HI-FI CHOICE

AMPLIFIERS & STEREO TUNERS

The most comprehensive guide to buying amplifiers and tuners ever published

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THE BOOK OF LINN

IN the beginning is the performer.
2 And as he singeth or stroketh his instrument, so shall ye hear his song and know that it is good.
3 And all who hear his song may attest to the wonder of his music.
4 But in the days before the coming of high fidelity, though they that would hear the performer came in multitudes, even so his song could not carry beyond the ears of the anointed.
5 Therefore did the prophet Edison come forth from the Land of Ohio and create a disc which would transcribe the performer's song and multiply it a thousandfold. And in this manner did the performer make his song known even unto the ends of the earth.
6 Now in the time of Edison the disc was but a pale reflection of the performer's song. But it came to pass, in the generations after him, that the art of the transcriber was increased greatly.
7 Yet all who would listen were not blessed with a joyful sound for there dwelt in the land false prophets who would distort the song and confound its progress from the record to the ear.
8 And there came then a manufacturer who looked upon this sore affliction and saith, Behold, there is a chain of reproduction and unless this chain be rendered faithfully, it shall not profit ye to listen. And though each link save the first be of the finest metal, nevertheless shall the result be without honour.
9 Thus was the law given by the manufacturer who was called Linn.

HI-FI CHOICE No 33
Amplifiers and Tuners

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by Martin Colloms

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Published by Sportscene Publishers Ltd, 14 Rathbone Place, London W1P 4DE Tel 01-631 1433
Distributed by Seymour Press Ltd, 334 Brixton Road, London SW9
Typesetting by Clerkenwell Graphics, 13-14 Vandy Street, London EC2A 2ED
Printed by H E Warne & Co Ltd, London and St Austell

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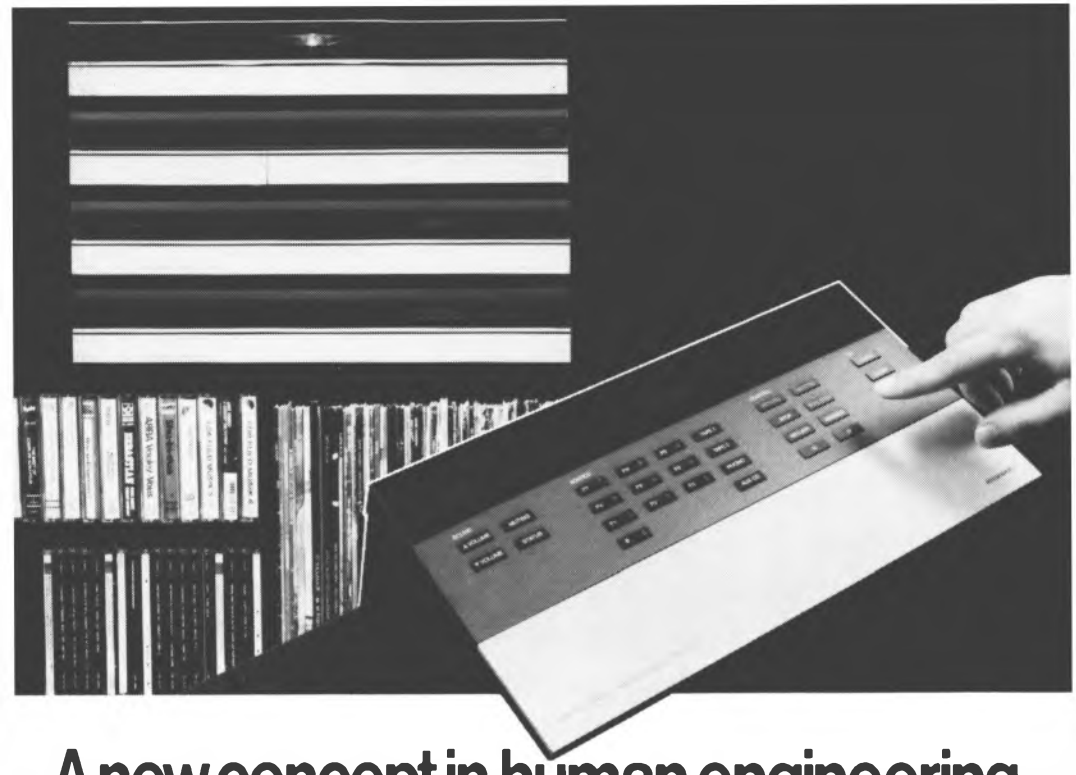

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*Beogram CD 50 Compact Disc Player available April 1984.

Bang & Olufsen

HOW TO USE THIS BOOK

Each edition in the *Hi-Fi Choice* series tests as many models as possible in a particular hi-fi product category. It provides both a comprehensive buying guide and a valuable reference.

At *Hi-Fi Choice* our steadfast aim is to provide, quite simply, the most comprehensive guide to current hi-fi products. Every competing model is tested exhaustively, under consistent conditions which make it possible to draw straightforward and valid comparisons between models on performance and value for money.

This edition deals with both amplifiers and tuners, and so effectively is divided into two parts. Amplifiers come first and have been given the lion's share of the available space, reflecting the importance of the amplifier's role in a hi-fi system; our tests on tuners are no less thorough, but we have assumed that most people will choose their amplifier first and then consider a matching tuner.

The **Editorial Introduction** gives a general background to the project, including recent market developments, general review policy and, perhaps most important, some words on interpreting the review findings. The very nature of amplifier reviewing is such that some care must be taken to keep things in perspective, and readers are entreated to heed these points before hurrying through to the reviews and 'Best Buys'!

The **Consumer Introduction**, dealing with amplifiers, is a non-technical guide to their functions and the facilities and features of current types. It covers the matching of amplifiers with other parts of the system, and what to look for when setting out to choose an amplifier to suit your needs. Written strictly in layman's language, this chapter is for the general consumer rather than the more knowledgeable hi-fi buff; it is well provided with subheadings which should make it easy to find clarification on any particular point without reading the whole chapter.

The **Technical Introduction** which follows describes the methods and standards used in amplifier testing, including the listening tests which were conducted to assess subjective sound quality.

Amplifier Reviews include comprehensive test measurement results with appropriate graphs, while the text in each case gives a careful analysis of the model's performance on test both in the lab and in the listening room, an assessment of the quality of materials, components and construction used, and the facilities provided. Each review is concluded with a clearly-stated summary of the model's merits in our view.

Conclusions summarises the findings of the amplifier test programme from a general point of view, and explains in some detail our criteria for final recommendation or otherwise.

Best Buys and Recommendation gives short summaries on those models we have chosen as outstanding performers or particularly worth considering in the various price categories.

The **Overall Comparison Chart** gives an 'instant' guide to some of the more important measurements and listening test results; while it may be a useful guide in shortlisting models for a particular requirement, please note that the tabulated assessments here should be taken in the context of the review comments, not in isolation!

Consumer Introduction: Tuners is a brief look at the way a modern tuner fits into a hi-fi system, the pros and cons of the various types of tuners and points to consider when buying.

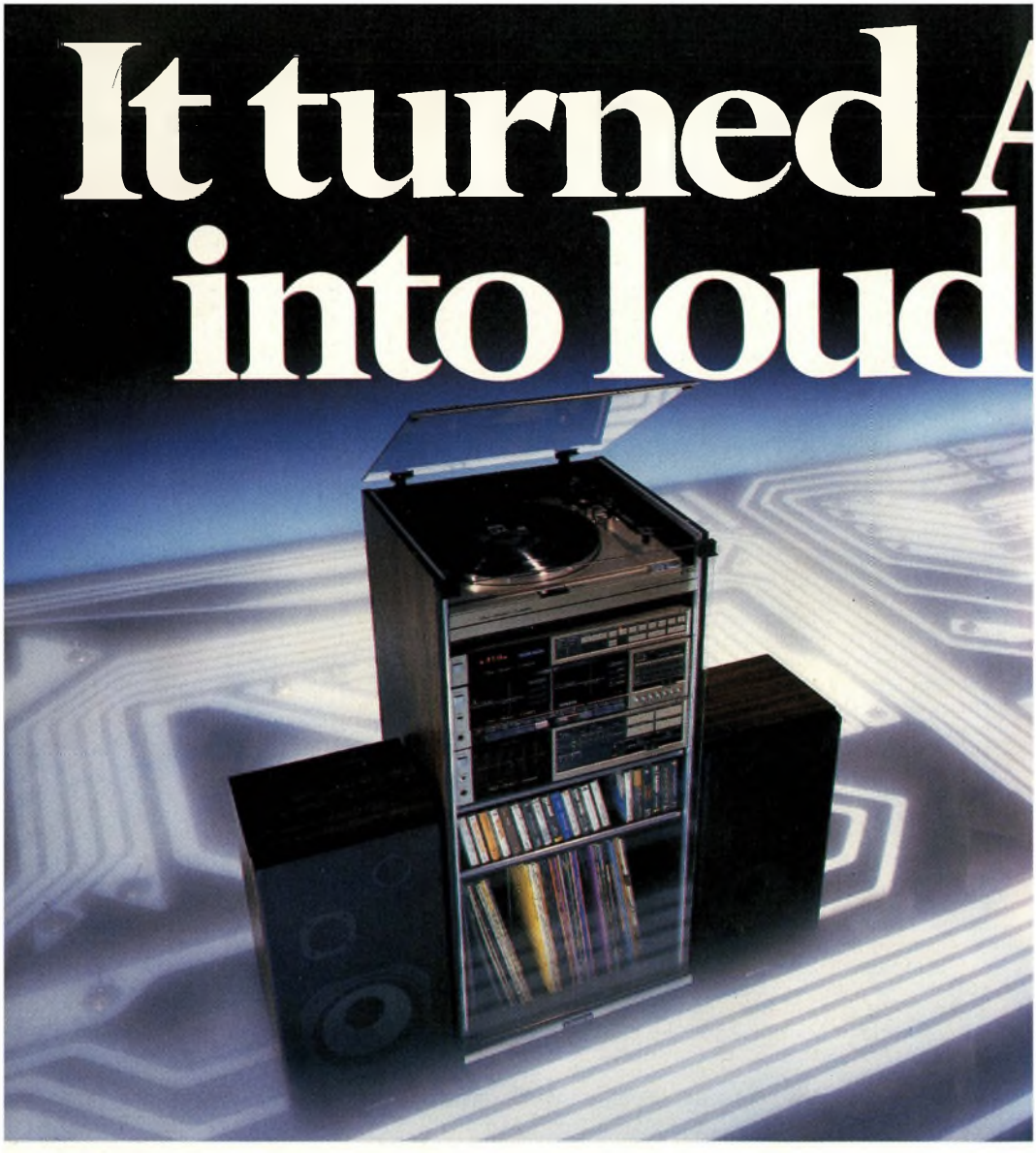
Technical Introduction: Tuners explains the relevance of the various technical measurements to performance in the home, and also covers aerial considerations.

Tuner Reviews include lab test measurement results, which are analysed in the text, and the results of the listening panel tests. In each case, the conclusion sums up the tuner's ability to give good results in poor reception areas as well as its general sound quality and ease of use.

Best Buys and Recommendations: Tuners gives a brief summary of the main points on those models in the test group which we feel are of outstanding merit.

Finally, the **Glossary** of technical terms gives quick explanations of amplifier and tuner jargon.

It turned A into loud



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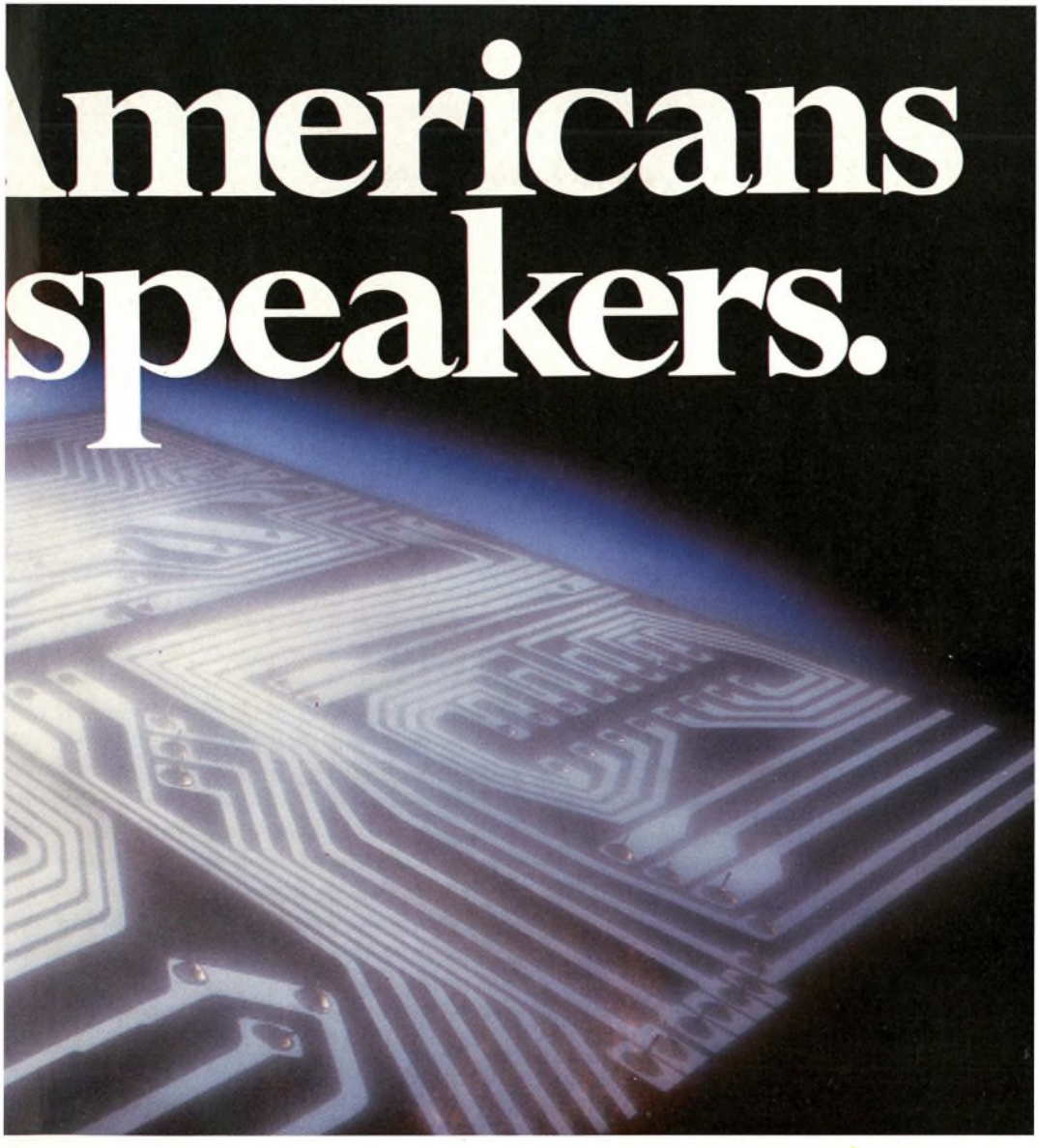

quartz locked synthesized tuner.

While the stereo single or optional twin deck cassette with Dolby* B and C noise reduction and two speed dubbing are features one simply cannot ignore.

Nor, could one fail to notice the aesthetic appeal of the 3-way speakers, component stacking, concealed wires, and soft touch controls.

Yet, before buying, one would still check that the experts agree on Fisher's impeccable reputation for quality engineering and reliability.

Only then will we purchase the new Fisher System 77, completely assured it is the best of its kind. At that point, we'll bring it home, plug it in, turn it on, and blast the neighbours till they're green with envy.

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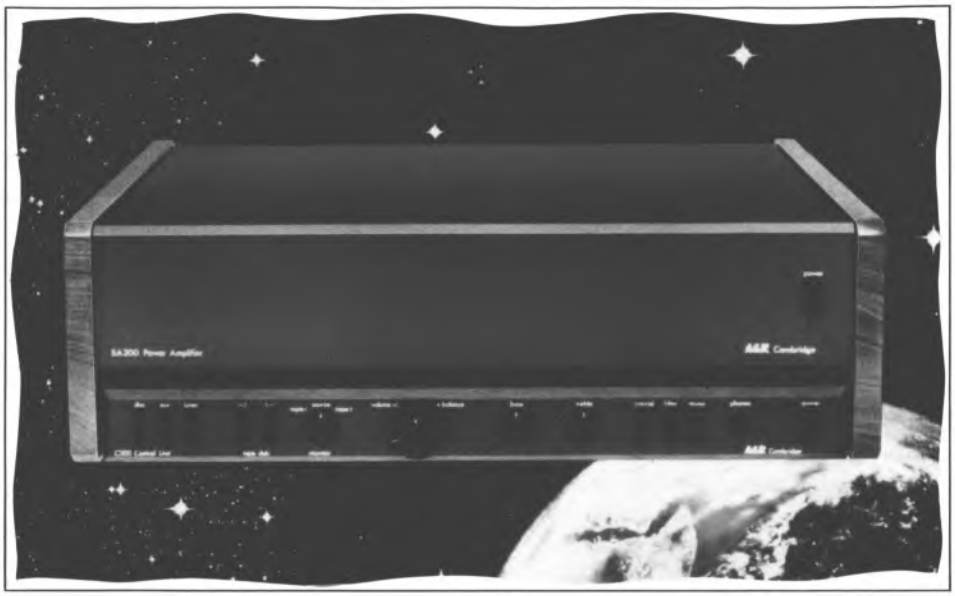

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EDITORIAL INTRODUCTION

Recently the ranks of Japanese-made hi-fi amplifiers have thinned a little, as some large manufacturers now concentrate entirely on integrated audio systems and no longer sell separate components. But at the same time there has been an unprecedented wave of activity in the more specialised British hi-fi industry, with the result that the range of amplifiers available is greater (or perhaps more bewildering!) than ever before.

Gone are the days when competing amplifier manufacturers could fight their battles on the safe ground of paper specifications, paring down their distortion figures and claiming just a little more power each year. Now, especially among the specialist manufacturers, the subjective sound quality of an amplifier is likely to be its main selling point. The audible superiority of one amplifier over another is actually very hard to prove, though easy to deny or to exaggerate, because audible differences do not seem to correlate at all well with traditional measurements of total harmonic distortion, for example.

Amplifier differences may often be subtle but can certainly be important to the overall sound of a system. To take extreme examples, a very poor-sounding amplifier may prove harsh and insidiously tiring to listen to, so that the user finds less and less satisfaction in his records and finds some of them too uncomfortable to listen to. A very good amplifier, on the other hand, might well reawaken interest and enjoyment in familiar discs, by reproducing the music in a manner which sounds lively but free from any sense of strain.

Our final judgements in this issue, then, are very firmly based on the author's asessment of sound quality, which in turn rests on the results of carefully conducted tests using a small listening panel; we have assumed that sound quality is of prime importance and hence in our value judgements have attached less weight to features and facilities, convenience of use and finish.

Matters are complicated by the fact that all design (except possibly at very high price levels!) must be a compromise, and clearly each designer will choose his own trade-offs to produce results which he feels to be subjectively as good as possible. Additionally, some designers will argue that an amplifier intended for use with a fairly modest turntable/arm/cartridge combination should be designed if anything to mask the latter's failings, rather than to be as 'good' as possible when tried with an expensive 'reference' system. There is perhaps no answer to this controversy, which will certainly cause some disagreement over the results in this book. Where a manufacturer claims special virtues for his amplifier when used with a particular system, the reader should take this into account, as our findings are inevitably aimed at establishing a general order of merit.

In any case, 'Best Buy', 'Recommended' and 'Worth Considering' classifications should be taken only as a guide and not as the be-all and end-all of the review analysis. With regard to system matching, the review comments on subjective tonal balance, such as 'hardness' or otherwise, and other sound-quality comments, may in themselves prove extremely helpful. We have tried to include pointers to successful matching wherever appropriate.

For the technical laboratory tests in this issue we were fortunate to be able to enlist the help of Stan Curtis, whose independent electronics consultancy CamTech Ltd has extremely comprehensive and up-to-date facilities. As a leading amplifier designer of many years standing, Stan Curtis could hardly be better qualified for the laboratory work, but we did not ask him to take any part in the listening tests or writing for this issue because of his involvement in the design of the Cambridge, Rotel and Sugden amplifiers covered in this book. Accordingly, Stan's name should not be associated with the subjective opinions or recommendations expressed by the author. By agreement, all test results relating to products where there might be a conflict of interest were confirmed separately by the author.

In retrospect, it seems that this time we have been able to cover the amplifier field more thoroughly than ever before, with the inclusion of an American 'super-fi' contingent as well as a solid coverage of the British scene and the leading Japanese products.

From the outset, our intention was to review tuners which matched the amplifiers tested, and while I must admit to having sacrificed the numbers slightly to make way for the 'last minute' amplifiers, I think we have included a good representation of what is available. It is often said that nearly all tuners today are very good, but we certainly found plenty of significant differences between models, even if there weren't quite as many surprises as with the amplifiers!

Steve Harris

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This section explains what the amplifier does, the inputs and facilities, what to look for in performance terms and when matching an amplifier to other parts of the system.

It's an old hi-fi cliche to say that 'the amplifier is the heart of the system', but the metaphor still holds good. Like hearts, amplifiers are often described as 'hard' or 'soft', 'fast' or 'slow' and while some are robust enough for any amount of hard work, others tend to give way under stress or produce results that are audibly anaemic. But before getting involved in the subtle and often controversial question of how amplifiers affect the sound of a system, we should start with their basic functions.

WHAT AN AMPLIFIER DOES

By definition, an audio amplifier takes small electrical signals which represent musical sounds and amplifies or enlarges them enough to drive loudspeakers. In practice this is not a simple operation, but is carried out in several stages. The stages of amplification needed to connect a record deck (for example) to a pair of loudspeakers may be all contained in one box — the familiar *integrated amplifier.* Or they may be separated into two units, each with their own mains power supply — the *pre-amplifier* and the *power-amplifier.*

Pre-amplifiers and power amplifiers

Sometimes referred to as the *control unit* or *control amplifier,* the pre-amplifier is primarily designed to take the very small voltage signals from the pickup cartridge or other source and amplify them to a suitable voltage for feeding to the power amplifier. The pre-amplifier will also incorporate facilities for switching between various inputs, routing signals to output sockets for cassette deck recording and so on. Tone controls may be provided which also operate on the signal at this stage, as does the volume control.

A power amplifier is once again a device that accepts a voltage and enlarges it — but in order to drive the loudspeakers, the power amplifier must be able to supply current as well as voltage. This current has to be supplied by the amplifier's mains transformer and associated components, known as the *power supply.* However good the design of the actual amplifier circuits, they depend on being able to draw the power they need from the power supply, and so the design of the power supply is very important. Sometimes the power supply unit is in a separate case of its own, and one or two manufacturers (such as Meridian and more recently Mission) have introduced optional-extra uprated power supplies whose greater capacity claims to give an improved sound from the amplifier.

Integrated amplifiers

The vast majority of hi-fi amplifiers are integrated amplifiers, which simply means that pre-amplifier, power amplifier and power supplies are built into one box. In the days of valves, it made a lot of sense to separate the pre-amplifier and power amplifier stages because the latter was a bulky and (except to enthusiasts' eyes) unsightly object, and also separation of the two units could be used to keep the power supply away from the small-signal stages which were likely to pick up radiated hum from the transformer. Nowadays there is little to be gained by separating the pre- and power amplifier stages in the case of lower powered units; but where large outputs are involved, the physical size of the power supplies and the heatsinks for the output transistors soon make two separate units a sensible idea again.

INPUT FACILITIES

A pre-amplifier, or the pre-amplifier section of an integrated amplifer, will need to have the ability to accept signals from record deck, cassette deck, tuner and perhaps a Compact Disc player, a second cassette deck or a reel-to-reel tape deck. It should also provide a suitable output signal for recording onto tape. In electrical terms, the same type of input characteristic will suffice for all these signal sources, with the notable exception of the record deck.

Disc Input

The pickup cartridge or disc input of the amplifier obviously should be designed around the kind of signals it receives from the cartridge. Until fairly recently, almost all cartridges were of the *moving-magnet** type with a typical output level of 1mV/cm/sec, this definition relating voltage output to groove velocity on the record. Although some mm

** the term 'moving-magnet' or 'mm' is used to cover cartridges more accurately described as 'moving-iron', 'induced magnet' and so on, as well.*

cartridges do produce measurably more output than others, the difference is not great enough to produce problems for a well-designed amplifer disc input stage.

When discs are mastered in the cutting studio, a standard amount of equalisation, taking the form of a bass cut and treble boost, is applied so as to get the maximum dynamic range onto the record while keeping the size of the groove excursions within reasonable limits (without this, loud bass notes would produce unacceptably large 'wiggles' in the groove, which would both limit the playing time available and present problems for the cartridge on replay).

Because of this pre-emphasis at the recording stage, the disc amplifier stage on replay must perform a compensating de-emphasis — effectively a bass boost and treble cut — to bring things back to normal. This compensation is called *RIAA equalisation*, and is built into the disc input circuitry of every amplifier. The standard curve for RIAA equalisation should be followed to very close limits by the amplifier designer — experience shows that even quite small deviations from the RIAA specification, giving small amounts of treble boost or cut to the final frequency balance of the hi-fi system, can have surprising results on the subjectively-perceived overall sound quality. Many designers now 'tailor' the RIAA somewhat to achieve the desired result.

Apart from making sure that the equalisation is accurate, the designer has to make sure that this stage does not introduce undue distortion either, and this calls for careful attention to detail.

This is not the end of the problems for the pickup input. The modern pickup cartridge is a mechanical miracle that has no right to work at all, and succeeds in doing so by mechanical wizardry that has placed the two major unavoidable 'resonances' outside the audio band. A resonance is, basically, a mechanical loss of control which will be reflected in the electrical output. This is a major difference between the pickup and the other types of signal with which the amplifier is required to deal; namely that neither the bandwidth, nor the behaviour outside the required bandwidth are accurately known or predictable. The preamp has to cope with resonances beyond the audio bandwidth in both directions, *ie* infra- and ultrasonic.

Until fairly recently, most moving-magnet cartridges incorporated an automatic HF rolloff (due to an electrical filter caused by the resonant interaction of their internal inductance and resistance with the resistance and capacitance of the arm lead and pickup input). For a number of reasons including the flirtation with CD4 quadrophony and the desire to avoid 'messy' compatibility problems, the emergence of low inductance cartridge types came about, including by their very nature the moving-coil types, leaving the ultrasonic band with its tip-mass resonance 'wide open'. The significance of this remains the subject of disagreement among manufacturers and designers, although I have heard of claims that signals of a much higher level than expected and at extremely high frequencies have been measured, and if this is substantiated it may cause some concern.

With cartridges of high inductance (this including many moving-magnet types) the effect of high input capacitance in the amp will be to rolloff the treble somewhat. This is mentioned in reviews where appropriate.

Moving-coil disc input

Typical moving-coil type cartridges produce much lower voltage outputs than moving-magnet ones — in the order of a few hundred microvolts (μV) rather than a few millivolts. For this reason they need a special input of greater sensitivity, or, to put it another way, the input needs to have about 20dB more gain. There are some 'high-output' moving-coils that will work satisfactorily into a moving-magnet input, but these are a minority.

In the days when moving-coil cartridges were a rarity, few amplifiers offered a suitable input and most users resorted to a step-up device (either a 'head amp' or a transformer) to raise the voltage to moving-magnet levels, but it must be said that the majority of these were either extremely expensive or had an adverse effect on sound quality or both. However, they are now generally unnecessary because even some quite modestly-priced amplifiers come with a moving-coil input. Some manufacturers offer a simple switch which alters the disc input sensitivity, while others offer their product in alternative mm and mc-compatible versions; and yet others allow the user to switch from mm to mc by changing over a plug-in circuit board inside the amplifier.

So all in all, the disc input of an amplifier has a number of potential troublespots: it requires heavy equalisation and much more gain than the other inputs, particularly for moving-coil

cartridges; certain input parameters are not standardised, and yet can affect the performance of the system; the absolute content of the signal in terms of bandwidth and amplitude is not precisely known, and therefore could cause overload or slew-limiting problems. As the disc is both the most important signal source for the hi-fi user, and also the one most likely to cause problems, we have concentrated on this input in our examination of the amplifier.

Tape inputs and outputs
Connections between a cassette recorder and the amplifier must not only allow replay of tapes through the system, but must also allow the cassette deck to record from any of the other signal sources, such as tuner or disc.

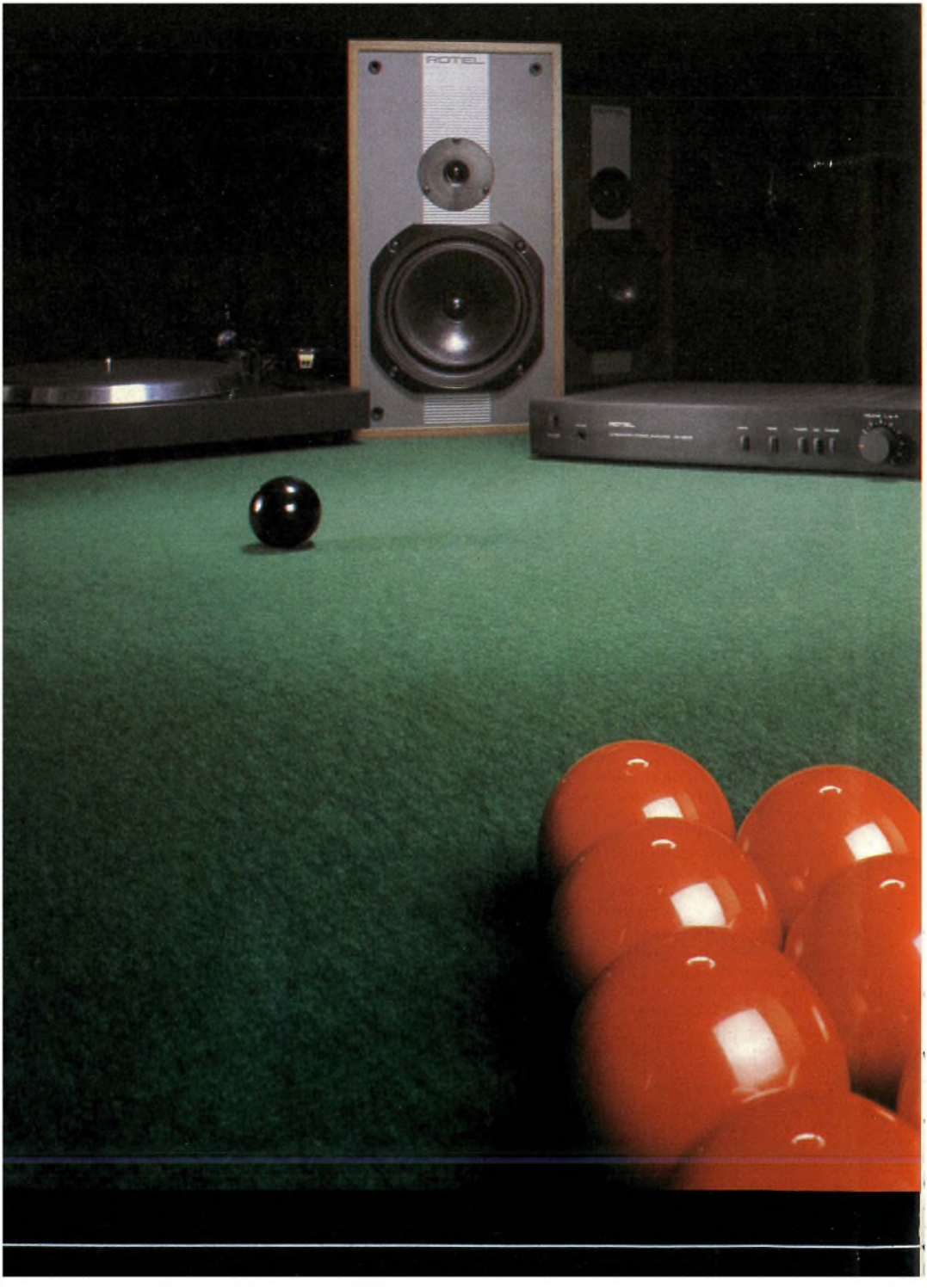
The compatibility of Brand X cassette decks with Brand Y amplifiers or *vice versa* depends on there being some standard for input sensitivities and impedance. The situation here used to be made rather tricky by the conflict between the German DIN standard, adhered to by European manufacturers, and the use of the so-called phono plug and socket by Japanese and American manufacturers. Now that there are virtually no hi-fi cassette recorders fitted with DIN sockets, and consequently wired to DIN input/output level standards, these problems should be virtually a thing of the past (Angus McKenzie, in *Hi-Fi Choice: Cassette Decks*, gave a hearty cheer on discovering that B&O were the only remaining deck manufacturer to retain DIN sockets).

The five-pin DIN connector is by no means dead, though. It does have some advantages over the phono in engineering, compactness and convenience. Many British amplifier manufacturers use DIN sockets for tape input/output, but these are virtually always wired to phono-level standards — not to the intended DIN levels at all. This means that a DIN-to-four-phonos lead should connect the cassette deck correctly, with no level matching problems. Ironically, you are only likely to have problems connecting a British amplifier's DIN socket to an older European cassette deck whose DIN socket is actually to the DIN standard! Conversely, where Japanese cassette decks were fitted with DIN sockets, these seldom did adhere to the DIN standard. If doubt or distortion should arise, your dealer will be able to sort things out for you.

Tape monitoring
The tape selector on an amplifier is usually fitted to a different switch than the main input selector in order to take advantage of off-tape monitoring, which is offered by many reel-to-reel and some of the more expensive cassette decks. This means that the pre-amp continues to handle input from disc or tuner, processing and sending this signal to the tape deck, while the power amp section of the amplifier (and the later stages of the pre-amp) can be switched independently between this 'source' and the tape input. Tape recorders which have separate record and replay heads (*ie* three-head machines) can replay a signal that they are recording almost simultaneously, so the user can make instant comparisions between the signal that he wishes to record and the recording that he is making, which is an extremely useful way of ensuring that no problems are being encountered.

Tape-to-tape dubbing
Many amplifiers offer 'tape dubbing or 'tape copy' switches, which are designed to allow you to make copies of cassette tapes by using a second cassette recorder connected to the 'tape 2' sockets. If you intend to do a lot of copying this facility may be worthwhile, but otherwise note that you can in fact produce tape copies using any amplifier that has an 'aux' (or even 'tuner') input by feeding the output of a second cassette deck to this and then recording on to a cassette deck connected in the normal way by setting the source selector to 'aux'.

Aux/Compact Disc input
Most amplifiers have an 'aux' or auxiliary input, which will accept a signal from cassette decks, reel-to-reel decks or Compact Disc players. Its specification will almost invariably be the same as that of the tape inputs. It is noticeable that a number of amplifiers now have inputs and switch positions labelled for Compact Disc, and strictly speaking the performance of these inputs should be of a high enough standard to do justice to the Compact Disc medium — they should have a wide frequency response, good overload margin and good stereo separation even at high frequencies, to do justice to the potential quality of CD programme. In practice, though, the demands which CD makes on the power amplifier stages are more likely to cause problems — more of this later.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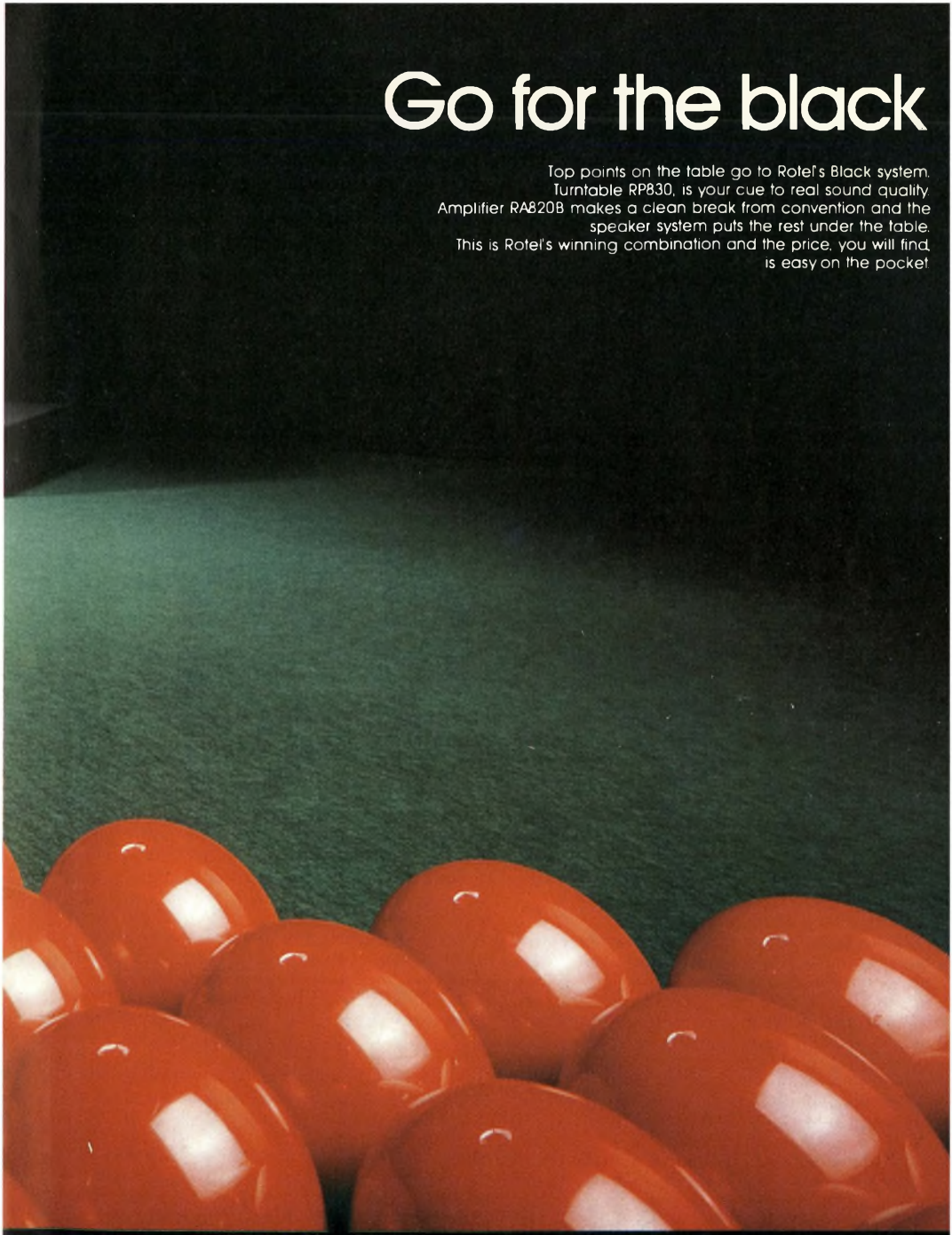

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ESSENTIAL CONTROLS

Which controls are essential and which are merely unnecessary extras is always a matter for debate. A number of manufacturers now unhesitatingly adopt the so-called 'straight-line' design approach, the idea being that the signal path through the amplifier should be as direct as possible, and it should not be routed through convoluted tone control circuitry or unecessary switch contacts. Few people these days would argue with the basic common sense of this approach, which is simply trying to avoid including in the amplifier any components which inherently degrade the sound. On the other hand, it is not safe to assume that amplifiers with tone controls sound worse than those without, because this certainly is not always the case!

Volume control

If the volume control on an amplifier is well designed, both electronically and ergonomically, you will happily use it without giving it any thought at all. But a poorly-designed volume control can be very annoying. Ideally the volume control should give control down to at least 60dB below full output without significant shifts in channel balance — any imbalance between the channels will only get worse as the volume goes down and this can be a nuisance if you want to listen quietly very late at night.

Another related failing of volume controls is that they often do not give fine enough control at the lower settings, a slight movement causing too big a change in volume. A 'muting' switch, which reduces the level by say 20dB, will effectively stretch out the lower part of the scale and allow accurate control.

Perhaps the worst kind of volume control to come to come into fashion was the 'click stop' type, which while actually using an ordinary potentiomenter, was made to mimic the step action of a professional-type attenuator. Usually the steps proved infuriatingly large and you could never get the volume exactly right — but fortunately this particular gimmick seems to have largely disappeared.

To the uninitiated, an amplifier gives an impressive display of its power output if it will produce normal listening levels with only a small movement of the volume control, but of course in reality this is no good indication of how loud it will go without distortion.

Volume controls using sliders instead of rotary knobs may be found more awkward to use, and the same goes for electronic types where you have to push a button for 'up' or 'down' and wait for the reaction of a motor driven potentiometer. In our opinion, such devices are just a nuisance in ordinary use but they do allow the manufacturer to add a remote-control facility.

Balance control

Giving control over the relative levels of the two channels, the balance control can be important. Its uses include compensating for an off-centre listening position, or for an imbalance caused by asymetrical room characteristics which make one speaker sound more dominant even when you are seated centrally; or for slight differences in sensitivity between two speakers, or volume control 'mistracking' between the channels, as mentioned already.

Most balance controls will almost completely silence one or the other channel at the ends of their travel, and most have a centre indent, that is a 'click' to mark the centre position, which is useful. Without this, there tends to be a feeling of uncertainty although of course the purist argument is that the listener should set the balance by ear anyway.

ADDITIONAL FACILITIES

Stereo/mono switch

Switching to mono can be a useful, some would say essential feature. When playing old mono records it can reduce background noise (especially low-frequency 'rumble' type effects) and it is of great benefit in mitigating the horrors of 'reprocessed for stereo' recordings, although it often doesn't cure them completely. It is a pity that so many record companies reissue excellent old mono recordings only in this unsatisfactory form.

Other 'mode' switching options such as left-channel or right-channel only, or stereo reversed left-to-right are seldom offered these days.

Tone controls

One of the classic definitions for an ideal amplifier a 'straight wire with gain', meaning that the amplifier should merely produce a magnified version of the input signal, and otherwise leave it unchanged. In fact few hi-fi users seem content to leave things as simple as that, and most seem to demand a number of special controls to interfere with the original sound balance created by the recording

engineer.

To return to the definition, a magnified version of the input signal implies that the amplifier magnifies all the frequencies presented to it by the same amount, and is therefore described as operating 'flat' — its frequency response graph is a straight line. The various sound-shapers, including tone controls, are designed to change this 'flatness' by emphasising or de-emphasising some frequencies with respect to others, and this is what is meant by changing the sound 'balance'. There are a number of different types of sound shaper, and these will be discussed separately, most have some potential for adversely affecting the signal, and for this reason, as already mentioned, a number of amplifiers omit them entirely, or going to some lengths to ensure that they can be switched out of the signal path.

Most tone controls are designed to act over a large segment of the audio band, usually introducing a tilt centred around the middle frequencies, so that the frequencies above or below receive a fairly gentle rate of boost or cut (the rate depending on the setting of the control). Some manufacturers like Quad for example offer slightly different modes of operation. Some manufacturers increase the flexibility of tone controls by providing alternative 'turnover points', *ie* the frequencies at which the shape of the frequency response changes, so that the bass control may operate only over the bass region or well up into the midband if desired.

A few manufacturers also offer a 'middle' tone control that boosts or depresses the midband, usually to a fairly small degree. If these three tone controls are in the form of sliders, we have the most rudimentary form of *graphic equaliser*; but even when the number of bands is increased to say, five, this in our view gives no benefit over a conventional array of tone controls and filters.

But what are the reasons for fitting tone controls in the first place? A number of explanations can be given, including enabling the user to compensate to some degree for the characteristics of the listening room, helping to overcome inadequacies in the other equipment used (notably cartridges, loudspeakers and cassette decks), and attempting to compensate for a poorly balanced commercial recording. Taking these applications in turn, the treble control can help to compensate for a poor loudspeaker/room match, but its action usually extends over too wide a band to give more than crude assistance, and it is more sensible to ensure speaker/room matching before purchase; as far as bass compensation is concerned, the tone control is completely inadequate, and the only solution is to use a professional type (expensive) graphic equaliser that enables complex tailoring to be accomplished. Even so many people regard the adverse effects of the multiple resonances introduced by such a device as far more detrimental than the original room-induced deviation from the 'flat' state.

The tone control can help compensate for the inadequacies of ancillary equipment, and indeed it was probably introduced to enable this to be done. Nowadays however even modestly priced equipment can be found which gives a tolerably flat response, or one which is sufficiently flat to be beyond effective tone control compensation. Cartridges are best compensated by their pre-amp loading, cassette decks can give a fairly flat response at modest cost provided they are aligned and adjusted correctly and used with a properly matching tape. Perhaps the most useful application is in helping to augment the bass response of a small loudspeaker, but as before the value of the tone control must always be offset against its distortions.

A further application of the tone control might be to doctor the balance offered by the recording engineer. This is also one of its more defensible roles, but again one only has to contrast the crudity of its operation to the variety of complex equalisations available to the engineer on the individual constituent parts of a recording to appreciate the ultimate futility of the 'hi-fi consumer as recording engineer'. This is not to deny that some users find the ability to change a recorded balance useful, particularly on recordings made more than about fifteen years ago; our experience on modern recordings is that it is invariably better to use a carefully set up and optimised 'flat' system.

