker. On listening tests, the Sara scored only average marks with digital material, with over-heavy upper bass, and thinned midrange on some piano and voice. Treble quality was good. The speaker improved noticeably when used with a Linn-based disc system, providing a more musical and realistic effect. Though not recommended in the usual HFC context, particularly if digital programme is to be used, the Sara can provide an 'involving' sound with analogue sources, especially if these are Linn derived. (87.5dB/Wm 25-100W)

Rogers Studio One (£450)

A 'classic' 200mm Bextrene-coned design, the 44 litre *Studio One* is a bass-reflex loaded model of comparatively high power capacity. As revised a year or two back, the *Studio One* showed less bass overhang, but still suffered a trace of bass excess, this admittedly more noticeable on digital programme. Overall performance was quite good, with well focused stereo images, fairly good depth and a pleasing level of detail; it appeared accurately balanced tonally, with an even, wide response; but there was some mild 'boxiness' or 'hollowness' with a mild brashness and less than perfectly sweet rendition in the treble registers. This model still represents good audio and engineering value and recommendation is continued. (86.5dB/W, 20-200W)

SD Acoustics SD2 (£525)

Sturdily and carefully made, measuring 55cm tall, the *SD2* uses an efficient 250mm bass/mid

unit and a 34mm soft dome tweeter, both from Son Audax. Panel listening results were rather mixed, but a definite 'character' was evident, and treble somewhat uneven, nasal and yet muted on strings. Bass was well controlled but felt to be too dry, this emphasised by the mid prominence. Superbly built and finished, with a wide dynamic range, good sensitivity and low distortion, the *SD2* is well worth auditioning, though too expensive for a full recommendation. (90dB/W, 20-200W)

Spendor SA3 (£1,210 passive £2,122 active) Designed specifically for accurately balanced reproduction of high sound levels, in particular where considerable bass energy is present in the programme, the 85cm high *SA3* has a massive 120 litre bass-reflex enclosure, tuned by a port and driven by a special 305mm Bextrene-coned bass unit. Treble unit is a Spendor-adjusted Audax high-flux 34mm soft dome. For such a large loudspeaker, the *HFC* listening room is in fact on the small side, and for correct stereo focus a listening distance of 4-5 metres is needed. Within these limitations, the SA3 scored an 'average' for overall sound quality. Some colorations were observed, namely a 'tubey', 'plummy' effect, but quite good detail was heard. When not driven hard enough to exploit its wide dynamic range, the *SA3* can be outclassed by smaller systems, but in its intended application it can produce effortless and extended bass with a musical performance well beyond that of the smaller domestic boxes. (89dB, 10-200W)

CONCLUSIONS

In some respects, this 1986 Project has been disappointing. Many new models were received for review, but very few were of unusual quality. This time around some may accuse us of a negative view-point, but in fact we always look forward to a sprinkling of new products appearing amongst the Best Buys. However, keeping faith with *Choice's* high standards has meant few such inclusions on this occasion — indeed, I cannot remember an issue with so many entries in the third 'worth considering' grade. The choice of review models was as representative and up-to-date as possible, so we cannot be accused of bias in this direction. Moreover, we tend to avoid reviewing obviously weak contenders, which should have increased the number of successes.

However, some conclusions can be drawn from the test results. Over recent years there has been a trend towards higher sensitivities, partly to meet the expectation of higher sound levels for popular commercial rock-oriented program, and partly to cope with the potentially greater dynamic range of digital recordings. Higher efficiency is beneficial to sound quality in several ways, but higher sensitivity is of little value if it is achieved at the expense of increased amplifier loading and a peaked up frequency response.

Higher efficiencies can provide lower distortion, sensible low frequency alignments, and make less demands upon the amplification for the same loudness. Unfortunately many speakers this year have apparently achieved these higher sensitivities by worsening the performance in other respects. In several cases the underlying reasons for an indifferent review lie in the trade-off made by the system designer: for example, a loss of bass power and extension, a forward 'thin', 'loud'-sounding midrange, and poorer amplifier loading, the latter resulting from lowering the impedance to deliberately 'suck' more power from the amplifier.