Loudness control

The *loudness* (contour) switch or control often fitted to amplifiers, is of even more questionable value than tone control circuitry. The theory is that because the ear is progressively less sensitive to low and high frequencies compared to middle frequencies as volume levels are reduced, the loudness control attempts to compensate for this effect by

boosting low and high frequencies by an appropriate amount, for use at low listening levels. However in our opinion the loudness effect perceived by the ear is an essential part of the hearing mechanism, and any attempt to mess around with it introduces its own forms of distortion. Because the mechanism is in-built, we are used to living with it, and in fact use it to help determine absolute levels of loudness. So when we are listening quietly it is more natural to hear the bass and treble somewhat suppressed than to boost them in order to try and fool the ear into believing that it is hearing sounds at a higher level than they in fact are. It seems that the better the hi-fi system is, the less necessary and the more obtrusive a loudness contour becomes.

Filters

The final 'sound-shaper' is the *filter*, whose operation is normally rather more discrete than tone controls and loudness contours. While a variety of different filter types are used in different electronic applications (with evocative names such as 'notch', 'comb', and 'band-pass'), from the point of view of the audio amplifier we really only have to consider two types: the treble, scratch, high, or (strictly speaking) 'low pass' filter, and the rumble, subsonic, low, or high-pass filter. As its name suggests, the filter acts to remove certain parts of the signal bandwidth, and its activities are usually restricted to the extreme ends of the audible frequency spectrum, or even beyond the audible range.

There is an old but nonetheless sound adage in audio that goes 'The wider you open the window, the more the muck flies in', and the purpose of filters that act beyond the actual audio band (*ie* infra- and ultrasonic types) is to curtail the passage of too much 'muck', which can have unpleasant repercussions on the actual audio signal. In many cases these filters are optional and operated by a front panel switch, but in other models they are tailored into the design concept of the amplifier, in order to prevent successive stages from getting each other into trouble. An advantage of the 'fixed' filter is that the designer can take it into account when considering the overall phase and slewing characteristics of the amp; if the filter is switchable, its effect upon the system phase or slew rate will depend on whether it has been selected by the user or not.

While most filters offer a fixed rate of attenuation, some enable gentle or steep slope rolloffs to be selected.

Although fixed or variable filters are sometimes fitted to operate outside the audio bandwidth, there are many designs which offer them working within the band also. This, like the tone control, is something of a throwback to the days when equipment was less capable than it is today, and the familiar names of these filters — rumble and scratch — indicate their original purposes. However very few turntables worthy of the description hi-fi produce significant amounts of rumble these days, and the problem at low frequencies has much more to do with the LF resonance of the arm/cartridge combination than any other factor. The 'scratch' filter is a hangover from the days before the LP disc, the idea being that it helped to remove record surface noise or the exaggeration of surface noise due to the tip mass resonance of the cartridge. Here again events have rather overtaken the filter, and surprisingly few hi-fi cartridges now have an obtrusive tip mass resonance within the audible regions. While the exaggeration of record surface noise remains an unpleasant phenomenon, it is more likely to be improved by a change of cartridge, arm, turntable or even pre-amp than any attempt to use filtering.

So despite their limitation, switchable filters can be useful in some circumstances, although predominantly in attempting to cover up problems in the system. The argument for fixed filtering at the extremes of the audio band does seem rather more cogent, because under these conditions the filtering can be regarded as an integral part of the amp itself, and hopefully, problems can be avoided while the benefits accrue.

THE POWER AMPLIFIER

What distinguishes the power amplifier from the preceding pre-amplifier stages is the fact, already mentioned, that in order to drive loudspeakers it must produce current as well as voltage — power, expressed in watts, is defined as voltage multiplied by the current in amps.

For those less familiar with electricity, the 'water analogy' gives a useful if simplified way of looking at volts, amps and ohms. Electricity is concerned with the movement of electrons within the atomic structure of a conducting material (usually a metal) and, crudely, this can be compared with the flow of water through a pipe.

If you consider the flow of water through a

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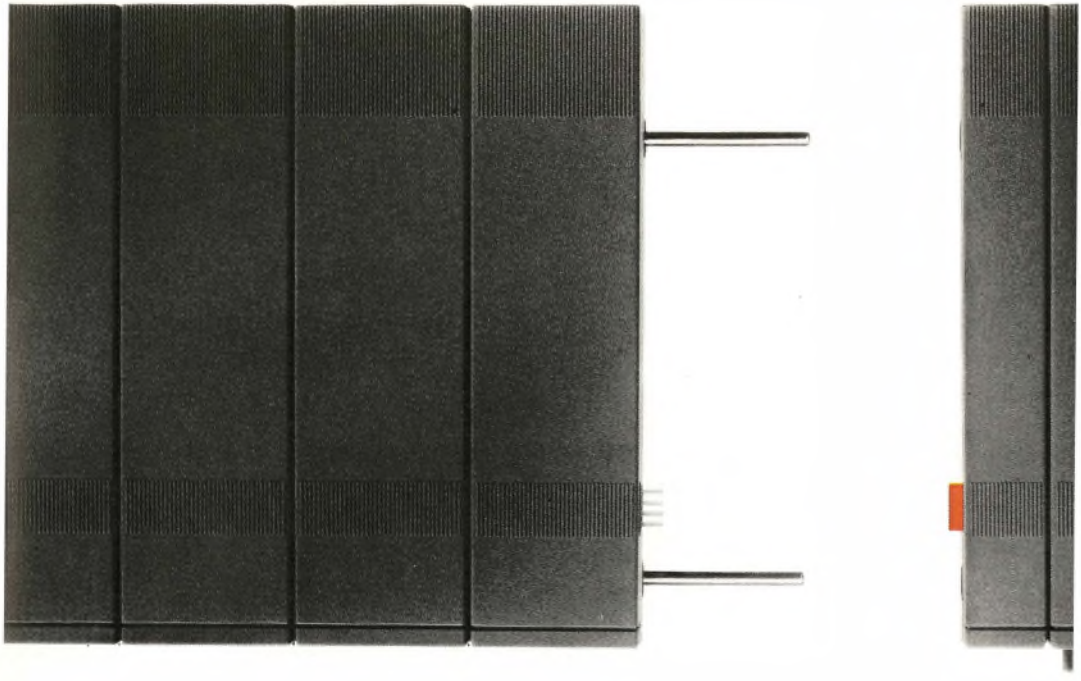

Between the power and pre-amp section can be plugged a series of modules to meet your specific needs. These modules are technically the very best and can extend to include up to 12 units selecting from FM tuner, headphone amplifier, tone controls, tape inputs, magnetic or moving coil cartridge and compact disc. As new technology is developed it will be incorporated into a module which you will be able to add to your system.

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tap, two factors determine the rate at which the water flows. One of these is the force or pressure at which the water is being pushed; this corresponds to the voltage in an electrical system. The other parameter is the size of the outlet through which the water flows, and this corresponds to the electrical circuit's resistance. The smaller the hole, the higher the resistance. So the rate at which the water flows (current) is dependent on both the pressure (voltage) and the size of opening through which it can pass (resistance).

When the tap is open as wide as it will go, water is flowing out as fast as the pressure (from the 'head' of water in the tank) will push it through the pipe. As anyone who has lived with antiquated plumbing will know, if somebody now turns on another tap drawing water from the same supply, the flow through the first one will probably slacken off; the two taps are sharing the available pressure, which is now not sufficient to drive the full amount of water through both of them. This situation can be avoided by having not only a sufficient head of water (voltage) but also big enough pipes (current capacity) to meet all demands.

The analogy becomes rather more hazy when considering how one uses electricity. Water is drawn by turning a tap so that the water flows, impelled by the pressure at a rate which also corresponds to the size of the orifice. One 'draws' electricity by completing a circuit so that a voltage difference lies across a resistance, and this impels the current to flow, the amount depending on the voltage and the resistance according to that tried and trusted relationship Ohm's Law. The resistance is frequently a heating coil (to provide heat or light) or a motor; in fact, a loudspeaker is just a rather specialised form of motor, in that it moves a cone back and fourth rather than turning a spindle.

Audio signals are in the form of *alternating current*, which means that the direction of flow around the circuit reverses at a number of times per second called the *frequency* of the signal. This complicates the whole idea of resistance, which in alternating current (ac) conditions becomes bound up with the more abstruse concepts of *capacitance* and *inductance*, and is known as *impedance*. In simple terms, both capacitances and inductances are resistive elements whose resistance changes with frequency, due to their ability to 'store' electricity for brief moments. These components have the effect of throwing the alternating cycles of voltages out of phase (out of step) with those of the current.

So, in the pre-amp stages the audio signal is in the form of a voltage developed across quite high impedances and little current actually flows. The power amplifier has to maintain the fidelity of the 'voltage model' to the original music waveform, while connected to a low impedance — the loudspeaker. The loudspeaker will draw current from the output stage corresponding to its impedance at any given instant in time, and as this varies with frequency, the current demand will also vary continuously. But determining what the actual impedance of a real loudspeaker is at any given moment while it is being driven with a musical signal is no easy matter.

Those who have read reviews of loudspeakers in hi-fi journals (including our own) will be aware that curves are shown which depict the 'modulus of impedance' of the loudspeaker, as a function of the different frequencies it is required to handle (typically from 20Hz-20kHz). Although this 'modulus of impedance is intended to represent the resistance load of the speaker at different frequencies, and hence the current that will be drawn to correspond to a particular voltage, it is well known that the capacitance and inductance components that make up part of this load may cause problems, due to large currents 'disguised' by the current/voltage phase-shifting mechanism mentioned earlier. Some designers take an even more extreme view, pointing out quite correctly that the modulus type of measurement merely averages out the impedance value over the whole cycle. This they suggest disguises the fact that at some frequencies, and under certain transient conditions common in music signals, the amount of current required to satisfy the speaker's demands (and hence keep it under control) can be considerably larger and also far less predictable than that required to meet steady state conditions.

While there has been no real end to the controversy over just how important a high current capability is for sound quality, the number and reputation of 'high current' designs has grown steadily, their manufacturers perhaps taking the lead from one or two well-established 'esoteric' or top-end models.

Slew rate limiting

Amplifier design never seems actually to

stabilise, even though many commentators and designers tend to suggest that all the problems are long solved and nicely under control, and certainly orders of magnitude less severe than the distortions which occur in other components in the audio chain. Over the last few years the related distortion mechanisms known as Transient Intermodulation (TIM Or TID) and Slew Rate Limiting have both been put forward, hotly debated, and finally won a grudging acceptance that has finally found its way into commercial design. The concept of slew rate limiting is fundamentally so simple and obvious that it is surprising it was not 'discovered' earlier.

As mentioned previously, the audio signal is modelled by a complex alternating voltage, and one of the amplifier's tasks is to magnify that voltage to a sufficient level to enable the attendant current to drive loudspeakers with the original signal. This is usually accomplished by using a number of amplification stages, each of which in turn enlarges the voltage. One of the characteristics that defines the performance of transistors is known as the 'slew rate', and this is the maximum speed at which the voltage in the transistor can change. When taking into account the maximum voltage swing required (*ie* the signal level), this slew rate determines how quickly the device can switch on and off, and hence how high a frequency it can handle before limiting and distortion sets in (it has been suggested that the slew rate should be two octaves — four times — the required high frequencies).

Obviously for the same device, the smaller the voltage swing required, the higher the frequency that can be handled. It we then start with a very small very high frequency signal, such as might be developed by a moving-coil cartridge for example, and the amplification stage provides an overall gain of X10, then the transistors that provide the output from that stage must be capable of slewing ten times faster than the fastest input signal to avoid distortion. This is not so much of a problem with the fast, small transistors used in the middle of the amplifier, but the large output transistors which have to pass heavy currents to drive the loudspeakers are by their very nature comparatively 'slow', so there is a danger that the devices will not be able to keep up with themselves. Two solutions are open to the designer, the 'low-key' approach is to use carefully designed low-pass filtering between the various stages so that no stage receives a signal that is too fast for it to handle; the 'hi-tech' approach is to develop faster and faster devices at the high voltage end, and this has led to 'superfast' output devices like the V-FET, EBT, and power MOSFET.

While Hitachi won some critical acclaim with their own original MOSFET power amplifier design, their devices are now available to other manufacturers; MOSFETs have now appeared in several British-built power amplifiers.

More or less complex circuit innovations for amplifier output stages have appeared from all the major Japanese manufacturers, in most cases attempting or claiming to get the benefits of *Class A* operation without drawbacks. Briefly, Class A is a mode of operation in which the paired transistors which produce the positive and negative halves of the output waveform are both 'on' all the time — this is because in addition to the actual audio signal they are fed an unchanging *bias* current which keeps the audio signal within the most linear part of the transistor's operating range. Now, this is inefficient in that a lot of power is used, and heat produced, even when the signal waveform is at the zero point in its alternation, and so Class A amplifiers need large and robust transistors, large heatsinks (and perhaps a cooling fan) and very large power supplies, all of which adds up to a lot of weight and expense.

So a whole generation of Japanese 'super amps' have attempted to get around these disadvantages. One answer, which varies from manufacturer to manufacturer in the actual execution, is to have a form of *sliding bias* — the amount of bias applied is varied in accordance with the signal conditions. Although this kind of hi-tech approach involves the use of many more components, these are in the form of relatively cheap ICs. As to the audible benefits, it would be very unwise to generalise, but we could cautiously state that the 'new' amp circuitry has not so far convinced UK ears that it inherently shows any benefits over the conventional compromise of Class A/B. This probably just goes to show, once again, that good results are to be attained by good overall design, and not merely by the application of some new innovation, excellent though this may be in achieving a specific goal.

Power output

The power of an amplifier is traditionally expressed in watts, which is the unit of

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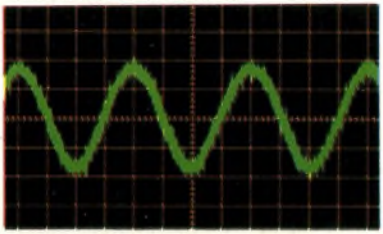
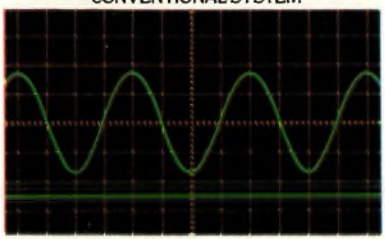


CONVENTIONAL SYSTEM



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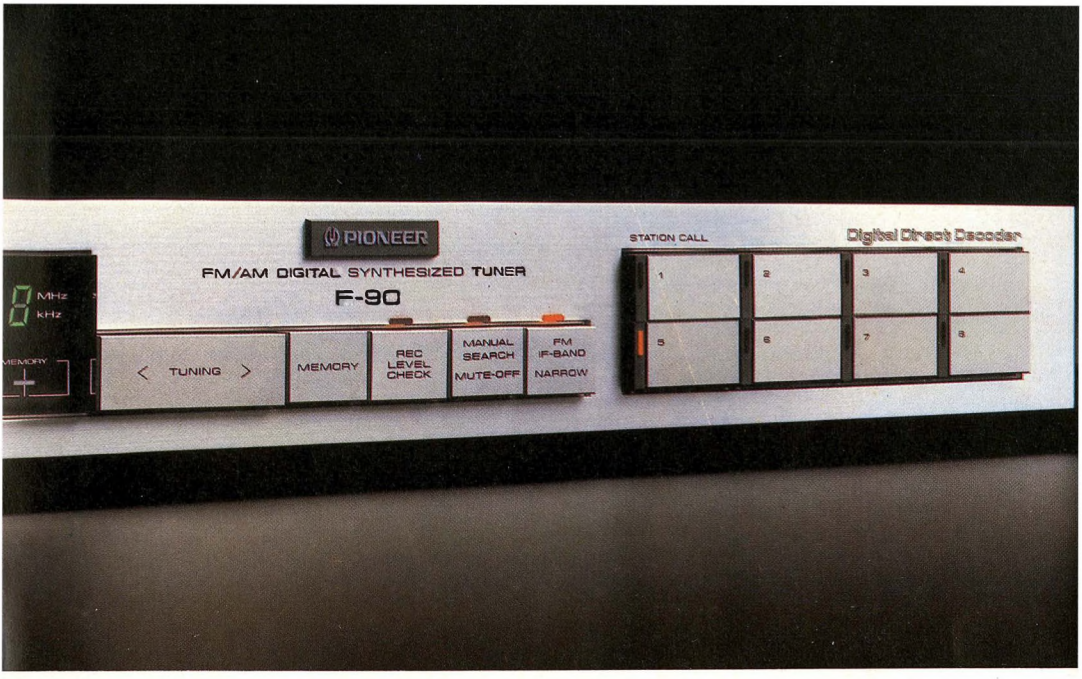

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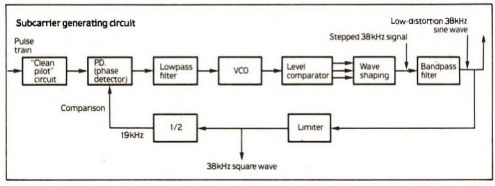

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electrical power derived by multiplying together the volts and amps supplied across and through a specified load.

All electrical power systems work by setting up a voltage across a load, and this itself determines the current required: with ordinary power systems like the mains or car battery (and ignoring AC voltage complexities), the voltage supplied is set at 240 and 12 respectively, so ¼ amp at 240volts will give 60watts, whereas 5amps will be necessary at 12volts to give 60watts ($¼ \times 240 = 5 \times 12 = 60$). If the voltage is fixed, then the power is determined by choosing the load to allow the right amount of current to flow. This can be worked out by means of Ohm's Law, which states that the current (I, amps) multiplied by the load (R, ohms) equals the voltage (V, volts). So the load that gives 60watts via ¼ amp from the mains will have a resistance of 960ohms, but with the 12volt battery it will be 2.4ohms. Getting back to the audio situation, the amplifier sets up a voltage that corresponds to the required loudness and the signal content, and the loudspeaker then specifies the required current according to its load.

As we have seen, the impedance of a loudspeaker is not in reality fixed at the nominal '8ohms' but is constantly changing. So when testing amplifiers it is well worth checking the power output into 4ohms and 2ohms to see whether the amp can still 'deliver the goods'. Because of Ohm's law, this comes back down to current capability, which is really dependent on the *power supply*. A power supply which will still feed the amplifier sufficient current to supply the loudspeakers under tougher load conditions is described as 'stiff'.

Watts can be a misleading way of quoting power output really, because they bear little relationship to the loudness that the amplifier can achieve. Decibels give a better picture of relative power, because their logarithmic scale has some relation to subjective perceptions of volume. The use of decibel (dB) ratings for amplifier power is explained in the *Technical Introduction*; suffice it to say here that power ratings in watts tend to give an exaggerated idea of the difference between two amplifiers; for example, you might think that a 40W amplifier would go noticeably louder than a 30W one, before overloading. In fact, the difference in level achieved (all else being equal) would be barely 1dB, and 1dB is usually taken as the smallest change in volume that the ear can easily detect. In practice, the subjective loudness to be got out of an amplifier is often not what would be predicted by the rated power output anyway. Some units are conservately rated and give far more power than their makers claim, others are only just able to give their rated power into 8ohms and 'give up' when trying to drive real speakers, Also, amplifiers behave differently at the onset of overload (called *clipping* because the peaks of the waveform are clipped off when the amplifier cannot supply any more power). Some will sound quite nasty almost immediately, while others will produce tolerable sounds when mildly clipping and so in practice be capable of higher subjective levels. The tests in this book have taken these factors into account to give an idea of the real capabilities of each amplifier in terms of subjective volume level on a typical speaker. As a parting shot at power output specifications, do not forget that changing to a loudspeaker 3dB more sensitive (say from one of 86dB for 1W (or 86dB/W) to one rated at 89dB for 1W) has the same effect as doubling the number of watts available from the amplifier!

Output connections and switches

Some designers have long held that switches or other movable connections are to be avoided between the output stage and the speakers, and so have omitted to offer switching for two sets of speakers for example. It would be very difficult to pronounce judgement on the significance of this in terms of any possible sound quality benefits.

Even where only one set of speaker outlets is provided, the existence of a headphone socket, which automatically mutes the speakers when used, means that there is a switch in the signal path to the speakers already. Some makers have elected not to provide headphone switch either! However, various approaches can be used to get the best of both worlds here and provide at least one 'straight through' speaker connection.

The whole area of interfacing between amplifiers and loudspeakers is sufficiently riddled with doubts, controversies and unknowns that the connection of more than one set of speakers for serious listening must be open to question. The problems of loudspeaker drive are complicated to say the least but the fact remains that an amplifier is primarily designed for one set on terms of its 'conventional' power rating and impedance

matching, and even its ability to do this adequately is challenged by the existence of multi-amplification systems (where a separate power amplifier is used for each loudspeaker drive unit).

Headphone driving poses few of the problems found with loudspeakers, if only because a far smaller amount of energy is required, the headphone only needing to energise the ear canal rather than an entire room. The majority of headphones should work without any difficulty from a normal headphone socket, which should be designed to give a fairly good match for the various types encountered as well as a measure of protection against their being overdriven and destroyed by the comparatively high-powered amplifier. Some of the more exotic headphone designs, typcially those using electrostatic or electret principles of operation, are designed for direct connection to loudspeaker terminals *via* special adaptor boxes which also ensure this matching/protection function. Those amplifiers which are not provided with headphone sockets can use them *via* an external adaptor/switch box, but the same comments and reservations about switching in the speaker signal path mentioned above will of course apply.

Power indicators

Many amplifiers are adorned with so-called *output power meters*, which these days usually consist of a fast-acting fluorescent display or a string of LEDs. In fact, such indicators measure the voltage across the speaker terminals rather than the power; they are calibrated in watts on the extremely unsafe assumption that the loudspeaker's impedance is a constant 8ohms, which in practice it never is.

But the voltage indication may be useful sometimes if it shows when the amplifier is going into clipping, though a more sober display of one or two LEDs can do this as well as a string of flashing lights. This kind of display does graphically illustrate that the average output level on music will be only a small fraction of that attained on peaks, with the meters indicating less than a watt a lot of the time. What really proves that power meters are purely cosmetic devices is the fact that some makers offer an option of a magnified scale reading in tenths or hundreds of a watt, to ensure that you can have the lights all flashing while listening quietly! However, they clearly do no harm, except that once installed at home the hi-tech display which seemed so alluring and appropriate in the shop might become just an irritation.

POWER SUPPLIES

In discussing the ability of the amplifier to drive loudspeakers we have really been looking at the abilities of the power supply — transformer, rectifier and reservoir capacitors — to provide power when demanded. The amplifier output devices are there to control the flow and make it resemble the musical waveform. So it is not surprising that the power supply has claimed a lot of attention from designers, some of whom would say that it is the most important part of an amplifier design.

It would be too easy to generalise and say that the bigger the transformer and capacitors are, the better, because there are plenty of amplifiers whose designers have skilfully produced very good results from relatively small ones. At the same time, it is possible to point to some amplifiers whose subjective sound quality defects — for example, lack of subjective dynamics, or weak bass — do apparently correlate with the easily-measured lack of instantaneous current availability from an inadequate power supply.

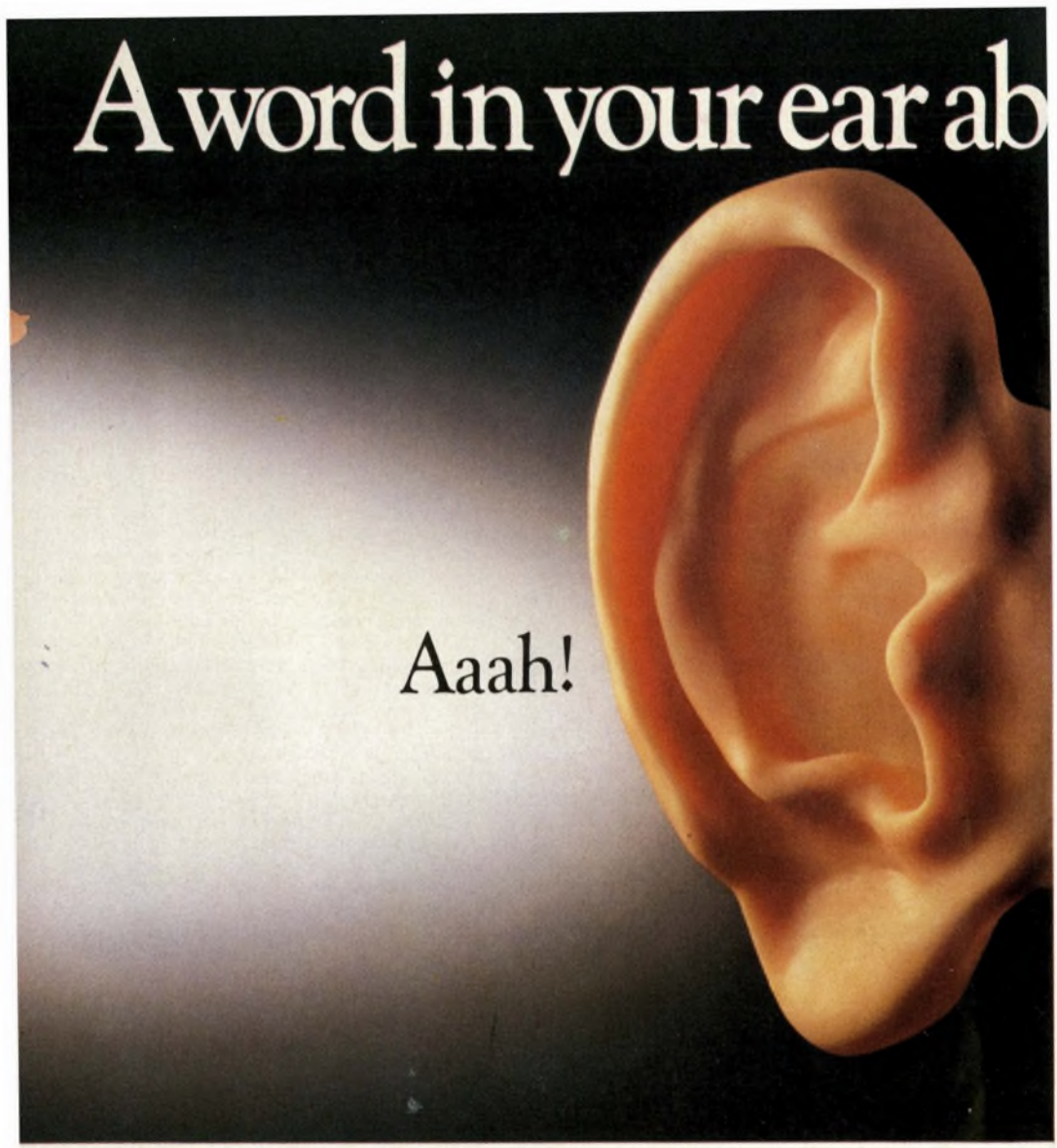
Even where the power supply is quite 'beefy', the current instantly available on demand may be limited by *protection circuits* which are there to save the output devices from overload. These represent a reliable alternative to fuses, which in some circumstances may not blow as quickly as the transistors they are meant to protect! While protection circuitry can make an amplifier virtually indestructable, well-designed amplifiers without protection should stand up to a fair amount of abuse and be reliable under normal circumstances.

On the basis that current drawn by one signal channel will affect that available at the same instant for the other, it would appear to be a good idea to have completely separate power supplies for the two stereo channels. The disadvantage, of course, is the added cost, bearing in mind that the power supply is the most expensive part of the amplifier anyway.

Another approach is to *regulate* a single power supply, that is, to control its output to the two channels by electronic means, and hence remove any problems of interaction though probably at the cost of peak output.

Recently, some manufacturers have evolved high-frequency *switching power supplies* in which the usual 50Hz mains transformer is

A word in your ear ab

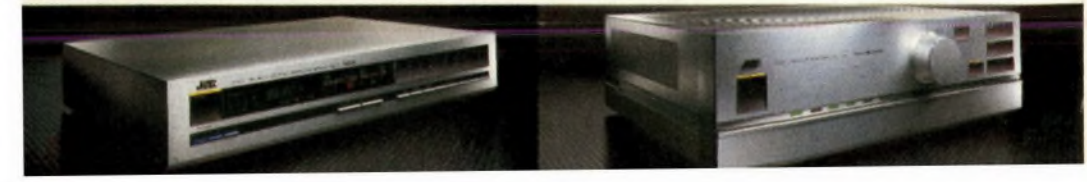


Sadly, not all amps and tuners are created equal.

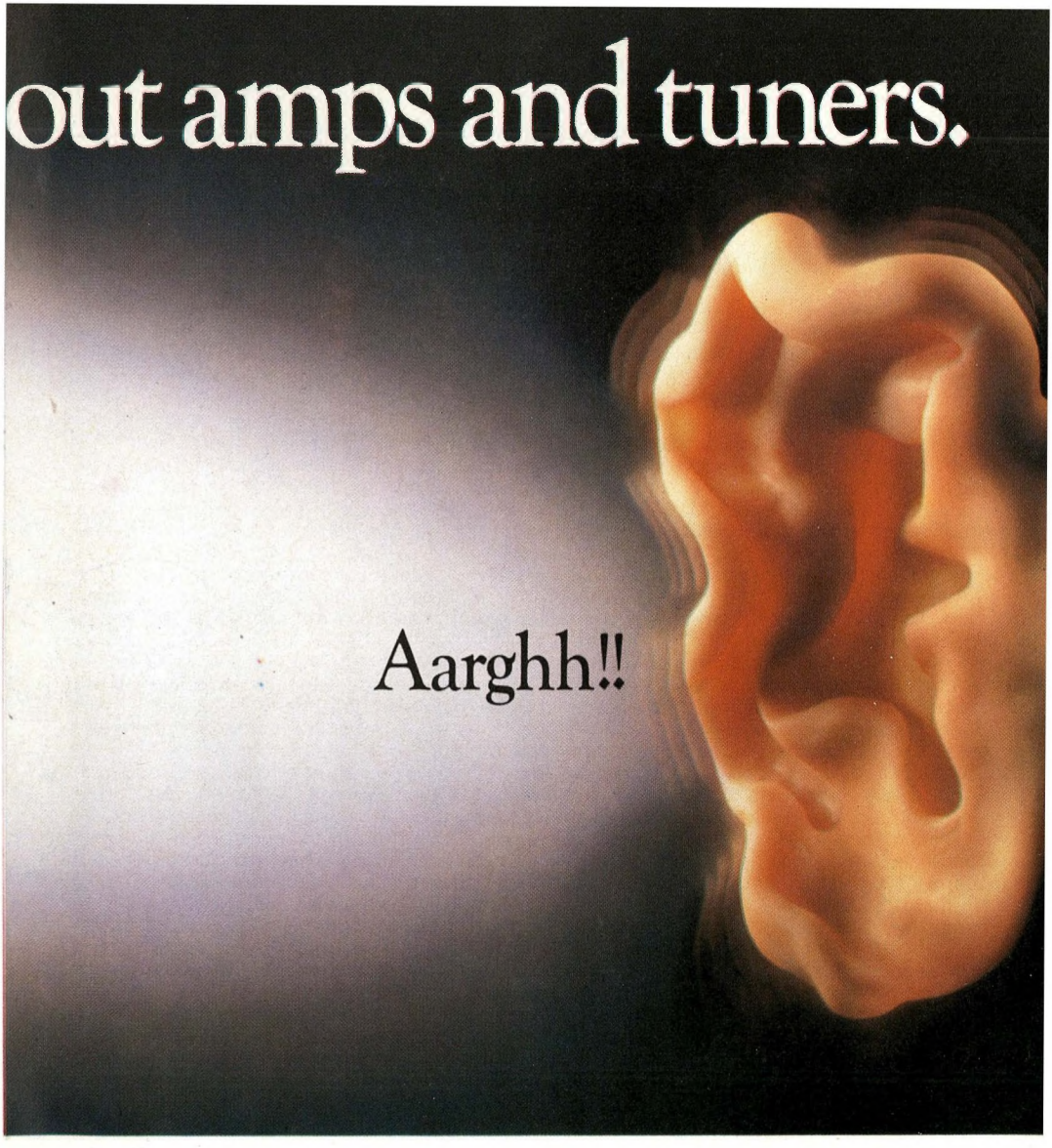
Too often, the sound produced can vary wildly from the good to the bad to the downright ugly. JVC amps and tuners on the other hand, are always music to your ears.

The AX-77 amp for instance features Dynamic Super A amplification to approach state-of-the-art sound.

A non switching output stage design eliminates crossover distortion, while Harmonic, Intermodulation, Transient Intermodulation (TIM), Dynamic Transient Intermodulation (DTIM) and other distortion parameters are all dramatically reduced too.



out amps and tuners.



Reduced in fact, to the point where only a passing bat could possibly take offence.

Which effectively means you never will.

Counter electromotive current feedback from the speakers is reduced too, for optimum performance, no matter what type of speakers are used.

In short, the sound never varies from the one standard – excellent.

The TX55 tuner meanwhile, delivers a source signal worthy of such an amp.

It boasts sophisticated Quartz PLL synthesizer tuning, to automatically optimise tuning parameters. Gain factors, IF Band width, stereo quieting and slope control in both mono and stereo modes are all optimised for the very best reception possible.

Moreover, when used in conjunction with a JVC cassette player, the TX55 can be programmed to record up to 8 pre-selected programmes on either AM or FM at different times. Thus 16 programmes can all be automatically recorded.

You'll find these, and the whole range of JVC Amps and Tuners at your local JVC dealer.

When you get there, tell him that you've heard the word.

JVC

You've either got it, or you haven't.

done away with altogether. First in this field were Sony, while recent top-end designs using this new form of supply are Meridian and Revox. Switching power supplies have the advantage of light weight as well as avoiding the high material cost of large copper-wire transformer windings.

AMPLIFIER/LOUDSPEAKER MATCHING

Many people are nervous about matching amplifier power with speaker power handling, and consequently stick slavishly to manufacturer's recommendations without perhaps realising the slim premises on which they are based. The ability of an amplifier to damage a loudspeaker depends on so many more things than just its power rating, not all of which can be predicted, and there are really no worthwhile rules. It depends on the type of programme (electronic synthesiser type music being the most dangerous), the ability of the amp to keep control of itself particularly when driven hard, and the clean-lines of the programme source. It was salutary to note during the work for *Choice: Loudspeakers* that a 500 watt amp was used for some of the time; although it was possible to make some of the speakers protest audibly, none were permanently damaged, and it was surprising how many quite modest models accepted the full power rating on peaks. Although this was partly due to the very clean signals used, it also tended to show how the extra headroom and consequent extra control of a big amp helped matters.

In practice, then, it is not very likely that you will end up with too much power. It is a fact that loudspeakers are far more often damaged by an underpowered amplifier than by an 'overpowered' one. This is because of the phenomenon of clipping, mentioned earlier, when at the limit of its power capability the amplifier can no longer stretch to the peaks of the signal waveform. Instead, it produces an output with the tops of the waveform 'clipped' off at the point where the amplifier runs out of volts. This means that most of the amplifier's power is going into the production of distortion harmonics, which are of high enough frequency to get into the speaker's treble unit and may well burn it out. Even on fairly large speakers, the tweeter alone may not be designed to handle, say, 20W continuous input, because normal music programme would not demand this. However, having warned against persistent overdriving of an underpowered amp, it must be said that treble units in quality speakers do seem to be more robust than they used to be.

So what is the minimum power you can get away with? Again one factor in the equation will be how well the amp behaves when it is giving almost its maximum output and begins to clip. But the most important considerations will be how loud you like to play music, how large the listening room is, and how sensitive the loudspeakers are. The first will depend on personal taste, and the second on circumstances, but we may as well consider an average room of say 80 cubic metres, while the third can have the most marked effect of all. Amongst the loudspeakers in one of our surveys there was a difference of rather more than 10:1 in the amplifier power needed to achieve the same level of loudness! So if you have very sensitive speakers, you should be able to get loud levels in a normal sized room using only a few watts of amplifier power, while the less sensitive designs may need as many as 40W to achieve a similar level; this in turn means that the less efficient speakers will be working an amp rather harder, and will leave less in hand to cope with peaks (which can be much higher than the average power levels in music). 50W or so is likely to leave sufficient in hand for the 'average' situation, but if the speakers used are fairly sensitive, 20W may be ample. If you find even more powerful amplifiers of 100W or more beginning to strain and giving insufficient 'headroom', it is time to consider using more sensitive speakers; this will usually be a cheaper way of getting a higher loudness capability. Once again there is no substitute for listening to a combination for yourself to determine whether it is loud enough or tolerable at its higher levels; sheer numbers of 8ohm watts do not give a reliable indication of whether a combination will sound good at high levels.

Facilities and features obviously have to be considered when choosing an amplifier and here the aim must be to sort out which 'extras' or inbuilt facilities are really going to be used. This does in a sense boil down to philosophies of system-building; if you once begin to adopt the purist or 'straight-line' approach, you will be more concerned with getting the signal sources and speakers (and even the room) right in the first place rather than trying to correct their imperfections electroncially. But even so, it is worth checking to see that the elegantly-simple controls of an 'audiophile'

amplifier won't leave you without the convenient source switching you really need.

Styling, finish and build quality are often important factors in choosing a purchase. Whether the 'looks' of a product appeal is a matter of personal taste, but most people are able to agree on the tangible 'quality' which comes from good materials and good workmanship. Unfortunately this may add quite a lot to the price of a product, but for many people will be worth it.

Finally, and of course in our view of overwhelming importance, is the question of actual sound quality. The whole business of subjective sound quality in amplifiers is a very vexed question indeed, and although in this book we have tried to give clear assessments of our findings there is still plenty of room for interpretation. We feel that ideally no hi-fi product should be sold without a demonstration, and that if at all possible customers should have the opportunity of comparing alternatives in the context of their own system, preferably in their own home. An amplifier, theoretically, can only reproduce what is fed into it, but many modern designs are cunningly wrought to mask the deficiencies of the incoming signal to a remarkable extent. Some designers have also learned how to produce subjectively better results with a little 'cheating' in terms of response tailoring; and this will work better in some systems than others.

A good dealer should be able to demonstrate an appropriate improvement if he tries to sell you a more expensive amplifier instead of a cheaper one. The main thing is to try and listen with a relaxed, open mind, and to be swayed by what you hear rather than anyone else's analysis or persuasion. A sympathetic and helpful dealer will allow you the time and facilities to do this.

Acknowledgements

We would like to thank all the manufacturers who have helped us with the loan of equipment for review and their patience in waiting to get it back!

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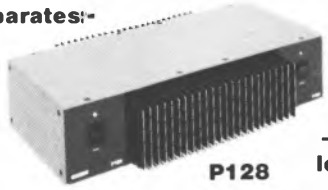

P128

150 watts/channel Mosfet power amp
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"I certainly enjoyed the results it gave me — and I think I could enjoy them long term too" J.M. Hughes.

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TECHNICAL INTRODUCTION

In the test programme for this edition, comprehensive laboratory testing was combined with carefully-controlled listening tests. This Technical Introduction explains the methods and relevance of the various lab tests and the approach used in the subjective assessment.

In this section, the test procedure is covered in some detail, both as regards subjective and objective methods. Within the constraints of time and finance, these tests were designed to extract the maximum of useful information while at the same time verifying all basic aspects of measured performance, in order to ensure that the samples supplied were to specification and were not faulty.

Laboratory tests

In general the tests conform to the IHF A202 practice which makes comparison of the results between units straightforward. Where possible use has been made of dB rather than percent or linear scaling, which again makes comparison of product performance rather easier. For example, dB scaling of power output shows the subjective capability far better than linear watts ratings. For reference purposes, 0dB is set at 1 watt and the typical 100w amplifier output is thus 20dBW. The next higher power to give a worthwhile subjective power increase is 23dBW, 200 watts. While when quoted in watts this may seem a lot louder, in reality it isn't that much of an increase. Average amplifier outputs are around 17dBW (50W) which in fact is not a lot less in subjective terms than the levels produced by the 100W/20dBW models. It is worth remembering that 3dB is only a little greater than one notch on a typical volume control.

While power output may be the most often quoted specification for amplifiers, in fact it is not the most important. Indeed the test programme demonstrated that some 50W-specified models could get louder under real use conditions than some 120W-specified units.

With a typical loudspeaker of 88dB for 1W sensitivity, a 100W undistorted programme input will raise an in-room stereo sound level of around 102 to 104dBA, which is pretty loud. A 25W model will still achieve 98-100dBA, and more if allowed to clip occasionally, while a 250W model, assuming the speakers are able to tolerate it, will raise only 4dB more, giving 106-108dBA.

With modern speakers in average rooms, 30-60W is all that is required for decently musical maximum sound levels. A low sensitivity model such as the Celestion *SL6* (at 83dB for 1W) will need 100W plus for highish volumes, while those users who want the potential for really loud sounds will need a combination of 100W plus per channel and speaker sensitivity of 90dBW or more; alternatively, an active speaker system might give them what they desire, employing multiple power amplifiers to do this.

Output power and current

Output power is referred to output level on the basis of a good amplifier representing a voltage source. Zero reference, 0dB, is equal to 1W, that is 2.83V across the standard 8ohm load. The scaling of level is not adjusted in power terms to account for the various load regimes, however. The objective is to explore the 'stiffness' or load tolerance of the amplifiers, and the addition of 3dB for 4ohms and a further 3dB for 2ohms only serves to confuse this fact. The reality of many of the more sophisticated 8ohm speakers is a complex and variable load impedance which can fall as low as 2ohms under dynamic music-related drive conditions. The matching amplifier is likely to have been purchased for its specified 8ohm output level, but we need to know how that level is sustained under possible real load variations.

Accordingly, the output level was examined for 8ohms, one channel, at less than 1% clipping distortion, as well as 4ohms both channels, and 2ohms pulsed, 20Hz to 20kHz. For pulsed and peak analysis a toneburst was used, consisting of 4 waveform cycles interspersed with 500mS rests.

In addition, peak output level readings for 8, 4, and 2ohms impedance are shown for comparative purposes. A further test served to explore momentary peak current capability and its symmetry. To achieve this a 1ohm or when necessary 0.5ohm load was used. Short pulses of 1kHz repetition rate are used here, current excursion being read from an oscilloscope trace.

The peak current figures should be judged with some discretion since the required capability logically must depend on the available power rating as well. Thus a small amplifier of up to 15dBW is unlikely to need more than ± 9 amps while for 20dBW (100W) model, ± 25A would be more appropriate. With really large amps of 23dBW and more, 35A

TECHNICAL INTRODUCTION

would be regarded as a generous peak current capability.

Total harmonic distortion
The figures recorded for total harmonic distortion include the noise within the measuring bandwidth of 400Hz to 80kHz, and for the 20Hz results they also include hum. The amplifier is set at one channel driven, 8ohms, rated output and these tests provide a check on sample quality as well as a general idea of linearity.

Intermodulation distortion
This is a more sensitive indicator of performance. The test is carried out with 19kHz and 20kHz input frequencies, the sum of the difference tones being recorded using an *HP3582a* sprectrum analyser with a resolution of 80dB. Where no products were visible the result is given as better than 80dB down. Via auxiliary input the peak composite input levels was 1V, via moving magnet 200mV, and via moving coil 20mV. These are strong signals but are within the normal expected dynamic range. For example, 50cm/sec peak disc modulation, 15kHz to 20kHz will typically raise 250mV peak from a moving magnet cartridge and 10-40mV from a moving coil model.

Noise
An average of left and right channels was recorded, with the input appropriately loaded — for example, with equivalent cartridge sources for mm and mc (200ohms, 100ohms). The noise contribution of the termination has been deducted, leaving weighted CCIR/ARM readings. Residual noise was also noted over a 20Hz to 20kHz bandwidth, with the volume control at zero. A 1kHz reference frequency was used.

DC offset
This was measured with inputs and outputs terminated and when the equipment was well warmed up.

Input overloads
These are referred to IHF input levels of 0.5mV for mc, 5mV for mm and 500mV aux at 1kHz. Note that for practical purposes the maximum recorded disc modulation remains pretty constant above a few kHz. In consequence an amplifier does not require a much increased disc input overload at high frequencies. More than 15dB at 20kHz will be ample for disc headroom.

Input overload for auxiliary/line input was also checked and if it exceeded 20dB, for example 5V, a '>20dB' figure was given.

Channel separation
Using a sensitive B&K tracking filter, stereo channel separation was measured with the inputs terminated.

Output resistance (damping factor.)
At 0dBW a 2ohm load was applied and the drop in open circuit output voltage noted. This loss represents the amplifier output resistance and is converted to ohms. The notion of damping factor is considered irrelevant in the light of cable and loudspeaker resistance. A simple figure for the amplifier's resistance contribution is much easier to judge.

Disc sensitivity
This and the other sensitivities were measured using a computing DVM to compare input and output voltage at a decent signal to noise ratio, providing the voltage gain. This is converted to IHF sensitivity for a rated 0.5V in the case of a pre-amp or for a complete amplifier, to a 0dBW output.

Input impedance
In general these were checked using an automatic RLC bridge but where the input conditions (biasing, overload etc) gave erroneous results, the loss produced over a 600ohms source resistance was computed to loading factor for 1kHz and 20kHz.

Disc equalisation
For moving magnet this was measured using an *HP85* computer via reference to a look up table of exact RIAA equalisation values which were then used to plot the final curve. A 600ohm source impedance generator was employed, representative of a cartridge source; and hence where substantial input capacitance was present some high frequency loss would be experienced in the response, as would be the case with a real cartridge.

General appraised
In addition to normal lab test procedures — for example observation of distortion waveforms and so on — where practicable, the products were opened up for an engineering design appraisal as well as an assessment of safety and constructional quality.

Some of the test result figures in the review may cause readers some confusion if they are compared with manufacturers' specifications. With the latter, for example, the sensitivities are usually related to full output, but with IHF practice they are referred to a standard 1W (0dBW) output for all amplifiers, thereby allowing better comparisons to be made. A 100W (20dBW) amplifier with an 0.28mV IHF disc sensitivity will have a sensitivity figure of 2.8mV for full output.

Listening tests

A two-tier system of listening tests was employed, whereby the procedure was divided into two parts. A/B full blind listening was found to be impractical for all the 75-plus models we auditioned, including the tuners. Instead, using listening techniques developed by the author and his assistant, the products were carefully assessed on an individual basis. Many of the products were subjected to repeat assessments, and in addition a number were monitored under blind conditions to ensure that the panelists were not subject to significant errors or indeed predjudice.

Key factors involved in arriving at satisfactory judgements included the author's personal experience of over 100 models over the past two years; the use of an acoustically controlled and neutral listening room; ancilliary equipment of good accuracy, and the use of both analogue and digital programme.

Typical listening levels were around 95dBA, which was within the compass of the smaller models. Following analytical auditioning via the disc inputs, (both mm and mc where applicable) and the auxiliary input, the amplifier's volume was increased to the onset of audible distortion under two conditions, namely on '8ohm' speaker load and a '3.0ohm' simulated speaker load. Peak programme power levels were monitored to subjectively assess the adverse load capability, as well. The dynamic possibilities of the larger amplifiers were also explored.

Where the pre- and power-amps from a given manufacturer could logically be separated, these were assessed as individual components, and if appropriate, individual ratings

may appear in the conclusions.

The Celestion *SL600* loudspeakers were used for monitoring in a high proportion of the tests, but the Quad *ESL63* was also employed, especially with the better amplifier designs where its use in the home is more likely. Dynamic tests on the smaller amplifiers benefited from the use of the more sensitive Spendor *SP1*.

Less critical moving magnet disc auditioning employed a Technics *EPC 205IIIL* cartridge specially fitted to an SL7 turntable, but for the bulk of the tests, a Koetsu *Black* moving coil was used, for both mm and mc inputs, with a high quality, low-ratio transformer where necessary. Rigid floor-coupled speaker stands with spiked feet aided evaluation, together with Mission speaker cable.

The test programme comprised classical and popular material, chosen for its revealing qualities. The models were assessed for tonal neutrality, stereo image sharpness, as well as depth, ambience and width; musical transparency; bass definition and extension, treble sweetness and clarity as well as overall musical effect, and the amplifier's ability to 'involve' the listeners in the musical programme.

Equipment used in listening tests

Reference pre-amplifiers: Burmester 808, Audio Research SP8, Sondex passive control unit
Reference power amplifiers: Krell KSA50, Mission 777BU
Disc inputs: Lux PD300 (special), Zeta arm, Koetsu Black and Red Level cartridges; Technics SL7 with EPC205IIIL cartridge.
Aux inputs: Sony PCMF1 and PCM701 for digital mastertapes; Sony CDP101 (latest) and Philips CD300 Compact Disc players.
Loudspeakers: Quad ESL63, Spendor SP1, Celestion SL600; used with matching custom stands, floor bonded.
Location: Author's IEC listening room.
Listeners: Paul Crook, Neil Whitely-Bolton and the author.

Programme material

Compact disc:
Roxy Music: 'Flesh and Blood'
Dire Straits: 'Love Over Gold'
Dire Straits: 'Communique'
Bartok: Concerto for Orchestra (Solti)
Nimbus Records sampler
Ry Cooder: 'Bop Till You Drop'
Shostakovitch: Symphony No 5 (Haitink)
Digital PCM 'classical sampler' master tape, compiled by Tony Faulkner.
Analogue discs:
Rickie Lee Jones: 'Pirates'
'Dave Grusin Revisited' (direct cut)
Ry Cooder: 'The Slide Area'

Laboratory test equipment

Amplifier tests were carried out by Camtech Ltd, under the supervision of Stan Curtis. Equipment used was as follows:
HP 8903A Analyser
HP 3314A Function Generator
HP 3580A Spectrum Analyser
HP 3582A FFT Analyser
HP 334A Analyser
Sound Tech 1700B Analyser
Gould 054040 Digital Storage Scope
Wavetek Sweep Generator
CSC Pulse Generator
Wayne Keer B424 Automatic Bridge
B&K 2305B Recorder
J. J. Lloyd PL4 Plotters (two)
Thurbly & Fluke Precision Programmable DVMs
HP 85C Controller
Radiometer BKF10 low-distortion Oscillator
B&K Tracking Multiplier 1901
B&K Band Pass Filter 2020 (two)

In addition to the main lab test programme, the following equipment was used by the author for cross-checking and additional tests:
HP 3582A FFT
HP 8903 analyser
HP 9816 computer
Baxendall sweep oscillator
Rion LR04 level recorder
Hitachi 50MHz scope
Aim microprocessor RCL bridge
Exact pulse generator
Nicolet 444 computing analyser
Audio Lab test loads
B&K 4403 equaliser
B&K 2203 sound level meter
Technics peak programme meters
Wayne Kerr AMS1 multipurpose unit

Acknowledgements

Special thanks are due to Stan Curtis for accepting the responsibility on behalf of Camtech Ltd for the lab test programme. The author would also like to thank Paul Crook for his invaluable general assistance throughout the project.

A&R Cambridge A60 Mk II

A&R Cambridge Ltd, Denny End Industrial Centre, Waterbeach, Cambridge CB5 9PB
Tel (0223) 861550

The *A60* has been available for a number of years but has undergone a series of upgrades, culminating in a fairly significant changes early in 1983 which were sufficient to justify a *Mk II* designation. Its track record has been a good one and this model in earlier form was strongly favoured in the last *Amplifiers* issue some two years ago.

For its type, the *A60* offers some usefully versatile features for example, the disc input boards are interchangeable for moving-magnet and moving-coil, and each of these in turn provides a comprehensive spectrum of loading options, which again are purchased separately in the form of an adjustable card.

Nicely finished in a veneered wooden case, the *A60* has a power rating of 35W per channel. Disc, tuner, auxiliary and tape inputs are all offered in DIN, plus a headphone outlet. Speaker drive is via 4mm socket/binding posts, and controls include a 7.5kHz treble filter, a mono button and bass and treble controls. The tape replay sensitivity may also be varied.

On the technical side, the output stage is a quasi-complementary configuration with direct speaker coupling to the plastic encapsulated '3055' type output transistors. A generous toroidal transformer feeds the $2 \times 10000\mu F$ reservoir capacitors with separate regulators to serve the low level stage. The disc input/equaliser is straightforward, using a 5534 IC, with the additional mc again provided by the usual low noise complementary buffer employing large chip transistors. It is safely built, to a high manufacturing standard.

Sound quality

Set against the new generation of integrated amplifiers, the *A60* no longer sparkles, and its overall subjective rating is now about average. It proved to be entirely competent, producing reliable noise-free sound from a variety of sources. Its shortfall was less evident on disc inputs with the more modest cartridges, but when fed master level material its general character appeared more strongly defined. Some mid tonal hardness was noted, with a 'compressive' effect tending to reduce the impression of life and stereo depth while the treble showed mild again, and the bass lacked real definition. It could however produce a healthy output and proved tolerant of the taxing special load, reaching 99dBA here.

Lab results

A&R are conservative in their specified data,

and the amplifier proved capable of 17dB (50W) on a programme basis into standard loads. Power bandwidth was fine, with 4ohm peak delivery good but disappointing into 2ohms. Peak current reached ±7amps, marginal for its peak power capability. Distortion was fine at lower frequencies but increased towards 20kHz particularly via mc disc (lower sensitivity options would improve this). Noise levels were good, and the dc output offset fine. Input overload margins were good.

Channel separation was typical, though for CD better figures would be helpful at 20kHz via aux. Channel balance was generally good though this deteriorated in the last few notches at the lowest volume settings.

The disc response curve was uniform centrally, but quite strongly filtered at the band extremes: −1.5dB at 20kHz and −4.5dB at 20Hz. The auxiliary response was wider, while the tone controls have perhaps over-generous control ranges.

Conclusions

The *A60*, while in my view no longer gaining a high commendation, nonetheless remains worthy of consideration. Consistency is perhaps, this model's keynote; it can be relied upon to give a competent result in many systems, and is both well built and finished with versatile inputs and good facilities.

Unfortunately, the past few months have seen the introduction of a new breed of small amplifiers offering distinct sonic improvements over the earlier generation. This recent activity has tended to leave the *A60*, along with many other good designs, just a little behind, though still very much worth considering.

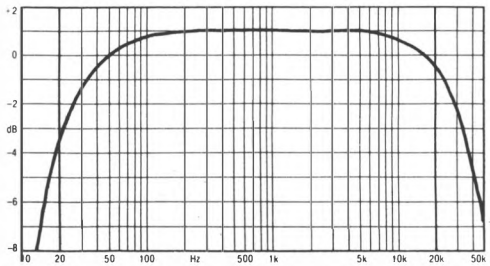
Test measurements

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

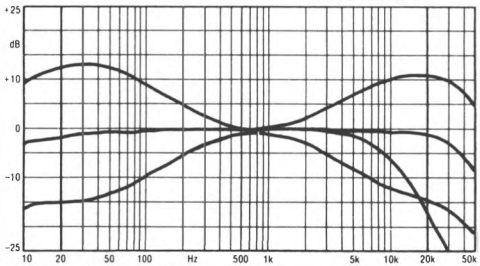
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			35W(= 15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.0dBW	17.0dBW	16.4dBW
Both channels, 4ohm load	12.8dBW	14.8dBW	14.3dBW
One channel, 2ohms, pulsed	6.8dBW	7.7dBW	7.5dBW
Instantaneous peak current		+7 A	−7 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−69dB	−70dB	−53dB
Intermodulation, 19/20kHz, rated power, aux input			−77dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−63dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−54dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−78dB
Disc (mc) input (IHF, CCIR weighted)			−72dB
Aux/CD input (IHF, CCIR weighted)			−84dB
Residual, unweighted (volume control at min)			−78dB
DC output offset			10mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32dB	32dB	32dB
Disc (mc) input (IHF)	26dB	26dB	11dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−69dB	−67dB	−40dB
Aux input	−74dB	−71dB	−42dB
Output impedance (damping)	0.18ohm	0.18ohm	0.20ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0dB	4dB

Input data	socket type	sensitivity	loading
Disc (mm) input	DIN	0.35mV	variable
Disc (mc) input	DIN	0.017mV	variable
Aux input	DIN	18.7mV	97kohms, 110pF

Disc equalisation error, 30Hz-15kHz +0dB, −2.4dB
Size (width, height, depth) 42 x 25 x 6cm
Typical price inc VAT £199



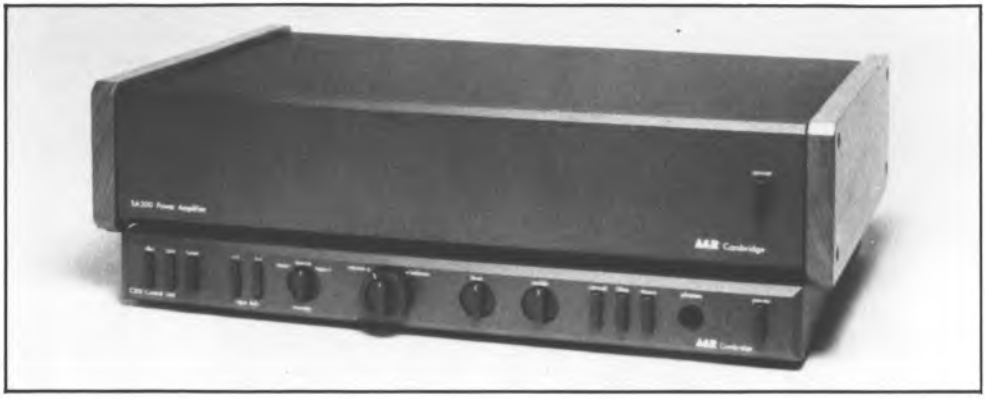
Disc input: RIAA equalisation accuracy



Tone control/filter responses

A&R Cambridge C200/SA200

A&R Cambridge Ltd, Denny End Industrial Centre, Waterbeach, Cambridge CB5 9PB
Tel (0223) 861550



Tested mainly as an amplifier combination, the *C200* pre-amplifier and *SA200* power-amp were also assessed individually, with ratings given where appropriate. At over £600 the pair, the performance needs to be good, although it must be said that the price is fairly competitive for the power rating and facilities offered.

The *C200* is internally constructed on modular principles, allowing the user considerable flexibility as regards the number and type of input facilities; for example, multiple moving-coil inputs if so desired. In its standard form it provides disc mm and mc, aux, tuner, and tape 1 and 2, with variable sensitivities and tape replay gain, plus a wide range of input loading possibilities. Most sockets are DIN, but the disc inputs are duplicated in phono. Bass and treble controls are also provided, and these circuits may be cancelled by the appropriate buttons. A treble filter, mono switch and headphone socket complete the facilities line up.

The *SA200* uses a generous toroidal transformer with separate rectifier/reservoir supplies for each channel, these kept physically well apart within the strong steel chassis. The output is a direct-coupled quasi-complementary while the input is ac coupled with an ultra-sonic filter. Fast acting, the electronic protection has a generous operating area.

While the preamplifier circuitry is quite conventional, with a mixture of many discrete plus some integrated devices, much work has been done of late on component sound quality, and both the *C200* and *SA200* show that great care had been taken in both design and build.

Sound quality

Via moving-coil input the sound quality was reasonable, with pleasing dynamics, good bass and quite good detail. The treble was a trifle uncontrolled but this improved when we tried the moving magnet input. Here depth effects and stereo focus were promising and both detail and vocal articulation were advanced in quality.

On digital programme the sound was on a large scale, with tuneful, musical quality, good tonal balance, decent bass plus an effective representation of depth and space. The *SA200* could be driven hard, producing high sound levels; 104dB into the adverse load was a fine result.

These two units are now well matched in quality terms, and do not change their subjective ratings much if partnered by more costly models.

Lab results

While representing a matched combination, these two units are well designed and integrate quite satisfactorily with other equipment when required. Power output comfortably exceeded specification, with a good peak reading, this excellently maintained over the

adverse load range despite measured peak current limits of ±11A. The latter figures are not representative of the unit's real power capacity, this confirmed in the listening tests.

Harmonic and intermodulation distortions were moderate, with decent noise levels recorded via the tested inputs. Measured dc output offset was satisfactory for both pre-and power amplifiers. Input overload margins were generous while channel separation was satisfactory, and channel balance was well maintained over the entire operating range. Sensitivities and input impedances were fine, though the auxiliary input value was lower than usual at 14kohms.

Disc equalisation was pretty accurate whilst the tone controls were usefully mild in action. The pre-amp is capable of driving long cables, and any other power amps, while the *SA200* also works well with other models of pre-amplifier.

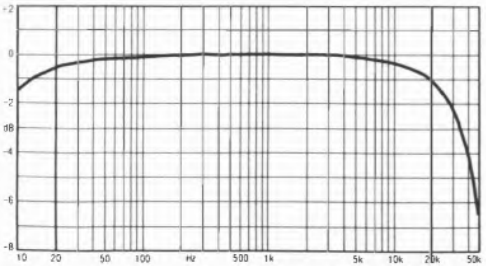
Conclusion

While I must say that in the past I have reserved judgement on the original *C200*, this current model has demonstrated much improved transparency and in now a worthy per former offering great versatility. The *SA200* also commands respect as a powerful, neutral amplifier capable of satisfying dynamics and stereo depth at a realistic price. The technical performance is also good, with tolerance of awkward loads impressive, and the build quality is high. Value considerations cannot be as relevant here as at lower price levels, but these two products have delivered a performance which merits inclusion in the 'recommended' category.

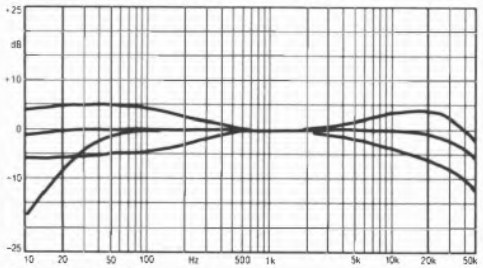
Test measurements

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

GENERAL DATA	Pre-and power amplifier		
Power output			
Rated power into 8ohms, maker's spec.	100W(=20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.5dBW	20.7dBW	20.1dBW
Both channels, 4ohm load	19.4dBW	19.9dBW	18.8dBW
One channel, 2ohms, pulsed	19.7dBW	19.8dBW	19.0dBW
Instantaneous peak current		+11A	−11A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−80dB	−81dB	−76dB
Intermodulation, 19/20kHz, rated power, aux input			−76dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−77dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−70dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−76dB
Disc (mc) input (IHF, CCIR weighted)			−72dB
Aux/CD input (IHF, CCIR weighted)			−78dB
Residual, unweighted (volume control at min)			−70dB
DC output offset			22mV
DC offset, pre-amp			2mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	36dB	35dB	35dB
Disc (mc) input (IHF)	30dB	30dB	30dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−64dB	−62dB	−41dB
Aux input	−67dB	−63dB	−41dB
Output impedance (damping)	0.04ohm	0.04ohm	0.12ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.2dB	0.2dB
Input data	socket type	sensitivity	loading
Disc (mm) input	DIN/Phono	0.27mV	50kohms, var pF
Disc (mc) input	DIN/Phono	0.015mV	340ohms, var nF
Aux input	DIN	11.1mV	14kohms, 170pF
Power amp	DIN/Phono	104mV	21kohms, 110pF
Output, pre-amp (tape)			8.9V max, 350ohms
Disc equalisation error, 30Hz-15kHz			+0dB, −0.6dB
Size (width, height, depth)			43 x 30 x 5cm, 43 x 34 x 10cm
Typical price inc VAT			£275, £350



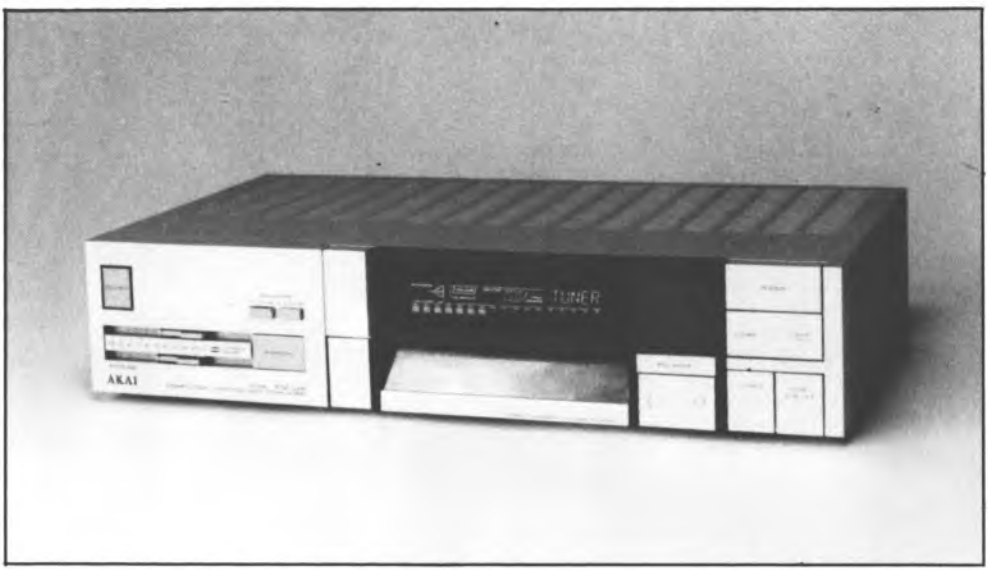
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Akai AM-U3

Akai UK Ltd, Unit 12, Haslemere Heathrow Estate, Silver Jubilee Way, Hounslow, Middlesex
Tel 01-897 6388



A feature of the *AMU-3*, a moderately-priced integrated amplifier, is the bright blue fluorescent display, illustrating the various functions selected. One idiosyncrasy of the front panel is that it employs a direct-access volume control, this being a horizontal touch plate where volume changes are made by sliding a finger along it. Electronic switching for source is used, but I wonder whether this is too complicated for its own good. Inputs provided are for disc (moving-magnet), tuner, Compact Disc/aux, plus tape 1 and 2. Two sets of speakers can be connected via bare-wire spring-clips. Bass and treble controls are sliders. The headphone socket is concealed behind a flap, and all rear sockets are phonos.

Inside, the power supply uses a large transformer with shared $2 \times 10000\mu F$ reservoir capacitors, and internal wiring was to a good standard, using properly shrouded mains connections.

An integrated-circuit disc amplifier stage is used, with another IC for the tone/buffer, and the direct coupled complementary output amplifier uses a DC servo loop and has electronic sensing protection plus a relay. Overall the constructional quality was good.

Sound quality

Rated below average on audition via the disc input, the *AMU-3* sound was considered fairly clear with reasonable vocal projection plus fair tonal balance. The bass appeared somewhat lumpy while the treble showed some 'breathiness' and although the stereo image was reasonably precise the amplifier did not portray depth well.

Some improvement was noted via auxiliary, particularly in the bass, and slight advances in clarity and detail were also achieved. Depth and ambience were still lacking however, with the stereo effect rather two-dimensional.

Driven hard, this amplifier coped well and also sustained a decent 99dBA sound level on the extreme speaker load. It was also well behaved into mild clipping.

Lab results

Comfortably exceeding specification on output power, this unit produced a typical

18dBW on a continuous-rated basis and a good power bandwidth was demonstrated. The delivery was fine on peaks into 4 and 8 ohm loads, falling moderately into 2 ohms, and the peak current capability was also good.

Harmonic and intermodulation distortions were low, particularly at moderate power levels. Noise levels were fine and dc output offset negligible. Disc overload was satisfactory if lower than usual, while stereo separation was to an average standard; it could be better via auxiliary, though. Channel balance was generally good, even at low volume settings.

Disc input parameters were normal, but tape/aux input showed a rather high capacitance of 700pF which might restrict the treble response of some sources.

The tone controls showed reasonably subtle ranges, whilst the subsonic filter was rather weak at just 6dB/octave, and −3dB around 25Hz. Auxiliary frequency response was wide, while the disc equalisation showed a mild bump of +0.6dB in the low bass, though this was insufficient to account for the subjective characterisations.

Conclusion

A generally well-built product, the *AMU-3* is in practice quite powerful, and also tolerant of the normal extremes of loudspeaker loading. Its sound is reasonably pleasant, but lacks image depth, as well as any convincing immediacy. In a sense it represents the average standard against which the 'special' designs can show their advantage, and while at the price it fails to be recommended it is nonetheless worth considering.

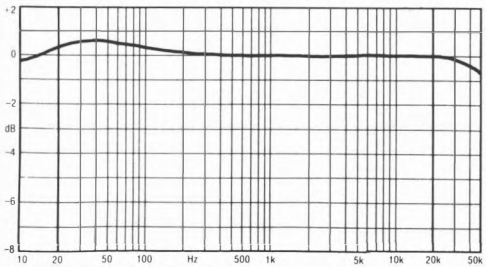
Test measurements

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

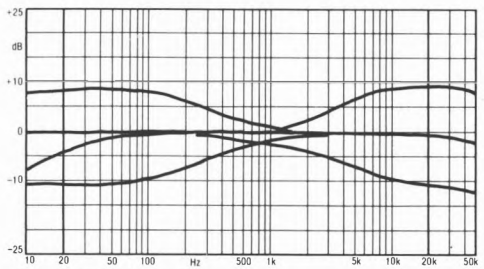
GENERAL DATA		Integrated amplifier	
Power output			
Rated power into 8ohms, maker's spec		45W(= 16.5dBW)	
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.1dBW	18.3dBW	18.1dBW
Both channels, 4ohm load	15.3dBW	15.8dBW	15.5dBW
One channel, 2ohms, pulsed	12.7dBW	14.2dBW	13.8dBW
Instantaneous peak current		+ 13 A	− 15 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	− 74dB	− 74dB	− 70dB
Intermodulation, 19/20kHz, rated power, aux input			− 79dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> − 80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			− 77dB
Aux/CD input (IHF, CCIR weighted)			− 85dB
Residual, unweighted (volume control at min)			− 81dB
DC output offset			4mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	21dB	20dB	19dB
Aux/CD input (IHF)	18dB	18dB	18dB
Stereo separation			
Disc input	− 65dB	− 61dB	− 46dB
Aux input	− 70dB	− 63dB	− 48dB
Output impedance (damping)	0.13ohm	0.15ohm	0.20ohm
Channel balance, disc, at 1kHz			0.3dB
Volume/balance tracking	0dB	− 20dB	− 60dB
Aux input	0.1dB	0.2dB	0.4dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.34mV	49kohms, 120pF
Aux input	Phono	23mV	38kohms, 700pF

Disc equalisation error, 30Hz-15kHz + 0.6dB, − 0dB
Size (width, height, depth) 44 x 21 x 10cm
Typical price inc VAT £129



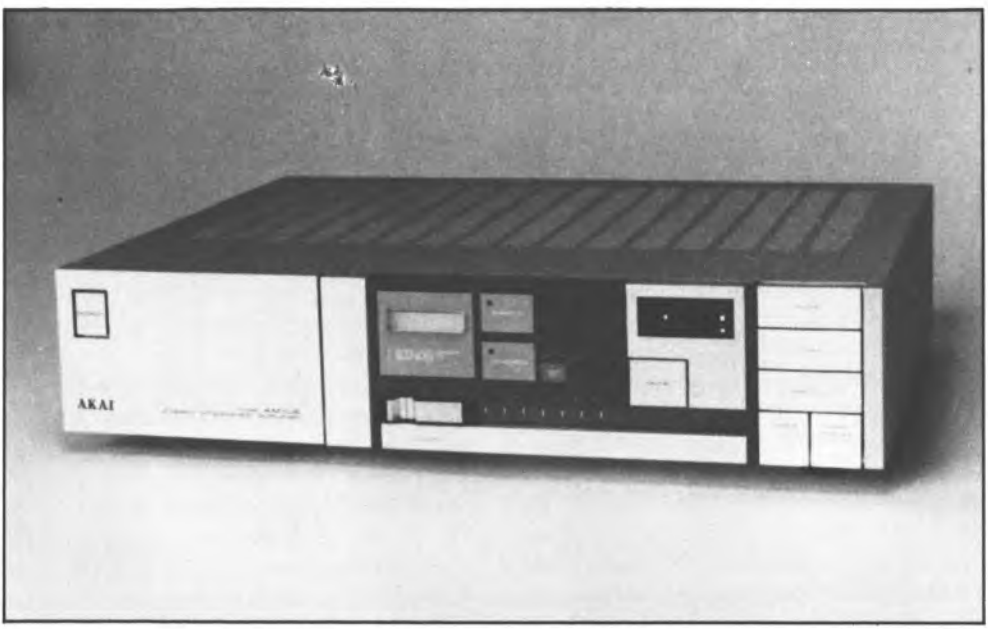
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Akai AM-U5

Akai UK Ltd, Unit 12, Haslemere Heathrow Estate, Silver Jubilee Way, Hounslow, Middlesex
Tel 01-897 6388



Costing nearly double the price of its smaller brother the *AMU-3*, theoretically the *'5* has a higher power output, offering 60 as opposed to 45 watts. However the rest results deny this.

Moving coil inputs are provided in gold plated phono sockets, with the test in normal nickel plate. Two sets of speakers may be used via binding post connectors, while the available inputs include disc (moving-magnet and moving-coil) tuner and Compact Disc, plus tape 1 and 2. The controls are unnecessarily complicated, with bass, treble and 'balance' concealed behind a panel; as with other Akai models, volume is controlled by a slider. Other facilities include a subsonic filter, mono switch, headphone socket and tone 'bypass/direct'. Three unshrouded mains outlets are provided, and mechanically it was very quiet.

The power supply transformer is toroidal, heavily shielded and feeding $2 \times 12000\mu F$ reservoir capacitors. The complementary direct-coupled output stage is subject to a dc servo loop and has 'zero drive' circuitry to reduce crossover distortion. Generous heatsinks are used for the Sanken A1105/C2580 output transistors, while dual FETS in the disc amplifier are followed by extensive use of dicrete transistor circuitry. The low-level supplies are carefully regulated, and the unit is as a whole well built.

Sound quality

All this attention to detail design has unfortunately not in our view produced a worthwhile sound quality. The *AMU-5* scored below average on an overall basis, the tonal balance appearing cold and thin, with evidence of resulting listener fatigue.

Via the moving-coil input, the treble was slightly brittle with a feathery quality, with loss of depth and stereo focus. Things improved however via moving magnet input, with better clarity and depth plus a lighter, firmer impression all round.

While the amplifier drove a complex speaker load well, the sound increased in hardness at

higher listening levels; superficially impressive via auxiliary inputs, the end result nonetheless failed to satisfy the listeners.

Lab results

Surprisingly, the test results show the *AMU-3* and not the *AMU-5* to be the larger amplifier! Very similar on peak power levels at 18.6dBW, 8ohms, the *'3* has the greater peak current capacity, so what price specification? Nonetheless the *'5* delivers its power well, except into the lowest impedances where a little more peak current would help. Distortion figures were satisfactory as were signal to noise ratios, while dc offset at the speaker terminals was very low.

On the plus side, the input overload margins were very generous, but conversely the stereo separation was rather poor at 20kHz, with 30dB recorded even via the auxiliary input. Output impedance for the power stage was higher than usual but still harmless.

Channel balance was fine, while sensitivities were on the high side, particularly moving coil and aux inputs. The 310pF input capacitance on the moving magnet input should be borne in mind when selecting a cartridge, this though was not apparent considering the treble lift noted on the RIAA equalisation. This curve has a bias towards a 'thin' tonal quality, in addition to that noted via the flat aux input.

Conclusion

We cannot see any advantage in this model over the cheaper *AMU-3*. The mc input is weak, the power delivery no greater than the *'3* and in our opinion the *AMU-5* actually sounds inferior, despite the doubling of price that is involved.

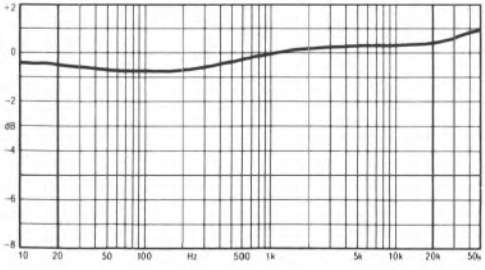
Test measurements

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

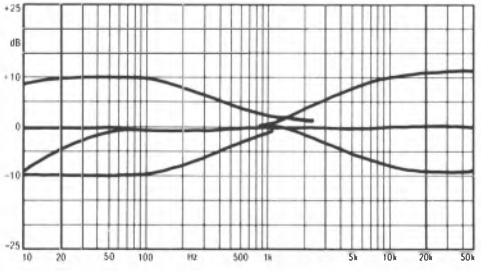
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			60W(= 17.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.2dBW	18.3dBW	18.0dBW
Both channels, 4ohm load	16.4dBW	16.4dBW	16.1dBW
One channel, 2ohms, pulsed	14.3dBW	15.8dBW	14.7dBW
Instantaneous peak current		+ 10 A	– 9 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 62dB	– 72dB	– 61dB
Intermodulation, 19/20kHz, rated power, aux input			– 65dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 70dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			– 69dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 79dB
Disc (mc) input (IHF, CCIR weighted)			– 74dB
Aux/CD input (IHF, CCIR weighted)			– 81dB
Residual, unweighted (volume control at min)			– 73dB
DC output offset			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	35dB	34dB	32dB
Disc (mc) input (IHF)	35dB	34dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 68dB	– 54dB	– 30dB
Aux input	– 67dB	– 53dB	– 30dB
Output impedance (damping)	0.32ohm	0.33ohm	0.39ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0dB	0.3dB	0.8dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.26mV	47kohms, 310pF
Disc (mc) input	Phono	0.007mV	49ohms
Aux input	Phono	19mV	150kohms, 190pF

Disc equalisation error, 30Hz-15kHz: + 0.3dB, – 0.7dB
Size (width, height, depth): 43.5 x 36 x 11cm
Typical price inc VAT: £250



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Audiolab 8000A

Cambridge Systems Technology Ltd, Roman Way Estate, Godmanchester, Huntingdon, Cambs PE18 9LN Tel (0480) 52521

A brand new amplifier, the *8000A* is intended to be one of a new range of electronics designed by two UK engineers with an established track record in this field. It is conservatively rated at 50W per channel.

In contrast to much UK equipment today, which is of 'straight line' design, the Audiolab does have tone controls; these are however said to be specifically designed to produce a negligible subtraction of sound quality. Comprehensively equipped, the input facilities are all in DIN, and include disc (mm and mc), tape 1 and 2, plus tuner and CD/aux. A proper 'record out' selector matches the input selector. Two sets of speakers can be used, with one permanently connected, the other switched, and the second pair partners the headphone socket. A small dealer modification provides for pre-amp/power amp use if this is required (note that in this mode the circuitry which prevents switch-on thumps does not operate).

As well engineered internally as it is finished externally, the amplifer uses a large 250VA toroidal transformer specially mounted to reduce mechanical hum. The output stages are high-current, direct-coupled complementary, with a dc servo to rolloff the extreme subsonic response without need for the usual decoupling capacitor in the feedback loop. Full electronic protection is fitted and designed to allow adverse load drive. All discrete circuitry is employed, the mc headamp a particularly careful design; in fact many of the design features are more commonly associated with more costly models.

Sound quality

This amplifier surprised all those who heard it. On moving-coil input the overall subjective rating was 'very good', which is miles ahead of the competition. Its character was highly neutral, if very slightly 'clinical', with an open, wide frequency range and very presentable bass, the latter offering power, precision and extension. The midband was well defined, articulate and well focused while the stereo image showed decent depth and ambience.

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

Via aux the sound remained very good, dominated by a fine transparency and with additional, admittedly minor, improvements in stereo staging, depth, bass power and detail. It could get pretty loud, and sounded very tolerable into clipping, with 103dBA possible into the normal loudspeaker. A fine load tolerance was also evidenced by the 102dBA produced into the severe load.

Lab results

Specified at 50W (17dBW) the amplifier demonstrated a fine power bandwidth at 19dBW into 8ohms. The 4ohm continuous delivery was also pretty good, while its ±15A peak current capability was more than sufficient for the rated power. Peak level approached 100W per

channel, at 19.8dBW, holding well into 4ohms at 18.6dB and still very strong at 18dBW, 2ohms.

Harmonic and particularly intermodulation distortions were at negligible levels, in a sense showing that high-linearity circuits are not in themselves a barriers to good sound quality. Noise levels were fine, and the dc output offsets negligible. Input overload levels were ample, and stereo separation up with the best in the issue, bar the special double-mono amplifier types. Output impedance was low and channel balance very accurate, except at the lowest volume settings. Input sensitivities were sufficient for all classes of source, and the input characteristics were well defined. The mm disc characteristic can be changed via optional loading plugs. RIAA equalisation followed the IEC rolloff, hence the subsonic fall shown here, while the tone controls were suitably mild in action. The pre-amp output also offered a decent output level at low impedance for other power amplifiers. Subjectively, no significant change in some quality could be heard with the tone controls engaged.

Conclusion

If sold just as a pre-amplifier the *8000A* would get a good value for money rating, but as its power amplifier section is of comparably good quality, then the end result is a highly competitive unit.

It was accurate, powerful, load-tolerant, versatile and compatible and it also set an enviable standard for sound quality. In our view this modestly priced but excellently built amplifier sets a new reference standard and easily achieves 'Best Buy' status.

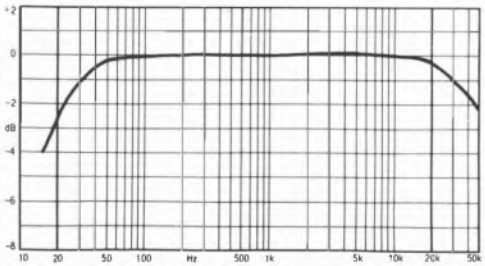
Test measurements

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

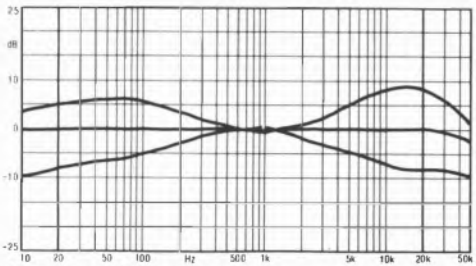
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			50W(= 17dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.4dBW	19.5dBW	19.0dBW
Both channels, 4ohm load	17.2dBW	17.6dBW	17.0dBW
One channel, 2ohms, pulsed	17.8dBW	18.0dBW	17.3dBW
Instantaneous peak current		+15 A	−15 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−83dB	−86dB	−77dB
Intermodulation, 19/20kHz, rated power, aux input			−85dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−85dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−78dB
Disc (mc) input (IHF, CCIR weighted)			−73dB
Aux/CD input (IHF, CCIR weighted)			−82dB
Residual, unweighted (volume control at min)			−78dB
DC output offset			left 2mV, right 3mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	29dB	30dB	30dB
Disc (mc) input (IHF)	26dB	26dB	26dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−90dB	−72dB	−50dB
Aux input	−78dB	−77dB	−56dB
Output impedance (damping)	0.03ohm	0.04ohm	0.12ohm
Channel balance, disc, at 1kHz			0.04dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.04dB	0.0dB	3.6dB

Input data	socket type	sensitivity	loading
Disc (mm) input	DIN	0.3mV	47kohms, 35pF
Disc (mc) input	DIN	0.007mV	100ohms, 4.7nF
Aux input	DIN	12mV	20kohms, 70pF

Output, pre-amp (tape) 7.7V max, 600ohms
Disc equalisation error, 30Hz-15kHz +0.1dB, −2.2dB
Size (width, height, depth) 44.5 x 7.4 x 34cm
Typical price inc VAT £250



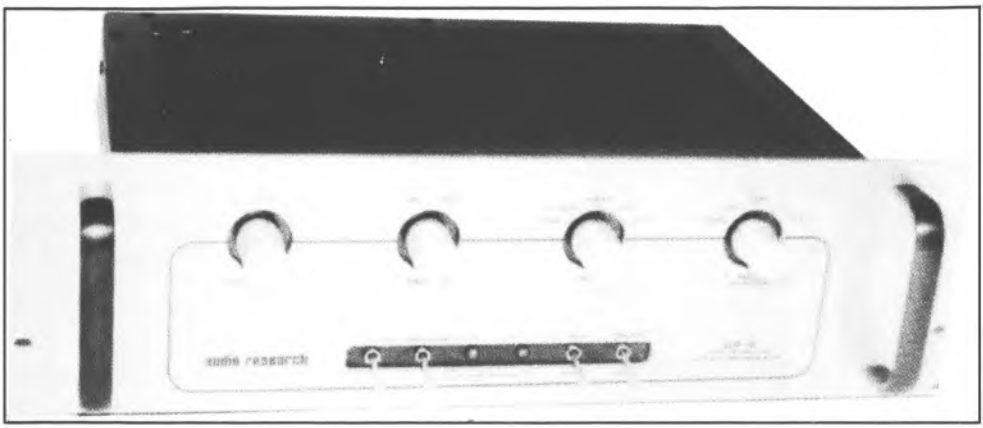
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Audio Research SP8 pre-amplifier

Absolute Sounds Ltd, 42 Parkside, London SW19
Tel 01-947 5047



Something of an audiophile legend, this US-made pre-amplifier is a valve (tube) design offering superb build quality. The design follows the purist school, and no tone controls or filters are provided, nor is there provision for a moving-coil input. The highest output moving-coils may however prove suitable for moderate listening levels, but if decently low input noise levels are required, then an external high quality pre-amp is essential.

A large and imposing unit, the *SP-8* is finished in silver aluminium, with large black handles. Input selection is from disc, tape, tuner plus aux 1 and 2 with all inputs via phono type sockets.

Inside, the power supply is almost as complex as the amplifier section with dc regulated lines to both the HT lines and to the valve heaters. Selected triodes are used throughout. The disc equalisation and input section comprises a three-stage circuit with conventional series feedback RIAA. A similar circuits is adapted for line level use and feeds the output terminal. Very high quality coupling capacitors are used, and particular care has been taken over the power supply decoupling. Frequency responses are very wide and only top-class signal sources are suitable.

Sound quality

As 'reference' pre-amplifiers go, this was undoubtedly a very fine-sounding unit. Equally good via aux or mm inputs, it was characterised by a fine spatial effect, the sound stage full of ambience and depth, with a natural perspective. Stereo focusing was very good, the mid tonal balance exceptionally pure and natural, while the frequency extremes sounded firm, detailed and well controlled. Even the bass was very rewarding when compared with lesser products. The auxiliary socket transmitted PCM digital material with very little alteration, giving a very truthful result.

A suspicion arose concerning a possible mild aberration, though; the ambience effect was a touch excessive and we believe this was actually a function of the mild microphony exhibited by this and several other tubed designs. Also, the audible level of mechanical transformer hum was a minor source of irritation, at least in my room, and a site well away from the listening position is therefore advised.

Lab results

The sensitivities are those obtained with the unit as supplied but they may be halved to achieve a lower value by a small board change which can be carried out by the supplier.

Harmonic distortions were very low, but the intermodulation result was poorer than expected, particularly via disc, though not enough to cause concern. Signal-to-noise ratios were above average but not outstanding, but input

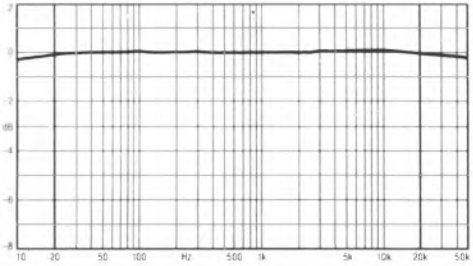
overload margins were exemplary. Likewise, the output could exceed many tens of volts at a low distortion level: sufficient for any known power amplifier.

Stereo separation was satisfactory via disc but suprisingly weak via auxiliary, here tending to compromise the high separation available on PCM programme.

Channel balance was well-maintained across the volume control range, while the input characteristics were standard. Components may be fitted on a board to adjust the disc input loading if so desired, with the RIAA proving to be very wide in bandwidth (exceptionally so for a valve model), and giving an almost textbook accuracy. Turntable/arm/cartridge combinations giving excessive subsonic resonance output are to be avoided.

Conclusion

This is one of those products that demands to be auditioned at home as part of a good system, and I believe that many of those who take this step will not return the *SP-8* to their dealer. It does possess certain minor irritations and also lacks an mc input, but with this level of sound quality, price becomes a secondary consideration, and a recommendation is clearly indicated.



Disc input: RIAA equalisation accuracy

GENERAL DATA Pre-amplifier

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 85dB	– 85dB	– 85dB
Intermodulation, 19/20kHz, rated power, aux input			– 75dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 65dB

Noise

Disc (mm) input (IHF, CCIR weighted)	– 77dB
Disc (mc) input (IHF, CCIR weighted)	—dB
Aux/CD input (IHF, CCIR weighted)	– 81dB
Residual, unweighted (volume control at min)	– 75dB
DC offset, pre-amp	left 0mV, right 0mV

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	40dB	44dB	43dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Stereo separation			
Disc input	—	– 70dB	– 43dB
Aux input	—	– 56dB	– 37dB

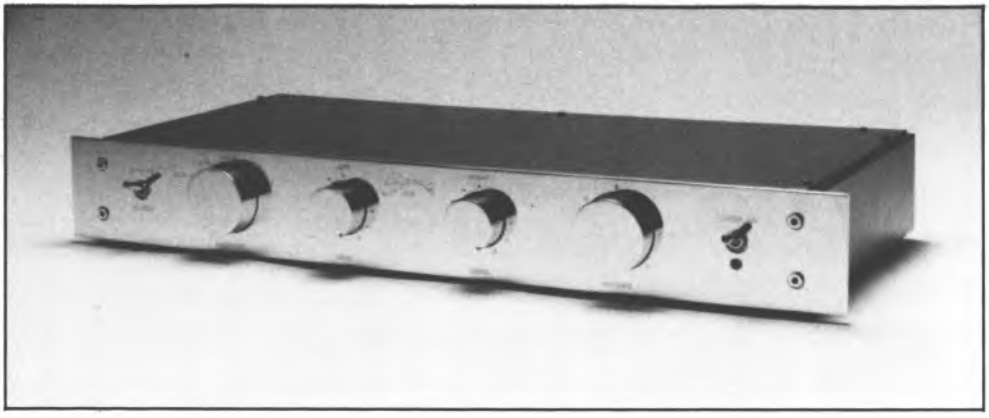
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0.05dB	0.1dB	0.3dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.2mV	50kohms, var pF
Aux input	Phono	29mV	50kohms, 100pF

Output, pre-amp (tape) >20V max, 600ohms
Disc equalisation error, 30Hz-15kHz + 0.1dB, – 0.1dB
Size (width, height, depth) 48 x 13.4 x 26cm
Typical price inc VAT £1400

Burmester 785 pre-amplifier

Automation Sciences Co, 5B Eton Avenue, London NW3
Tel 01-435 8210



Though the name is not widely known in the UK, the Burmester audiophile pre-amplifiers have been in production for some five years now, and are built in West Berlin. Minor improvements have been made over the years to maintain standards, and the designer aims to provide a very long and trouble free life for these units. Built to very high standards, the pre-amplifier may be obtained in three panel colours, namely mirror-finish brass or chrome as well as a more sober satin black. A 'straight-line' design, the *785* has no filters or other facilities; just moving-coil and moving-magnet disc, tuner and two tape inputs. Disc inputs are duplicated to allow the fitment of a variety of loading plugs to give many impedance and capacitance variations.