In an effort to exploit the sensitivity angle, many designers have also opted for wall mounting, which in some respects represents yet another trade-off. With wall or shelf mounting the bass is rarely as uniform as in free space, while the local reflections tend to colour the sound right in the critical midrange, degrading neutrality and 'flattening' stereo image depth. This seems to be a heavy price to pay for a speaker design that sounds 'louder' in a point of sale demonstration, though it does appear that many are prepared to make the sacrifice in the interests of room aesthetics.

Given reasonable expenditure on the drive unit motors, it is possible to define a natural range of loudspeaker sensitivities that allow neutral, wide frequency responses with sensible values of amplifier loading. For sealed-box designs, making some allowance for price and size, the relation between the bass unit frame size and sensitivity is roughly as follows: 100mm: 84dB; 160mm: 86dB; 200mm: 88dB; 250mm: 90dB; 300mm: 92dB. If you step significantly outside these guidelines the design can go wrong. For example, a 120mm/90dB model will have little bass, while a 200mm/85dB model will probably have too much.

To some degree lowering loudspeaker impedances is self-defeating. Ideally, halving the system impedance should double the current drawn and add 3dB to the specific sensitivity. However, in practice, non-ideal motor-coil windings, increased crossover losses, losses in the connecting cables, and a measurable loss in peak voltage delivery from the amplifier can all conspire to reduce the gain to around 1.5dB — an almost inaudible improvement. Is it really worth it when the cost in terms of performance seems so great?

Interestingly, one successful Japanese entry did not show any serious signs of weakness, offering a good combination of extended bass, moderate sensitivity and a neutral tonal quality. If UK models begin to go off the rails, such imported designs may make greater inroads in the UK market, which has hitherto been dominated by specialist domestic manufacturers.

BEST BUYS AND RECOMMENDATIONS

Drawing on the experience of previous editions as well as the new reviews included this time, the recommendations here are in effect selected from a pool of over 150 models. Inevitably, with each succeeding issue, the poorest models have been weeded out and the number of Recommended and Best Buy models has increased, reflecting higher market standards.

Best Buy denotes exceptional value for money, and we have drawn an upper price limit for the Best Buy category, this time at £270. Above this price the 'law of diminishing returns' comes into effect, so better examples at more than £270 are 'Recommended' instead.

Recommended means that either the performance was particularly good irrespective of price or that good value is offered but overall attainment falls short of Best Buy classification. However the dividing line between what constitutes a Best Buy or a Recommended system is often quite hard to draw, and obviously depends on *our* interpretation of performance characteristics.

BEST BUYS: UNDER £105

The title 'most speaker for the money' goes to the present *Mk II* version of the £80 British-built Toshiba *33es* a loudspeaker of generous size with a well balanced and wide response suited to free space location. Three fine small systems also merit inclusion in this section. The B&W *DM100*, Celestion *DL4* and Mission *70 II*, are all at the £100 level, are all suited to near wall mounting, and have similar specifications.

A new miniature from Goodmans reviving the *Maxim* name is the cheapest model in this year's issue at around £70, yet it gave a surprisingly good performance, even surviving free space mounting.

RECOMMENDED: UNDER £105

Firm recommendations go to the Morduant Short *MS10* (£80), the Wharfedale *Diamond II* (£85), the Tannoy *Titan* (£100), and the Akroyd *25* (£100), the latter a somewhat larger model with a more extended bass than usual.

BEST BUYS: £105-£185

This is a strong area of the market, and a number of models qualify for Best Buy rating. In ascending price order we have the Rotel *RL850* (£110), the Acoustic Research *AR18* (£115), the B&W *DM110* (£140), the Tannoy *Mercury II* (£150), and the Celestion *DL8* (£180). Except for the *AR18*, all these models are suitable for free space mounting. Sony's *APM 20es* is a new entry at £130, also a free space system.

RECOMMENDED: £105-£185

Recommended amongst the smaller boxes suited to wall mounting are the Wharfedale *504* (£120), the Mission *LE700* (£125), the Mordaunt Short *MS100* (£160) and the Castle *Clyde* (£112), while slightly larger models include the *AR22* (£150) the Monitor Audio *R252* (£150) and the JPW *P1* (£115). More suitable for siting on open space stands are the Celestion *DL6* (£130), the Castle *Durham* (£150), and the Rogers *LS2* (£165). Provided that the quality of the original sample has been maintained the Goodmans *Mezzo* (£150) may also be recommended.

BEST BUYS: £185-£270

Only two models were judged to offer a sufficiently high standard of performance to qualify as Best Buys at this higher price level, the previously underrated and recently improved Rogers *LS6* (£230), and the established classic compact Spendor *Prelude* (£270). Both work well in free space.

RECOMMENDED: £185-£270

The free space miniature *LS3/5a* soldiers on (£180-230) — indeed it may now be more highly regarded with improved cleaner program sources than it used to be. If you can still get it, the Spendor *SA1* is a worthwhile equivalent with surprising bass for the size.

Amongst the compact boxes we have the Diesis *Solitaire* (£220), the Monitor Audio *R700* (£250), the Castle *Pembroke* (£240) and the Sony *APM 22 ES* (£200), the latter two being free space models. Two larger models which are both well established and optimised for free space use are the Monitor Audio *R352* (£200), and the B&W *DM220* (£200). The JPW *AP3* (£195) and the well-balanced Tannoy *Venus* (£270) must also

be recommended. Though not reviewed here, recent experience suggests that the KEF *C60* (£250) is also worth noting.

RECOMMENDED: OVER £270

Moving up the price ladder, the *AR44* (£339) is a new three-way system with modern drivers and unusual bass extension, representing good value for the size. The compact Rogers *LS7* (£335) shows little sign of dating while Harbeth's revitalised *HL1 IV* (£345) sets a high standard for clarity and musical balance.

A similarly priced newcomer is the Celestion *SL6S* (£350), a refined compact performer with fine metal dome tweeter. The new floorstanding JBL *L60T* (£370) is a larger speaker with an extended frequency range, while the Spendor *SP2* (£390) enjoys continuing success as a compact version of the reference quality *SP1*. *The Rogers Studio One* offers similar characteristics in a slightly larger package at £450.

At £500 there is the new high quality Technics compact, the planar co-axial *RX50*. Representing a total contrast, KEF's floorstanding *104* has proved a commercial success, and represents a remarkable package for £750.

The Celestion *SL600* (£700) continues to take the honours for stereo image subtlety and resolution with its miniature alloy honeycomb enclosure, while the £1000 Ensemble *FA1* is a sort of 'airy' Swiss equivalent in a veneered box, with the recommendation of prior audition.

Quad's *ESL63* (£1340) electrostatic offers, unrivalled neutrality and a good stereo performance while the Magneplanar *MG IIIa* (£2,880) adds dynamic range to the open panel concept. The most expensive we have yet reviewed is the Apogee *Scintilla* at some £5,000. Now set for 1 ohm working, these need the correct amplifiers and the right room and system, but if these can be arranged, then a great musical performance can result. In this upper price territory, it would be narrow-minded not to include several other interesting models worthy of audition and consideration. These include the Linn *Isobarik*, (or for that matter the cheaper *Sara*), the Yamaha *NS1000*, the Spendor *SA3*, and the Sony *APM 66ES*. Other interesting models are also made by Magneplanar, Audiostatic, Acoustat and Infinity — for example, the large but impressive *RSIIB*.