Two gain adjustments are also possible for disc, via a subsidiary switch marked 1 or 5mV, and also 'level' controls on the front panel which are secondary to the main volume control. All sockets are phono types, apparently silver plated and slightly oversized externally, making for a very tight grip on the plugs.

Internally, this unit, like the Musical Fidelity, is built using high quality integrated circuit amplifiers, carefully decoupled and employing first rate power supplies. Component quality is excellent, with the volume control handbuilt as a precision attenuator using discrete metal film resistors. The mains supply is filtered, and an earthed three core mains cable should be used to obtain the lowest noise levels. This versatile pre-amp is self-contained and should prove to be compatible with a number of superior quality power amplifiers.

Sound quality

It proved hard to realistically separate the sonic achievement of the *785* from that of some of the finest pre-amps we tried. In fact, the tabulated 'excellent' rating is slightly generous, but only just.

A hallmark of the sound was its neutrality — a general aura of accuracy and precision which inspired confidence. The bass was to a high standard being deep, articulate and well defined, while the treble was clear and open, and possessed a pleasant nature. The mid was evenly balanced, and free of hardness, with stereo images produced with good precision. Depth and ambience effects were also well reproduced.

Another strong feature was its consistency of sound quality with no evident shortcomings via the wide range of inputs that were tried.

Lab report

The unit could produce more than 7V output from a source resistance of typically 100ohms, and will drive most known power amplifiers, including the difficult Electrocompaniets.

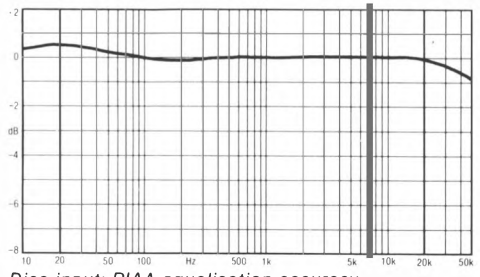
Distortion levels were very low except via moving coil, and here the poorer figure is a

function of the high gain setting used for test. Likewise the disc overload margins were referred to a maximum gain setting and improved to decent levels when the pre-amp overall gain is adjusted to suit the cartridge.

Stereo separation was very high while channel balance was excellent. The output was dc coupled but had no unwanted offset, while sensitivities were in accord with the specification; the moving coil sensitivity, though, remains possibly too low for the lowest output models.

Conclusion

Demonstrably an audiophile product, the *785* left me with an impression of enduring consistency. Although it is not strictly comparable with exotic pre-amps in the £1500 range and higher it nonetheless offers a very high standard of sound quality and has the advantage of being fully-self-contained. Compared with its serious competition the *785* is fairly priced for its build quality, finish, and compatibility and we found it partnered the Krell *KSA50* and Mission *777BU* power amps well, although no doubt there are many other suitable combinations. Those interested in Burmester products should note the availability of a new modular design in the not too distant future, this costing in the region of £700-£1300, based on sections of the £3500 *808* model. In any case, the *785* is recommended.



Disc input: RIAA equalisation accuracy

GENERAL DATA — Pre-amplifier

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at 1V, 10kohms load	−87dB	−98dB	−85dB

Intermodulation, 19/20kHz, rated power, aux input > −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm) > −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc) −67dB

Noise

Disc (mm) input (IHF, CCIR weighted) −72dB
Disc (mc) input (IHF, CCIR weighted) −67dB
Aux/CD input (IHF, CCIR weighted) −96dB
Residual, unweighted (volume control at min) −96dB
DC offset, pre-amp 2mV

Input overload	20Hz	1kHz	0mV
Disc (mm) input (IHF)	20dB	20dB	20dB
Disc (mc) input (IHF)	3dB	3dB	3dB*
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Stereo separation

Disc input	−75dB	−77dB	−76dB
Aux input	−84dB	−74dB	−49dB

Channel balance, disc, at 1kHz 0.1dB
Volume/balance tracking 0dB −20dB −60dB
Aux input 0dB 0dB 0dB

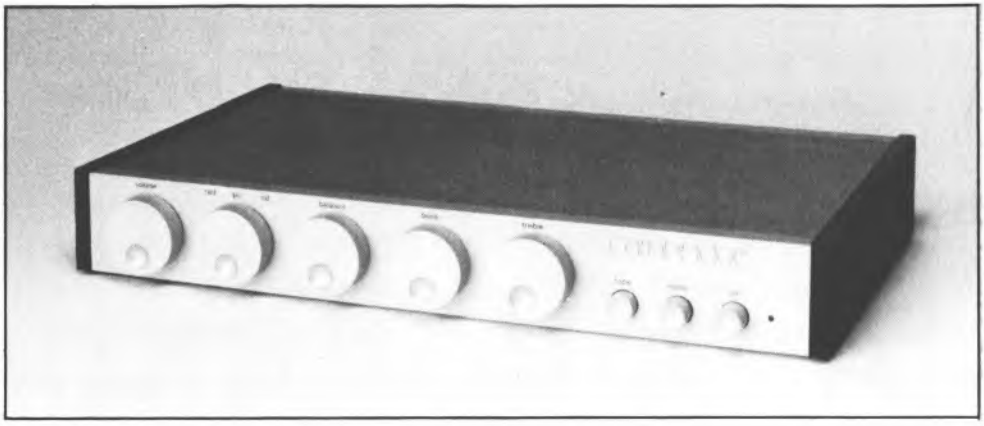
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	2.40mV	50kohms, 50pF
Disc (mc) input	Phono	0.03mV	500ohms, 0.3nF
Aux input	Phono	45.1mV	30kohms, 60pF

Output, pre-amp 7.73V max, 100ohms typical
Disc equalisation error, 30Hz-15kHz +0.35dB, −0.1dB
Size (width, height, depth) 48 x 23 x 7cm
Typical price inc VAT £800

Note: all results ref 500mV output
**At max gain; improves to 26dB at min gain*

Cambridge P35

Cambridge Audio Research Ltd, Home Farm, Diddington, Huntingdon, Cambs PE18 1XU
Tel (0480) 811811



In traditional Cambridge Audio livery of silver and grey with solid wood end caps, the *P35* is nonetheless a completely new design. A moderately-priced 35W integrated amplifier, it provides disc, tuner and CD inputs, with moving-magnet and moving-coil disc options selected via a rear switch. Bass and treble controls are also included, plus a mono button, with the headphone socket at the rear — a trifle inconvenient. 4mm sockets connect the speakers, while inputs are DIN, with the exception of the disc input, which has phono sockets.

The review sample supplied by Cambridge initially was a prototype; the company did promise a production model to follow, but unfortunately were unable to deliver one before we went to press. Thus in fairness to all the 'official' products here included, a full approval, must be withheld, and the following findings are only provisional.

Internal construction was clearly to prototype level, using two main expoxy printed circuit boards. A decent-sized toroidal transformer supplies the shared reservoirs, with the output direct coupled complementary, and the system non-inverting. Following a variable gain mm/mc input buffer, the RIAA equalisation is performed in two stages; an input buffer feeds the passive tone controls leading to the power amplifier. The steel baseplate of the case itself forms the heatsink.

Sound quality

Slightly marred by some residual hum (which was better with a second sample we obtained), the design scored a commendable 'good' on the listening tests sessions.

Via the auxiliary input the sound was smooth, even bland, with reasonable midband stereo focus and some good depth effects. Musical detail was to a high standard in the mid register, but the amplifier sounded less on control at the frequency extremes.

Via disc some loss of detail and clarity were noted but the standard remained pretty good. Both bass and treble registers were above average and the midband particularly so, with the overall effect quite musical. The amp did not clip particularly well, and the adverse loading, while well-attempted in the sense of maintaining loudness, otherwise served to produce an effect of increasing 'thinness' and muddle. In fact, 100dBA was possible on the difficult load, this improving to a decent 102dB with 8ohms.

Lab results

Rated at 15.5dBW, the second sample gave a generous 18.8dBW, which is heading towards 80W per channel. Power bandwidth was fine at 8ohms but more restricted at 4ohms. Peak power into 8ohms approached 100W (19.5dBW) and held well into 4ohms, while at 2ohms, a reasonable 4dB overall loss occurred. Peak

current capacity was a generous ±19A. Distortion was satisfactory, with the IM and the 20kHz results only average, but at lower levels the high frequency results improved greatly.

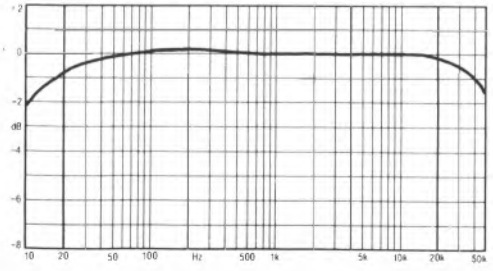
Signal-to-noise ratios were good (second sample) and dc offset satisfactory. All input overloads were ample while separation was fairly typical and could be improved via the aux/CD input. Output impedance was constant and moderate, while channel balance was good at higher levels but deteriorated at low volume settings.

Moving-magnet sensitivity was lower than usual, and the moving-coil gain will not suit the lowest output models such as certain Ortofon models. Note that the mm and mc resistances are the same at 47kohms/150pF, while the aux input impedance is lower than usual at 10kohms; however this should not cause problems except possibly with older sources.

Conclusion

This visually attractive amplifier, if well built and well quality-control tested in production could be 'Best Buy' material. It offers a clear, musical sound with a good performance standard, while the technical results were most promising. It was also generous as regards power and tolerant of adverse loading. However, as the *P35* was available only in prototype form at the time of writing, I must give it only a reserved recommendation.

(Note: fortunately we were able to test a production sample just as we went to press, and this confirmed the 'Best Buy' rating for this model.)



Disc input: RIAA equalisation accuracy

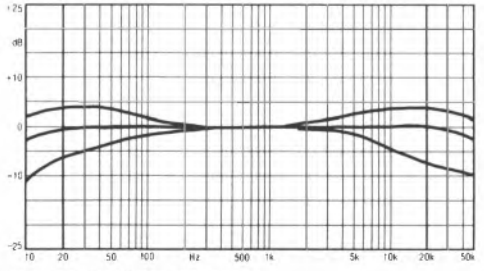
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			35W(= 15.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.8dBW	18.9dBW	18.9dBW
Both channels, 4ohm load	15.5dBW	16.5dBW	14.4dBW
One channel, 2ohms, pulsed	12.0*dBW	15.6dBW	14.0dBW
Instantaneous peak current		+19A	−19A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−70dB	−73dB	−65dB
Intermodulation, 19/20kHz, rated power, aux input			−63dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			>−80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−79dB
Disc (mc) input (IHF, CCIR weighted)			−75dB
Aux/CD input (IHF, CCIR weighted)			−81dB
Residual, unweighted (volume control at min)			−77dB
DC output offset			34mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	34dB	32dB	30dB
Disc (mc) input (IHF)	31dB	29dB	28dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−68dB	−62dB	−42dB
Aux input	−70dB	−62dB	−42dB
Output impedance (damping)	0.3ohm	0.3ohm	0.3ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.1dB	0.1dB	5.8dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.52mV	47kohms, 150pF
Disc (mc) input	Phono	0.032mV	47kohms, 150nF
Aux input	DIN	24.2mV	10kohms, 50pF

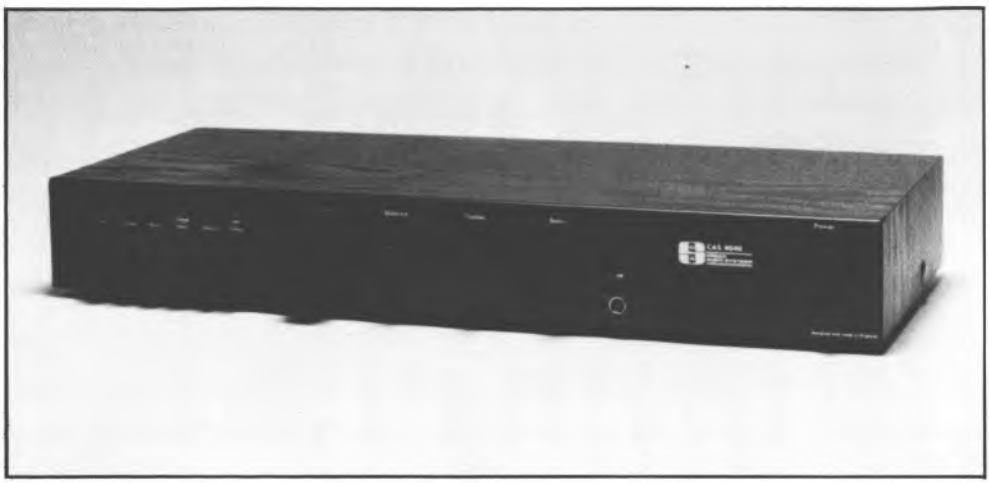
Disc equalisation error, 30Hz-15kHz: +0.2dB, −0.3dB
Size (width, height, depth): 43 x 7 x 28.5cm
Typical price inc VAT: £170
**Fuse blows at this level*



Tone control/filter responses

Creek 4040

Creek Audio Systems, 2 Bellevue Road, Friern Barnet, London N11 3ES
Tel 01-368 4425



Creek's UK-built budget amplifier has been making good headway on the market in recent months. Priced at just over £100, it is specified at 35W (15.5dBW) per channel, and while features are fairly basic, it does provide tone controls as well as a headphone socket. Loudspeaker connection is via 4mm socket/binding posts, while all the input connectors are DIN sockets. These are chosen by many designers of budget equipment for their assembly convenience, low cost and good electrical performance.

The *4040's* low-level stages use top quality integrated circuits, with the RIAA effected in two stages. The treble rolloff section is passive, with a separate switchable rumble filter to add the final low-frequency rolloff, this – 3dB at 45Hz.

The tone controls are incorporated in the feedback loop of the power amplifier section, this a high loop gain design. The strong negative feedback is necessary to reduce the otherwise high level of distortion that results from the use of an unbiased pure Class B output stage, with further assistance given by the Class A driver, which is run at higher than usual current. The review sample, we should point out, was obtained via retail channels and not direct from the manufacturer.

Sound quality

Performing fairly well on audition, the disc input showed a noticeable treble and presence lift, in other words more deviation from a flat tonal balance than is usually encountered. The bass was slightly softened with a lumpy effect but solo vocalists were quite well projected with a lively effect. Above average depth and ambience were noted, but a trace of muddle was apparent in the mid register, this increasing on loud passages.

Via the auxiliary input the clarity improved, and tonally it was more neutral showing only slight hardness. Fairly good stereo focus and depth were demonstrated, but the bass was probably the weakest point, sounding a touch lumpy and inarticulate. The treble was satisfactory.

The Creek could be driven hard, showing good clipping tolerance and it also coped with the adverse loading in an acceptable manner.

Lab results

Some weakness was exposed by the lab tests. The output specification was just met over the power bandwidth, 8ohms, one channel driven. The small power supply was reflected by the loss into 4ohms on continuous drive, but it made a good try at the 2ohm load on peaks, the

RECOMMENDED

level here falling by a reasonable 4.5dB below the 8ohm peak level. The peak current capacity was satisfactory at +10, −9A

Harmonic distortion results were poor and the high frequency intermodulation also weak, with a figure of −35dB, or 1.6%, noted here. The intermodulation result via disc was in fact so poor that the result is not shown, this due to the inadequate overload margin. In fact, at 20Hz and 1kHz, disc overload margins were barely adequate, particularly since the low sensitivity would suggest the use of higher output cartridges, while only 3dB of overload was permissible at 20kHz, a figure I regard as seriously inadequate. Noise levels were satisfactory and dc offset negligible.

Stereo separation was about average and channel balance good, except at very low volume settings where a 5dB error appeared. Input sensitivities were rather low, particularly auxiliary, this measuring 70mV as opposed to the usual 20mV or so. Disc equalisation had a significant error in the treble.

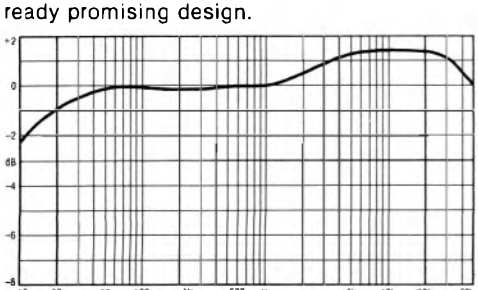
Conclusion

At moderate disc modulation levels one cannot deny that this amplifer sounded quite presentable — almost 'Best Buy' quality in view of its price. However it suffers from an overload problem which goes on to affect the sound on loud recorded sections. Distortion is also high for a hi-fi amplifier, and is believed to be responsible for the slight 'hardness' and 'muddle' we noted. Relying more on the sound than the test results, I can give the Creek a reserved recommendation, but I feel personally that more work could much improve this already promising design.

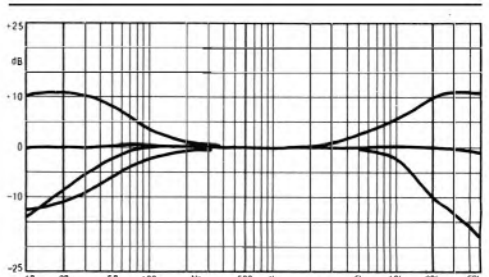
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec.			35W (= 15.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	15.5dBW	16.1dBW	16.0dBW
Both channels, 4ohm load	11.0dBW	13.9dBW	13.2dBW
One channel, 2ohms, pulsed	8.5dBW	12.0dBW	12.6dBW
Instantaneous peak current		+10 A	−9 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−50dB	−57dB	−38dB
Intermodulation, 19/20kHz, rated power, aux input			−35dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			see text
Noise			
Disc (mm) input (IHF, CCIR weighted)			−74dB
Aux/CD input (IHF, CCIR weighted)			−75dB
Residual, unweighted (volume control at min)			−61dB
DC output offset			2mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	16dB	15dB	−3dB
Aux/CD input (IHF)	17.9dB	18dB	17.9dB
Stereo separation			
Disc input	−69dB	−67dB	−43dB
Aux input	−65dB	−65dB	−40dB
Output impedance (damping)	0.03ohm	0.04ohm	0.09ohm
Channel balance, disc, at 1kHz			0.4dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.6dB	0.2dB	5.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.47mV	47kohms, 220pF
Aux input	DIN	70.4mV	54kohms, —pF
Disc equalisation error, 30Hz-15kHz			+1.4dB, −0.5dB
Size (width, height, depth)			42 x 6 x 18cm
Typical price inc VAT			£115



Disc input: RIAA equalisation accuracy



Tone control/filter responses

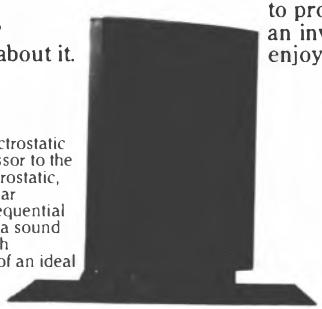
Paradox.

Quad products incorporate the same traditional values of engineering and craftsmanship which have made early Quad products collectors items.

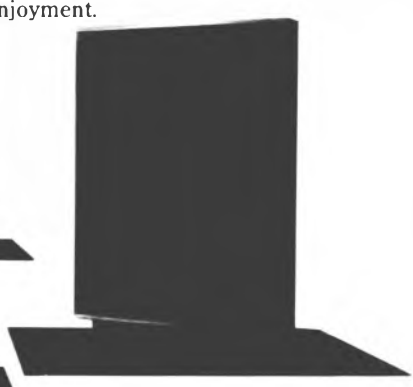
Quad products incorporate innovative ideas which put them ahead of their time and set standards for the industry.

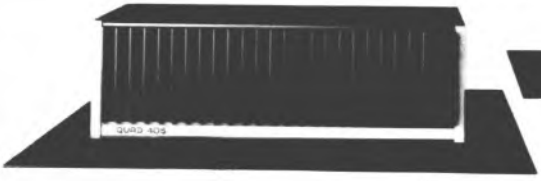
Paradoxical?
Not if you think about it.

Quad is designed and manufactured by a company which for 45 years has been unremittingly devoted to the cause of excellence in music reproduction, a company in which respect for tradition and a quest for improvement go hand in hand to produce products which represent an investment in musical enjoyment.



The Quad ESL 63 Electrostatic Loudspeaker – successor to the legendary Quad Electrostatic, uses concentric annular electrodes fed via a sequential delay line to produce a sound pressure pattern which approximates to that of an ideal point source.





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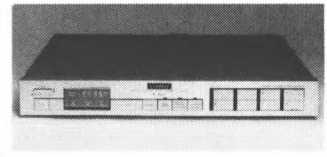

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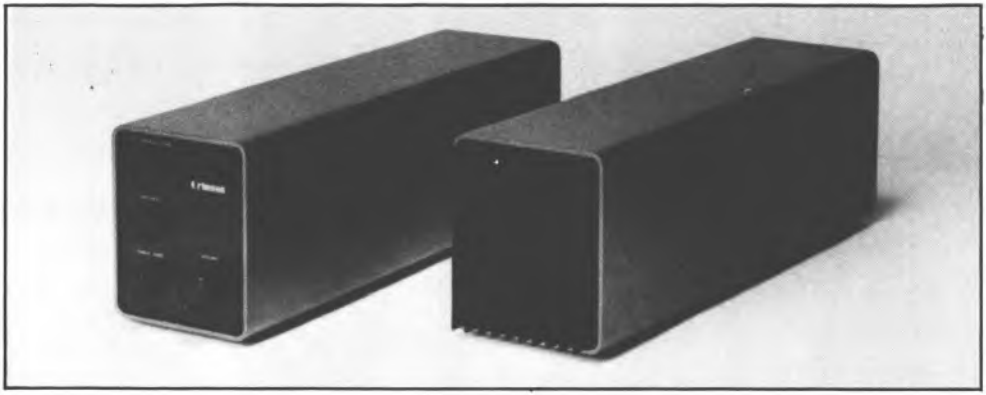
Crimson 610/620

Crimson Elektrik, 9 Claymill Road, Leicester
Tel (0533) 761920



Crimson first supplied us with the *610/630* combination for test, but later they submitted a more recent *610/620* duo for audition. As a result, the tabulated figures are for the *610/630*, an 80W (18.5dBW) combination, while the audition comments are for the *610/620*. The *620* power amp is a 40W model and aside from the 3dB reduction in maximum output level, is generally similar to the *630*.

The Crimson units are encased in long tubular extrusions with small front panels, and are finished in metallic grey. Facilities are basic, inputs being for disc (with an mc option) tuner/aux and tape, and the output cables are carefully designed, coded and fitted with superior quality BNC hardware. The power amplifier has no controls as such, the front comprising a small heatsink, and the rear equipped with 4mm socket/binding posts for speaker connection.

The pre-amp is unusual in that its power is provided by nickel-cadmium layer rechargeable batteries, which are themselves supplied by an external transformer unit. The power amp is self-powered using a toroidal transformer, with a quasi-complementary output, this direct-coupled to the speakers. In the pre-amp the usual complementary large-chip low-noise transistors are used for moving coil, their bases spread by extra diodes to improve signal handling. RIAA equalisation is a combination of active and passive stages, and back-to-back electrolytics appear in the signal path in an attempt to minimise the distortion from this source. Overall constructional quality is reasonably good.

Sound quality

The Crimson *610/620* achieved an above average result overall. Via moving coil input, the midrange was notably sweet and natural, with vocalists well reproduced. The treble resister was also pleasant, with reasonable detail but some added 'haze.'

In stereo terms, acoustic space was not fully revealed, while focusing was mildly blurred, but some depth was present. It was weakest in the bass where definition was notably softened.

Via auxiliary, the sound was not particularly transparent, and it sounded a little constricted, with a lack of real articulation and precision. The full authority of some PCM programme was not conveyed and when played loud, further detail was lost. The 'extreme' loudspeaker load was handled well, however.

Lab report

These test results pertain to the *610* and *630* combination, which gave a typical 19dBW output. For reference, the *620* was also checked and gave around 16dBW. The output power on peak programme reached 20dBW and showed a good performance into adverse loads, falling 3dB from 8 to 2 ohms. Some lack of power was

evident at 20kHz where the full output was more restricted than usual, and when measuring harmonic distortion it was necessary to reduce the 20kHz level to 18dB, but even then the figure was poorer than −60dB. Distortion improved to satisfactory levels at lower powers, and via other inputs, and a good peak current capacity was recorded.

Noise levels were generally satisfactory though the residual at volume control minimum was poorer than average. The dc offset was satisfactory as were the input overloads, though these were on the lower limit of desirability.

Channel separation was modest, but consistent over the band, while the power amplifier output resistance was negligibly low. Channel balance was poorer than average with increasing low level error culminating in a serious 15.3dB at −60dB; at this price level a more accurate potentiometer is desirable.

Input sensitivities were satisfactory and the pre-amp output just sufficient for most other power amplifiers. Disc equalisation was fine, with a well tailored subsonic rolloff, though a treble rolloff would also have been welcome.

Conclusion

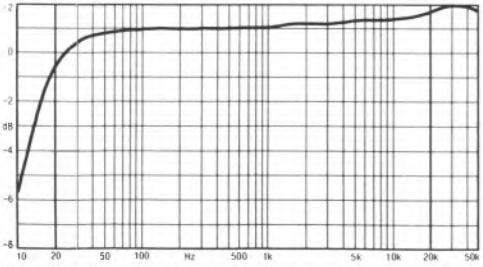
This generally pleasant amplifier is unfortunately not so strong as regards its clarity at high sound levels, and bass definition, while stereo focus could also be sharper. In the light of its current £300 plus price for the *610/620* combination, the performance is not all that unreasonable, but it is insufficient to justify recommendation in this highly competitive market.

Test measurements

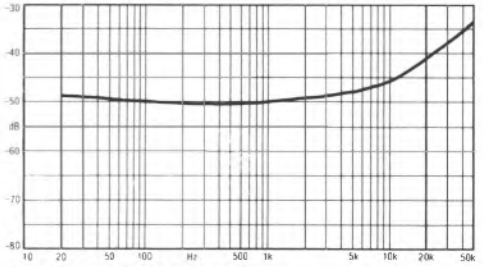
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA	Pre-and power amplifier		
Power output			
Rated power into 8ohms, maker's spec	80W(= 19dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.4dBW	19.4dBW	18.9dBW
Both channels, 4ohm load	17.9dBW	18.3dBW	17.1dBW
One channel, 2ohms, pulsed	15.7dBW	16.9dBW	16.3dBW
Instantaneous peak current		+ 19 A	− 17 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at 60W output, aux input	− 77dB	− 81dB	− 58dB
Intermodulation, 19/20kHz, rated power, aux input			− 69dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> − 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			− 79dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			− 81dB
Disc (mc) input (IHF, CCIR weighted)			− 72dB
Aux/CD input (IHF, CCIR weighted)			− 88dB
Residual, unweighted (volume control at min)			− 64dB
DC output offset			23mV
DC offset, pre-amp			0mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	22dB	22dB	21dB
Disc (mc) input (IHF)	21dB	21dB	15dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	− 48dB	− 50dB	− 42dB
Aux input	− 50dB	− 49dB	− 46dB
Output impedance (damping)	0.08ohm	0.10ohm	0.40ohm
Channel balance, disc, at 1kHz			1.0dB
Volume/balance tracking	0dB	− 20dB	− 60dB
Aux input	1.0dB	1.9dB	15.3dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.30mV	50kohms, 130pF
Disc (mc) input	Phono	0.01mV	100ohms, 10nF
Aux input	Phono	15.5mV	53kohms, 50pF
Power amp	Phono	8.8mV	
Output, pre-amp			3.4V max, 700ohms
Disc equalisation error, 30Hz-15kHz			+ 5dB, − 0.5dB
Size (width, height, depth)			9.5 x 12.5 x 37cm, 9.5 x 12.5 x 37cm
Typical price inc VAT			£135, £270*

**Note: Test results refer to 610/630 system; listening tests were carried out on latest 610/620 combination. See text.*



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Denon PMA-750

Hayden Laboratories Ltd, Churchfield Road, Chalfont St Peter, Bucks SL9 9LW
Tel (0753) 888447

Cleanly styled in the usual silver finish, the medium-priced *PMA-750* is quite substantially-built and is rated at 80W per channel. The front panel is well supplied with controls, giving quite a 'technical' appearance, and indeed many facilities are offered.

Inputs include both moving-magnet and moving-coil disc options, tape 1 and 2, tuner and aux/CD, all these indicated on an LED display. Two sets of speakers may be connected, using strong binding posts. Other details include a headphone socket, stereo/mono switching, bass and treble controls plus tone 'defeat', and both subsonic and loudness filtering. Input connectors are all phono types except tape 2, which is duplicated in DIN.

Good components are used in this design, with a massive power supply and a $2 \times 15000\mu F$ reservoir capacitors, but the internal wiring is rather untidy, and some mains contacts are left unshrouded. Some ICs are used in the pre-amp, though the vital mc section has a dual FET stage to improve noise levels. The power amplifiers are of considerable complexity, using a direct coupled complementary output, protected via top-class relay. Large Sanken SC2838/A1187 output devices are fitted.

Sound quality

Achieving an 'average' rating on audition, the *PMA-750* did quite well against its oriental opposition, but proved to be less competitive when compared with recent UK offerings.

Via moving-coil input, it was pleasantly delicate on low level sounds but it worsened on louder sections. Some tonal 'thinness' was observed, with a forward quality that compressed stereo depth. The bass sounded uneven with some boominess and, in the mid-band, soloists lacked real focus or 'vocalisation'. However, significant improvements were heard via the moving magnet input and so this should be considered more seriously.

On line input, clarity was quite good, depth satisfactory though with a mild brashness in the treble. Detail still appeared to be mildly obscured, but the bass was definitely firmer via this input. High sound levels were possible and it clipped well, driving the complex speaker loads to a substantial 103dBA.

Lab results

The maker's power specification was comfortably exceeded at 20.3dBW on test, with 21dBW peak programme on 8ohms. This was quite well maintained into 4ohms but it deteriorated

into 2ohms. Nevertheless, this is rather better than the low peak current measurement of ±3 amps suggests — this figure is probably not a true representation but is due to premature operation of the protection circuits.

From the 2ohm test, the peak current is nearer 13.5A, which is not quite enough for a 20dBW amplifier. Power bandwidth was very good, while all measured distortions were negligible.

Noise levels were good, including the dc offset at the speaker output terminals. Overload margins were ample, and not obtained at any compromise to input sensitivities. Stereo separation was good and power amp output impedance negligible. Channel balance was accurate throughout the operating range.

The disc (moving-magnet) input impedance was a little higher than usual, with a significant input capacitance, but other inputs were fine, and the disc equalisation was held to very fine close error limits indeed. Tone control ranges were sensible and the auxiliary response was very wide — perhaps too much so. The graph shows no visible deviation from 10Hz to 50 kHz!

Conclusion

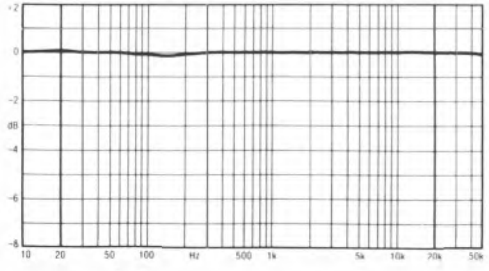
This well made and well specified amplifier offered a good power delivery, especially into normal loudspeaker loads. Many facilities are offered, and it should appeal to the more technically-minded user. It is superior to the average run-of-the-mill Japanese product, but unfortunately just did not sound good enough for a recommendation, though it must be said that it fell short of this by only a small margin.

Test measurements

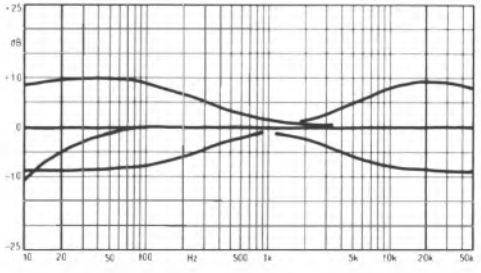
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA	Integrated amplifier		
Power output			
Rated power into 8ohms, maker's spec.	80W(=19dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.5dBW	20.5dBW	20.3dBW
Both channels, 4ohm load	18.0dBW	18.3dBW	18.0dBW
One channel, 2ohms, pulsed	15.3dBW	15.8dBW	15.7dBW
Instantaneous peak current		+3A	−3A*
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−76dB	−84dB	−77dB
Intermodulation, 19/20kHz, rated power, aux input			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			>−80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−84dB
Disc (mc) input (IHF, CCIR weighted)			−76dB
Aux/CD input (IHF, CCIR weighted)			−85dB
Residual, unweighted (volume control at min)			−85dB
DC output offset			3mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32dB	31dB	28dB
Disc (mc) input (IHF)	32dB	32dB	30dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−64dB	−60dB	−45dB
Aux input	−74dB	−69dB	−45dB
Output impedance (damping)	0.08ohm	0.08ohm	0.08ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.1dB	0.3dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.28mV	54kohms, 190pF
Disc (mc) input	Phono	0.013mV	110ohms
Aux input	Phono	16.9mV	74kohms, 80pF
Disc equalisation error, 30Hz-15kHz			+0dB, −0.1dB
Size (width, height, depth)			43.5 x 39 x 13.5cm
Typical price inc VAT			£235

**Not a representative result; see text*



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Electrocompaniet Preampliwire/Ampliwire II

Gotham Audio, 12 Gwendoline Avenue, London E13 0RF
Tel 01-471 1512

Now generally known as Electro for short, the Electrocompaniet amplifier line has suffered an uneven history, mainly due to the lack of continuity in manufacturing and distribution. The original 25W power amplifier acquired a very good reputation some years ago and was joined by a less well developed pre-amplifier with moving-coil input. However for this review we chose the latest series, comprising a new pre-amp with an external mc head amplifier, and an updated stereo power amplifier. The style and finish are in the audiophile tradition coming in satin black aluminium with a minimum of spurious facilities, filters or tone controls. All the units are now self-powered, and thus may be used with other equipment or in isolation.

The amplifiers are now built to rather a better standard than before, though signs of late modifications and amendments were still evident. The pre-amp uses a toroidal mains transformer with a good reservoir capacity and sub regulators, while all-discrete circuitry is used, with matched and selected transistors.

Inside the power amplifier is a massive toroidal transfomer with separate reservoirs to feed each channel. Designed on low-TID guidelines for a good high frequency performance, the output stage uses a direct-coupled complementary configuration with a large number of small, fast output transistors connected in parallel. When factory-wired in bridge mode, the stereo power amplifier forms the basis of the 150W mono power amplifier also available and measured in the lab.

Sound quality

Pre- and power amplifiers were considered to be well matched, providing equivalent sound quality at an impressive 'very good' level. The power amplifier possessed a spacious, slightly 'sweet' character, with a touch of softness in the bass, while the pre-amp offered a closer stereo perspective with a mild tonal hardness evident in the mid register. Using the moving-coil headamp, a clear well defined sound was produced with good detail, focus and stereo depth, and via moving-magnet a slight sharpening of detail was observed, with the effect a mite more controlled. Finally, a really good sound was obtained via auxiliary, with fine ambience and depth, sharp image focusing and a clean detailed treble. A maximum sound level of 102dBA was obtained with good delivery into the adverse loading at 100dBA, but the amplifier was not thought to sound too good when clipped, so it should not be driven too hard.

Lab results

Rated at 50W (17dBW) per channel, this amplifier delivered 17.5dBW over its 8ohm power

RECOMMENDED

bandwidth with very little deterioration into 4ohms. It exhibited a good load tolerance with the 4ohm peak output at close to the 8ohm peak level of 18.5dBW. Premature fuse blowing curtailed the 2ohm and peak current tests on this model.

Both the total harmonic distortion and the intermodulation test results were fine, if a little poorer at higher frequencies. Good signal-to-noise ratios were demonstrated, while the dc output offset was quite satisfactory. Ample input overload margins were measured, while the stereo channel separation was well above average. Power amp output impedance was negligible while channel balance and tracking were held to a very good standard even at low volume control settings.

Good sensitivities were shown, with normal matching characteristics, except for the power amplifier, which has a rather low input resistance. The pre-amp provided a low source impedance to match, with a healthy output of up to 17V.

RIAA equalisation was very accurate with a welcome subsonic rolloff to the IEC recommendation. No filtering occurred in the measured range to 50kHz.

Conclusion

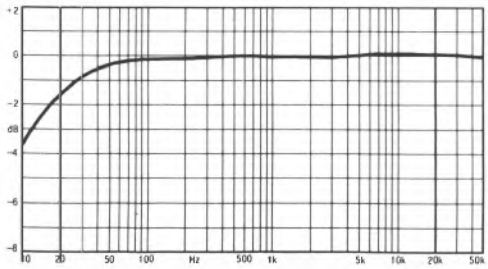
Left with the feeling that this design is still slightly pre-production, we nonetheless found that the Electro gave a good lab performance together with a fine transparent sound and very good stereo images. It was however rather an expensive model for its power rating and thus value for money is not very good, and it scores a recommendation on the basis of its sonic merit alone.

Test measurements

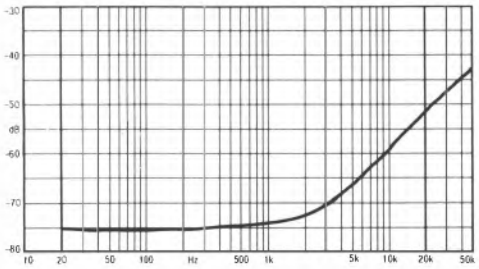
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA	Pre- and power amplifier		
Power output*			
Rated power into 8ohms, maker's spec	150W(= 21.5dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	21.0dBW	22.2dBW	22.0dBW
Both channels, 4ohm load	20.8dBW	21.0dBW	20.8dBW
One channel, 2ohms, pulsed	fuses blow		
Instantaneous peak current	fuses blow		
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 76dB	– 75dB	– 72dB
Intermodulation, 19/20kHz, rated power, aux input	– 79dB		
Intermodulation, 19/20kHz, at 0dBW, disc (mm)	– 71dB		
Intermodulation, 19/20kHz, at 0dBW, disc (mc)	> – 80dB		
Noise			
Disc (mm) input (IHF, CCIR weighted)	– 81dB		
Disc (mc) input (IHF, CCIR weighted)	– 76dB		
Aux/CD input (IHF, CCIR weighted)	– 89dB		
Residual, unweighted (volume control at min)	– 61dB		
DC output offset	17mV		
DC offset, pre-amp	0mV		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	36.5dB	36dB	35.5dB
Disc (mc) input (IHF)	cartridge-dependent		
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 75dB	– 73dB	– 51dB
Aux input	– 75dB	– 75dB	– 51dB
Output impedance (damping)	0.08ohm	0.08ohm	0.16ohm
Channel balance, disc, at 1kHz	0.4dB		
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0.4dB	0.3dB	0dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.22mV	47kohms, 220pF
Disc (mc) input	Phono	cartridge-dependant	
Aux input	Phono	10.8mV	50kohms, 50pF
Power amp	Phono	82mV	13kohms, —pF
Output, pre-amp (tape)	17.1V max,	51ohms	
Disc equalisation error, 30Hz-15kHz	+ 0.2dB, – 0.8dB		
Size (width, height, depth)	38 x 9 x 33cm, 38 x 9 x 33cm		
Typical price inc VAT	£785, £785*		

**Power measurements are for mono power amplifiers in bridge mode. See text. Power amp price is for single mono unit.*



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Fisher CA-275

Fisher Sales (UK) Ltd, 1-4 Walter Lawrence Estate, Otterspool Way, Watford, Herts.
Tel (0923) 31974

Fisher, incidentally a subsidiary of Sanyo, specify the *CA-275* as a fairly modest 75W per channel design, selling at a moderate price of well under £200. In the event it turned out to be one of this edition's more interesting surprises since it proved to be one of the most powerful models tested into an 8ohm type load!

Fitted with a 'busy' looking front panel in black, this amplifier offers many controls and facilities. For example there is a three band graphic equaliser (100Hz, 1kHz, 10kHz centres) with an A/B switching headphone socket, a subsonic filter, mono switch and loudness control. Inputs include disc (moving-magnet only) tape, aux/CD and tuner. Large dual scale fluorescent power meters are fitted, and input selection is possible via a touch panel switch which may be remotely tuned to matching ancilliaries. Input connectors are phono/sockets while the speaker connectors are linked via bare wire spring clips, which are rather light duty for the amp's measured power capability.

Inside, the unit was neatly constructed with a generous power transformer and large heat-sink. Integrated circuit blocks designed for audio use are used extensively, including the output stages, these direct coupled and fed from a $2 \times 7500\mu F$ 75V – rated electrolytic reservoir capacitors.

Sound quality

Scoring 'average' on the listening tests, which was reasonable for the price, the *275* sounded best with the tone control circuits bypassed. The midband was fairly neutral in a frequency-balance sense, with the treble a trifle 'obvious' and splashy, and the bass of only average definition. Stereo depth was restricted though it was reasonably clear-sounding.

Via auxiliary, digital programme gave a surprising 'big' effect and stereo depth was also improved. Bass definition was reasonable and the treble of cleaner quality. It could get very loud indeed into the normal speaker load, reaching 107dBA, but it collapsed into the extreme load, falling to 102dBA, which was still a decent level, though. Used with well-matched speakers, this is a surprisingly big amplifier.

Lab results

Confirming the listening test result, the *275* peaked at 23.5dBW into 8ohms, which is over 200 watts. Into 4ohms (resistive) it also did well at 22dBW but is showed its adverse-load weak-

ness on 2ohms where it fell 9dB below the 8ohm peak level. Awkward speakers are not recommended here. For the delivered power, the ±15amps peak current capability was only just adequate.

At close on full power and more than 3dB above spec, the amplifier demonstrated a good power bandwidth.

Harmonic distortion rose at high frequencies towards full power, but was otherwise very good, as was the high frequency intermodulation result.

Disc input noise was satisfactory and the dc output offset set correctly low. In view of the unit's higher than average input sensitivity input overloads were sufficient, but stereo separation was about average and was not particularly good at higher frequencies.

Disc input capacitance was a little high at 210pF, and this requires allowance to be made when used with certain cartridges. Disc equalisation was pretty good with just a hint of lift at 35Hz and 10kHz, which was however insufficient to significantly influence the audible results. Graphic equaliser variation is shown on the graph, and was clearly quite broad acting.

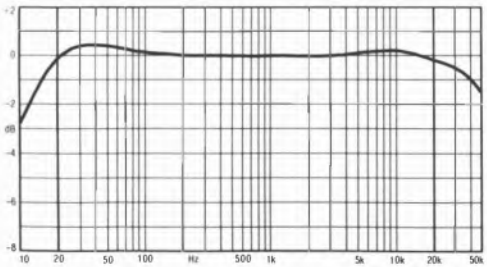
Conclusion

The Fisher tuned out better than we anticipated. Its general sound quality was merely average but it provided an exceptional dynamic range with straightforward loudspeaker loads. On this basis therefore the design is worth considering. It seems well built and could form the basis of a 'disco-orientated' system using powerful, high sensitivity loudspeakers.

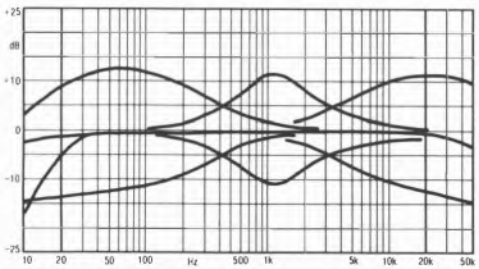
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			75W(=18dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	22.6dBW	22.8dBW	22.6dBW
Both channels, 4ohm load	17.8dBW	18.5dBW	18.1dBW
One channel, 2ohms, pulsed	14.0dBW	14.1dBW	14.1dBW
Instantaneous peak current		+15 A	−15 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−80dB	−83dB	−65dB
Intermodulation, 19/20kHz, rated power, aux input			−76dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−73dB
Aux/CD input (IHF, CCIR weighted)			−76dB
Residual, unweighted (volume control at min)			−77dB
DC output offset			4mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	25dB	25dB	23dB
Aux/CD input (IHF)	19dB	19dB	19dB
Stereo separation			
Disc input	−62dB	−61dB	−37dB
Aux input	−56dB	−61dB	−36dB
Output impedance (damping)	0.16ohm	0.16ohm	0.21ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.5dB	1.4dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.20mV	50kohms, 210pF
Aux input	Phono	14.1mV	87kohms, 40pF
Disc equalisation error, 30Hz-15kHz			+0.4dB, −0dB
Size (width, height, depth)			44 x 27 x 11cm
Typical price inc VAT			£180



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Hafler DH110/DH220

HW International Ltd, 3-5 Eden Grove, London N7 8EQ
Tel 01-607 0293

The recently-introduced *DH110* and *220* units complement the earlier *100/200* models and as before they can be obtained at a notable discount if purchased in kit form. Finish and styling is much improved however by comparison with the earlier models; this is especially true of the power amplifier with (thankfully!) bevelled heatsink fins. Lettering on the pre-amp does however remain a trifle coarse.

The *DH110* is quite comprehensive in offering a headphone outlet in addition to bass and treble controls with tone defeat, a mono switch and filter. Inputs may be selected from disc 1 and 2 (mc optional), tuner, aux tape 1 and 2. The sockets are all phono, but cheap tinned types.

The power amplifier uses good 4mm socket/binding posts for speaker connection, and has no controls bar on/off. It uses a large transformer and two 10000μF computer grade reservoir capacitors. This largely symmetrical amplifier has high-power MosFET output devices — some secondary components, soldered on their back pins, were nearly shorting on our sample. Inside the pre-amplifier, neat construction was evident, with ribbon cables linking the boards. A basic amplifier gain block is used for all stages, this of complementary symmetry and employing six transistors per unit; in general good switches and controls have been used.