COMPARISON CHART

	H	W	D(cm)	Bass enclosure volume (litres)	Max Sound level in 100m³ pair at 2m (dBA)	Lab Sens of 1m 2.83V—6dB (dB)	Low freq/ Rolloff (HZ)	Suggested min/max amplifier power (W)	Overall Frequency Response	Dispersion/ Distribution
Acoustic Research AR18	44	28	21	15.4	103	90	60	10-60	ave	ave
Acoustic Research AR22	44	27.5	21	16	101	88.5	60	10-75	ave+	good
Acoustic Research AR44	70	32	34.5	52	104	88.5	43	10-150	good+	good
A&R Arcam One (R-a)	47	27	33	30	104	88	55	15-150	good	good
A&R Arcam 2 (R-a)	38	23	28	13	101	87	52/65	15-75	good	v. good
Akroyd 25	51	30	24	25	100	87	52	12-75	ave—	ave+
Apogee Scintilla (R/C)	145	88	9	n.a.	104*	79*	20	100-200*	good	good+
Audiostatic ES200 (R/C)	130	53	23*	n.a.	96*	81*	45	100	good	ave+
Audiostatic ES 300	193	44	5	n.a.	95	82.5	30	50-75	ave	ave+
B&W DM100 (R)	37	22	22	11	103	89	75	10-75	excellent	excellent
B&W DM110 (R)	49	26	25	22	107	89.5	56	10-200	good+	good
B&W DM220 (R)	68	29	34	50	105	90	52	10-200	v. good	v. good
BBC LS3/5A (R/C)	30	18.5	16	5.5	93.5	81.5	57	30-50	average+	v. good
BLQ 1	29	18	20.5	5.6	101	87	90	12-50	ave—	good
Boston A40 II (R)	34	21	20	8	101	88.5	63	12-50	ave+	good
Castle Clyde (R-a)	37	21.5	22	10	102	89.5	64	10-50	good	excellent
Castle Pembroke (R)	55	27.5	30.5	32	103	88	46	10-100	v. good	v. good
Castle Durham	40	21.5	25	13	102	89	67	10-50	ave+	v. good
Celestion DL4 (R)	38	21	23	11	102	89	85	10-75	good	v. good
Celestion DL6 (R)	45	25	25	28	105	88.5	60	10-100	good	good
Celestion DL8 (R)	50	28	27	24	104	88	55	15-150	v. good	good
Celestion SL6S	37.5	20	27	11.3	101	84	50	20-150	v. good	good+
Celestion SL 600 (R)	37	20	25.5	12	99	83	55	30-150	v. good	excellent
Diesia Solitaire (R)	35	26	20	12	100	85	57	20-100	ave+	excellent
Ensemble PA1	35	23	20*	10	103	89	60	10-75	ave+	good
Gale 301	44	23.5	22	23	100	86.5	63	12-100	good	good+
Goodmans Maxim	26	17	21	5	97	85.5	82	20-50	good	excellent
Goodmans Mezzo (R)	60	32	26	37	104	88	46	12-100	ave—	ave
Harbeth HL1 IV (R/C)	63.5	32.5	30.5	50	102	87.5	46	15-100	good	v. good
Heybrook HB1 (R-a)	47	29	23	22	104	90	55	10-80	ave—	good
Heybrook HB2R	41	23	23	12	103	88	61	10-100	ave+	good+
Infinity RS IIB (R/C)	160	57	30*	50	110	90	25	100-250	good	good
JBL L60T	78	30.5	26.5	35	104	88	40	10-150	good+	v. good
JBL TLX3 GI	38	25.5	22	12	102	87	55	10-100	ave	ave+
JBL 18Ti (R)	34	24	22.5	10	104	85.5	53	20-150	v. good	excellent
JBL 250 Ti (R/C)	132	57	36		109	89	25	25-250	good+	good+
JPW P1 (R-a)	105.5	26	26.5	18	105	90	60	10-100	good+	good+
JPW AP3 (R)	52	26	29.5	25	105	90	57	10-100	ave+	good
KEF C10	30	20	17.5	62	101	87.5	75	10-75	good+	excellent
KEF C40	65	24.5	26.5	28	108	90	58	10-200	good+	good+
KEF 104/2 (R-a, R/C)	90	28	41.5	50	110	92	50	10-200	v. good	v. good
Linn Index (R-a)	43.5	28	20.5	15	101	86	52	15-100	ave—	ave
Linn Kan (R)	30.5	19	16.5	5	98	85	90	75-50	ave—	ave+

(R-a) = re-auditioned/ (R/C) = reprinted from The Collection/ (R) = reprinted from Hi-Fi Choice No 4 Loudspeakers (1985) *See text

Coloration	Ease of Drive	Peak Distortion performance 100W	Swept Distortion Performance 96dB	Stereo Image Quality	Overall Sound Quality	Typical price/pair (£)	Value Judgement (BB, R, WC)	
ave+	good	ave+	ave	ave	ave	115	BB	Acoustic Research AR18
ave	good	ave+	ave+	ave	ave	149	R	Acoustic Research AR22
good	good	good+	good+	ave+	ave+	339	R	Acoustic Research AR44
ave+	v. good	ave+	ave	ave	ave	330	WC	A&R Arcam (R-a)
good	v. good	good+	good	ave+	ave	200	WC	A&R Arcam 2
ave	good+	ave—	ave—	ave—	ave—	100	R	Akroyd 25
good*	appalling!	excellent	excellent	excellent	excellent*	5,000	R	Apogee Scintilla
excellent	good	good	good+	v. good	good	1,400		Audiostatic ES200
good	poor	good+	ave—	good+	good*	2,300	WC	Audiostatic ES300
good	v. good	good	v. good	good+	good	100	BB	B&W DM100
good	v. good	good	v. good	good+	good	140	BB	B&W DM110
good	good	good	good	good+	good	220	R	B&W DM220
ave+	excellent	ave—	ave+	ave+	ave+	220	R	BBC LS3/5A
ave—	v. good	good	ave—	ave	ave—	120		BLQ 1
ave	ave	ave	ave—	ave—	ave—	110	WC	Boston A40 II
ave+	good	ave	good+	ave+	ave	112	R	Castle Clyde
good	v. good	good	good	good	good	240	R	Castle Pembroke
ave+	v. good	good	ave+	ave	ave+	150	R	Castle Durham
ave	good	ave	ave	good+	good+	100	BB	Celestion DL4
good	good	good	good	good+	good+	130	R	Celestion DL6
good	good	good	good	v. good	v. good	180	BB	Celestion DL8
good+	good	good	good	v. good	v. good	350	R	Celestion SL6S
excellent	ave+	ave+	ave+	excellent	v. good	700	R	Celestion SL600
good	v. good	good+	ave	good	good	220	R	Diesis Solitaire
good	ave—	ave	ave—	v. good	good+	1000	R	Ensemble PA1
good	v. good	good	good	ave+	ave	250	WC	Gale 301
ave	v. good	ave—	ave—	ave+	ave—	70	BB	Goodmans Maxim
ave+	good	good	v. good	ave	ave+	150	R	Goodmans Mezzo
good+	v. good	good	ave	v. good	v. good	345	R	Harbeth HL1 IV
ave	ave+	good	ave+	ave+	ave	150	WC	Heybrook HB15
ave	ave—	good	ave+	ave	ave—	240		Heybrook HB2R
good+	ave	good+	good+	good	v. good	3,500	WC	Infinity RS 11B
ave+	ave	good	good	ave+	ave+	370	R	JBL L60T
ave	v. good	ave+	ave	ave	ave—	130	WC	JBL TLX3
good	good	v. good	v. good	ave+	ave+	550	WC	JBL 18Ti
good	good	v. good	v. good	good	good+	3,300		JBL 250Ti
ave+	v. good	good+	ave+	ave+	good	115	R	JPW P1
ave+	v. good	good	good+	good	ave+	195	R	JPW AP3
ave+	good	ave	ave+	ave—	ave—	90	WC	KEF C10
ave	v. good	good+	good	ave+	ave	200	WC	KEF C40
v. good	ave	excellent	v. good	v. good	good	750	R	KEF 104/2
ave—	good	ave	ave+	ave	ave—	150		Linn Index
ave—	v. good	ave	ave—	ave+	ave—	260		Linn Kan ▷