Sound quality

The pre-amplifier was not fitted with moving-coil input, but past experience with the *101* pre-amplifier would suggest that quite a good performance can be expected from this section when used. Commensurate with its track record, the Hafler system gave a good account of itself on audition.

On analogue disc the sound was clear, with a 'solid' midrange and an above-average bass quality, demonstrating weight, extension and definition. The high frequencies were less favourable, with some loss of definition here. Tonally it sounded a trifle 'clinical and cold' while the full depth effects of familiar programme were not wholly discernible.

Via, auxiliary, the sound was somewhat improved. The treble register was tidier now, almost equalling the fine bass, while depth was also improved; though neither in this respect nor as regards absolute transparency did it compare too well against the top class references.

Driven to high levels the sound held up well, bar a mild increase in mid 'hardness'. A high

106dBA sound level was produced which was very well maintained into the adverse loading.

Lab results

Rated at 20dBW, the Hafler power amplifier comfortably exceeded this specification over the full bandwidth. A generous 23dBW into 8ohms, the level barely fell with 4ohms, and only showed signs of stress at 2ohms, with a 4.2dB fall in level from the 8ohm figure. In fact, the ±20 amp peak current rating is not quite sufficient to support full 2ohms drive, but it nonetheless remains a lusty amplifier. Distortion levels were generally low, though the −67dB two tone intermodulation result (mm disc) was higher than expected. Noise levels were fine, and power amp dc offset satisfactory. Disc overload margins were very good, and while stereo separation was good via disc, it could have been better via aux, particularly in view of the superior performance of digital sources.

Channel balances were closely defined and the input impedances gave rise to no concern. Disc equalisation was respectably accurate and the pre-amp could supply a substantial output if so required for alternative power amplifier inputs.

Conclusion

This impressive product was capable of high levels with good power and authority. Good to listen to, it provided flexible input facilities and signal handling. While it is not a front rank design as regards the more subtle aspects of musical reproduction, such as rendition of depth and ambience, it nonetheless sets a standard that justifies recommendation.

Test measurements

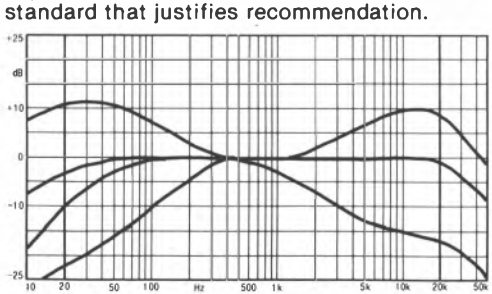
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA		Pre- and power amplifier	
Power output			
Rated power into 8ohms, maker's spec.		115W(=21dBW)	
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	22.1dBW	22.4dBW	22.0dBW
Both channels, 4ohm load	20.0dBW	20.9dBW	20.3dBW
One channel, 2ohms, pulsed	17.5dBW	18.8dBW	18.7dBW
Instantaneous peak current		+20 A	−19 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−87dB	−92dB	−83dB
Intermodulation, 19/20kHz, rated power, aux input			−73dB
Intermodulation, 19 20kHz, at 0dBW, disc (mm)			−69dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−76dB
Aux/CD input (IHF, CCIR weighted)			−80dB
Residual, unweighted (volume control at min)			−71dB
DC output offset			24mV
DC offset, pre-amp			2mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	36dB	36dB	36dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−70dB	−59dB	−43dB
Aux input	−70dB	−59dB	−43dB
Output impedance (damping)	0.04ohm	0.04ohm	0.10ohm
Channel balance, disc, at 1kHz			0.4dB
Volume/balance tracking	0dB	−20dB	−60d B
Aux input	0.4dB	0.2dB	0.2dB

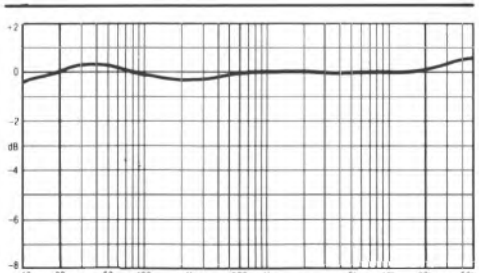
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.27mV	47kohms, 190pF
Aux input	Phono	14.3mV	34kohms, 100pF
Power amp.	Phono	14.1mV	249kohms, 130pF

Output, pre-amp 15.3V max, 330 ohms

Disc equalisation error, 30Hz-15kHz +0.2dB, −0.2dB
Size (width, height, depth) 43 x 24.5 x 8cm, 40.5 x 26 x 12.5cm
Typical price inc VAT £310, £360 (in kit form, £245, £295)



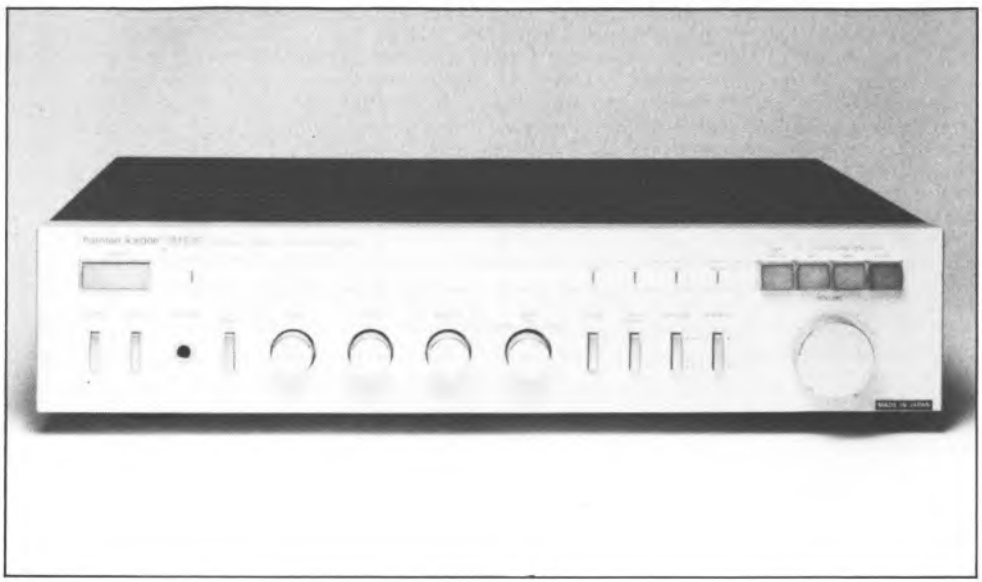
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Harman-Kardon PM-640

Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD
Tel (0753) 76911



Harman-Kardon have been researching the peak current requirements of loudspeakers, resulting in their producing a new line of amplifiers. As the 'starter' model in this range, the *PM-640* is a fairly modest unit, selling for around £170 and rated at 30W per channel, yet endowed with a high current capability. It is a slim design in the usual HK livery, offering switching for two pairs a speakers, bass and treble controls with 'tone defeat', mono/stereo; subsonic filter and, finally, a loudness control. Inputs are provided for disc, tuner and two tape decks, all connections being phono, while speaker connections are via fairly light-acting spring clips.

Internally, this unit is carefully constructed, with properly-shrouded mains sections. The complementary direct-coupled output stages are designed to provide a high current and use substantial driver transistors, while heat-sinking is ample.

Sound quality

With scores well above average, listening tests confirmed that the *640* was a competitive performer. Its basic qualities included an easy, clear character with an above average performance over the whole frequency range.

Via moving magnet input, the sound was described as pleasant, with a good midrange, fair stereo depth and satisfactory bass definition, the latter with good extension. The treble was clear and unfatiguing, but slight muddle and defocusing was evident on more complex sound textures.

Via auxiliary input, a fine performance was obtained; the sound was considered to be neutral, well integrated and of decent 'scale' and depth. Quite good sound levels were obtained, which belied the modest specification, and it also tackled the 'extreme' loudspeaker load with little hesitation. Even here, sound levels topped 100dBA, good for a small amplifier.

Lab results

Specified at 15dBW, the *640* typically measured at 17.5dBW with a fine power bandwidth. The loss into 4ohms on continuous loading suggested that the money has been

RECOMMENDED

spent on good peak delivery rather than high continuous powers. The peak programme ratings confirmed this, with 18dBW available at 8ohms, which was double the specification, and still held to a decent 15.5dBW into 2ohms. Peak current capacity was very good at ±25A, which is sufficient for the most difficult of speakers.

Distortion levels were satisfactory, if poorer than average, but noise levels were particularly good. Power amp dc offset was a little high at 30mV. Input overload margins were fine and generally good separation results were recorded, though better 'aux' results would be an advantage for CD programme.

Amplifier output impedance was negligible, and channel balance more than satisfactory throughout the range. Input characteristics were typcial though the sensitivities were a little lower than average, which is fine for CD, but the use of very low output moving magnet cartridges might be questionable. Disc equalisation showed a slight treble range depression of just 0.25dB, and the tone control responses were sensibly tailored. The subsonic filter provided −5dB of cut at 10Hz, which was a reasonable compromise.

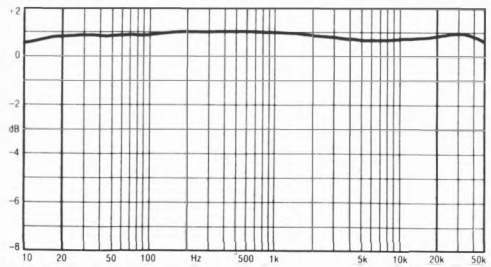
Conclusion

The *640* is a more powerful amplifier than it looks and it delivered a generally good lab performance combined with a strong results on the auditioning test. Its provided a pleasing dynamic sound of wide response, good stereo presentation and substantial strength, even with severe speaker loads, and while we felt it was not best buy material, it still deserves a confident recommendation.

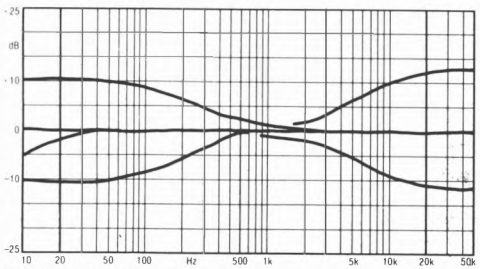
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			30W(= 15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.4dBW	17.6dBW	17.6dBW
Both channels, 4ohm load	14.7dBW	15.7dBW	15.5dBW
One channel, 2ohms, pulsed	14.0dBW	15.6dBW	14.7dBW
Instantaneous peak current		+25 A	−25 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−69dB	−70dB	−65dB
Intermodulation, 19/20kHz, rated power, aux input			−69dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−65dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−83dB
Aux/CD input (IHF, CCIR weighted)			−87dB
Residual, unweighted (volume control at min)			−74dB
DC output offset			30mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	30dB	30dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−70dB	−66dB	−42dB
Aux input	−74dB	−63dB	−39dB
Output impedance (damping)	0.13ohm	0.13ohm	0.15ohm
Channel balance, disc, at 1kHz			0.2dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.2dB	1.0dB	1.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.41mV	53kohms, 98pF
Aux input	Phono	24mV	150kohms, 300pF
Disc equalisation error, 30Hz-15kHz			+0dB, −0.2dB
Size (width, height, depth)			44 x 36 x 10cm
Typical price inc VAT			£169



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Harman-Kardon PM-650

Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD
Tel (0753) 76911

Although a larger *660* model is also available in the HK 'high peak current' range, it seemed to us that the already well-received *650* was the more natural choice for inclusion here. Basic power rating is specified as 50W per channel (17dBW). It comes in a 'champagne silver' case with a neat front panel layout, and is well equipped; both mm and mc disc inputs are provided as are aux, tuner, tape 1 and 2, while two sets of speakers may be connected via substantial binding posts — which are necessary in view of the high current capacity. The moving magnet input capacitance may be adjusted in four steps via a front panel control, to give an additional 50, 100, 150 or 250pF; other facilities include a subsonic filter, bass and treble equalisation plus a 'loudness' contour.

The amplifier is constructed to a high standard using good supply wiring, this marred on the sample by the inclusion of three unshuttered US-type mains sockets on the rear. Ideally, these should be blanked off to conform to UK standards. A substantial mains transformer is fitted, using double secondaries which feed separate rectifiers and reservoirs for each channel. In accordance with modern practice, the amplifier output is direct-coupled complementary, using a generous Sanken output transistors mounted on a large internal heatsink.

Sound quality

This model scored well in the listening tests, achieving an impressive 'good plus' via its auxiliary input. Here it was considered to be a powerful performer, well focused with firm, punchy bass substantial depth and ambience rendition with a generally neutral character. It clipped well, providing substantial sound levels and also took the adverse speaker load in its stride, attaining over 103dBA on this difficult test.

This generally good sound was maintained via the disc (mm) input, the main effect being that of promising attack and definition. Via the mc input, a mild shortfall was however apparent, for although the sound was more than satisfactory, the treble register nonetheless showed a mild 'featheriness', while the stereo images were mildly diffuse and the bass less well controlled. If the amp is to be used with mc cartridges it might even be worth consid-

ering a competent ancilliary step-up or head-amp unit since the good quality of the mm input would appear to justify this.

Lab results

Rated at 17dBW, the *650* raised around 18.5dB under continuous-rated conditions, with a good power bandwidth. On peaks, 19.5dBW was available into 8ohms, this falling by only 2.5dB into 2ohms (Of passing interest may be the fact that such a level is equivalent to 200W peak, 2ohms!) Peak current was exemplary at ± 39 amps which was in line with HK's design target.

Harmonic distortion was fine, although the intermodulation results were poorer than expected. Noise levels were fine except on moving coil, where the high sensitivity achieved has served to reduce this somewhat. The dc offset was satisfactory with ample input overload margins and stereo separation rather better than usual.

Good channel balancing was demonstrated, and all the input parameters were satisfactory. Disc equalisation showed some mild bass rolloff though it met close tolerances above 80Hz.

Conclusion

This well built and powerful amplifier has an outstanding peak current capability, and in consequence it is very load-tolerant. The sound was confident and firm, working particularly well with digital programme while moving-magnet disc source also gave fine results. A dependable product, then, offering good value for money, the *650* achieves certain recommendation.

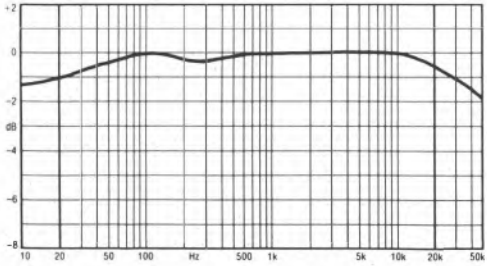
Test measurements

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

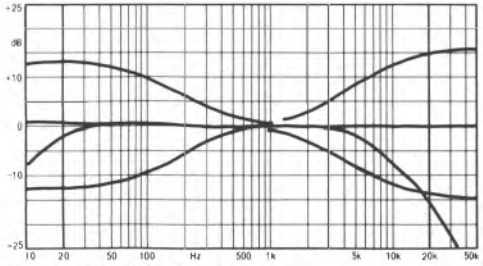
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			50W(= 17dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.4dBW	19.03dBW	18.4dBW
Both channels, 4ohm load	19.6dBW	20.7dBW	20.3dBW
One channel, 2ohms, pulsed	21.7dBW	23.0dBW	22.5dBW
Instantaneous peak current		+ 39 A	– 39 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 78dB	– 79dB	– 72dB
Intermodulation, 19/20kHz, rated power, aux input			– 69dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 71dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			– 67dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 80dB
Disc (mc) input (IHF, CCIR weighted)			– 68dB
Aux/CD input (IHF, CCIR weighted)			– 80dB
Residual, unweighted (volume control at min)			– 78dB
DC output offset			19mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	33dB	34dB	34dB
Disc (mc) input (IHF)	23dB	23dB	23dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 73dB	– 74dB	– 53dB
Aux input	– 73dB	– 71dB	– 49dB
Output impedance (damping)	0.07ohm	0.07ohm	0.15ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0dB	0.1dB	1.2dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.28mV	46kohms, var
Disc (mc) input	Phono	0.008mV	112ohms
Aux input	Phono	18.4mV	31kohms

Disc equalisation error, 30Hz-15kHz + 0dB, – 0.8dB
Size (width, height, depth) 44 x 40 x 14cm
Typical price inc VAT £230



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Hitachi HA-2

Hitachi Sales (UK) Ltd, Hitachi House, Station Road, Hayes, Middlesex UB3 4DR
Tel 01-848 8787

An inexpensive slimline model, the Hitachi *HA-2* has a rather cluttered front panel, sporting an over-bright blue fluorescent display, which shows both power output and the various functions selected. Bass/treble and balance are controlled via rather awkward sliders. The usual phono input sockets are provided for aux, tuner, disc and tape. Two sets of speakers may be connected (via spring clips) and a headphone socket is also fitted. The volume control is power-operated via push buttons — another nuisance in our view. The remaining facilities comprise a subsonic filter, 20dB mute switch and loudness contour.

Inside this 50W per channel amplifier is a single large printed circuit board, with a central coutout for the integral multifinned heatsink. A 4558D IC is used for the disc amplifier stage, with another IC in the line buffer. Modular power amp packages are used, these numbered STK 4191, while the small mains transformer supplies $2 \times 6800\mu F$ reservoirs of average quality. The live mains wiring is neither shrouded or sleeved in accordance with safety regulations. Electronic protection is used with a 'fault' relay.

Sound quality

Scoring below average, the *HA-2* showed some degree of 'up front' midrange hardness. Depth effects were weak, while ambience seemed suppressed. Stereo focus was none too sharp in the frontal plane and the reproduction also suffered from a general lack of real definition.

The amp did not clip very well, very quickly sounding hard when driven beyond full peak output, but the 4ohms load was reasonably well handled at lower levels.

Via moving magnet disc input, the sound was similar, but with with a mild further loss of definition.

Lab results

Output power comfortably exceeded the specificaion, meeting 18.8dBW for the full power bandwidth. Loss of level into 4 and 2ohms was greater than usual, and using peak measurement, the loss from 8 to 2ohms was high at 9.2dB. Adverse loads are not recommended, though a simple 8ohm speaker should be coped with.

All the distortion results were satisfactory. Disc input was however poorer than average, despite a comparatively low sensitivity, and as a result, weak-output moving magnet cartridges may not suit this model particularly well. The dc offset was fine while disc input over load levels although adequate, were again poorer than average.

Stereo separation was uninspiring, particu-

larly via auxiliarly where only 27dB was recorded at 20kHz. On the other hand, channel balances were excellently maintained. Disc input capacitance was on the high side, totalling 370pF with a typical tonearm, and may need consideration when choosing a cartridge, while the auxiliary input capacitance was also surprisingly high at 400pF.

RIAA equalisation showed a mild upper treble rolloff and some bass lift, but at just 0.6dB this was not very serious.

Conclusion

This model frankly offers nothing special, possessing no strong points. In general it was rated as below average, both in the lab and the listening room, and while it was possibly spoilt by its overcomplicated controls, it does not merit any recommendation.

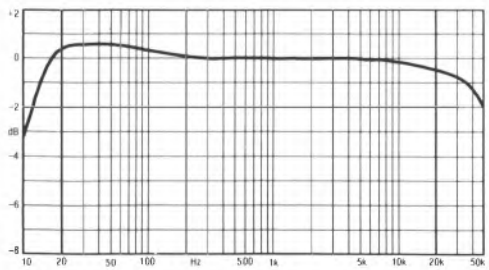
Test measurements

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

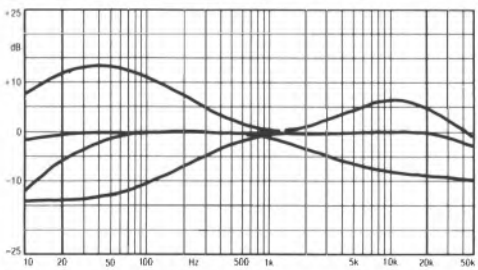
GENERAL DATA		Integrated amplifier	
Power output			
Rated power into 8ohms, maker's spec.		50W(= 17dBW)	
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.1dBW	19.1dBW	18.8dBW
Both channels, 4ohm load	16.1dBW	16.7dBW	16.4dBW
One channel, 2ohms, pulsed	10.2dBW	10.3dBW	10.0dBW
Instantaneous peak current		+ 14 A	– 12 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 61dB	– 79dB	– 74dB
Intermodulation, 19/20kHz, rated power, aux input			– 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 75dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 76dB
Aux/CD input (IHF, CCIR weighted)			– 86dB
Residual, unweighted (volume control at min)			– 73dB
DC output offset			8mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	25dB	23dB	23dB
Aux/CD input (IHF)	19dB	19dB	19dB
Stereo separation			
Disc input	– 63dB	– 55dB	– 32dB
Aux input	– 73dB	– 50dB	– 27dB
Output impedance (damping)	0.23ohm	0.23ohm	0.30ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0.1dB	0.2dB	0.2dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.34mV	48kohms, 220pF
Aux input	Phono	23.1mV	36kohms, 400pF

Disc equalisation error, 30Hz-15kHz + 0.5dB, – 0.3dB
Size (width, height, depth) 44 x 27 x 8.5cm
Typical price inc VAT £120



Disc input: RIAA equalisation accuracy



Tone control/filter responses

JVC AK-22

JVC (UK) Ltd, 6-8 Priestley Way, Eldonwall Trading Estate, Staples Corner, London NW2 7AF
Tel 01-450 2621

Rated at 38W per channel, the *AK-22* is an inexpensive integrated model which sells for under £100. Finished in silver and blue, it has a low-profile format and facilities include connections for two sets of speakers, via clamp spring terminals. Inputs are provided for tape, video (aux), tuner and disc, while the slider-type bass and treble controls are supplemented by a loudness button. All input sockets are phonos.

Inside, the *AK-22* was found to be neatly constructed with a good standard of mains wiring. One main printed circuit board is used, with secondary link boards for front and rear panel facilities. Disc input and RIAA equalisation are catered for by a 4558D integrated circuit, with discrete circuitry used for the tone controls. The output is complementary direct-coupled, the transistors protected by a relay, with the comparatively small mains transformer feeding a 2 × 4700μF reservoir, shared for both channels. Internal wiring is tidy, and well harnessed.

Sound quality

Scoring below average the '22 showed no serious subjective faults but failed to convey a convincing impression of the programme reproduced. Via disc (mm) input, the low frequency range lacked attack and was not very 'tuneful', while at moderate levels the mid was fairly pleasant, even delicate, with a promising clarity. Conversely, however, stereo focus was unexceptional and little impression of depth or space was apparent.

Via auxiliary, digital programme seemed to lack power and authority, with tonal balance marred by a touch of nasality. Deterioration set in at higher listening levels, and the amplifier was none too comfortable on the adverse speaker load, even to the extent of the protection relay operating occasionally.

Lab results

Rated at about 15dBW, the *AK-22* did well in output terms on 8ohms loads, maintaining 17.6dBW over the power bandwidth. on peaks 18.5dBW was possible but the small power supply was reflected by the considerable reduction in the continuous 4ohm level. On peaks the 2ohm output fell by a total of 9.5dB. The current output suggested better than this, but was upset by a marked assymetry, 16A positive, but with 25% less in the negative direction.

Distortion levels were good, and noise levels more than satisfactory via the various inputs. No problem should arise with input overloads and the stereo separation figures were quite typical. Higher than average, the output imped-

ance figures were still comparatively harmless.

Channel balance was well maintained over the operating range and the input characteristics were satisfactory, though the disc input resistance was 20% higher than usual at 57K ohms.

The auxiliary response was very wide, and the uniform, but RIAA equalisation was lumpier than usual, though still within a reasonable tolerance.

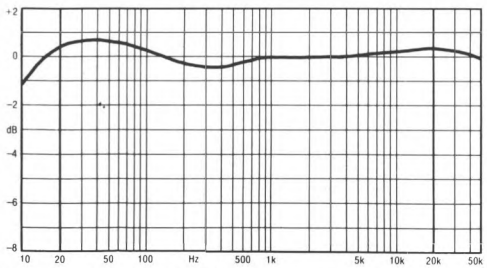
Conclusion

The *AK-22*'s performance was quite reasonalbe for the price level, but in our view it nonetheless has nothing special to offer. Unfortunately, such are the standards shown by some new designs in this issue, that models which might have had some chance of recommendation two years ago, no longer qualify. 'Easy' loudspeaker loads are suggested for this unit; and given these conditions it does get quite loud for the price asked.

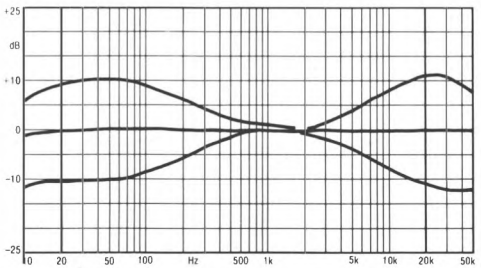
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			38W(= 15.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.9dBW	17.9dBW	17.6dBW
Both channels, 4ohm load	13.0dBW	13.8dBW	13.5dBW
One channel, 2ohms, pulsed	8.0dBW	9.0dBW	9.0dBW
Instantaneous peak current		+ 16 A	− 12 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	− 76dB	− 87dB	− 68dB
Intermodulation, 19/20kHz, rated power, aux input			> − 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			− 78dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			− 75dB
Aux/CD input (IHF, CCIR weighted)			− 80dB
Residual, unweighted (volume control at min)			− 84dB
DC output offset			4mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	27dB	27dB	27dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	− 70dB	− 61dB	− 37dB
Aux input	− 72dB	− 61dB	− 37dB
Output impedance (damping)	0.20ohm	0.22ohm	0.30ohm
Channel balance, disc, at 1kHz			0.2dB
Volume/balance tracking	0dB	− 20dB	− 60 dB
Aux input	0.1dB	0.6dB	0.9dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.28mV	59kohms, 98pF
Aux input	Phono	25mV	54kohms, 300pF
Disc equalisation error, 30Hz-15kHz			+ 0.7dB, − 0.4dB
Size (width, height, depth)			44 x 30 x 8cm
Typical price inc VAT			£90



Disc input: RIAA equalisation accuracy



Tone control/filter responses

JVC AX-40

JVC (UK) Ltd, 6-8 Priestley Way, Eldonwall Trading Estate, Staples Corner, London NW2 7AF
Tel 01-450 2621

A mid-priced model from one of the larger Japanese companies, the *AX-40* is specified at 50W per channel (17dBW). This amplifier uses JVC's 'Super A' power amp circuitry which minimises switching distortion and employs a proprietory IC. Also following current JVC practice, a simple graphic equaliser tone control is fitted, with operating frequencies set at 64Hz, 250Hz, 1kHz, 4kHz and 16kHz. Wide-range fluorescent power meters are also fitted, scaled from a low 3mW to 100W, and other facilities include two sets of speaker outputs (with connection made via binding-post terminals), a headphone socket and a loudness switch. All input sockets are phono save tape 1 which is duplicated in DIN; the selection includes video/aux, tuner, disc tape 1 and 2.

Interior layout was considered to be rather untidy with no less than 16 printed circuit boards wired together. Power supply arrangements followed normal practice, and the mains section was to a good standard of safety.

The disc amplifier/equaliser is based on an integrated circuit type 4560D, but discrete circuitry is used to drive the graphic section. The output stage is the usual direct coupled complementary and electronic protection is employed with a diconnect/muting relay.

Sound quality

This amp was rated as below average on audition. It was considered to be rather similiar to the smaller JVC model, the *AK-22*, and failed to set a worthwhile standard.

Via the disc input, the bass lacked definition and sounded a little 'thumpy', while the treble was slightly harsh and the mid both forward and hard. A modicum of stereo depth could be heard, and stereo focus and detail were both fair enough. A dry, crisp character was noted.

Using the auxiliary input a better impression of depth and space was obtained, and the sound was rendered with more authority and detail. Some listener fatigue was however recorded and the sound quality deteriorated further at high levels, and more particularly into adverse speaker loads. Under the latter conditions only 96.5dBA could be obtained, which is rather less than the specified power suggested. Simple 8ohms speakers are recommended in consequence.

Lab results

On test the specification was certainly met on

8ohm loads, but showed signs of rapid weakening into 4 and especially into 2ohm conditions. For the latter, even on peak, the output fell a crippling 10dB and only ±5A peak was available, this confirming its poor performance on the high level listening test. However under ideal 8ohm conditions, the power bandwidth was fine.

Highly linear, the *AX-40* gave very low harmonic and intermodulation distortions, once again demonstrating the lack of correlation between these parameters and sound quality. Signal-to-noise ratio were satisfactory, and dc offset at the speaker terminals was negligible. Input overloads were fine, and channel balance also held up well. Input characteristics were standard, albeit with some parallel input capacitance while disc RIAA equalisation was very good, and the versatile tone control responses can be seen on the graph (note that only the boost positions are shown; the results are complementary for the cut positions.)

Conclusion

The graphic equaliser might be an attractive feature and the peak power meters look technical, but neither these nor the other facilities offered can make up for the fact that this design is not equipped to drive real loudspeakers. Its basic capability is for 8-16ohm models; and for hi-fi purposes the idea of using two pairs of speakers together, for example in another room, is in my opinion out of the question. In any case the lower volume-level sound quality was not sufficient for a recommendation. In our view the *AK-22* is a superior amplifier.

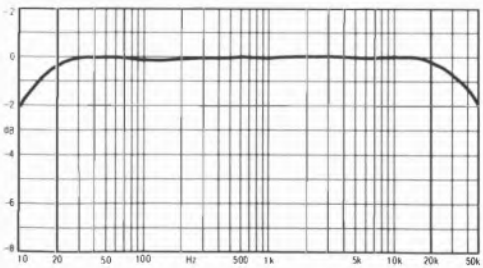
Test measurements

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

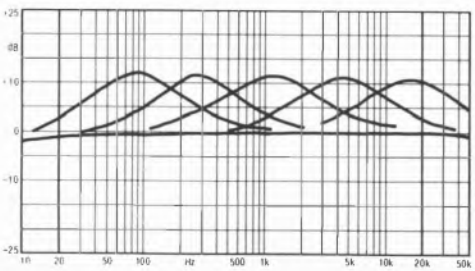
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			50W(= 17dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.8dBW	18.9dBW	18.4dBW
Both channels, 4ohm load	14.5dBW	14.6dBW	14.3dBW
One channel, 2ohms, pulsed	8.2dBW	8.8dBW	7.8dBW
Instantaneous peak current		+5 A	−5 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−83dB	−89dB	−80dB
Intermodulation, 19/20kHz, rated power, aux input			> −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−76dB
Aux/CD input (IHF, CCIR weighted)			−79dB
Residual, unweighted (volume control at min)			−80dB
DC output offset			8mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	31dB	31dB	30dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−56dB	−55dB	−33dB
Aux input	−69dB	−55dB	−33dB
Output impedance (damping)	0.08ohm	0.08ohm	0.12ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.2dB	1.0dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.30mV	50kohms, 200pF
Aux input	Phono	19.4mV	63kohms, 290pF

Disc equalisation error, 30Hz-15kHz: +0dB, −0.1dB
Size (width, height, depth): 44 x 30 x 12cm
Typical price inc VAT: £154



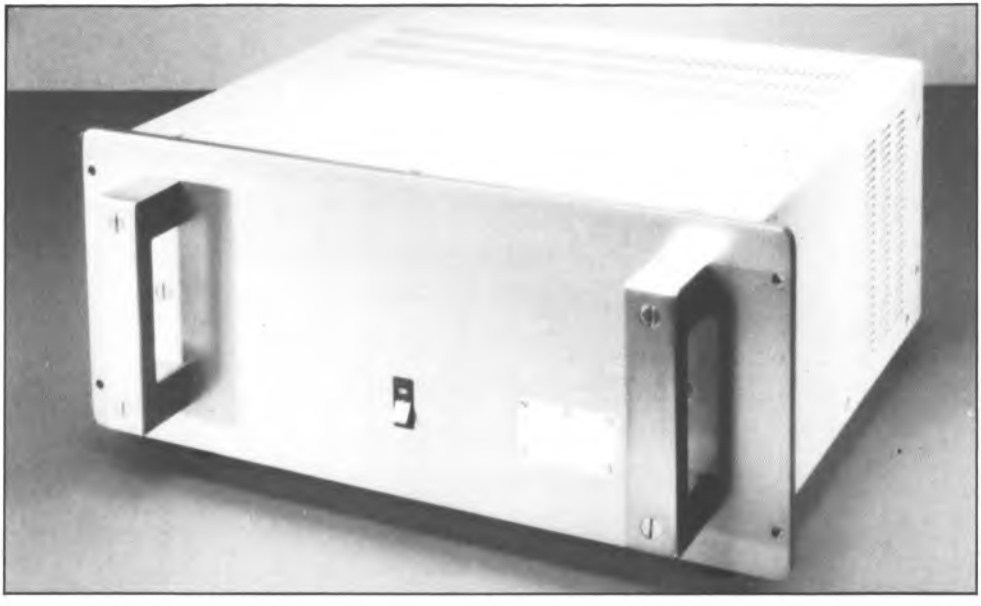
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Krell KSA-50

Absolute Sounds Ltd, 42 Parkside, London SW19
Tel 01-947 5047



An American heavyweight built to the highest standards of finish and construction, the *KSA50* is a very expensive power amplifier modestly rated at 17dBW (50W). Versions at 100W and 200W are also available, and with the exception of the power output, these are broadly similar in performance to the *'50*.

The amplifier runs in pure Class A into 8ohm loads up to its rated power, and employs a forced-air heat dissipator to provide steady thermal conditions as well as a rapid warm up (minutes rather than the usual hour or so for other Class A designs.) The fan is relatively quiet producing no more noise than the large toroidal transformers fitted, audible hum from the latter varying according to the quality of the mains supply, which depends on the time of day! I would not recommend locating the amplifier too near the listening position if the room's ambient noise levels are low, however.

Below 8ohms, and at higher output levels, the amplifier momentarily departs into Class B operation, and here a large reserve current capability is provided to cope with the most taxing of loads. Internally, no expense has been spared and the unit is arranged as a double mono design. Just a hint of its engineering quality may be gleaned from the use in the power supply of two 1kVA toroids, and $4 \times 40000\mu F$ high-current reservoir capacitors!

Sound quality

This remarkable amplifier delivered an exceptionally good sound, and rarely has a product so consistently exposed the shortcomings of others. It lead the field by a substantial margin, providing stereo images of seemingly effortless depth, clarity and focus. Its stature was apparent throughout the frequency range, from its deep, powerful, and highly articulate bass to a neutral accurate midrange, and a sparkling but delicately musical treble. It consistently provided more musical information in a more natural manner than other models we tried, including a number of reference at rather higher prices. Its sound also continued to improve with the use of better pre-amplifiers, these ranging from the

Audio Research *SP8* to the Burmester *808*.

It sailed through the awkward load test, and the maximum sound levels obtained contradicted the conservatively-rated output specification. A considerable 102 to 103dBA volume was obtained in the listening room, which was not that much less than some of the most powerful designs tested in this issue.

Lab results

Rated at only 17dBW, the Krell typically produced on continuous ratings at 19.1dBW output level, and such was the extraordinary power bandwidth that no significant fall occurred from 20Hz to 20kHz, relative to 1kHz. Likewise the loss into 4 and 2ohms was small. Peak output was approaching 100W, reading 19.3dBW, with 18dBW still provided into 2ohms, the Krell proving to have one of the 'stiffest' output and power sections measured. Peak power into 2ohms exceeded 240W. Peak current output was symmetrical at a substantial +29A, −30A, which was sufficient for the worst loads.

Harmonic and intermodulation distortion was negligible with noise levels also very low. One sample had a slight driver fault resulting in some moderate dc offset, this negligible once the problem was corrected. Stereo separation was predicably excellent, and the output impedance at levels of little importance. Input requirements were straightforward, indeed, suitable for the direct connection of some of the higher-level output sources via a passive control.

Conclusion

This massive amplifier can be expected to deliver an exceptional sound for many years, and could be viewed more as an investment than, as is all too often the case, a product likely to become obsolete rapidly. For dedicated audiophiles the Krell will justify its high price in an enduring sonic pleasure. We managed also to briefly audition the matching *PAM1* pre-amplifier (too late to do a full report) we can confidently say that this beautifully-built product was capable of attaining a similar fine sonic standard.

GENERAL DATA — Power amplifier

Power output

Rated power into 8ohms, maker's spec		50W(= 17dBW)	
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.1dBW	19.1dBW	19.1dBW
Both channels, 4ohm load	18.4dBW	18.9dBW	18.3dBW
One channel, 2ohms, pulsed	17.9dBW	17.9dBW	17.8dBW
Instantaneous peak current		+29 A	−30 A

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−90dB	−91dB	−83dB
Intermodulation, 19/20kHz, rated power			>−80dB

Noise

PA input (IHF, CCIR weighted)	−103dB
Residual, unweighted (volume control at min)	−92dB
DC output offset	left 6mV, right 74mV*
Output impedance (damping)	0.02ohm 0.02ohm 0.04ohm
Channel balance, at 1kHz	0dB

Input data	socket type	sensitivity	loading
Power amp	Phono	110mV	22kohms, 176pF

Size (width, height, depth) 48 x 43 x 21cm
Typical price inc VAT £1250
**Sample fault, see text*

Luxman L230

HW International Ltd, 3-5 Eden Grove, London N7
Tel 01-607 0293

Well-presented and finished in the usual Lux manner, the *L230* is a medium-priced integrated amplifier and comes with a comprehensive specification. Rated at 60W per channel (17.5dBW), it offers moving-coil and moving-magnet disc inputs plus tuner and aux/CD and facilities for two tape decks.

Elaborate tone controls offer a choice of frequency turnovers for bass and treble plus a loudness contour, plus 30Hz subsonic and 7kHz treble-cut filters. Two sets of speakers can be used (connected by bare-wire spring clips) and a headphone socket is provided. All input sockets are phonos.

Built on one large printed circuit board, the *L230*'s internal constructional quality was considered to be average, with a number of trailing wires in evidence. As noted with certain other cost-conscious designs, the tone controls are integrated in the feedback circuitry of the power amplifier, the latter a direct coupled complementary type using bipolar transistors. A large transformer feeds 2 x 10000μF reservoir capacitors, and while a primary fuse protects the mains side of the equipment, the mains wiring is unshrouded, not to BS recommendations.

An integrated circuit is used for the disc input/RIAA equaliser, gain adjusted for moving magnet and moving coil sensitivities, with good quality components in evidence through out.

Sound quality

The *L230* gave an encouraging performance during its auditioning. Rated as 'good' which is competitive at its price level, it was felt to have a slightly 'thin' tone quality giving a clinical effect which was however not too severe.

Via moving-coil input the sound was judged precise and well-controlled with a pleasant mid and treble. Focus and depth were both better than average, though the bass was midly lumpy. Via moving-magnet some moderate improvement in focus and detail were apparent, while the bass extension also seemed to be improved.

The amplifier gave a pleasant relaxed presentation via auxiliary, with fairly good perspectives, although it failed to properly capture the attack and life of the best digital programme. It could be driven hard, though,

and did not deteriorate appreciably into clipping using normal loudspeakers. Its performance on adverse loading was also pretty fair.

Lab results

Rated at 60W, 17.5dBW, the *L230* could produce a continuous full-bandwidth output into 8ohms happily exceeding 19dBW, and on peaks it reached 20dBW (100W). Lower load impedances were however handled less well, with a fall of 3dB on 4ohm peak, and a serious 10.5dB into 2ohms. The maximum current limits checked out at ±6A, so this model clearly preferred higher impedance speakers.

Low levels of distortion were measured throughout the test range, while the signal-to-noise ratios were fine, considering the sensitivity, with the exception of moving coil. Speaker terminal dc offset was negligible and input overloads ample. Stereo separation was pretty average for all inputs, while channel balances were well maintained except at the lowest volume setting.

RIAA equalisation did show a mild uptilt which might have influenced the comment of a 'thin' tonal balance, but the deviation was quite small. Tone controls and filters were all satisfactory (see graph).

Conclusion

While more difficult speaker loads are inadvisable, in all other respects this model represents a competent and versatile package offering a pleasant sound and better-than-average stereo presentation. A recommendation is in order since in this instance such a combination of attributes costs well under £200.

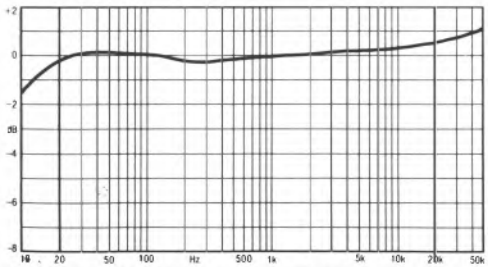
Test measurements

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

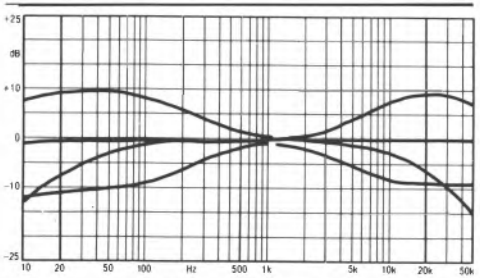
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			60W(= 17.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.1dBW	19.4dBW	19.3dBW
Both channels, 4ohm load	14.8dBW	14.9dBW	14.9dBW
One channel, 2ohms, pulsed	9.5dBW	9.5dBW	9.5dBW
Instantaneous peak current		+6 A	−6 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−81dB	−86dB	−80dB
Intermodulation, 19/20kHz, rated power, aux input			> −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			> −80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−82dB
Disc (mc) input (IHF, CCIR weighted)			−70dB
Aux/CD input (IHF, CCIR weighted)			−84dB
Residual, unweighted (volume control at min)			−72dB
DC output offset			5mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	29dB	29dB	23dB
Disc (mc) input (IHF)	37dB	34dB	29dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−57dB	−60dB	−34dB
Aux input	−75dB	−63dB	−38dB
Output impedance (damping)	0.16ohm	0.16ohm	0.2ohm
Channel balance, disc, at 1kHz			0.4dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.2dB	0.8dB	2.7dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.23mV	55kohms, 160pF
Disc (mc) input	Phono	0.023mV	117ohms
Aux input	Phono	24mV	52kohms, 200pF

Disc equalisation error, 30Hz-15kHz: +0.3dB, −0.2dB
Size (width, height, depth): 45 x 32 x 11cm
Typical price inc VAT: £180



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Luxman L430

HW International Ltd, 3-5 Eden Grove, London N7
Tel 01-607 0293

Substantially more expensive than the *L230* also reviewed the *430* claims nearly twice the output at 105W (20dBW). Comprehensively equipped, it comes in a substantial case and provides good input facilities — disc moving-magnet and moving-coil, tape 1 and 2, tuner, and aux/CD. Subsonic and treble filters are provided, togther with mono switching and 'four frequency' tone controls at 20Hz and 400Hz in the bass, with 1kHz and 10kHz in the treble. A headphone socket is included plus facilities for two sets of speakers, their cables connected via substantial binding-post terminals. A direct path for high-quality CD signals is present.

The control layout is logical and the standard of finish is high. Inside the amplifier is well built, but employs the multiple-board style of construction, the boards linked by neat wiring looms. A large power transformer is fitted, the rectifier feeding $2 \times 15000\mu F$ special audio-quality reservoir capacitors.

The disc input stage begins with low noise dual FETs, these followed by an integrated circuit RIAA equaliser section. Later circuitry is discrete, with a complex FET input amplifier leading to the substantial output stage, the latter employing parallel pairs of complementary output devices, direct-coupled to the load. The mains cabling is well managed and high quality components are used in the construction.

Sound quality

Rated as 'good plus', the *L430* did quite well on the auditioning. Its strong points were its clarity and stereo depth, the latter exceptional among Japanese-type integrated designs.

No specific problems were noted via moving coil though changing to the high-level moving magnet input provided a significant improvement in several areas. Stereo focus was pretty good, with pleasing depth, and a well-controlled overall impression but the tonal balance remained slightly thin-sounding.

Moving on to the aux input, further gains in sound quality were noted. Here the amplifier seemed capable of providing a large scale sound stage, plus decent depth and good midband clarity, focus and articulation. It could also be taken to the limit on the normal load, providing a substantial 105dBA, and

although 104dBA was attained on the adverse loading, the amplifier did not sound quite so comfortable here.

Lab results

Demonstrating an excellent power bandwidth, a fine tolerance to 4ohm resistive loading, the *430* proved itself to have a substantial power supply. 21.6dBW was available into 8ohms on peaks, this barely reduced into 4ohms. However, the 2ohm load was not favoured, with a 7dB shortfall here. In practice, the 'worst' 8ohm speakers should be avoided, but most others will be driven very well by this model.

Peak current was just satisfactory at ±16 amps, while harmonic distortions were negligible as were the intermodulation figures. Noise levels were generally good, and dc offset satisfactorily low. The disc overload levels were sufficient, particularly in view of the higher than average input sensitivities; but stereo separation was only about average, and could be improved for CD purposes. Channel balance was accurate with fine input characteristics, the usable with the least sensitive models. RIAA equalisation was pretty flat, aside from a mild bump at 25Hz, before the subsonic rolloff comes in.