COMPARISON CHART

	H	W	D(cm)	Bass enclosure volume (litres)	Max Sound level in 100m³ pair at 2m (dBA)	Lab Sens of 1m 2.83V—6dB (dB)	Low freq/ Rolloff (HZ)	Suggested min/max amplifier power (W)	Overall Frequency Response	Dispersion/ Distribution
▷ Magneplanar SMGa (R)	122	48	4.5	n.a.	102.5	85	56	25-150	ave—	ave+
Magneplanar MGIIIa (R/C)	180	62	38*	n.a.	106	85	35	25-300	good+	good+
Meridian M30	38.5	18	32	9	102*	n.a.	40	n.a.	good	good
Mission 70 II (R)	35	21	21	9	104	89	68	10-100	good+	v. good
Mission LE 700	38	21	21	9.5	104	89.5	73	10-100	ave+	good
Mission 737 (R)	54	25	27.5	25	104	89.5	58	10-100	good	good+
Monitor Audio R100 (R)	40.5	25	21	11	103	87.5	70	15-75	ave+	v. good
Monitor Audio R252 (R)	47	25	24	17	102	89	62	10-75	ave	good
Monitor Audio R352 (R)	64	25	32	36	105	90	50	10-100	ave+	ave
Monitor Audio R652	51	20	27	18 5	103	86	54	15-100	good	good
Monitor Audio R700/MD	35	21.5	25	11.5	102	87.5	62	12-75	ave+	ave+
Mordaunt-Short MS10 (R)	28.5	19.5	18	5	98	85	80	20-50	good	v. good
Mordaunt-Short MS15	32.5	22.5	17.5	8	101	86.5	60	15-75	good	v. good
Mordaunt-Short MS25TI	40	26	23.5	16	104	89	65	10-100	ave+	good+
Mordaunt-Short MS100 (R)	32.5	22.5	21.5	8.5	100	88	80	15-50	ave+	v. good
Mordaunt-Short MS300 (R)	54	22.5	25	19	104	89	65	10-100	good	good
NAD 20 (R)	75	23	26	25	105	90	50	10-100	ave+	good
ProAc Tablette EBT Super (R)	40.5	15.5	23	8	100	86	75	25-75	good+	v. good
Quad ESL-63 (R/C)	92	66	27	n.a.	99	84	34	25-100	excellent	ave—
QED 234	30.5	20	18.5	6.8	101	89	80	10-50	good+	excellent
Rogers LS2 (R)	36	23	22	10.5	100	86.5	51	25-100	ave	excellent
Rogers LS6 (R)	51	27	28	23	104	87.5	50	15-150	v. good	excellent
Rogers LS7 (R/C)	56	27	28	30	106	88	48	10-200	v. good	v. good
Rotel RL850 (R)	44	25	25	20	103	87	52	15-150	good	good
Sony APM20ES II	43	25	29	18	100	86	48	15-75	v. good	excellent
Sony APM22ES (R)	51.5	29	30	30	106	88.5	46	15-200	v. good	v. good
Sony APM66ES	66	38	36	51	107	89.5	35	10-200	good	v. good
Spendor Prelude (R)	50	26	28	28	105	88	52	15-200	good	v. good
Spendor SP2 (R/C)	50	26	30	30	104	87	45	15-150	excellent	excellent
Spendor SP1 (R)	63.5	29.5	30.5	44	104	87	41	12-150	v. good	v. good
Tannoy Titan (R)	41	24	27	10	102	89	67	10-50	ave	ave+
Tannoy Mercury II	50	25	23.5	20	103	88	55	10-150	good+	excellent
Tannoy Venus (R/C)	53	30.5	27	30	106	86.5	47	15-300	good+	excellent
Technics SBC250EK	36.5	23.5	20.5	10.6	99	86	60	12-50	ave+	good
Technics RX50EK	48	30	26	23	103	86	40	15-150	v. good	excellent
Toshiba SS33 II (R-a)	48	27	21.7	17	100	86	49	15-75	ave+	ave+
Wharfedale Diamond II (R-a)	24	18.5	20.5	5.2	98	86	74	15-50	ave—	ave+
Wharfedale 504	29	18.5	20	6	98	85	75	15-50	ave—	good
Wharfedale 507	49	25.5	28.5	23	106	89.5	56	10-150	good	v. good
Wharfedale 510	61.5	28	28.5	33	105	88.5	52	10-150	good	good+
Wharfedale 708 (R/C)	49	25.5	22	14	102	85	54	25-150	good	good+
Yamaha NS1000M (R/C)	67.5	37.5	32.5	55	108	90	40	10-200	v. good	v. good