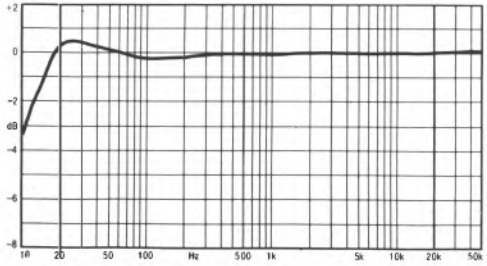
Conclusion

A robust, well-finished and well-built amplifier, the *L430* offers a good blend of facilities, power and sonic performance. If severe loudspeaker loads are avoided, it will perform well, and although it is above the true 'value for money' price limit, this design is strong enough to merit a performance recommendation.

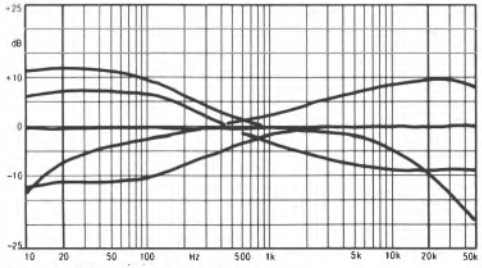
Test measurements

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

GENERAL DATA			Integrated amplifier
Poweroutput			
Rated power into 8ohms, maker's spec			105W(=20dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	21.2dBW	21.2dBW	21.1dBW
Both channels, 4ohm load	19.1dBW	19.6dBW	19.5dBW
One channel, 2ohms, pulsed	14.1dBW	14.1dBW	14.0dBW
Instantaneous peak current		+16A	−16A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−88dB	−88dB	−77dB
Intermodulation, 19/20kHz, rated power, aux input			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−76dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−79dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−84dB
Disc (mc) input (IHF, CCIR weighted)			−71dB
Aux/CD input (IHF, CCIR weighted)			−85dB
Residual, unweighted (volume control at min)			−80dB
DC output offset			10mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	23dB	28dB	26dB
Disc (mc) input (IHF)	24dB	21dB	19dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−60dB	−56dB	−43dB
Aux input	−76dB	−66dB	−43dB
Output impedance (damping)	0.14ohm	0.16ohm	0.26ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0dB	0.3dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.19mV	50kohms, 100pF
Disc (mc) input	Phono	0.3mV	220ohms
Aux input	Phono	21mV	44kohms
Disc equalisation error, 30Hz-15kHz			+0.5dB, −0.15dB
Size (width, height, depth)			45 x 42 x 14cm
Typical price inc VAT			£325



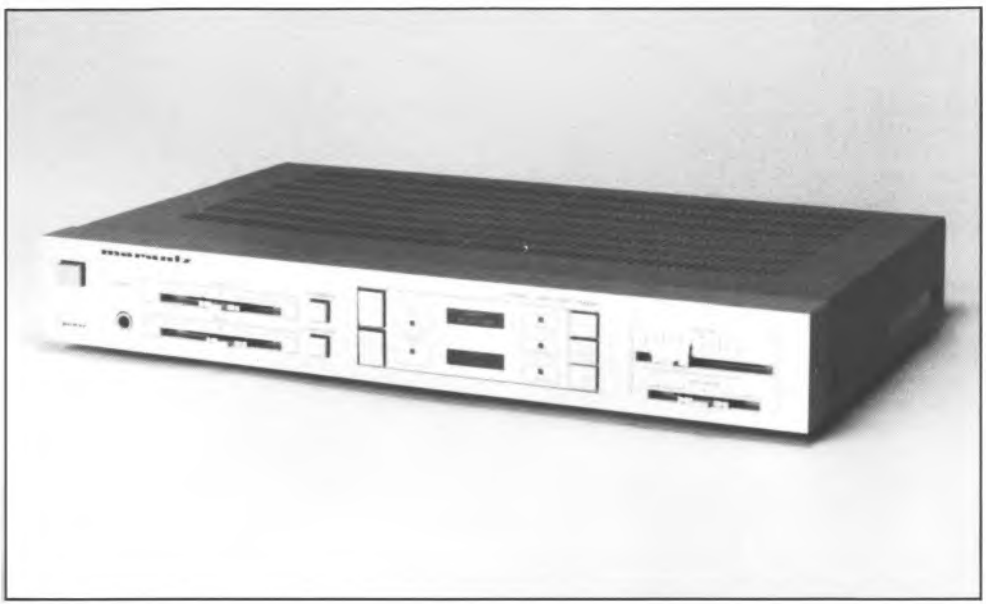
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Marantz PM-230

Marantz (UK) Ltd, 15-16 Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middlesex UB7 0LW Tel 01-879 6633



A budget priced, low-profile amplifier the *PM-230* is in fact one of the cheapest models to be included in this issue, and is rated at 30W (or 15dBW) per channel. We found its gold-finished alloy front panel awkward to use, carrying as it does most of the controls in slider form. These included volume, balance, bass and treble, with other facilities comprising a loudness compensator (which ought perhaps to be called a 'softness compensator'!) plus a low filter and a headphone socket. Inputs for CD, tuner, disc, tape and tape/aux are provided, the sockets all in phono, and speaker connection is via light spring clips.

The interior layout is very tidy; the main printed circuit board used is common to other Marantz models, though some sections are omitted for the *230*. Disc amplification/equalisation is carried out by means of a dual IC, with CMOS electronic signal switching following. Another IC is used in the tone control stage, feeding an integrated power amplifier driver, number STK3042, which is turn is coupled to large Sanken output transistors. The latter are direct-coupled complementary. The transformer is adequately sized, feeding rather small $2 \times 1800\mu F$ reservoirs, and while construction was quite good, live mains parts were unshrouded.

Sound quality

Careful auditioning revealed via the disc input a just adequate sound quality. The tonal balance was pleasantly neutral but no real definition or impact was apparent; the bass was rather flabby and the treble mildy fizzy.

Turning to the aux/CD input, the treble improved a little but nor so the bass. The sound just did not appear 'interesting' or involving. Sound stages were relatively flat, and detail was compressed. In clip it proved comfortable, reaching 101dBA, and it remained pleasant at a lower power level into awkward speaker loads.

Lab results

Rated at 15dBW, the *230* comfortably

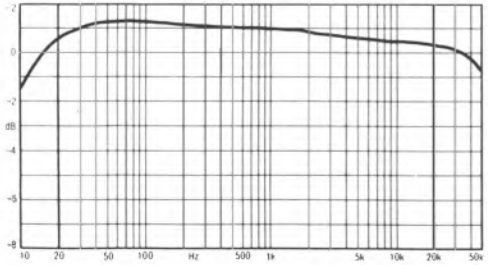
maintained a 15.4dBW level into 8ohms over the measured bandwidth. The loss into 4ohms reflected the most power supply and in contrast, this unit's peak current capacity was quite good at + 13, – 14A. This was no doubt a factor in the reasonable peak programme levels reported, the 2ohm figure reading 4dB below that for 8ohms.

Distortion increased at high frequencies, but remained within satisfactory limits. Intermodulation via the disc input was poorer than average, especially in the light of the fairly insensitive pickup input, but dc offset was fine, and disc overload margins fairly typical. Stereo channel separation was considered to be quite good, while the channel balance was satisfactory over the normal working range.

Disc input capacitance was fairly high at 280pF, and should be noted in connection with the use of some of the more termination-sensitive cartridges. The disc equalisation showed a gentle downtilt, which may partly account for its slightly rich and veiled quality via the disc input. The low filter rolloff had rather dramatic effects on the bass response (see tone control responses).

Conclusion

In fact, it is worth noting that previous models at the bottom end of the Marantz range have done well in reviews, but the *230* emerged as a pretty ordinary sort of amplifier, with its main redeeming feature being its low price. This is not unreasonable in view of its output power, as well as load-tolerant speaker matching. However, on audition it failed to excite sufficient interest to warrant any special commendation.



Disc input: RIAA equalisation accuracy

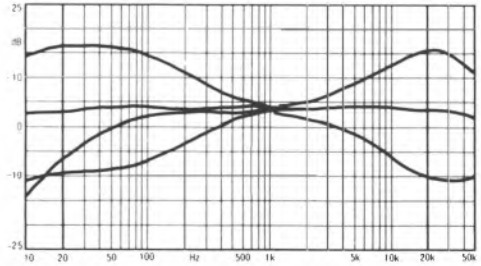
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			30W(= 15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	15.7dBW	15.7dBW	15.4dBW
Both channels, 4ohm load	13.0dBW	13.3dBW	12.7dBW
One channel, 2ohms, pulsed	11.6dBW	12.1dBW	11.7dBW
Instantaneous peak current		+ 13 A	– 14 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 79dB	– 86dB	– 72dB
Intermodulation, 19/20kHz, rated power, aux input			> – 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 66dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 74dB
Aux/CD input (IHF, CCIR weighted)			– 82dB
Residual, unweighted (volume control at min)			– 70dB
DC output offset			8mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	28dB	28dB	28dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 65dB	– 63dB	– 40dB
Aux input	– 69dB	– 64dB	– 41dB
Output impedance (damping)	0.10ohm	0.10ohm	0.13ohm
Channel balance, disc, at 1kHz			1.0dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0.7dB	1.2dB	0.1dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.45mV	49kohms, 280pF
Aux input	Phono	31.7mV	42kohms, 160pF

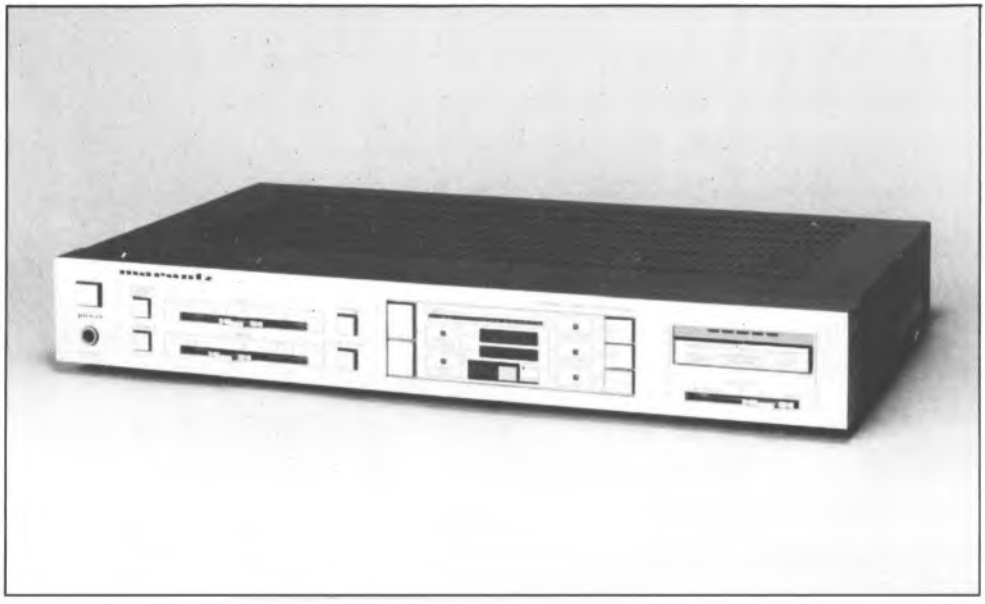
Disc equalisation error, 30Hz-15kHz + 0.3dB, – 0.6dB
Size (width, height, depth) 42 x 27 x 6.5cm
Typical price inc VAT £90



Tone control/filter responses

Marantz PM-330

Marantz (UK) Ltd, 15-16 Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middlesex UB7 0LW Tel 01-879 6633



Priced at some £30 more than the *PM-230*, the Marantz *PM-330* actually has the same specified power rating. However, in addition to the features of the cheaper model, the *330* offers a 'power' volume control, using an electronic attenuator rather than the normal mechanical type. I must say that personally I fail to see the advantage of this.

The case is a similar slimline form to the *230*, and the usual disc, tape, tuner and aux inputs, plus bass, treble and loudness controls are provided, together with a subsonic filter. Speaker connection is made via weak spring clips and all the input socketry is in phono.

Inside, the resemblance to the *230* is strong, though the *330* is fitted with rather larger power transformer which should improve the 4ohm power ratings a little. Integrated circuits are widely used, while the complementary output transistors themselves are discrete units. Good quality workmanship was evident.

Sound quality

While the sound quality from the *230* was thought inoffensive on audition, the *330* was rather less pleasant. On the disc input, the midrange was a trifle 'hard' sounding while the treble was splashy and fatiguing. The bass was adequate, with reduced definition; but depth rendition in stereo terms was weak, clarity was marginal and stereo focus none too sharp.

Via its auxiliary input a slight improvement was noted, but this was insufficient to mask what one panelist described as the 'music centre sound'. The programme lacked interest or immediacy and seemed both muddled and defocused.

On the positive side, the *330* could be driven hard to respectable levels, did not become aggressive into clipping, and also survived the adverse speaker load quite well. Maximum sound levels averaged 100dBA.

Lab results

Rated at 30W (15dBW) its output was typically 2dB better, measuring 17dBW over the bandwidth. The fall into 4ohms was about average

at 2.7dB and the peak programme results were reasonable, with the fall at around 4dB from 8 to 2ohms. A decent 16A peak current capacity was measured while harmonic and intermodulation results were satisfactory, as were the signal-to-noise ratios via the standard inputs. The dc offset at the speaker terminals was commendably low, while input overload levels were fine, though disc input sensitivity was lower than average. Stereo separation was satisfactory and output resistance negligible. The electronic volume control maintained a good channel balance over the entire operating range. Disc input capacitance was fairly high at 270pF; consider this added to the typical 120pF of arm cable, and the 400pF or so total may need some thought when matching a cartridge.

Disc equalisation, as with the *230*, showed a 'rounded' effect with mild upper bass lift and a rolled off treble. Via the aux input some bass rolloff was also apparent though the coarser scale of tone control graph makes this less obvious.

Conclusion

Despite its modest price and clearly favourable peak current capability, the sound quality of this design fell well short of the required standards on the listening tests. The *PM230* is the better buy, with the *330* coming nowhere near to 'recommended' levels of performance.

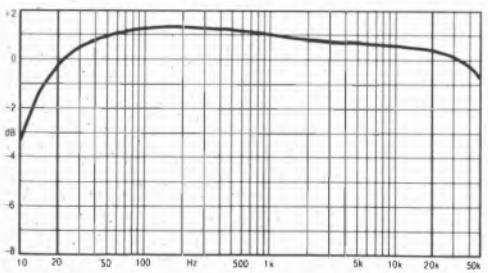
Test measurements

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

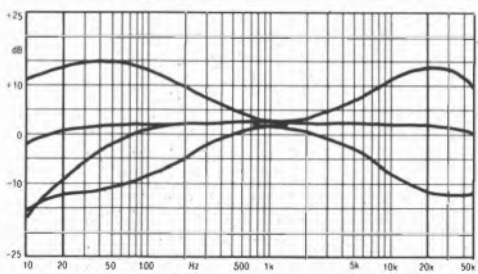
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			30W(=15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.2dBW	17.3dBW	16.8dBW
Both channels, 4ohm load	14.4dBW	14.6dBW	14.6dBW
One channel, 2ohms, pulsed	13.3dBW	13.9dBW	13.7dBW
Instantaneous peak current		+16 A	−16 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−79dB	−84dB	−72dB
Intermodulation, 19/20kHz, rated power, aux input			−71dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−75dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−76dB
Aux/CD input (IHF, CCIR weighted)			−82dB
Residual, unweighted (volume control at min)			−75dB
DC output offset			3mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	28dB	28dB	28dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−64dB	−64dB	−42dB
Aux input	−72dB	−60dB	−42dB
Output impedance (damping)	0.06ohm	0.06ohm	0.12ohm
Channel balance, disc, at 1kHz			0.3dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.1dB	0.1dB	0.4dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.40mV	49kohms, 270pF
Aux input	Phono	25.5mV	35kohms, 290pF

Disc equalisation error, 30Hz-15kHz: +0.2dB, −0.5dB
Size (width, height, depth): 42 x 27 x 6.5cm
Typical price inc VAT: £110



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Meridian MCA-1

Boothroyd Stuart Ltd, 13 Clifton Road, Huntingdon, Cambs PE18 7EJ
Tel (0480) 57339

In the space available here we cannot do full justice to the new Meridian modular system of electronics. When complete, the range of modules will allow the purchaser to select the combination to meet his requirements. For example, if you only play records you need only buy the amplifier with phono facilities, but modules can be added to give other combinations of multiple inputs, with tuner, tone controls, headphone outputs, and separate power amplifiers.

All the modules clip readily together with automatic electrical interconnection, so there are no trailing wires. The slimline cases are all finished in durable grey Nextel paint.

We tested the *MCA-1* unit, which assumes the role of an integrated amplifier selling at about £375, offering only a single moving-magnet disc input; in adding moving-coil and auxiliary input options we brought the total cost to nearer £500.

Internal design of the *MCA-1* is also unusual — the power amplifier has complementary transistor outputs in a double-mono configuration, fed from a balanced input signal. Power supplies use 'flyback transformer' switching and are regulated. The pre-amp itself is designed with balanced signal handling stages based on the use of multiple high quality integrated circuits. The moving-coil input is discrete and employs shunt feedback which gives a 'universal' input with a terminating impedance of 12ohms resistive.

Sound quality

As an integrated amplifier, the *MCA-1* rated a 'good plus' score, and as a pre-amplifier used with more substantial power amplifiers, this improved to 'very good.'

Via moving-coil input, the sound was substantially good, with a clean and articulate bass, a natural and pleasant midband, and quite good treble, the latter suffering from just a hint of 'edge' or 'featheriness'. In stereo image terms it was particularly competent, proving capable of fine natural perspectives with good space and depth, plus much low level detail. The moving-magnet input was generally similar; these input options are in each case dedicated modules rather than 'add on' compromises.

Via aux the sound was still clearer, and slightly more 'open'. The mid treble anomaly remained however. Driven hard the amp did not clip well, and sounded a little 'small', while heavy drive into the adverse load constrained the maximum level to a modest 97.5dBA. The pre-amp section could sound better with a

larger power amplifier, where the dynamics were better reproduced.

Lab results

Measured output levels were close to specification, with a good power bandwidth into the 8ohm load. Sufficient peak current, ± 12A, was available to fully drive all the loads on the peak programme tests, while the loss from 8 to 2ohms was only 0.8dB — an excellent result. Clean, short peaks will be well handled into some of the most difficult loads. Harmonic and intermodulation distortion results were fine, and even better at low levels, with the signal to noise ratios particularly good, even though some dc offset was observed at the speaker terminals.

Input overload margins were ample, while the pre-amp could produce decent output levels from a 600ohm balanced or 300ohm unbalanced terminal. Stereo separation was very good, and output impedance negligible, while channel balance was fine and the input characteristics well in order. Disc equalisation was to a good accuracy, with a subsonic rolloff on moving-coil but not on moving-magnet.

Conclusion

Its musical, spacious and relaxed sound quality makes this combination a natural candidate for recommendation despite the fairly high price tag, which is not particularly competitive in view of its 100dBA or so maximum sound level. The pre-amplifier section also sounded good, and is also a competitive contender in the quality stakes; this too is recommended, especially for use with Meridian's own active speaker systems.

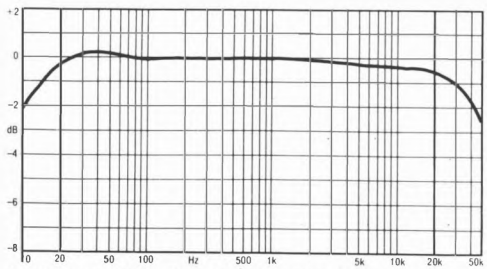
Test measurements

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

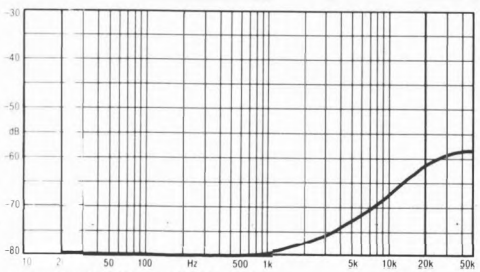
GENERAL DATA — Pre- and power amplifier

Power output			
Rated power into 8ohms, maker's spec		35W(= 15dBW)	
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	14.6dBW	15.3dBW	14.2dBW
Both channels, 4ohm load	13.8dBW	14.0dBW	13.0dBW
One channel, 2ohms, pulsed	14.2dBW	14.7dBW	14.0dBW
Instantaneous peak current		+12 A	−11 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−76dB	−84dB	−74dB
Intermodulation, 19/20kHz, rated power, aux input			−77dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			> −80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−84dB
Disc (mc) input (IHF, CCIR weighted)			−76dB
Aux/CD input (IHF, CCIR weighted)			−94dB
Residual, unweighted (volume control at min)			−87dB
DC output offset			40mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	29dB	30dB
Disc (mc) input (IHF)	24dB	23dB	22dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−80dB	−78dB	−58dB
Aux input	−80dB	−82dB	−61dB
Output impedance (damping)	0.06ohm	0.05ohm	0.10ohm
Channel balance, disc, at 1kHz			0.5dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.1dB	0.1dB	0.9dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.36mV	50kohms, 100pF
Disc (mc) input	Phono	*	12ohms, 0nF
Aux input	Phono	24.4mV	49.5kohms, 130pF
Output, pre-amp.			>6V 600/300ohms
Disc equalisation error, 30Hz-15kHz			+0.2dB, −0.3dB
Size (width, height, depth)			480 x 6 x 31cm
Typical price inc VAT			£375 (disc only)

**Cartridge-dependent*



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

The review is by Martin Colloms

"This visually attractive amplifier, if well built and quality control tested in production, could be best buy material.
It offers a clean musical sound with a good performance standard, while the technical results were most promising. It was also generous as regards, power and tolerant of adverse loading.
However, as the P35 was available only in prototype form at the time of writing, I must give it only a reserved reccomendation.
NOTE: ! Fortunately, we were able to test a production sample just as we went to press and thus confirming the best buy rating for this model."

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Mission 778

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Tel (0480) 57477

A recent introduction to the Mission range, this elegant and compact amplifier forms the heart of the company's complete mid-priced disc playing system.

Finished in satin black, this model belongs to the 'straight-line' generation, with no tone controls or filters provided — there is not even a balance control. The calibrated volume control is accompanied by two selector switches, one for input (disc, aux, tuner, CD or tape) and the other being the tape record output selector. The latter includes an off position to prevent distortion due to an unpowered anciliary. Inputs are in phono, with output to 4mm sockets/binding posts, these rather closely spaced for comfortable access. A neat rear-mounted plug/switch selects moving-coil or moving-magnet sensitivity.

Inside, the main circuit is largely based on the established Mission separates. The power amp is a direct-coupled design with FET output devices and no protection circuits. A modest power supply is fitted, though this section can be upgraded by the user with the addition of an optional extra plug-in power booster. The standard of construction was high with fine quality components employed extensively.

Sound quality

Rated as 'good plus' on audition, this amplifier has done well in its price group. Used via its moving-coil input, it delivered a well-balanced, 'musical' sound, with a pleasing accurate treble, an open and clear presentation, plus quite good bass. Occasionally a hint of hardness was noted in the upper-mid and the full depth and focus of programme was not wholly reproduced.

Comparably good results were obtained via the moving-magnet, input, together with some added precision and focus. Via aux, digital programme was well reproduced with good rendition of detail, and while the bass was well extended it lacked ultimate authority as well as attack, this aspect said to benefit from the booster supply.

High sound levels were attained on normal loading with a consistent sound into clipping. Good results were also possible with the adverse load, though maximum level reduced here to a more modest 101dBA.

Lab results

Rated at 50W per channel (17dBW), the *778* comfortably met this specification into 8ohms, with a satisfactory power bandwidth. More

loss than usual occurred with continuous drive into 4ohms, but the pulsed power delivery was fine, with 18dBW at 8ohms, and a pretty good 14dBW into 2ohms. The peak current was sufficient but assymetric at + 14, – 20A, and due to speaker impedance asymetry, maximum power in some cases may be obtained by reversing the cable polarity.

Distortion levels were satisfactory, if poorer than average, with moving-coil signal-to-noise ratio at a figure which must be rated average in view of the low sensitivity; very low output cartridges are not suitable. The other figures were however fine.

Input overloads were ample, though disc-input separation could have been better. Channel balance was well maintained while the input parameters were quite typical. Fitted with the IEC rolloff, the RIAA equalisation on the disc input showed the usual bass droop, in this case – 1.8dB by 30Hz. Effectively, then, a subsonic filter is inbuilt.

Conclusion

Suited to all sources bar really low output moving-coils, this compact and load-tolerant amplifier proved to be a lusty performer, particularly into normal 8ohm speaker loads. In the listening tests, it gave a lively performance and yet had much detail and musical subtlety to boot.

While this might be regarded in some aspects as a 'minimalist' product, in fact the *778* does what it sets out to do. It is also competitively priced for the sound quality, available loudness and build quality offered, and logically it must be awarded 'Best Buy' status in this edition.

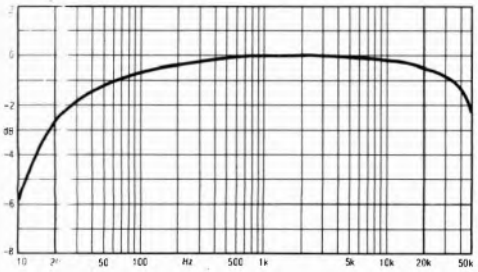
Test measurements

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

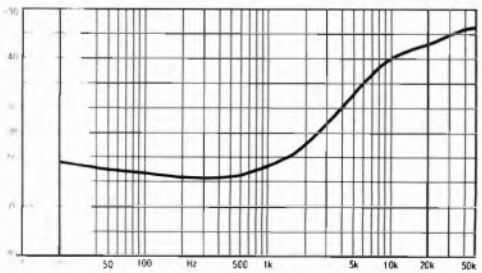
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			50W(= 17dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.0dBW	18.4dBW	17.9dBW
Both channels, 4ohm load	14.3dBW	14.8dBW	14.1dBW
One channel, 2ohms, pulsed	13.5dBW	14.0dBW	13.5dBW
Instantaneous peak current		+ 14 A	– 20 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 68dB	– 68dB	– 68dB
Intermodulation, 19/20kHz, rated power, aux input			– 65dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 68dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			– 58dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 77dB
Disc (mc) input (IHF, CCIR weighted)			– 68dB
Aux/CD input (IHF, CCIR weighted)			– 79dB
Residual, unweighted (volume control at min)			– 71dB
DC output offset			25mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	34dB	32dB	32dB
Disc (mc) input (IHF)	30dB	30dB	26dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 64dB	– 62dB	– 36dB
Aux input	– 73dB	– 68dB	– 44dB
Output impedance (damping)	0.09ohm	0.08ohm	0.18ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0dB	0.1dB	0.9dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.31mV	46kohms, 110pF
Disc (mc) input	Phono	0.02mV	119ohms
Aux input	Phono	17.11mV	12kohms

Disc equalisation error, 30Hz-15kHz ..... + 0dB, – 1.8dB
Size (width, height, depth) ..... 22 x 35 x 8cm
Typical price inc VAT £240



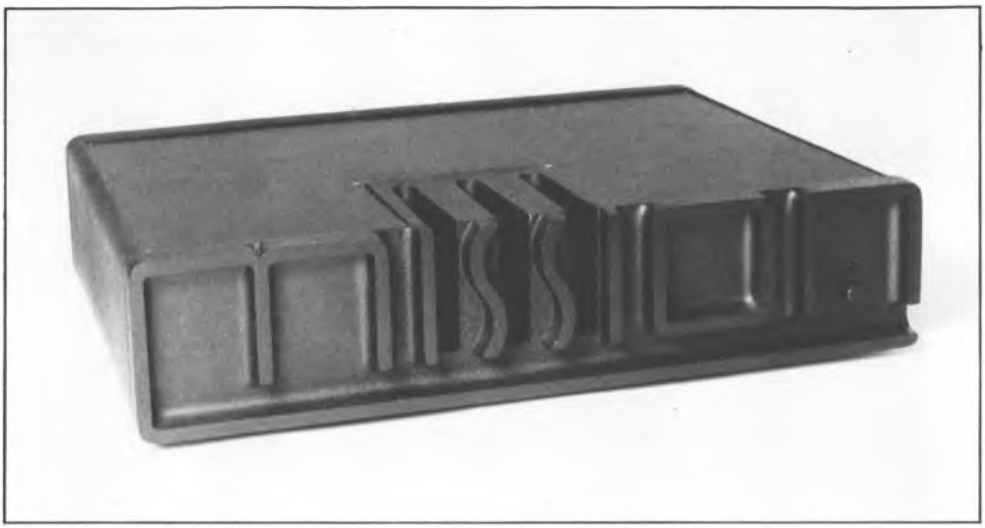
Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Mission 777BU power amplifier

Mission Cambridge, Stonehill, Huntingdon, Cambs PE18 6ED
Tel (0480) 57477



Mission's largest component power amplifier currently awaits a pre-amp revision and so was assessed alone. The distinctive cast enclosure has the front deeply sculpted in the company logo, this styling feature also being exploited as a heat radiator.

Massively constructed, this amplifier was by far the heaviest for its size in the test group. Generous screened toroidal transformers are used these feeding a total of 70,000μF reservoir capacity. It is built as a double mono unit in one case, and rated at 100W per channel, using paralleled complementary FET output devices. The design has a wide bandwidth, nominally dc to 1MHz, and it uses a low order of negative feedback, quoted at 14dB. Inputs are in phono while the single speaker connections are via 4mm socket/binding posts. The output speaker fuse is included in the feedback loop to minimise its effects on the loudspeakers.

Sound quality

With a comfortable 'very good' rating for sound quality the *777BU* is up with the best in its price range.

It sounded lively with an impressive clarity, while tonally it was essentially neutral, with perhaps a trace of mid hardness. Subjective frequency response was very wide with a clean sparkling treble, plus articulate powerful bass of good transient attack, despite a slight effect of low frequency overhang. Stereo images were quite stable and well focused, with both depth and ambience effects well portrayed. It could play to very high volume levels with an above-average clipping tolerance; 104dBA was reached into the normal load, and 102dBA into the adverse load. It also proved tolerant of a wide range of speaker types including electrostatics.

Lab results

Rated at 100W (20dBW), the *777BU* proved to have a substantial power supply and its output into 4ohms was barely lower than that into 8ohms. Power bandwidth was excellent at 20.8dBW with the peak 8ohm output at 21.3dBW backed by a high but rather asymetric peak current capacity of +17, −28A, the imbalance fortunately in the preferred negative direction. The output was well maintained into 2ohms at 19.4dBW, approaching 275W burst per channel, with total harmonic distortion measured at better than −60dB and the two-

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tone intermodulation figure at −66dB.

Signal-to-noise ratio was fine, output impedance negligible and dc offset satisfactory. Input sensitivity was high enough for direct connection of some auxiliary signals especially CD. For its power rating, mechanical hum was fairly low.

Conclusion

While this is an expensive amplifier, it was pretty powerful, with double mono power supplies of a size that bring the unit close to a regulated supply performance. The output was comfortably load tolerant and could be driven into mild clipping, producing high sound levels. The sound quality was in the very good class which goes some way towards meeting the price, and aside from strict value considerations, such results do justify a firm recommendation.

GENERAL DATA Power amplifier

Power output

Rated power into 8ohms, maker's spec			100W(=20dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.8dBW	20.9dBW	20.8dBW
Both channels, 4ohm load	20.3dBW	20.4dBW	20.2dBW
One channel, 2ohms, pulsed	19.2dBW	19.4dBW	19.1dBW
Instantaneous peak current		+17 A	−28 A

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−63dB	−64dB	−60dB
Intermodulation, 19/20kHz, rated power			−66dB

Noise

PA input (ref 1W, 8ohms CCIR weighted) ..... −91dB
DC output offset ..... left 25mV, right 25mV

Output impedance (damping) 0.12ohm 0.12ohm 0.15ohm

Input data	socket type	sensitivity
Power amp	phono	80mV

Size (width, height, depth) ..... 45 x 10 x 32cm
Typical price inc VAT £750

Musical Fidelity The Pre-Amp/Dr Thomas

Musical Fidelity Ltd, Unit 208, 16 Brune Street, London E1 7NJ
Tel 01-247 3066

On the market for some time now, and priced at around £250, *The Preamp* has already made a good name for itself. The matching power amplifier has only become available more recently.

Outwardly, the *Preamp's* appearance is unusual and rather plain, except that when switched on, its name is brightly illuminated in red. Simple lever switching provides for tape, tuner and disc selection while interchange between moving-magnet and moving-coil requires the lid to be removed to gain access to an internal switch (but disconnect from the mains first).

The Dr Thomas power amplifier offers a substantial 120W per channel, and is conceived with elongated proportions, the sides clad in finely-finned heatsinks.

Constructional details of the review sample suggested that the pre-amplifier's mains wiring was not to full safety standards; for example the transformer appeared not to be double insulated but the case is not grounded. Integrated circuits are used — for example, LM394 for the moving-coil input and LF363W for later stages.

The power amplifier uses a large transformer plus a generous reservoir capacity and paralleled Hitachi MOSFET output transistors from the direct coupled output stage. The speaker protection fuses are incorporated in the feedback loop in order to reduce their spurious effects.

Sound quality

As a combination this system held up well during the listening tests, scoring a 'good plus'. Dynamics were strong and the power amp could play very loud, attaining 106dBA for the normal loudspeaker load and 104.5dBA for the adverse load.

Via the moving-coil input, the sound showed good clarity and was generally well balanced, particularly in the midrange but overall it did tend to a mild 'brightness'. Bass was well above average, however, with fine power and attack, with vocal lines nicely articulated.

On the debit side, the stereo presentation was a little two dimensional, and the depth effects were not as strongly portrayed as by some models.

Moving-magnet input performance proved to be quite similar, confirming the good mc result. Via aux, digital programme was clear and articulate with good weight and extension in the bass. Impressive in scale and power, more depth and subtlety would have further enhanced the sound.

Lab results

Rated at 120W (21dBW), the amplifier showed a good power bandwidth at a 22dBW level, and held to practically its rated power into 4ohms, both channels continuously driven. Peak ratings were good, measuring 23dB (200W) into 8ohms, falling only 1.2dB into 4ohms, and a

reasonable – 4dB into 2ohms. For its power, the amp's + 21, – 19A peak current capacity is just satisfactory.

Distortion and high frequency intermodulation levels were negligible over the measurement range, while signal-to-noise ratios were good, and output offsets, for both pre and power amp, were negligible. Input overload levels were fine and the power amp output impedance low. Good at higher settings channel balance deteriorated at ± 60dB volume setting to a poor – 10dB, due to the cheap volume control used.

Input characteristics for *The Preamp* were very satisfactory, but it should be noted that the power amplifier has a lower than usual input impedance, not suited for example, to weak pre-amps or passive control units.

Conclusion

Priced well above the 'value-conscious' brackets, the Musical Fidelity combination was a clear candidate for recommendation on the ground of its basic sound quality, as well as dynamic range and maximum sound level.

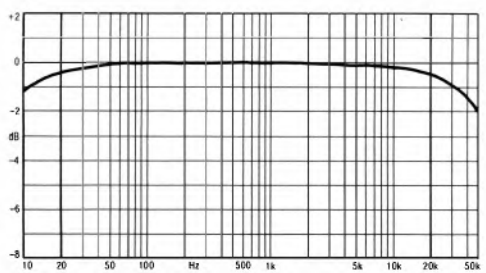
Considered separately, the power amplifier was load-tolerant as well as powerful, and provided a pretty good sound. If it had sounded a little 'sweeter', with more stereo depth our enthusiasm would be greater. *The Preamp* continues to stand up well as a musical performer, with particularly good midrange.

(Note: Since this review was completed, Musical Fidelity have changed the cabinet and internal layout of the Dr Thomas power amp; although the circuit itself is unchanged, the new layout is claimed to improve performance in the areas criticised.)

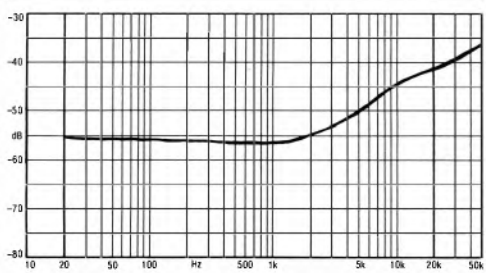
Test measurements

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

GENERAL DATA	Pre- and power amplifier		
Power output			
Rated power into 8ohms, maker's spec	120W(= 21dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	22.0dBW	22.4dBW	22.1dBW
Both channels, 4ohm load	19.8dBW	20.4dBW	20.1dBW
One channel, 2ohms, pulsed	18.4dBW	19.0dBW	19.0dBW
Instantaneous peak current		+ 21 A	– 19 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 77dB	– 77dB	– 77dB
Intermodulation, 19/20kHz, rated power, aux input			– 71dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			– 79dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 79dB
Disc (mc) input (IHF, CCIR weighted)			– 78dB
Aux/CD input (IHF, CCIR weighted)			– 82dB
Residual, unweighted (volume control at min)			– 65dB
DC output offset			13mV
DC offset, pre-amp			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32dB	32dB	32dB
Disc (mc) input (IHF)	24dB	25dB	14dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 55dB	– 56dB	– 41dB
Aux input	– 68dB	– 67dB	– 43dB
Output impedance (damping)	0.04ohm	0.04ohm	0.12ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0dB	0.1dB	10dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.35mV	47kohms, 170pF
Disc (mc) input	Phono	0.016mV	198ohms, 10nF
Aux input	Phono	18.5mV	44kohms, 60pF
Power amp	Phono	101.6mV	10kohms, 380pF
Output, pre-amp (tape)		9.4V max,	ohms
Disc equalisation error, 30Hz-15kHz			+ 0dB, – 0.3dB
Size (width, height, depth)			30 x 11 x 5cm, See note
Typical price inc VAT			£250, £490



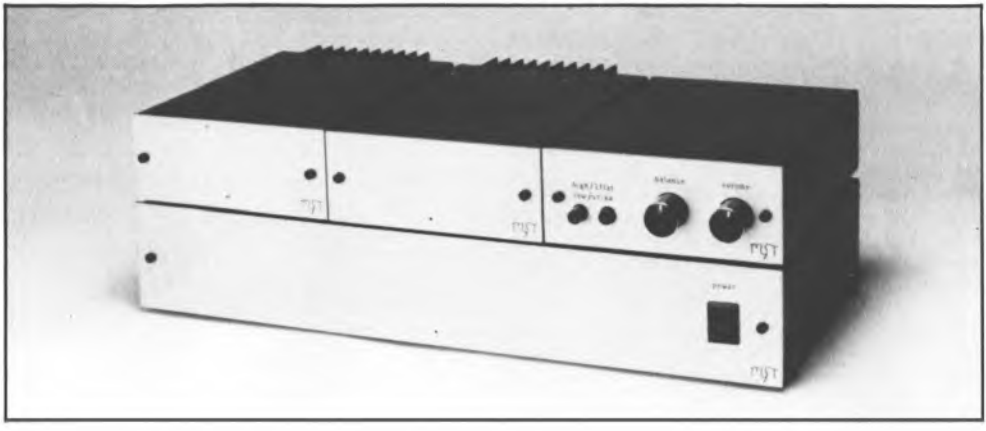
Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Myst G-Ohm and Tma-3

Myst Ltd, The Old Surveyors Office, Weobley, Hereford
Tel (05445) 8811



When this review of the established *G-Ohm* amplifier system had been completed, we were informed by the manufacturers that we should try out their new integrated model, which we were happy to do. Bearing in mind broad similarities in circuitry and design, the test results were pretty close with the proviso that the integrated *Tma-3's* output level was 3dB less than the *G-Ohm* separates.

Built into a set of excellently finished cases which are assembled together and interconnected at the rear, the *G-Ohm* comprises a large power supply, the bottom unit, a small pre-amplifier (moving-coil or moving-magnet available) plus two 80W power amplifier units. The *Tma-3* integrated comes as a single low-line case, and as with the *G-Ohm*, also has only input selection buttons and a volume control. Inputs are in DIN, with speaker connection via 4mm socket/binding posts.

Technical details for the *G-Ohm* include a fine standard of construction and a minimum of wiring. Disc input (mm) is by a 5534 IC buffer followed by TL071 ICs for the two stage RIAA equalisation. Variable gain and loading is possible, while moving-coil uses the LM394 multiple transistor chip, and a TL072 used in shunt/feedback configuration. The power amplifiers are straightforward, and used a complementary MOSFET output stage, and a large transformer is fitted, feeding 2× 15000μF computer grade reservoirs.

Sound quality

Fairly well-regarded in the listening tests, the *G-Ohm* was felt to be in good control, but with some mid-hardness, this notwithstanding a good performance in the vocal register. The bass and treble were not obtrusive, and the amplifier showed good focus and depth in the stereo image. Both moving-coil and moving-magnet inputs were of comparable quality.

On master programme via aux, the sound appeared quite dry in the bass, and well balanced, crisp and clear, but somehow seemed held back. Transparency and depth were not present in full measure, while a trace of 'edge' was also apparent in the treble. A decent 102dBA was available into the adverse load.

The integrated *Tma-3* was not as powerful, producing 102dB into 8ohms, and just 97.5dBA into the adverse load. The family resemblance was clear, though this model appeared to show some improvement in transparency and detail, sounding more 'open' than the *G-Ohm*.

Lab results

Rated at 80W (19dBW), the *G-Ohm* demonstrated an excellent power bandwidth, holding fairly well into 4ohms. Peak current capability was +15, −21A, rather assymetric, and not really sufficient for the 20dBW maximum available. 1ohm was handled well on peaks, but into 2ohms a 5dB loss was recorded relative to 8ohms. At full power the distortion results

were good, except at 20kHz, but the high frequency intermodulation was found to improve at lower power levels.

Signal-to-noise ratios were satisfactory, but input sensitivities were on the low side, suggesting the use of higher output cartridges. Output dc offset was within acceptable limits, as was that of the pre-amplifier. Via moving-magnet input, disc overload level were fine, while the lower figures obtained at 20kHz via moving-coil were still just sufficient to avoid trouble. Stereo separation was better than usual, though worse on aux than disc. Channel balance was fine except at very low volume settings. However, 220pF of capacitance is present on the moving-magnet input, which should be allowed for when matching cartridges. The power amplifier input resistance is also rather low at 8kohms.

Following the IEC bass rolloff, the disc equalisation met close limits above 50Hz, but showed no ultrasonic filtering.

Conclusions

The *G-Ohm* represents that now not-so-uncommon British phenomenon — a carefully-designed and built product, coming from a small manufacturer. Despite one or two oddities the system did provide good sound levels at a well above average sound quality, which warrants a recommendation.

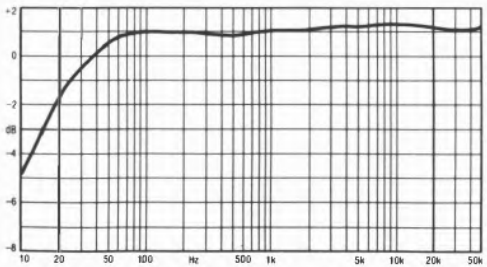
Turning to the integrated version, costing about half as much as the *G-Ohm*, it offered a further improvement in sound quality, though with an indication of poorer adverse load tolerance. Since the smaller model was not subject to full test, a reserved recommendation is appropriate here.

Test measurements

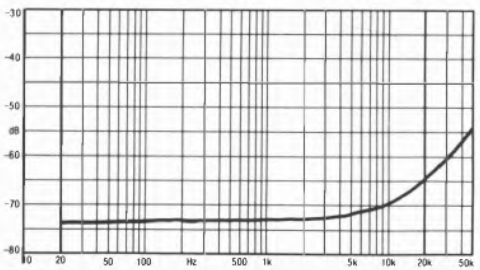
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA		Pre- and power amplifier	
Power output			
Rated power into 8ohms, maker's spec		80W(= 19dBW)	
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.7dBW	19.7dBW	19.7dBW
Both channels, 4ohm load	17.2dBW	17.7dBW	17.5dBW
One channel, 2ohms, pulsed	14.1dBW	15.0dBW	15.0dBW
Instantaneous peak current		+ 15 A	− 21 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	− 76dB	− 80dB	− 60dB
Intermodulation, 19/20kHz, rated power, aux input			− 72dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			− 75dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			− 78dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			− 76dB
Disc (mc) input (IHF, CCIR weighted)			− 70dB
Aux/CD input (IHF, CCIR weighted)			− 74dB
Residual, unweighted (volume control at min)			− 71dB
DC output offset			22mV
DC offset, pre-amp			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	33dB	30dB	− 18dB
Disc (mc) input (IHF see note 1)	20dB	17dB	− 7dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	73dB	73dB	65dB
Output impedance (damping)	0.1ohm	0.1ohm	0.19ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	− 20dB	− 60dB
Aux input	0.1dB	0.1dB	6.5dB
Input data	socket type	sensitivity	loading
Disc (mm) input	DIN	0.45mV	47kohms, 220pF
Disc (mc) input	DIN		see note 2
Aux input (See note 3)	DIN	38mV	32kohms, 100pF
Power amp	DIN	974mV	8kohms
Output, pre-amp			9.7V max, 160ohms
Disc equalisation error, 30Hz-15kHz			+ 0.3dB, − 1.4dB
Size (width, height, depth)			37.5 x 20.5 x 12cm
Typical price inc VAT			£440

Note: 1, with 2R2 source; 2, depends on source Z 0.14mV for 600ohm source Z; 3, LOW gain position



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

NAD 3020A

Hi-Fi Markets Ltd, Cousteau House, Greycaine Road, Watford WD2 4SB
Tel (0923) 27737

When first produced a few years ago, the budget-price *3020* amplifier showed original design work. In fact, its introduction helped a re-evaluation of standards at this end of the market. The *3020A* is an updated version of this bestseller, with a moving-coil input now fitted.

A 20W per channel model, it has many facilities such as bass and treble controls, a loudness button, mono and a headphone socket. A row of LEDs gives a coarse-scale indication of peak power, this shared for both channels. Inputs include tuner, aux, tape, and disc; moving-magnet or moving-coil options are selected via a lever at the rear. Spring-clip connectors are provided for the speaker cables, while input connections are via phono sockets, with tape duplicated in DIN. The moving-coil input has been added by altering the disc input gain, but the input characteristic remains unaltered at 47kohms.

Engineering examination revealed an untidy layout with considerable surface wiring, although the soldering quality was superior to that of earlier *3020* versions. The output is direct coupled complementary, with 'workhorse' 3055/2955 transistors on an aluminium-bracket heatsink. Commercial quality 4400μF reservoir capacitors are used for the power supply. Some circuitry has been simplified since the design was first introduced, but the *A* form is otherwise quite similar to the original, including the optional 'soft clip' mode, which allows working into clipping but with a reduction in 'edgy sounding' distortion harmonics.

Sound quality

Scoring above average on audition, the NAD lent a slightly bloomed or rich character to the reproduction, which was quite pleasant. Via moving-coil input it provided quite good definition but lacked real 'see-through' clarity. Complex passages showed some confusion in the midrange and neither stereo focus or depth were very strongly shown. Via moving-magnet, the sound improved a little with more explicit presentation, but bass was still just average.

The output was however notably improved via aux, with better focus and depth as well as a feeling of better control all round. It could play rather louder than the specification suggested, reaching 100dBA and falling only 1dB into the adverse load.

Towards full output the sound hardened somewhat, while at higher mild clipping level, the 'soft clip' switch did smooth the sound at

the expense of added muddle, which was not really considered an advantage.

Lab results

Rated at 14dBW, the amplifier produced 15.6dBW over the power bandwidth into 8ohms. The small power supply was reflected by the greater-than-usual fall into 4ohms on continuous loading; but the peak delivery was, however, good, with nearly 50W (16.5dB) available into 8ohms, falling only by 3.6dB into 2ohms.

Distortion, both harmonic and intermodulation was exemplary, measuring typically better than 80dB down overall. Signal-to-noise ratios were also good, bar the moving-coil input where some compromise was evident. Disc overload margins were ample, and channel separation good at low and mid frequencies. More separation at 20kHz is desirable though, especially via CD/Aux. Channel balance was fine throughout, and the input characteristics were satisfactory, bearing in mind the lower than average sensitivities, as well as the 50kohm input resistance. Typical bass and treble control responses were obtained, while the RIAA equalisation was pretty linear with the mild 0.8dB lift at 30Hz rated as unimportant.

Conclusions

The NAD *3020A* continues to justify its position as a popular budget amplifier. Strong on maximum sound levels, it was also load tolerant, and will now accept the higher output moving-coil cartridges. Sound quality was also above average at a well below average price, a sure recipe for recommendation.

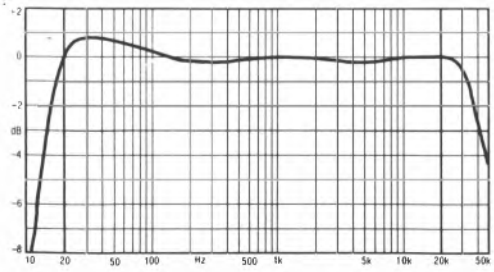
Test measurements

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

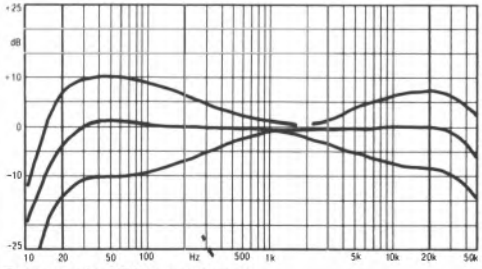
GENERAL DATA		Integrated amplifier	
Power output			
Rated power into 8ohms, maker's spec		20W(=13.5dBW)	
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	15.6dBW	16.3dBW	16.1dBW
Both channels, 4ohm load	12.4dBW	13.8dBW	13.7dBW
One channel, 2ohms, pulsed	12.0dBW	13.0dBW	13.0dBW
Instantaneous peak current		+17A	−14A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−84dB	−86dB	−81dB
Intermodulation, 19/20kHz, rated power, aux input			−78dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			>−80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−83dB
Disc (mc) input (IHF, CCIR weighted)			−70dB
Aux/CD input (IHF, CCIR weighted)			−88dB
Residual, unweighted (volume control at min)			−86dB
DC output offset			96mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	35dB	34dB	34dB
Disc (mc) input (IHF)	33dB	32dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−76dB	−60dB	−35dB
Aux input	−78dB	−61dB	−36dB
Output impedance (damping)	0.12ohm	0.12ohm	0.16ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.1dB	0.1dB	0.3dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.48mV	50kohms, 80pF
Disc (mc) input	Phono	0.033mV	50kohms, 80pF
Aux input	Phono	33.5mV	84kohms

Disc equalisation error, 30Hz-15kHz: +0.8dB, −0.2dB
Size (width, height, depth): 42 x 24 x 10cm
Typical price inc VAT: £119



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Naim NAIT

Naim Audio Ltd, Southampton Road, Salisbury SP1 2LN
Tel (0722) 332266

Awaited with eager anticipation, the *NAIT*, Naim's inexpensive integrated amplifier, was included in this issue on the basis of its market importance. At well under £200 it offers an 'unspecified' low output power, with a 'straight-line' circuit design format.

Tape, tuner, and disc mm inputs are provided, the first two in DIN and the last-named in phono. Controls comprise push-button selectors, balance and volume. The unit is built in a traditional Naim extruded alloy case with a black texture finish and the front edge satin polished. The effect is simple and clean, this aspect also reflected by the interior, which from an engineering viewpoint, is most elegant. A single printed circuit board is employed, well laid out and using good quality components. A toroidal transformer supplies the modest reservoir capacitors, chosen to give a quick recovery as well as high peak current capacity. The output stage is fully complementary direct-coupled, while the electronic protection integrates voltage and current against time, and allows the use of complex speaker loads. In fact the circuitry is largely borrowed from Naim's more costly amplifier line.

Sound quality

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

Via disc the tonal balance was a trifle thin, but vocal detail was impressive with decent focus and depth rendition. The bass was not perfect and yet it seemed articulate and gave a good impression nonetheless. The treble was not too precise, but did not raise objections from the panelists.

On auxiliary input, the sound quality was better still, with the detail and mid transparency of this design remaining its strongest point.

Overall the effect was that of a lively, involving and musical sound, one which bore comparison with some of the best amplifiers tested in this issue.

Lab results

Hearsay suggests a 15W programme rating (12dBW), though Naim offer no specifications whatever. Measurement indicated 13dBW over the audio bandwidth, with a fair tolerance of 4ohm loading on continuous duty. The ± peak current delivery was fine for the size of amplifier, with the 8ohm peak output level

measuring 13.5dBW and still holding up well at 11.3dBW for the 'extreme' 2ohm load.

Harmonic distortion was just satisfactory at 20kHz, but improved at lower frequencies. Via aux the full-power intermodulation was fine, but via disc at a lower output it was less impressive. The input signal level was closer to the disc overload point in this test. Signal-to-noise ratios were fine, though the disc input sensitivity was lower than average. Disc input overloads were satisfactory and stereo separation about average, with output impedance negligible and channel balance good, except at the lowest volume settings.

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

Conclusion

Despite its mild RIAA response aberration, which in a sense is inextricably bound up with any judgement of sound quality, and also bearing in mind the modest output, the *NAIT* must nevertheless be viewed very favourably. Possessing an excellent build quality and good load tolerance, it also delivered a sound which comfortably bettered its immediate competition, and it went on to demolish a number of more expensive and established performers. With little hesitation, then, we give the NAIT a Best Buy rating. We were not, however, impressed by the switch-on thumps from the loudspeakers!

Test measurements

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

GENERAL DATA — Integrated amplifier

Power output

Rated power into 8ohms, maker's spec. . . . . 15W(= 12.5dBW)

Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	13.0dBW	13.3dBW	13.1dBW
Both channels, 4ohm load	10.0dBW	11.6dBW	11.4dBW
One channel, 2ohms, pulsed	9.4dBW	11.3dBW	10.9dBW
Instantaneous peak current		+9 A	−9 A

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−68dB	−72dB	−51dB

Intermodulation, 19/20kHz, rated power, aux input . . . . . −70dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm) . . . . . −52dB

Noise

Disc (mm) input (IHF, CCIR weighted) . . . . . −78dB
Aux/CD input (IHF, CCIR weighted) . . . . . −80dB
Residual, unweighted (volume control at min) . . . . . −75dB
DC output offset 2mV

Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	25dB	25.5dB	24dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Stereo separation

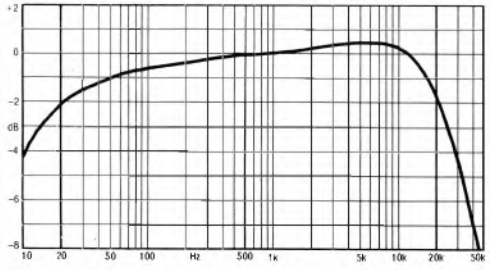
Disc input	−69dB	−66dB	−50dB
Aux input	−68dB	−66dB	−42dB

Output impedance (damping) 0.03ohm 0.04ohm 0.04ohm
Channel balance, disc, at 1kHz 0.3dB

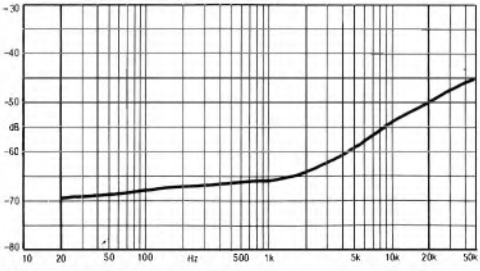
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.3dB	8.1dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.52mV	46kohms, 140pF
Aux input	DIN	21.1mV	61kohms, 220pF

Disc equalisation error, 30Hz-15kHz . . . . . +0.5dB, −1.5dB
Size (width, height, depth) . . . . . 28 x 22 x 7.5cm
Typical price inc VAT £180



Disc input: RIAA equalisation accuracy



Disc input: Stereo separation

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Naim NAC32/NAP250

Naim Audio Ltd, Southampton Road, Salisbury SP1 2LN
Tel (0722) 332266

Designed as a system, these Naim components are rarely assessed as separate items. It is probably true to say that their manufacturer has dominated the UK audiophile amplifier area for many years now, and in conjunction with the special power supply *(SNAPS)* for the pre-amplifier, the units here reviewed represent the company's top line models. Active crossovers are also available for selected speakers, allowing the use of multiple power amplifiers.

The *NAC32* lacks tone controls or filters but can offer moving-coil and moving-magnet disc inputs, as well as tuner and tape. Sockets are mainly DIN, with disc duplicated in gold plated phonos. Both output signal and supply power are sent via the pre-amp power supply, en route to the power amplifier, using special cable and 4-pin DIN connectors.

Both units are built to an excellent constructional standard, the *250* power amplifier using a refined version of a traditional quasi-complementary circuit, direct-coupled and employing high quality power regulators, these as complex as the amplifier itself. A large torodial transformer is fitted. The pre-amplifier employs a mother board with an array of plug-in circuit cards. The mm and mc sections are separate, and following an input buffer, passive high frequency and active low frequency RIAA equalisation is used. Top quality components are used throughout. The power amplifier uses electronic protection, this set so as not to prejudice the peak delivery into complex loads.

Sound quality

Though the price is high the *32/250* quickly demonstrated the standard of sound quality appropriate to its high reputation.

Although a trifle 'doctored' or 'bandlimited' in character, with a mildly 'forward' stereo presentation, the amplifier sounded superbly confident and controlled. It proved to be both detailed and articulate throughout the frequency range and held a good standard of image focus and reasonably good depth. Relaxed and musical, the performance was both involving and revealing.

Via moving-coil the results were fine, improving a little further on clarity and focus via moving-magnet. Via auxiliary, a good impression of the scale and attack present on the PCM programme was also given. It clipped well and could provide 103dBA into the normal speaker load, with a decent 101dBA into more difficult loads. Good subjective volume levels were possible, with more 'power' than the specification suggests.

Lab results

Rated at 70W (18dBW) the *32/250* showed a

superb power bandwidth into 8ohms, delivering 19dBW. The loss into 4ohms was very small, though the amp disliked the 2ohm pulses at 20kHz. A sufficient ±16A peak current rating was noted, with the fall in level from 8 to 2ohms held to just 2.5dB, which was a fine result. This is clearly a load tolerant model. Distortion levels were low, except at high frequencies where the results were poorer than average, and were considered just satisfactory. Signal-to-noise ratios were fine and output terminal dc offsets also commendably low. Input overload margins were fine, and stereo separation better than average, though it could be better still via aux. Channel balance and tracking were very good, with the pre-amp input characteristics fine. The power amplifier was not considered a difficult input to drive, and with short or even low-capacitance interconnects, it is possible to use even a passive control unit. The pre-amp will happily drive other models of power amp. The disc equalisation showed a broad, tailored response, very uniform through the middle octaves, and 1dB down at 20Hz and 10kHz.

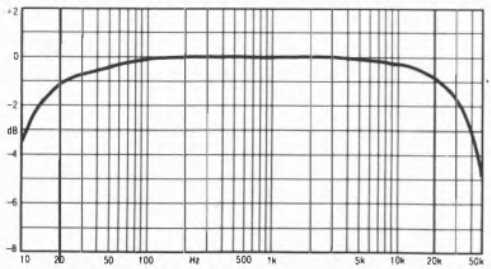
Conclusion

This costly amplifier system comes with an excellent reputation and an evidently high build quality. It was well finished and produced reasonably high sound levels, with a fine tolerance of the more awkward speaker loads. The sound quality was rated at the 'very good' level, consistently maintained via the various inputs and over the whole dynamic range. The two units are well matched to each other, and set a standard that justifies recommendation despite the substantial price.

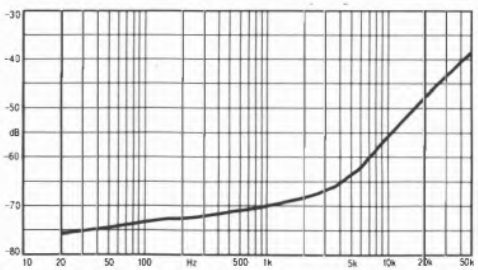
Test measurements

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

GENERAL DATA	Pre- and power amplifier		
Power output			
Rated power into 8ohms, maker's spec	70W(= 18dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.0dBW	19.0dBW	19.0dBW
Both channels, 4ohm load	18.3dBW	18.3dBW	18.3dBW
One channel, 2ohms, pulsed	16.3dBW	16.5dBW	16.9dBW
Instantaneous peak current		+ 16 A	− 16 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	− 80dB	− 80dB	− 63dB
Intermodulation, 19/20kHz, rated power, aux input			− 69dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			− 65dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			− 63dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			− 79dB
Disc (mc) input (IHF, CCIR weighted)			− 72dB
Aux/CD input (IHF, CCIR weighted)			− 80dB
Residual, unweighted (volume control at min)			− 75dB
DC output offset			11mV
DC offset, pre-amp			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	32dB	32dB
Disc (mc) input (IHF)	25dB	25dB	25dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	− 74dB	− 70dB	− 47dB
Aux input	− 75dB	− 70dB	− 48dB
Output impedance (damping)	0.18ohm	0.16ohm	0.18ohm
Channel balance, disc, at 1kHz			0.3dB
Volume/balance tracking	0dB	− 20dB	− 60dB
Aux input	0.5dB	0dB	0.2dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.20mV	46kohms, 100pF
Disc (mc) input	Phono	0.01mV	1kohm
Aux input	DIN	10.3mV	20kohms, 220pF
Power amp	XLR	105.4mV	18kohms, 190pF
Output, pre-amp (tape)			7.7V max, 4.9ohms
Disc equalisation error, 30Hz-15kHz			+ 0dB, − 0.7dB
Size (width, height, depth)			32 x 20.5 x 8.5cm, 32 x 43.5 x 8.5cm
Typical price inc VAT			£340, £780



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Nytech 202

Nytech Audio Ltd, High Street, Chew Magna, Bristol BS18 8PW
Tel (027589) 3232

Nytech's *CA202* is the least expensive model in their current range of electronics. It borrows much from the more costly *252*, essentially only lacking the latter's moving-coil facility.

Ergonomically styled, with a conveniently sloped front panel, this compact unit offers input selection from disc, tuner and tape, the only other controls being balance and volume sliders. At the rear there are 4mm sockets for speaker cable connection, the signal input connectors being DIN save for the disc, which is via phono sockets mounted on short lengths of cable. A rear headphone socket is provided, which mutes the second set of speaker outlets.

Of good workmanship, the interior displays a surprising total of five printed circuit boards interconnected by extensive wiring. The amplifier output is capacitor coupled complementary, with quite complex circuits, and a single-rail power supply is used, with a 3300μF capacitor plus separate regulators to the low level stages. Good quality components are employed, though I would not like the task of servicing this model, as I feel that disassembly is likely to prove something of a headache.

Sound quality

Despite its modest price, the *202* rewarded the panel with a generally above-average sound quality. Pleasant and lively, with a mildly 'thin' or light texture, it was easy on the ears — an important aspect, as some budget amplifiers can prove fatiguing over extended listening.

Via the disc input quite good detail was shown, and singing voice demonstrated good exposition and detail. Bass was of average definition, with some loss of power in the lowest register, while stereo focus was quite good, with an above-average representation of depth.

Via auxiliary, a hint of treble 'grain' and imperfection was heard but not considered to be too serious. The *202* sounded comfortable up to full power, providing a moderate 98dBA with the normal load, and a presentable 96dB into the adverse speaker load. It was found to clip quite well, subjectively.

Lab results

Rated at 20W (13.5dBW), the *202* could produce 15dBW at mid and treble frequencies but the power bandwidth was reduced at 20Hz, pos-

sibly due to the small power supply. This shortfall was shown more severely under 4ohm continuous drive, where only 8.9dBW was available at 20Hz. It did better on the pulsed tone tests, producing 15.5dBW into 8ohms with a good 14dBW into 4ohms and a reasonable 10.6dBW into 2ohms. Peak current was asymetric and just satisfactory at +4, −6A.

Distortion, both harmonic and intermodulation, was fairly satisfactory, with the weak two tone IM result partly due to the poorer-than-average result for disc input overload. Disc signal to noise was reasonable, and dc offset quite negligible.

At just 13dB, the disc overload measurment suggests that some of the higher-output moving-magnet cartridges should be avoided, and indeed CD players with a 2V maximum output level will also overload the aux input by a few dB (1.4V max). Stereo separation was rather below average with a 3dB channel imbalance noted via disc. The auxiliary input sensitivity was rather high at 16.8mV IHF, and a line attenuator would be advisable for CD players with fixed 2V maximum output levels.

The disc equalisation was uniform and well-tailored bar a mild 0.5dB lift in the treble, and showed an effective subsonic filter.

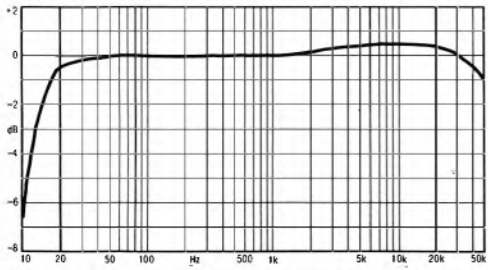
Conclusion

Despite some weaknesses that were exposed during the lab testing, it would be difficult not to recommend this model on the simple grounds of its good sound quality for the price. Assuming the dealer is helpful in the choice of ancilliary equipment, to avoid input problems, then the *202* does in fact merit a recommended status.

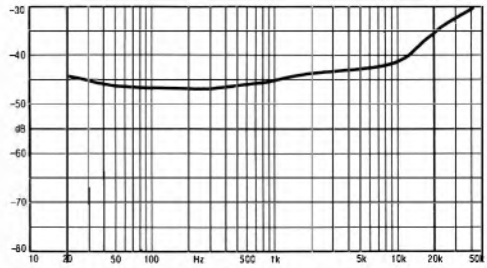
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			20W(= 13.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	13.4dBW	15.0dBW	15.0dBW
Both channels, 4ohm load	8.9dBW	12.0dBW	12.0dBW
One channel, 2ohms, pulsed	8.2dBW	10.6dBW	10.5dBW
Instantaneous peak current		+4 A	−6 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−64dB	−62dB	−60dB
Intermodulation, 19/20kHz, rated power, aux input			−60dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−54dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−76dB
Aux/CD input (IHF, CCIR weighted)			−82dB
Residual, unweighted (volume control at min)			−74dB
DC output offset			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	13dB	13dB	12dB
Aux/CD input (IHF)	9.6dB	9.6dB	9.6dB
Stereo separation			
Disc input	−43dB	−45dB	−35dB
Aux input	−49dB	−48dB	−39dB
Output impedance (damping)	0.10ohm	0.04ohm	0.18ohm
Channel balance, disc, at 1kHz			3dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.2dB	0dB	0.6dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.33mV	42kohms, 140pF
Aux input	DIN	16.8mV	46kohms, 20pF
Disc equalisation error, 30Hz-15kHz			+0.5dB, −0dB
Size (width, height, depth)			21 x 34 x 8cm
Typical price inc VAT			£125



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Onkyo A22

Goodmans Loudspeakers Ltd, Downley Road, Havant, Hants
Tel (0705) 486344

Onkyo products are now available again in the UK after a gap of some years. The *A22* amplifier is an inexpensive but presentably-finished model, which offers 35W per channel. It is comprehensively specified to the IHF A202 recommendations. Front panel facilities include a headphone socket, speaker selection ('A' or 'B' speaker sets or both), bass and treble controls and a loudness switch. Also on the front is a jack socket for connection of an electronic musical instrument such as a keyboard. There is a selector for disc, tuner and tape 1 and 2 inputs, while the volume and balance controls are arranged concentrically. Rear connectors for all input sources are phono, with spring clip type sockets for the loudspeaker cables.

Internal inspection showed the wiring to be none too tidy, and the mains cabling was unshrouded. Obviously built to a budget, the input is designed to use mainly ICs, with the STK 645 output dual power IC mounted on a large heatsink and fed from 6800μF reservoir capacitors. The signal circuits are catered for by a 45590 IC dual amplifier equaliser, and the mains transformer was considered quite small. Protection steps included a muting relay and speaker plus power supply fuses.

Sound quality

Without doubt the *A22* performed well on audition. Barring a mild 'thinness' or hardness in tonal balance, vocal soloists 'sang' well with quite good clarity and articulation. Focusing of the stereo image was better than usual and a good representation of depth and space was conveyed. The treble was fairly tidy, with a slightly brittle, forward character and the bass was likewise above average with a decent subjective extension to lower frequencies, this degrading a little at high sound levels.

Via the auxiliary input the sound quality continued to impress, the unit sounding generally tidy, and comparable with models at higher prices. Towards full power it became marginally more aggressive, but it clipped fairly well and produced a decent 101dBA into the normal load, with a well sustained 100dBA into the adverse loudspeaker load. It was thus quite load-tolerant and will be able to sustain its output into two pairs of speakers simultaneously.

BEST BUY

Lab results

Rated at 35W (15.5dBW), the *A22* comfortably produced 16.8dB over the whole 20Hz to 20kHz bandwidth. 4ohm power delivery was also quite good, with sufficient peak current, although this was rather asymetrical at + 15A, – 10A. Peak level into 8ohms was a generous 17.7dBW, fine into 4ohms at 16.0dBW and moderately reduced to 13.1dBW for 2ohms. Both harmonic and intermodulation distortion results were fine, as were the input noise levels. The dc offset at the speaker terminals was well within bounds and the input overload margins were ample. Stereo separation was above average, and the power amplifier output impedance was negligible.

Channel balance was well maintained throughout, and the input characteristics satisfactory, bar the higher than usual input capacitance values. The auxiliary response was quite uniform and the tone controls of gentle action, the RIAA equalisation smooth, though showing a mildly downtilted response from 100Hz to 20kHz, which is perhaps suprising in view of its subjectively good detail and clarity. Perhaps this compensates for a character which might otherwise sound too bright.

Conclusion

Attractively priced, this well-equipped amplifier showed a generous output power, good load tolerance plus a well-ordered and predictable lab performance with no matching or overload problems. Its sound quality was above average but its price rather below, such a combination assuring this newcomer of 'Best Buy' status.

Test measurements

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

GENERAL DATA — Integrated amplifier

Power output

Rated power into 8ohms, maker's spec			35W(= 15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.8dBW	17.1dBW	16.9dBW
Both channels, 4ohm load	13.3dBW	14.5dBW	14.3dBW
One channel, 2ohms, pulsed	11.0dBW	13.1dBW	13.0dBW
Instantaneous peak current		+ 15 A	– 10 A

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 77dB	– 84dB	– 70dB
Intermodulation, 19/20kHz, rated power, aux input			> – 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 79dB

Noise

Disc (mm) input (IHF, CCIR weighted)	– 77dB
Aux/CD input (IHF, CCIR weighted)	– 83dB
Residual, unweighted (volume control at min)	– 81dB
DC output offset	14mV

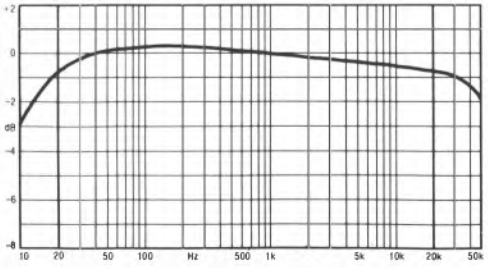
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	33dB	32dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Stereo separation			
Disc input	– 72dB	– 65dB	– 41dB
Aux input	– 73dB	– 66dB	– 42dB

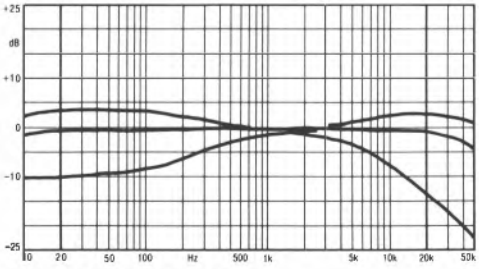
Output impedance (damping)	0.08ohm	0.11ohm	0.15ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0dB	0.5dB	0.4dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.43mV	47kohms, 210pF
Aux input	Phono	24.9mV	43kohms, 400pF

Disc equalisation error, 30Hz-15kHz	+ 0.3dB, – 0.4dB
Size (width, height, depth)	44 x 39 x 12cm
Typical price inc VAT	£90



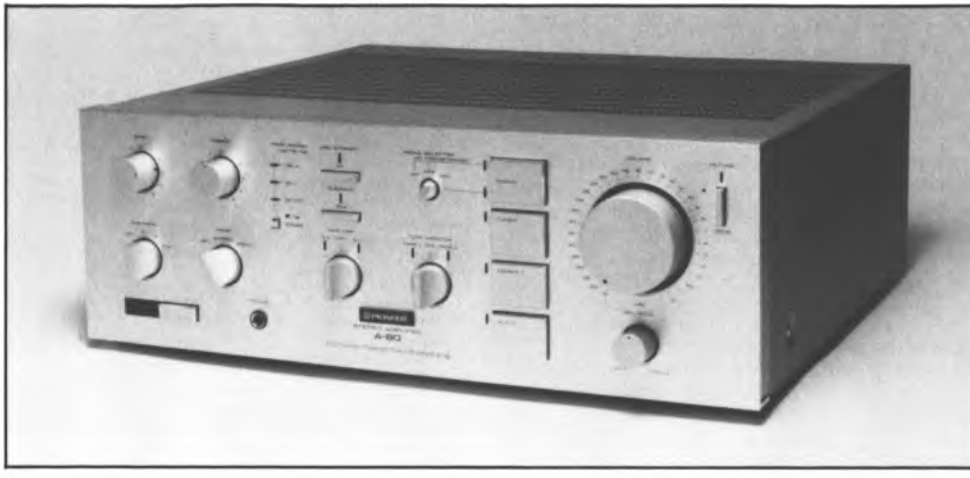
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Pioneer A-80

Pioneer High Fidelity (GB) Ltd, Field Way, Greenford, Middlesex UB6 8UZ
Tel 01-575 5757



One of Pioneer's larger integrated models, the *A80* costs close on £400, and is a heavy silver-alloy finished amplifier is rated at 100W, or 20dBW channel. In the Pioneer tradition, it comes comprehensively equipped, for example providing switching for speaker sets A or B or both, with an impedance matching selector present on the rear panel to help optimise the output stage for these different regimes. A headphone socket is included, with a power-level indicator, plus bass and treble controls, and a subsonic filter operating at a nominal 15Hz. Input selection is from tape 1 and 2, disc (moving-magnet or moving-coil, this with 3ohms or 40ohm matching) tuner, CD/aux 1 and aux 2. Rear connections are in phono, which are gold plated for disc, while speaker cable connections are made to large binding posts.

The interior is a complex jumble of no less than 13 printed circuit boards, linked by a mass of wires and ribbon cables. Interestingly, the mc input uses a screened step-up transformer with two gain/impedance settings. A large mains transformer is fitted, with separated secondaries feeding the left and right input channel power supplies. Employing fully discrete circuitry, the amplifier uses a direct-coupled output stage with massive complementary output transistors, well heat-sinked, and apart from the untidy wiring, the component quality and workmanship was to a high standard.

Sound quality

Judging by this sample, the sound of Pioneer amplifiers does not appear to have advanced a lot in recent years. Scoring just 'average' despite its upmarket price, the *A80* possessed a touch of 'thinness' or brightness in its tonal balance and did not portray stereo depth very well. Via mc (40 ohms) the output was fairly crisp sounding, but was also strangely 'veiled', and while the bass was above average in weight and definition, the treble lacked clarity. Ambience was weak, and stereo focus merely average. Via moving magnet, more low frequency definition was apparent, with a clearer treble register. Midrange focus was reasonable, but overall the effect was rather lifeless. Via the aux input the amp sounded a trifle brash, forward and thin tonally, and it did not prove to be a good clipper. On the normal load it sounded loud, reaching 105dBA, but fell significantly into the adverse combination, with nearly 3dB of level reduction here.

Lab results

The 20dBW specification was comfortably met at 21.7dBW, 8ohms, over the entire power bandwidth. The large power supply maintained

a good level into 4ohms, but a significant loss occurred into 2ohms. For 8ohm peaks, 22.5dBW was possible, but the output fell 7dB into 2ohm loading, with current limiting at ±11A mainly responsible; this was insufficient for peak level delivery into the adverse load. Harmonic and intermodulation results were however exemplary with the signal to noise ratios also very good (disc mc measured via the high ratio, 3ohms); dc output offset was very low.

Ample overload margins were measured via all inputs, and the stereo separation was rather better than average. Channel balances were excellently maintained, with input sensitivities sufficiently high for all known sources. The mm input capacitance was however on the high side. RIAA equalisation was commendably accurate, with helpful tailoring at the bandwidth extremes. The subsonic filter was rather gentle in slope measuring just −5dB at 30Hz, while the tone controls had more range than was strictly necessary for correction of programme differences.

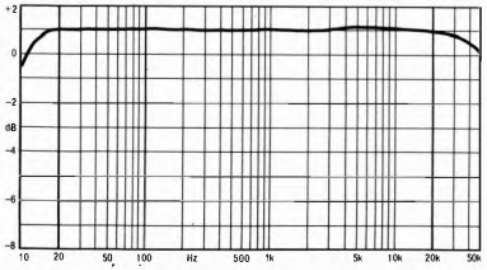
Conclusion

Aside from the somewhat limited peak capability, a point of stress towards maximum output level only, the measured performance of this design was very good indeed, and will match a wide variety of signal sources. This stood in marked contrast with the plain 'average' sound quality rating. In a sense, this amplifier continues to show how weak the correlation is between conventional lab measurement and subjective sound quality. Lacking in depth, life and ambience, the *A80* was a sonic disappointment and cannot be recommended.

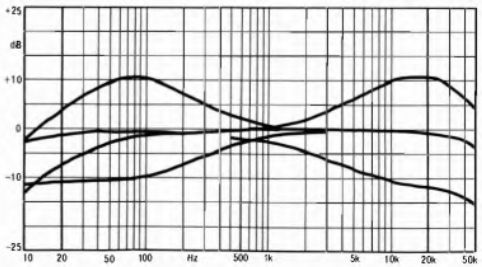
Test measurements

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

GENERAL DATA	Integrated amplifier		
Power output			
Rated power into 8ohms, maker's spec	100W(=20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	22.1dBW	22.3dBW	21.7dBW
Both channels, 4ohm load	19.7dBW	20.2dBW	19.5dBW
One channel, 2ohms, pulsed	14.6dBW	15.5dBW	14.8dBW
Instantaneous peak current		+11 A	−11 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−89dB	−92dB	−86dB
Intermodulation, 19/20kHz, rated power, aux input			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−83dB
Disc (mc) input (IHF, CCIR weighted)			−69dB
Aux/CD input (IHF, CCIR weighted)			−84dB
Residual, unweighted (volume control at min)			−83dB
DC output offset			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	40dB	40dB	37dB
Disc (mc) input (IHF)	33dB	36dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−70dB	−75dB	−58dB
Aux input	−75dB	−75dB	−58dB
Output impedance (damping)	0.04ohm	0.04ohm	0.06ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0dB	0.5dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.16mV	47kohms, 250pF
Disc (mc) input	Phono	0.005mV	3ohms, 0.5nF
Aux input	Phono	12.1mV	49kohms, 200pF
Disc equalisation error, 30Hz-15kHz			+0.15dB, −0dB
Size (width, height, depth)			42.5 x 42 x 15cm
Typical price inc VAT			£390



Disc input: RIAA equalisation accuracy



Tone control/filter responses

PS Audio IV/Two C

PS Audio, 27 Long Causeway, Peterborough PE1 1YJ
Tel (0733) 45890

A respected American-made amplifier system, the PS Audio range offers several possible options. We chose the model *IV*, a comprehensive pre-amplifier which includes a passive control option for high level sources, plus the 50W *Two C* power amplifier.

Presented in slim satin black aluminium cases, both units use separate power supply transformers, with that for the pre-amp not much smaller than the generous power amplifier supply unit. Pre-amp facilities include a choice of inputs from tape 1 and 2, video/aux, tuner and disc (moving-magnet). Input connections are phono sockets, which lock when the appropriate locking plugs are used. The *Two C* uses 4mm socket/binding posts for speaker connection, and may be switched to mono bridged mode to give 150W plus per channel when a second power amplifier is added.

Beautifully built, the pre-amplifier uses entirely discrete circuitry with passive RIAA equalisation, plus special three-wire signal cabling, comprising signal and ground, twisted together, plus a screen wire. High quality components are much in evidence.

The power amplifier is less tidy, but uses careful decoupling of the reservoir capacitors with smaller-value components. The output is complementary direct-coupled, with Darlington type power transistors, and no electronic protection is provided bar simple speaker line fuses which are not feedback corrected.

Sound quality

Via moving magnet, the sound was thought a trifle brittle and clinical, but very transparent. Stereo focus was very good, with fine vocal articulation as well as a sharp, well-defined bass full of detail. A good proportion of the depth available in the programme was present in the reproduced sound stage. Via auxiliary (active), the 'cool', clinical impression remained, with the treble a trifle edgy and prominent, but the overall sound was nonetheless very good. Switching to 'passive' operation, the sound stage opened up, and the effect was one of better dynamics with a rather clearer and purer treble, a more rounded voice balance and improved depth.

The power amplifier could play quite loud, reaching a measured 101.3dBA before clipping on the normal load, and its fine clipping performance meant that higher subjective levels were possible. It proved very tolerant of the adverse load, as a 'bridgeable' amplifier should be, and could still produce 100dBA. In bridge mode on the standard load, 106dBA was possible, a substantially high sound level.

Lab results

Rated at 17dBW, the amplifier returned an excellent power bandwidth at 17.6dBW. The strength of the power supply was demonstrated by the good 4ohms continuous delivery, both channels driven. It also possessed a very generous current capacity for its output

level, at ±25A, and drove the peak levels into 2ohms very well, falling only 2dB below the 8ohm level. This amplifier is superbly load-tolerant and will therefore drive most loudspeakers even in bridge mode. Harmonic and intermodulation distortion results were fine, as were the signal-to-noise ratios for the various inputs. Overload margins were more than satisfactory, while stereo separation was above average.

Input and output impedances were in accordance with sensible practice, though the fairly low 10kohms auxiliary input impedance should be noted. RIAA equalisation met very close tolerances, and although tailored at the treble end (above the limit of audibility), no roll-off appeared in the bass, this responsibility left to the switchable subsonic filter.

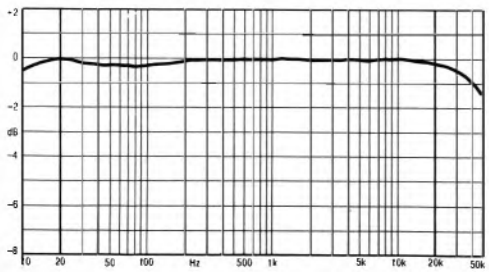
Conclusion

Overall this combination was bigger and better than its specification might suggest. Despite the 'clinical' character noted, the sound quality was nonetheless very good, with a consistently open and transparent sound, a fine articulate bass, sharp stereo focus plus good ambience and image depth. Of the two PS models tested here the power amp is in our view the superior unit, in fact near to Krell class so far as load tolerance is concerned. As a system, this PS combination can be recommended despite its high price, with the sweeter sounding power amplifier possibly justifying further investigation if coupled to an even better pre-amplifier. The potential for a fourfold increase in power output by adding a second unit in bridge mode is a further consideration in its favour.

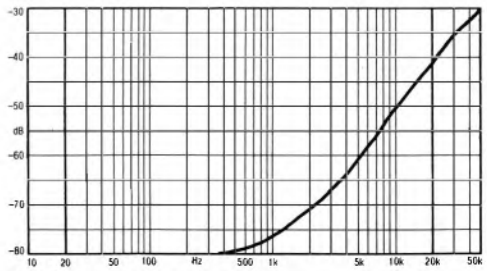
Test measurements

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

GENERAL DATA	Pre- and power amplifier		
Power output			
Rated power into 8ohms, maker's spec.	50W(= 17dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.6dBW	17.7dBW	17.7dBW
Both channels, 4ohm load	16.7dBW	17.0dBW	17.0dBW
One channel, 2ohms, pulsed	16.0dBW	16.3dBW	16.0dBW
Instantaneous peak current		+25 A	−25 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−77dB	−78dB	−68dB
Intermodulation, 19/20kHz, rated power, aux input			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−72dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−72dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−80dB
Disc (mc) input (IHF, CCIR weighted)			−71dB
Aux/CD input (IHF, CCIR weighted)			−82dB
Residual, unweighted (volume control at min)			−75dB
DC output offset			3mV
DC offset, pre-amp			0mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	31dB	30dB	22dB
Disc (mc) input (IHF)	25dB	24dB	16dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−81dB	−76dB	−45dB
Aux input	−79dB	−64dB	−40dB
Output impedance (damping)	0.04ohm	0.04ohm	0.05ohm
Channel balance, disc, at 1kHz			0.9dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.1dB	0.2dB	0.5dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.23mV	100kohms, 100pF
Disc (mc) input	Phono	0.01mV	50kohms, 100pF
Aux input	Phono	33.0mV	10kohms
Power amp	Phono	137mV	36kohms, 30pF
Output, pre-amp (tape)			19.2V max, 1.3ohms
Disc equalisation error, 30Hz-15kHz			+0dB, −0.2dB
Size (width, height, depth)			48 x 24 x 6cm, 48 x 26 x 9cm
Typical price inc VAT			£569, £411



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Quad 34/405

Acoustical Manufacturing Co Ltd, St Peters Road, Huntingdon PE18 7DB
Tel (0480) 52561

Quad's *34* and *405* are a well-established pre- and power amplifier combination, selling for little under £500. A 100W per channel unit, the *405* 'Current Dumping' power amplifier is now in MkII form and seeks to serve more difficult loudspeaker loads than previously accommodated, this overcoming a known drawback for *405* purchasers in the past. The compact *34* pre-amp is attractively styled, and offers good versatility. Inputs here include disc (moving-magnet and moving-coil modules are user-interchangeable, with alternative loading as well as sensitivity options available), tuner, aux/CD and tape. If a three-head tape machine is to be used, the aux may alternatively double as a second tape facility.

Together with electronic signal switching using CMOS, the main pre-amp circuitry is based on TL071 IC amplifiers. The power amp uses a generous 'C core' mains transformer feeding 10000μF reservoir capacitors, with the output stage employing unbiased, quasi-complementary current dumpers, with a 5W Class A 'base amplifier'. Another TL071 is used at the input here. The new electronic protection provides for peak currents up to 8A depending on the previous programme power history.

Sound quality

Scoring rather above average over the spectrum of listening tests, the result was nonetheless not too promising in view of the high attainment achieved by some of the latest generation of amplifiers.

Via disc (moving-coil) the sound was pleasantly neutral, particularly in the mid register. Both bass and treble resolution were above average though it was not especially transparent. Stereo images were rendered with only average focus and depth, but via moving-magnet the sound did improve slightly as regards clarity.

Via the auxiliary input some additional improvement was noted, but this was insufficient to raise the subjective rating into the 'Good' category. The treble was still showing some mild 'feathery muzziness', while the bass could have offered more extension and impact, this especially noted on digital programme. The amplifier did show an improved capability into adverse loading, with a mild 1dB fall from the normal 105dBA maximum output, but it still sounded poor if even mildly clipped; and the maximum sound level was in practice little higher than for the smaller PS Audio model, for example.

Lab results

Rated at 100W (20dBW) the Quad *405* met specification over the 20Hz to 20kHz power bandwidth. Into 4ohms the bandwidth loss was more serious but this result may be due to the operation of protection circuits. Peak current measured ±8A which was not really enough for the output level. Peak output held well from 8 to 4ohms, but fell by a total of 7·8dB into 2ohms. Really severe loads are not recommended.

Distortion levels raised no queries, while the signal-to-noise ratios were fine. The dc output

offset was very low. Disc overload margins were also satisfactory; the reduced 10kHz figure still within the required margin. Stereo separation was above average and channel balance highly accurate over the whole operating range.

Input characteristics were typical and though the moving-magnet capacitance was rather high, this could be easily altered if required by the dealer. The power amp was easy to drive but as supplied the pre-amp has a rather limited output, of just over 0·6V. A resistor change inside (Quad-approved) will however allow an increase to several volts if required for use with other power amplifiers of 1-2v sensitivity. The RIAA equalisation was uniform in response, and sensibly tailored to rolloff the output beyond the audible range. The versatile tone control stages are shown, our graph too small to carry the additional variable 'tilt' tonal balance facility.

Conclusion

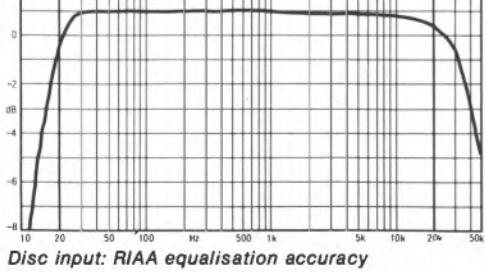
These two finely-constructed components partner each other well, and for basically 8ohm speaker loads, they can offer a pleasant and consistent sound, with considerable versatility. In particular the special tone controls provide for a wide range of adjustment to cope with some of the more difficult programme sources available, and would for example suit a collector with an extensive disc library.

The sonic attainment was however not in our view quite sufficient at the price for a full recommendation, but the system nonetheless remains worthy of consideration, taking into account aspects such as build quality and longevity.

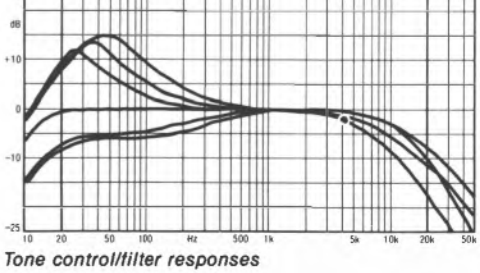
Test measurements

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

GENERAL DATA	Pre- and power amplifier		
Power output			
Rated power into 8ohms, maker's spec	100W(= 20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.4dBW	20.6dBW	20.3dBW
Both channels, 4ohm load	15.3dBW	19.1dBW	15.3dBW
One channel, 2ohms, pulsed	12.7dBW	13.2dBW	10.4dBW
Instantaneous peak current		+8 A	−8 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−68dB	−79dB	−66dB
Intermodulation, 19/20kHz, rated power, aux input			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−70dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−69dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−80dB
Disc (mc) input (IHF, CCIR weighted)			−74dB
Aux/CD input (IHF, CCIR weighted)			−81dB
Residual, unweighted (volume control at min)			−70dB
DC output offset			3mV
DC offset, pre-amp			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	30dB	19dB
Disc (mc) input (IHF)	27dB	27dB	16dB
Aux/CD input (IHF)	20dB	20dB	20dB
Stereo separation			
Disc input	−68dB	−67dB	−49dB
Aux input	−68dB	−65dB	−51dB
Output impedance (damping)	0.04ohm	0.04ohm	0.08ohm
Channel balance, disc, at 1kHz			0.2dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0dB	0.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.30mV	48kohms, 277pF
Disc (mc) input	Phono	0.013mV	100ohms, 22nF
Aux input	DIN	11.3mV	kohms, pF
Power amp	DIN	53.0mV	37kohms, 300pF
Output, pre-amp (tape)			0.65V max, 800ohms
Disc equalisation error, 30Hz-15kHz			+0dB, −0.35dB
Size (width, height, depth)			32 x 21 x 6cm
Typical price inc VAT			£229, £259



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Quantum IA100

Sound Marketing Ltd, Halldore Hill, Cookham, Berks
Tel (06285) 22726

Quantum had been making the *IA-100* for some time, housing it in a plain black metal case, before updating the styling to a black ash wood-surround case with a silver grey front panel. In addition a moving-coil amplifier board may now be fitted internally at an extra cost of some £10.