(R-a) = re-auditioned/ (R/C) = reprinted from The Collection/ (R) = reprinted from Hi-Fi Choice No 4 Loudspeakers (1985) *See text

Coloration	Ease of Drive	Peak Distortion performance 100W	Swept Distortion Performance 96dB	Stereo Image Quality	Overall Sound Quality	Typical price/pair (£)	Value Judgement (BB, R, WC)	
ıve+	ave	v. good	good+	good	good+	700		Magneplanar SMGa
. good	ave—	excellent	v. good	v. good	v. good	2880	R	Magneplanar MGIIIa
ood	n.a.	ave—	ave—	ave+	ave	725	WC	Meridian M30
ood	good	good	ave	good+	good+	100	BB	Mission 70 II
ve	ave—	ave	ave	ave	ave—	125	R	Mission LE 700
ve	good	v. good	good+	ave+	ave	230	WC	Mission 737
ve	v. good	good+	v. good	ave	ave—	130	WC	Monitor Audio R100
ve+	good	ave+	good	good	ave+	150	R	Monitor Audio R252
ood	v. good	good	v. good	good	good	200	R	Monitor Audio R352
ve	v. good	ave	ave+	ave+	ave	300	WC	Monitor Audio R652/MD
ve	v. good	ave	ave+	good	ave+	250	R	Monitor Audio R700/MD
ve—	excellent	ave—	ave—	ave+	ave—	80	R	Mordaunt-Short MS10
ve—	v. good	ave	ave	ave+	ave—	100	WC	Mordaunt-Short MS15TI
ve—	good	ave+	good	ave+	ave—	120	WC	Mordaunt-Short MS25TI
ve	v. good	ave	ave	good	ave+	160	R	Mordaunt-Short MS100
ve+	v. good	good	good+	ave+	ave	300	WC	Mordaunt-Short MS300
ve—	ave—	ave	ave	ave	ave—	160		NAD 20
ood	v. good	good	good	good	ave	340	WC	ProAc Tablette EBT Super
good	v. good	v. good	v. good	v. good	v. good	1340	R	Quad ESL-63
ve	good	ave—	ave—	ave+	ave—	120	WC	QED L234
ood	v. good	ave	ave+	v. good	good	165	R	Rogers LS2
ood	v. good	v. good	v. good	v. good	good+	230	BB	Rogers LS6
good	good	v. good	v. good	v. good	v. good	335	R	Rogers LS7
ve+	v. good	ave+	ave	good	good	110	BB	Rotel RL850
ve+	ave	ave+	ave+	good	ave+	130	BB	Sony APM20ES II
ood	good	good+	ave	good+	good+	200	R	Sony APM22ES
ood	ave—	good+	good	good+	good	700	WC	Sony APM66ES
ood	v. good	good	v. good	good+	good+	270	BB	Spendor Prelude
good	v. good	good+	v. good	v. good	v. good	390	R	Spendor SP2
ood+	v. good	v. good	v. good	v. good	v. good	600	R	Spendor SP1
'e	v. good	ave+	ave	ave	ave—	100	R	Tannoy Titan
ood	good	good	ave+	good+	good+	150	BB	Tannoy Mercury II
ood+	v. good	v. good	ave	good+	good+	270	R	Tannoy Venus
e—	ave—	ave—	ave—	ave—	ave—	130	WC	Technics SBC250EK
ood	ave—	good+	good+	v. good	good+	500	R	Technics RX50EK
e	v. good	good	good	ave+	ave+	80	BB	Toshiba SS33 II
oor	v. good	poor	ave—	ave	ave—	85	R	Wharfedale Diamond II
e	good	ave	ave+	ave+	ave	120	R	Wharfedale 504
e—	good	good	good	ave—	ave—	170		Wharfedale 507
od	ave	good+	good	ave+	ave	250	WC	Wharfedale 510
od+	good	v. good	good	v. good	good	350		Wharfedale 708
od	ave—	v. good	excellent	good+	good	900	WC	Yamaha NS1000M

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G L O S S A R Y

ACTIVE: Speaker systems which contain electronic crossovers and where the drive units are connected directly to power amplifiers.

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.

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.

BEXTRENE: A plastics material frequently used for bass and mid-range cones.

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.

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.

DIN: German standards body, responsible amongst other things for a popular range of standard plugs and socket specifications.

DAMPING: A means of controlling resonances by means of a resistive medium (electrical, mechanical, or acoustic depending on situation).

DECIBEL (dB): A logarithmic unit that is convenient for expressing ratios that span a wide range on a linear scale. For simplicity it can be regarded as a measure of relative loudness.

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..

DRIVE UNIT (DRIVER): The term used to distinguish the loudspeaker unit itself, be it bass, mid-range, treble or fullrange in application, from the complete loudspeaker system which combines drive units, cabinet and crossover into a total design.

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.

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.

EQUALISATION: *(general)* The deliberate modification of frequency response, usually in response to some engineering limitation of deficiency.

FARAD: Measure of capacitance.

FERRO-FLUID: A magnetic fluid which is introduced into the voice-coil gap to provide damping and/or improved cooling.

FILTER: A circuit (normally) used to restrict the bandwidth of a system; may be fixed or switchable.

FREQUENCY RANGE OR SPECTRUM: Can refer to any particular group of frequencies, but commonly applied to the audible band from 20 to 20,000 cycles per second (Hz), extending from the deepest bass to the highest audible harmonics.

FREQUENCY RESPONSE: The variation in output over a frequency range, particularly of a transducer; can be expressed as a range with decibel limits, or depicted graphically.

Hz (HERTZ): 1 Hz = 1 cycle per second and is a measure of frequency which corresponds to musical pitch (the higher the frequency the higher the pitch).

HF: High frequency.

HARMONIC: Harmonics are the whole number multiples of a base frequency called the *fundamental*.

HARMONIC DISTORTION: The addition of unwanted harmonics to a signal.

HUM: A low fequency interfering sound produced by break-through or interference from mains wiring or circuitry.

IHF: American Institute of High Fidelity, an im- ▷

G L O S S A R Y

◁ portant 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.

LINEAR: A transducer that produces an output that exactly portrays its input over the required operating range is described as linear, and is hence distortion free. Hence also nonlinearities (distortions).

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.

MICRO- (μ): Prefix for units meaning one millionth of.

MIDRANGE, MIDBAND: The central part of the audible frequency range where the ear is most sensitive.

MILLI- (m): Prefix for units meaning one thousandth of.

MOVING-COIL: A transducer (eg cartridge, loudspeaker, or headphone) where the signal is generated by the movement of a coil within a magnetic field.

NANO (n): Prefix meaning a thousandth of a millionth of.

NOISE: Random unwanted low level signals.

OCTAVE: Two-to-one ratio of pitch or frequency.

OHM: Unit of electrical impedance (including reactance) or resistance; also kohm, where 1 kohm=1,000 ohms.

PASSIVE: The most common type of system, where drivers and crossover are driven from a single power amplifier.

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.

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.

SIGNAL-TO-NOISE, SIGNAL/NOISE, S/N: The difference in total output when an applied signal is removed.

SUBSONIC: Below the audible range, ie below 20Hz.

THD: Total harmonic distortion.

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*.

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.

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