The *IA-100* is essentially an inexpensive 'straight-line' model, with no tone controls or filters. Input selection is via two push buttons which cover aux/tuner, tape and disc (moving-magnet as tested). A headphone socket is provided on the front panel, and at the rear the speakers are connected via 4mm socket/binding posts. Both tape and aux inputs are in DIN, with the disc in phono type sockets.

Internally the unit is built on a strong steel chassis plate with the majority of components mounted on a single printed circuit board, this helping to reduce construction costs. The circuitry is quite comprehensive; for example the disc section employs a linear input buffer followed by the RIAA equalisation section, the latter using a TL082 IC in shunt feedback mode and working from a single rail supply. A further IC stage follows the selector and volume control, thence feeding the power amplifier section. The latter's output configuration is quasi-complementary, direct coupled. It uses sturdy Toshiba devices, these rather better than the ubiquitous 3055s often encountered.

The construction standard is quite good while both 2A speaker fuses and an electronic circuit provide for fault and overload protection.

Sound quality

Scoring a little above average, the *IA100* did quite well during the listening tests. Commencing with the moving-magnet input, the sound was judged quite lively and detailed. Bass was encouraging, and the stereo focus above average, and some impression of depth and ambience was noted. On the debit side the tonal balance tended to brightness, together with some brittle effects in the treble.

Via aux, there was some improvement in terms of both clarity and depth. At higher sound levels the tonal balance began to harden, though the amplifier's clipping performance was pretty fair and it also coped with the severe loudspeaker load test quite

well. It provided 97dBA maximum sound level here, as opposed to 99dBA for the normal loading.

Lab results

Rated at 25W or 14dBW the *IA 100* managed to produce a decent 16.1dBW level over the 8ohm power bandwidth and held up fairly well into 4ohms. Peak current was generous at ± 12A, though the peak level into 2ohms did not quite reflect this ability. At 17dBW, peak level into 8ohms was equivalent to 50W; this fell 1.2dB into 4ohms and 4.4dB into 2ohms, which was pretty reasonable. Harmonic and intermodulation distortion levels were sensibly low, while noise levels were more than satisfactory. However, the dc offset was marginal at almost 50mV. Input overload margins were fine but the stereo separation measured oddly, improving at higher frequencies to 65dB (this noted with a second sample), but only 45dB mid band. Output resistance was negligible, and the input characteristics normal. The RIAA equalisation was pretty uniform, particularly for a budget amplifier, and illustrated desirable out-of-band rolloff tailoring, below 20Hz and above 20kHz.

Conclusion

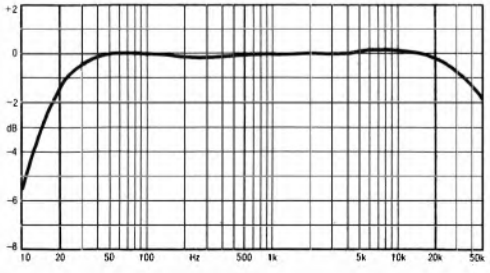
Selling at present at £120 for the moving-magnet and £130 for the moving-coil version, this Quantum in its latest form provides a generally good performance with a quite respectable output power. Its load tolerance was also above average and its sound quality, similarly, of a promising standard. All in all, this UK–built amplifier fully deserves a *HFC* recommendation.

Test measurements

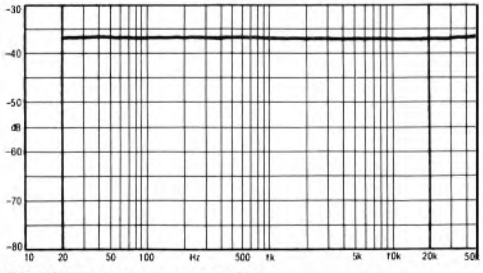
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA	Integrated amplifier		
Power output			
Rated power into 8ohms, maker's spec	25W(=14dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.1dBW	16.5dBW	16.2dBW
Both channels, 4ohm load	14.6dBW	15.0dBW	14.2dBW
One channel, 2ohms, pulsed	10.8dBW	12.6dBW	12.4dBW
Instantaneous peak current		+12A	−12A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−72dB	−81dB	−74dB
Intermodulation, 19/20kHz, rated power, aux input			−72dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−79dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			*
Noise			
Disc (mm) input (IHF, CCIR weighted)			−77dB
Disc (mc) input (IHF, CCIR weighted)			*
Aux/CD input (IHF, CCIR weighted)			−83dB
Residual, unweighted (volume control at min)			−62dB
DC output offset			49mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	29dB	23dB
Disc (mc) input (IHF)			*
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−37dB	−37dB	−37dB
Aux input	−37dB	−36dB	−37dB
Output impedance (damping)	0.06ohm	0.06ohm	0.13ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.1dB	0dB	6.7dB
Input data	socket type	sensitivity	loading
Disc (mm) input	DIN	0.37mV	52kohms, 100pF
Disc (mc) input			*
Aux input	DIN	26.5mV	120kohms, 30pF
Disc equalisation error, 30Hz-15kHz			+0.2dB, −0.2dB
Size (width, height, depth)			38 x 28 x 7cm
Typical price inc VAT			£119

**Moving-coil input version not available in time for lab tests.*



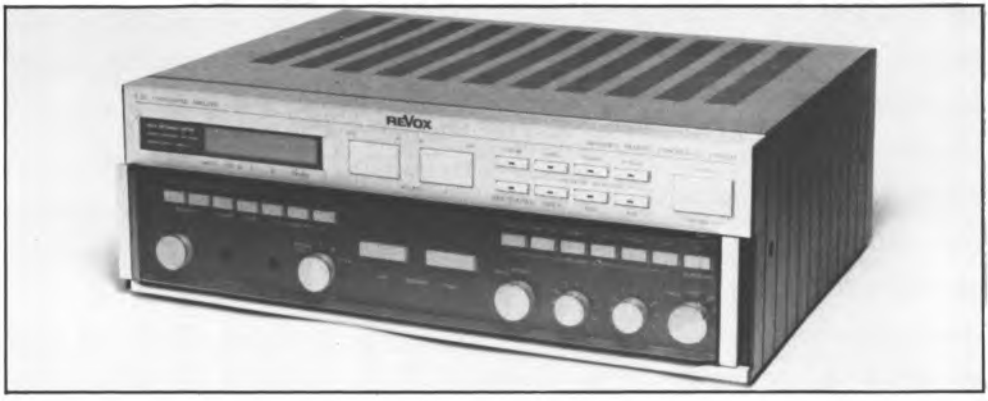
Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Revox B251

F W O Bauch Ltd, 49 Theobald Road, Borehamwood, Herts WD2 4RZ
Tel 01-953 0091



Part of a new range of high-quality electronics, the Revox *B251* is a generously-powered amplifier with a fully equipped front panel catering for almost every conceivable need of the technically-minded enthusiast. Not surprisingly perhaps, some of the numerous features are directed towards tape recording, such as the accurate peak-responding meters which can be directed to show gain, balance level and output power.

Rated at 100W per channel, the *B251* has variable gain inputs, moving-coil and moving-magnet disc facilities in addition to all the usual features such as multiple speaker sets, headphone socket, tone controls and filter. The volume and source selection are under electronic control with an optional handheld transmitter providing full remote operation, this shared with the other units in the range.

Inside, the design is unusual in many ways. The power supply dispenses with the usual mains transformer, and instead a fully stabilised high-frequency supply is used, with a saving in weight which makes the *251* a lightweight model. A heat pipe cools the output stage, dissipation being achieved via a large multi-finned heatsink within the case. The circuitry is built to a high standard, mainly with discrete transistors, while the direct-coupled complementary power amplifier runs at a low quiescent current, with a dynamic biasing circuit to minimise crossover distortion. IEC rolloff is used on the disc input, this a conventional series feedback RIAA equalisation type.

Sound quality

With a price approaching £900 if the remote control is included, the sound rating of merely 'average' was a serious shortfall. The numerical scores told their own story but it proved quite difficult to pin down what we felt to be the actual shortcomings of this model.

At moderate sound levels it sounded smooth and relaxed with a fairly neutral tonal balance. Subjectively, the music played right enough, but somehow it seemed the amplifier's 'heart' was not in it. Stereo image focus was satisfactory but depth and ambience both seemed obscured; one panelist used the word 'lifeless' though this is probably too extreme a judgement. Somehow the transient and percussive qualities in the recordings were smoothed over, removing the impact, life and attack of the music. Some treble imprecision was also noted, this of a feathery and slightly brittle nature, and heard mainly via the moving-coil disc input.

The amp was reasonably load tolerant, clipped well, and achieved a loud 106dBA into the 8ohm speakers.

Lab results

Tho *B251* illustrated a fine bandwidth at 1.3dB above the specified 20dBW (100W), and also drove 4ohms well under continuous duty. Peak

measured currents of ±5A were meagre for a 100W model, however, and this was responsible for the level reduction of 7dB from 8ohm to 2ohm peak delivery. The more awkward speaker systems are not advised!

Distortion results were in the main exemplary, though the intermodulation distortion was weaker via mc despite an ample overload margin.

Signal-to-noise ratios were particularly fine, while the dc offset was also very low. Overload levels were fine and stereo separation remarkably good. Channel balance was well maintained and the various input characteristics gave no cause for concern; the moving-magnet disc input allows a range of optional loading variations.

RIAA equalisation followed the IEC rolloff at low frequencies, the result showing a gentle uptilt in response. The tone controls and subsonic filter, as shown in the graph, provided suitable moderate control ranges. The subsonic filter was quite steep, and in my view, would make the IEC rolloff redundant on the disc inputs.

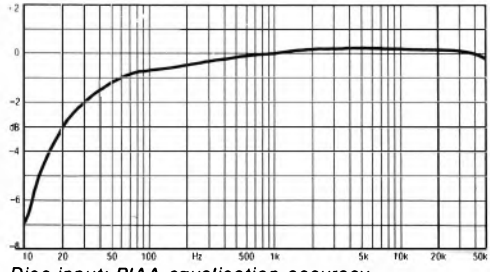
Conclusion

For a tape enthusiast committed to the new Revox system, the *B251* would be a logical consideration, with the matching tuner proving to be a particularly good example of its kind. The amplifier is however likely to disappoint an audiophile used to extracting the maximum musical impact and involvement from his recordings. An audition is mandatory for as a system amplifier it succeeds very well, but as a music amplifier it fails, in *HFC* terms, to meet the required standard.

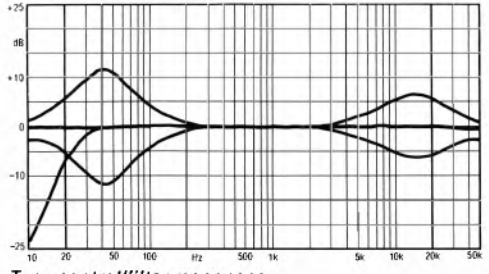
Test measurements

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

GENERAL DATA	Integrated amplifier		
Power output			
Rated power into 8ohms, maker's spec	100W(=20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	21.3dBW	21.7dBW	21.6dBW
Both channels, 4ohm load	20.1dBW	20.3dBW	20.2dBW
One channel, 2ohms, pulsed	15.0dBW	15.0dBW	15.0dBW
Instantaneous peak current		+5A	−5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−87dB	−86dB	−79dB
Intermodulation, 19/20kHz, rated power, aux input			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−82dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−60dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−85dB
Disc (mc) input (IHF, CCIR weighted)			−76dB
Aux/CD input (IHF, CCIR weighted)			−100dB
Residual, unweighted (volume control at min)			−95dB
DC output offset			6mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	27dB	23dB
Disc (mc) input (IHF)	37dB	36dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−80dB	−83dB	−80dB
Aux input	−86dB	−86dB	−80dB
Output impedance (damping)	0.05ohm	0.05ohm	0.11ohm
Channel balance, disc, at 1kHz			0.6dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.6dB	0.4dB	1.8dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.19mV	46kohms, var
Disc (mc) input	Phono	0.02mV	98ohms
Aux input	Phono	24.35mV	46kohms
Disc equalisation error, 30Hz-15kHz			+0.2dB, −2dB
Size (width, height, depth)			45 x 34 x 16cm
Typical price inc VAT			£897



Disc input: RIAA equalisation accuracy



Tone control/filter responses

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Rotel RA-820

Rotel Hi-Fi Ltd, 2-4 Erica Road, Stacey Bushes, Milton Keynes MK12 6HS
Tel (0908) 317707

Rotel have had a successful 820 model in their range for some time now, but this review relates to the more recent version which will be available by press date. If critics thought the last model was promising, then wait until they hear this one!

Rated at 20W (13.5dBW), the *820* seems to all outward intents and purposes to be a normal 'Japanese style' amplifier, Taiwan-made, with tone controls, headphone sockets and the like. Inside however it has benefited from a sizable injection of British audio circuitry, directed towards maximising sound quality. An audiophile version *(RA820B)* will also be available, offering a mild further improvement in sound quality by stripping out the tone controls and other related non-essentials, and spending a little more on components.

Using a simple, single board construction, the power supply is reasonable at the price, with a high current rectifier bridge feeding *6800μF* reservoir capacitors. A dual integrated circuit 5532(4) is used in the disc input stage with normal series feedback equalisation. The tone controls are passive. The power amplifier is quite standard, direct-coupled complementary, and dispenses with protection, using high current output transistors. The speaker fuses are included in the negative feedback loop to null their effect, while special phase compensation is used and the usual output choke is absent.

Sound quality

The 'good' sound quality rating achieved was disbelieved at first until rechecked, whereupon the *820* happily demonstrated a repeat performance. This economy lightweight easily bettered a large number of rather more expensive designs.

It provided, on disc, a musical-sounding immediacy, with a sound field conveying depth, space and ambience, all in good proportion. The bass was reasonably articulate, and the mid tonal balance generally good with presentable focus; the treble had a 'silvery' quality, a trifle too bright with a hint of 'edge'.

Via auxiliary, the stereo focus showed a further improvement, the sound impressive as regards both dynamics and clarity. Reasonably good sound levels were provided into the normal loudspeaker, reaching 99dBA, while on adverse load it showed signs of mild weakness, this more a 'running out of breath' than a protection-initiated limiting. It also sounded a trifle 'glassy' and bright played to the power limit but was considered to clip fairly well.

Lab results

Rated at 20W (13.5dBW), this little amplifier produced a generous 15.4dBW over the power bandwidth into 8ohms. On 4ohms some loss was seen at the band edges and the design recipe was clearly balanced more towards

peak than continuous delivery. A high 16.3dBW (nearly 50W) was available on 8ohm peaks which held up well at 15.1dBW into 4ohms while into 2ohms it was still 13.0dBW, almost equaling the 8ohm specification. Peak current was a surprisingly high ±25A.

Harmonic and intermodulation distortion results were satisfactory and noise levels equally unspectacular. The dc output offset was a little high but probably not sufficient to do any harm. Input overload levels were fine and the output impedance moderate and consistent over the frequency range. Stereo separation was below average, particularly the 20kHz results, which could so easily be improved. Channel balance was satisfactory.

Input sensitivities were rather low, particularly on auxiliary, but I understand from Rotel that this has subsequently been improved.

RIAA equalisation was quite uniform with a sensible rolloff at low frequencies corresponding to a built-in rumble filter. The tone controls gave a sensibly mild action, with treble cut also acting as a useful treble filter.

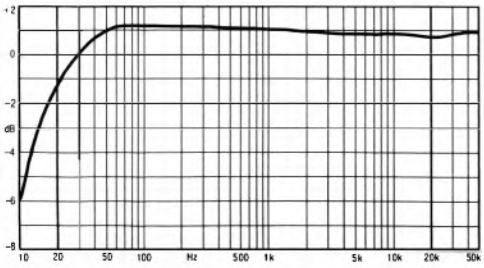
Conclusion

For the price the *RA820* proved a remarkably good product. Offering a good standard of load tolerance, it produces a fairly decent output with a basically neutral sound of good clarity, musical quality and solid stereo imaging. The rating in this issue is a good one, as reference to the comparator table will quickly demonstrate. 'Best Buy' classification is a certainty for such a high value product, and this rating must also be extended to include the 'straight-line' version, which is designated the *RA820B.*

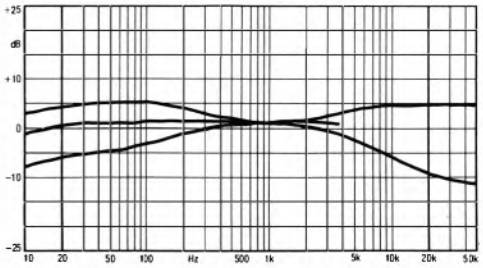
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			20W(=13.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	15.6dBW	15.9dBW	15.4dBW
Both channels, 4ohm load	12.4dBW	14.3dBW	13.8dBW
One channel, 2ohms, pulsed	12.0dBW	13.0dBW	12.3dBW
Instantaneous peak current		+26 A	−26 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−62dB	−70dB	−62dB
Intermodulation, 19/20kHz, rated power, aux input			−58dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−58dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−70dB
Aux/CD input (IHF, CCIR weighted)			−71dB
Residual, unweighted (volume control at min)			−64dB
DC output offset			35mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32dB	30dB	29dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−59dB	−40dB	−25dB
Aux input	−60dB	−39dB	−27dB
Output impedance (damping)	0.30ohm	0.30ohm	0.30ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.4dB	1.3dB	3.2dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.58mV	48kohms, 150pF
Aux input	Phono	53mV	16kohms, 320pF
Disc equalisation error, 30Hz-15kHz			+0.2dB, −1dB
Size (width, height, depth)			43 x 27 x 6.6cm
Typical price inc VAT			£80



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Rotel RA-870 and RB-870

Rotel Hi-Fi Ltd, 2-4 Erica Road, Stacey Bushes, Milton Keynes MK12 6HS
Tel (0908) 317707

Rotel's current flagship amplifier system consists of the integrated 60W per channel *RA870* partnered by the *RB870* power amplifier. When both are set to bridge mode, a system giving around 200W per channel results! We assessed the combination, the *RA870* alone, and finally the *RB870* taken as a separate stereo power amplifier.

Mainly designed in the UK though built in Taiwan, the *RA870* is a 'straight-line' model lacking such frills as tone controls or the usual Rotel power meters. Nonetheless, two sets of speakers may be used, with binding posts for connection, and a headphone socket is included. The input sockets are all in phono.

Internally, the *RA870* contains rather a lot of messy wiring interconnecting a number of printed circuit boards. The power supplies are substantial with double mains transformers and 2 × 8200μF reservoir capacitors. The disc input uses a high-gain input amplifier of variable gain for the mc and mm input sensitivities, followed by two stage RIAA equalisation, first the passive 75μS rolloff and then the active low frequency boost.

The power amplifiers in both models are straightforward differential input types, but they are distinguished by a good performance in the driver stage, thereby providing a high peak current capability from the paralleled pairs of complementary, direct coupled output transistors. Electronic protection is deliberately omitted, while the single output fuses are included in the error-correcting negative feedback loop.

Sound quality

As an integrated amplifier the *RA870* aquitted itself very well. Via moving coil, good stereo images were produced, with a decent rendition of both focus and depth. The bass showed good extension and tunefulness, but the tonal balance was a touch 'bright' with mild 'brashness' in the treble. The latter aspect improved via the moving magnet input while stereo depth and focus also advanced a little. Via aux, the character remained unchanged – a touch light and hard but with a well-integrated, lively effect and good detail.

The bridged *RA870/RB870* combination was capable of very high sound levels but did not sound quite as tidy, with mild bass softness. However it was a different story when a separate preamplifier was employed. Here the RB870 proved to be a very pleasant device, full of relaxed detailed power, with good marks scored for stereo depth and focus despite a midly 'slow' character. It worked well in bridged mode reaching a very good 105dBA into the normal load, while unbridged the amplifiers reached 102dBA into the adverse load and illustrated a fine load tolerance.

Lab results

Rated at 60W (18dBW), the *RA870* delivered 18.3dBW over the 8ohm power bandwidth and

the all under 4ohm continuous drive was mild. Peak current capability was a whopping ±34A, providing a good peak power into adverse loads. With 19dBW into 8ohms, the fall into 2ohms was fine at less than 3dB for programme peaks. In bridged mode 24dB peak was available falling to 18dBW for 2ohms, such a load rather tough for bridge duty. Distortions were generally low though the moving coil intermodulation result was not too encouraging. Both dc output offset and input noise levels were fine. Input overload margins were considered ample and stereo separation was rather above average, with power amp output impedance negligible.

Disc input capacitance was a little high, but the other input characteristics were fine. It is worth noting that the power amp sensitivity was slightly low, especially in bridge. The RIAA response was pretty flat over the midband and mildly over-tailored at the band extremes, measuring – 2dB at 20Hz and 20kHz.

Conclusion

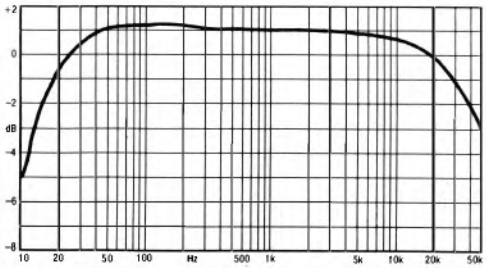
Once again Rotel UK have been instrumental in producing an amplifier design which is rather better than the opposition – load tolerant, offering decent output power a good stereo sound with versatile input facilities. The basic *RA870* comfortably scored a 'Best Buy', but the *RB870* plus suitable pre-amp is priced out of this category, so must be content with 'strongly recommended.' Finally, although it is not reviewed here, the author has also assessed the *RA860*, the cheaper, tone-control-equipped version of the *870* whose performance would also justify a warm recommendation.

Test measurements

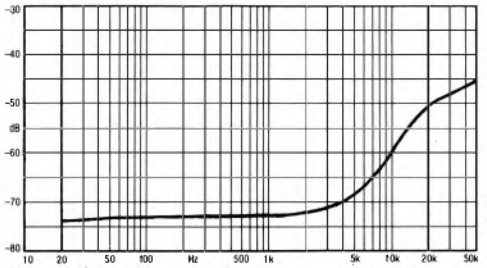
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA			Integrated amplifier*
Poweroutput			
Rated power into 8ohms, maker's spec			60W(= 18dBW)
Power out put	20Hz	1kHz	20kHz
One channel, 8ohm load	18.3dBW	18.6dBW	18.6dBW
Both channels, 4ohm load	17.1dBW	17.6dBW	17.6dBW
One channel, 2ohms, pulsed	15.6dBW	16.5dBW	16.4dBW
Instantaneous peak current		+ 34 A	– 34 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 74dB	– 75dB	– 80dB
Intermodulation, 19/20kHz, rated power, aux input			– 77dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 69dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			– 52dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 80dB
Disc (mc) input (IHF, CCIR weighted)			– 78dB
Aux/CD input (IHF, CCIR weighted)			– 86dB
Residual, unweighted (volume control at min)			– 75dB
DC output offset			4mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	34dB	34dB	28dB
Disc (mc) input (IHF)	31dB	31dB	23dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 74dB	– 73dB	– 50dB
Aux input	– 75dB	– 75dB	– 52dB
Output impedance (damping)	0.04ohm	0.06ohm	0.08ohm
Channel balance, disc, at 1kHz			0.3dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0.2dB	0dB	1.6dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.27mV	44kohms, 240pF
Disc (mc) input	Phono	0.013mV	270ohms, 0.2nF
Aux input	Phono	19.5mV	54kohms, 110pF
Power amp	Phono	135mV	21kohms, 400pF
Disc equalisation error, 30Hz-15kHz			+ 0.2dB, – 0.5dB
Size (width, height, depth)			43 x 32 x 9.4cm
Typical price inc VAT			£220

** Note: Test results refer to RA870 only. With RB870 added in bridged mode, power at 1kHz was 217W (23dBW) into 8ohms.*



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Sansui AU-D101

Sansui (UK) Ltd, Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford Middlesex
Tel 01-575 1133

A budget model, the *101* is specified at 30W per channel and comes in a low, slim-profile satin black case. Tidily presented, the front panel offers a headphone socket, speaker muting, bass and treble controls, a high frequency filter, and selection of inputs: these are tape 1 and 2, aux/CD and tuner. A loudness contour switch is also provided and there are coloured lamps to show which input function is selected.

Sansui are pursuing a policy of continuous product development, and this explains why an earlier sample of the *AUD-101*, which I reviewed in a monthly magazine some months ago, did not do as well as this one has done in the *HFC* test programme.

Inside, an average sized mains transformer is fitted, with 2 × 4700μF reservoir capacitors. The output stage is fully complementary using Sanken A1102/62377 output transistors, in a Sansui 'Super Feedforward' circuit. Electronic output protection is employed with peak current limiters and the heatsinking is generous, cooling both faces of the power transistors. The disc input is built around a M5220L dual integrated circuit stage with good 2% tolerance equalisation components, and the tone controls are incorporated in the feedback loop of the power amplifier. The usual line buffer amplifier is absent.

The construction is of good quality but the main terminals are unshrouded internally, and located rather close to the headphone socket – possibly a questionable aspect of the construction!

Sound quality

On disc the *101* scored an 'average sound' quality rating which was quite good for its modest price. Via the moving magnet disc input vocal sections sounded a touch 'thin', while the bass and treble regions were satisfactory. Some 'featheriness' and 'grain' could be heard in the upper register and while the stereo focus was quite good, the impression of depth was weak.

Via the auxiliary input, some improvement was noticed particularly with regard to clarity. Some 'lispiness' was heard on vocal sibilants and the overall sound was lacking real attack and life. It was however relativity unfatiguing. The amplifier also sounded quite pleasant into mild clipping, and reached a 101dBA equivalent sound level into the normal load. The adverse load was less well handled, however, with a reduction of 4dB in maximum level.

Lab results

Rated at 30W per channel or 15dB, this amplifier produced considerably more output

on test, meeting a 17.7dBW level over the 8ohm power bandwidth; this is more than 50W. The small capacity power supply was reflected by the shortfall into 4ohms on continuous loading, this averaging 3dB. Peak current was modest at ±6A, and clearly curtailed the peak delivery into the most severe load. A generous 18.5dBW was available into peaks into 8ohms but this fell by 9dB into 2ohms, and difficult speaker impedances are therefore to be avoided.

As claimed by the makers, harmonic and intermodulation distortion results were excellent, while input noise levels were also very good, and the dc offset satisfactory.

Disc and auxiliary input overload margins were fine while the channel separation was reasonably good. Output resistance was negligible and channel balance well maintained on all inputs over a range of volume control settings.

Input characteristics were typical, while the RIAA equalisation was very good, especially for a budget model. The tone controls has sensibly moderate control ranges, the treble action centred more in the main treble range than usual, and continuing to roll off at higher frequencies.

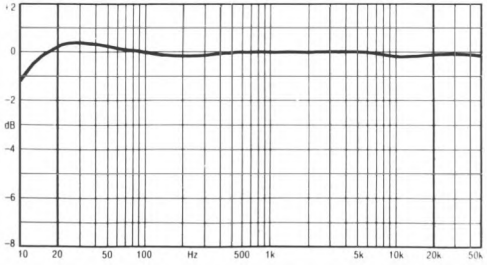
Conclusion

This neat little amplifier has been improved since first introduced, and into straightforward speaker loads it provided good 'strain-free' sound levels, all for a modest price. It was relatively unfatiguing on audition, and offered a presentable overall quality, with the combination of test and subjective results making recommendation appropriate.

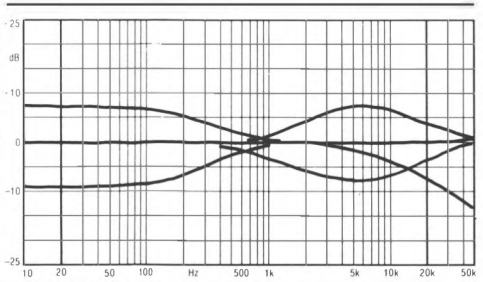
Test measurements

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

GENERAL DATA		Integrated amplifier	
Power output			
Rated power into 8ohms, maker's spec		30W(= 15dBW)	
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.8dBW	17.9dBW	17.7dBW
Both channels, 4ohm load	14.5dBW	15.0dBW	14.4dBW
One channel, 2ohms, pulsed	9.0dBW	9.4dBW	9.0dBW
Instantaneous peak current		+6 A	−6 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−83dB	−91dB	−84dB
Intermodulation, 19/20kHz, rated power, aux input			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			>−80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−81dB
Aux/CD input (IHF, CCIR weighted)			−83dB
Residual, unweighted (volume control at min)			−77dB
DC output offset			33mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	−32dB	−31dB	−30dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−68dB	−76dB	−48dB
Aux input	−76dB	−76dB	−51dB
Output impedance (damping)	0.10ohm	0.11ohm	0.15ohm
Channel balance, disc, at 1kHz			0.2dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.3dB	0.6dB	0.9dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.39mV	46kohms, 160pF
Aux input	Phono	36.7mV	52kohms, 140pF
Disc equalisation error, 30Hz-15kHz			+0.4dB, −0.2dB
Size (width, height, depth)			43 x 27 x 8cm
Typical price inc VAT			£99



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Sansui AUD-55X

Sansui (UK) Ltd, Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford Middlesex
Tel 01-575 1133

The *AUD-55X* is a fairly upmarket design, rated at 70W per channel and employing the latest Sansui 'Super Feedforward' power amplifier circuitry. Comprehensively equipped, it offers facilities for two sets of speakers, plus tone controls, a headphone jack socket, record/out dubbing selector, a high filter, loudness button and 20dB mute. The inputs comprise tape 1 and 2, aux, tuner and disc, both moving-coil and moving-magnet. Speaker connection is via spring clip terminals, and all input connectors are in phono. Bright fluorescent power meters dominate the front panel.

Internal design points include the use of a heatpipe dissipator system for the complementary direct-coupled output stage, plus toroidal mains transformer with separately-rectified supplies for each channel, having total of 4 x 10000μF of reservoir capacity.

Internal wiring was very neat, with safe mains sections. The output stage uses modest output transistors, possibly over-protected by an integrated circuit over-current/fault detection unit. The disc amplifier/equaliser uses the M5220L integrated circuit with series feedback plus a gain change to accommodate moving coil and moving magnet cartridge sensitivity requirements. A further IC plus some discrete circuitry forms the basis for the line amplifier and the tone control buffer functions. A separate section runs the output power meters.

Sound quality

Given the good results obtained from some of the larger Sansui amplifiers in previous years, those obtained for the *55X* were a distinct disappointment. This amplifier was well above the base price level of the group tested, but its overall sound quality rating in fact fell below average by some margin; in other words rather worse than the inexpensive *101*.

Via the moving-coil input the sound was 'thin' and noticeably lacking in detail and transparency. Stereo depth was virtually absent while only moderate image focus was observed. The treble register was not favoured.

Via moving-magnet, a noticeable improvement in clarity and depth were noticed, though the bass remained seriously lacking in definition.

On auxiliary input the grainy treble effect continued, while the overall effect was soft and bland with very restricted depth and ambience. It sounded unpleasant in even mild clipping, and was worse still when subjected to the severe speaker loading. However, its high level of 8ohm delivery should ensure that in normal use there will be no need to drive it into clipping anyway.

Lab results

The manufacturer's 18dBW rating was comfortably exceeded on test with an 8ohm power bandwidth of at least 20.2dBW. Nearly 4dB of

loss was noted on 4ohm continuous delivery, both channels driven. Peak current was meagre at ± 7 amps, in view of the output level, and this was reflected in the considerable curtailment of peak output level into the lower 2ohm load. Here the 21dBW 8ohms result dipped a serious 10.4dB, the resulting 10.6dB level rather smaller than that provided into similar loads by several budget 'tinies'. Difficult loudspeaker loads are thus not advisable with this particular amplifier.

Harmonic and intermodulation distortions were very low but dc output offset was rather high at 91mV; less than 20mV is advisable. Signal-to-noise ratios were fine in view of the input sensitivities, while input overload margins were ample, but stereo separation was weak at high frequencies. Output impedance was quite negligible. Channel balance was found to be satisfactory as were the input characteristics.

RIAA equalisation was clearly accurate with signs of a careful subsonic rolloff, and the typical tone control responses can be seen on the accompanying graph.

Conclusion

Something must be seriously wrong if the sound quality of this amplifier falls so far below that of Sansui's much cheaper *AUD-101*. Many of the results were good but the high level performance into awkward loads was distinctly weak; furthermore stereo separation was below par with indications of treble distortion crosstalk. Last but by no means least, the below-average sound of this model unfortunately must rule out any recommendation here.

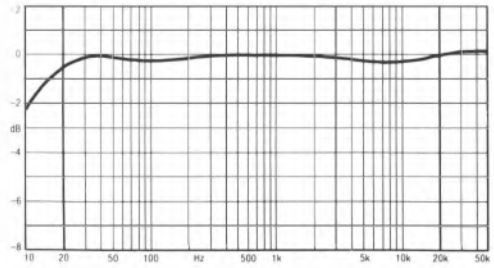
Test measurements

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

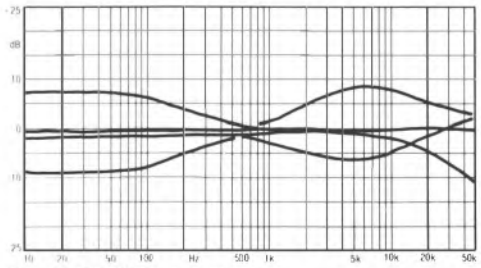
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			70W(=18dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.5dBW	20.5dBW	20.2dBW
Both channels, 4ohm load	16.1dBW	16.7dBW	16.4dBW
One channel, 2ohms, pulsed	10.7dBW	10.8dBW	10.8dBW
Instantaneous peak current		+7A	−7A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−90dB	−91dB	−82dB
Intermodulation, 19/20kHz, rated power, aux input			>−80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			−78dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			−76dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−83dB
Disc (mc) input (IHF, CCIR weighted)			−71dB
Aux/CD input (IHF, CCIR weighted)			−86dB
Residual, unweighted (volume control at min)			−87dB
DC output offset			91mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	31dB	31dB	28dB
Disc (mc) input (IHF)	31dB	30dB	28dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−68dB	−52dB	−28dB
Aux input	−75dB	−53dB	−30dB
Output impedance (damping)	0.10ohm	0.10ohm	0.12ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.3dB	2.6dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.24mV	50kohms, 210pF
Disc (mc) input	Phono	0.005mV	100ohms, 0.3nF
Aux input	Phono	22mV	55kohms, 270pF

Disc equalisation error, 30Hz-15kHz: +0dB, −0.3dB
Size (width, height, depth): 43 x 33.5 x 11cm
Typical price inc VAT: £239



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Sondex S230

Aston Audio Ltd, 4 West Street, Alderley Edge, Cheshire
Tel (0625) 582704

This moderately-priced amplifier comes from a small UK manufacturer whose chief designer was responsible for the early Radford valve amplifiers. Rated at 30W per channel, it is a 'straight-line' type where, unusually, the auxiliary/CD input bypasses the pre-amp section and instead is fed direct to the power amp via the volume control. Alternative plug-in circuit boards can be fitted by the dealer to give moving-coil or moving-magnet disc input as required, with no difference in price.

A compact unit, the *S230*'s rear input socketry is in phono while speaker connection is via 4mm socket/binding posts. The internal construction is very tidy, employing a single printed circuit board. Unusually, the output stage is capacitor-coupled, this component being included in the feedback loop to correct its residual errors. The main reservoir of 6800μF is fed by a toroidal transformer, the supply shared between the two channels. The output stage employs complementary output transistors biased in conventional class A/B mode. Load-line electronic protection is fitted; we are informed that this will be tailored to provide higher peak currents than on the review sample before this review goes to press.

The disc input begins with a variable-gain, low noise input buffer followed by passive RIAA equalisation and then active LF equalisation, a good system. Discrete transistors are employed, the mains wiring neat and well shrouded.

Sound quality

Scoring a respectable 'good plus' in the listening tests, the Sondex gave a good result for an under-£200 model. Via moving-coil input it seemed marginally bright, but with a neutral mid range balance and pleasant voice reproduction. Stereo focus was quite good, and depth better still. Slight bass softness and treble grain were evident but not enough to detract from the musical performances.

Via the moving-magnet input the sound was similar except it was slightly sweeter in treble tonal balance terms.

Via auxiliary a further improvement in definition occurred, with superior bass and all-round detail. Good results were obvious via this input, and the amplifier also proved tolerant of mild clipping, producing decent sound levels. In practice it also coped better than expected with the adverse load, with 101dBA possible into 8ohms and 99dBA into the low load.

Lab results

For a full power bandwidth at 8ohms, the Sondex just met the 30W specification at 15.1dBW. The modest power capacity was reflected by the fall on 4ohms continuous duty,

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both channels driven, but peak current capacity at ±8A was reasonable for the power level concerned peak output level into the adverse loads was quite well held, measuring about a 5.5dB drop from 8 to 2ohms.

Distortion levels were satisfactory except via disc where the intermodulation results was marred by premature input overload. Due to its passive control unit construction, the disc sensitivity needs to be correctly matched to the chosen cartridge to get the best results, and if this is done, the input overload margins will be sufficient. Noise levels were satisfactory, and the output offset negligible.

Stereo separation was ample and the output impedance low even at 20Hz. A mild disc channel imbalance was noted, but tracking over the volume control range was very good. Input characteristics were quite standard bar the auxiliary which has a designed low sensitivity to give suit high output sources such as CD. However, check that your tuner or tape unit will also produce sufficient level.

RIAA equalisation follows the IEC rolloff, nominally – 3dB at 20Hz and above this range the curve is nicely accurate.

Conclusion

Given the versatility offered by the manufacturer, with respect to input sensitivity and cartridge matching, the limited overload margin should not present a problem. Fairly load tolerant, this compact, 'musical ' sounding amplifier offers good clarity and depth effects in the stereo image, and its objective score was sufficiently high compared with the group average to indicate a Best Buy rating at its well-under £200 price.

Test measurements

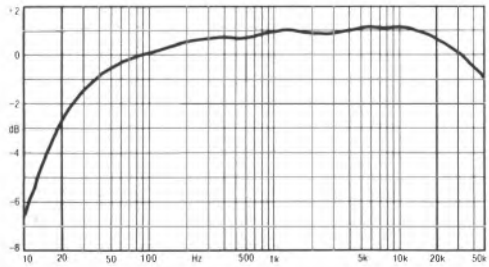
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			30W(= 15dBW)
Power output*	20Hz	1kHz	20kHz
One channel, 8ohm load	15.1dBW	16.0dBW	16.0dBW
Both channels, 4ohm load	11.6dBW	13.6dBW	13.5dBW
One channel, 2ohms, pulsed	9.0dBW	11.0dBW	10.8dBW
Instantaneous peak current		+8 A	–8 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	–59dB	–61dB	–54dB
Intermodulation, 19/20kHz, rated power, aux input			–68dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			–36dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			–80dB
Disc (mc) input (IHF, CCIR weighted)			–77dB
Aux/CD input (IHF, CCIR weighted)			–75dB
Residual, unweighted (volume control at min)			–72dB
DC output offset			2mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	18dB	16dB	17dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	–66dB	–60dB	–40dB
Aux input	–64dB	–60dB	–36dB
Output impedance (damping)	0.1ohm	0.08ohm	0.1ohm
Channel balance, disc, at 1kHz			2.0dB
Volume/balance tracking	0dB	–20dB	–60dB
Aux input	0dB	0.4dB	0.3dB

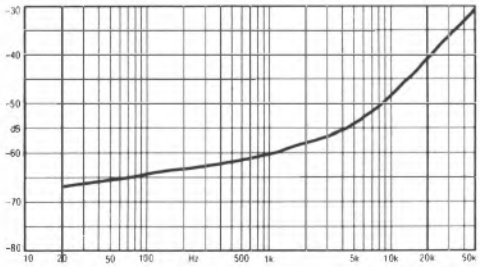
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.36mV	48kohms, 130pF
Disc (mc) input	Phono	0.04mV	330ohms, 22 nF
Aux input	Phono	82mV	48kohms, 316pF

Disc equalisation error, 30Hz-15kHz: +0.2dB, –2.6dB
Size (width, height, depth): 32 x 26.5 x 7.5cm
Typical price inc VAT: £179

* *Note: dislikes capacitive loads*



Disc input: RIAA equalisation accuracy



Disc input: stereo separation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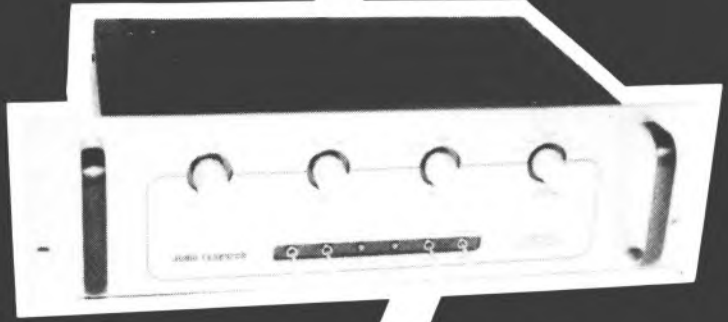

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Sony TA-AX500

Sony UK Ltd, Staines House, 158-162 High Street, Staines, Middlesex TW18 4AZ
Tel Staines 61600

The previous generation of Sony integrated amplifiers were lightweight affairs with clever microprocessor-run control panels and switching power supplies. However, the *TA-AX500* reverts to a more traditional style, with a normal mains transformer and control hardware. Costing fractionally under £200, it looks impressive in satin silver livery and sports a comprehensive specification which includes provision for A and B speaker sets usable separately or in combination, a headphone socket, bass and treble controls' 'CD Direct' pre-power connection and subsonic filter. Inputs may be selected from tape 1 and 2, auxiliary (front jack socket provided) disc (moving-magnet and moving-coil), plus CD and tuner.

Inside, the contruction was neat but without properly shrouded mains sections. The *TA-AX500* is labelled 'audio current transfer', and current drive amplifiers are used in the pre and power sections, to minimise their mutual interaction. A large mains transformer charges the main reservoir capacitor of $2 \times 15{,}000\mu F$ capacity. A very large internal heatsink is fitted, and much of the pre-amp employs multiple section integrated circuits. Speaker connections are via tough binding posts while the signal inputs are all in phono.

Sound quality

Scoring a straight 'average' on listening tests, the *TA-X500* set no new records for fidelity. Via moving-coil input, the bass was somewhat lumpy with a loss of detail here, and in the treble register. A feathery, blurred quality was noted in the treble and neither stereo focus or depth were very good. Via moving-magnet, focus improved, and the sound was clearer with a better mid tonal quality as well as more image depth. Via auxiliary, set to CD direct, the midrange showed little enhancement, but depth effects were a trifle improved and left-to-right separation appeared more promising. No real impression of the scale and liveliness of the master programme was however conveyed.

The *TA-X500* was also of average merit as regards mild clipping, reaching 104.5dBA, and it drove the adverse load to a quite good 103dBA; but it would not tolerate any clipping in the latter condition, the amplifier then shutting down under relay protection.

Lab results

Rated at 80W per channel, or about 18.5dBW, the unit happily exceeded this specification over the 8ohms power bandwidth, producing 20.1dBW. The continuous delivery into 4ohms was also good. For the output level, the

restriction to a peak current of ±9amps was too severe and certainly curtailed the peak output level into 2ohms resistive, this 6.2dB below the 20.8dB level which was available into 8ohms.

All distortion results, harmonic and intermodulation, were exemplary, typcially at −90dB relative to the fundamental — or 0.003%. Signal-to-noise ratios were also good, and the dc offset at the speaker terminals was quite microscopic. Input overload margins were ample and stereo channel separation was particularly good.

Output resistance was at a negligible level, while channel balances held to a high standard of accuracy on all inputs and even at low volume control settings.

Noting the 210pF on the mm disc input, the remaining input characteristics were to the usual standard. RIAA equalisation was rather wideband, with no out-of-band tailoring at all, remembering that our graph extends right from 10Hz to 50kHz. The useful subsonic filter can be seen on the graph along with the tone control responses, but in use it does degrade the midband tonal balance somewhat.

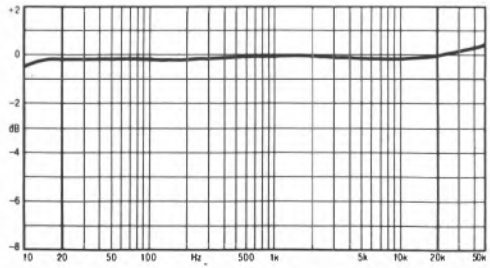
Conclusion

In some respects Sony are providing a lot of amplifier for the money, for the *TA-AX500* is well equipped, well built and well finished, and possesses considerable versatility. Into moderate loads it is capable of decent sound levels proportional to its near 100W per channel output power, but on the debit side the sound quality is certainly uninspiring. While not the stuff of which recommendations are made, it is nonetheless worth considering.

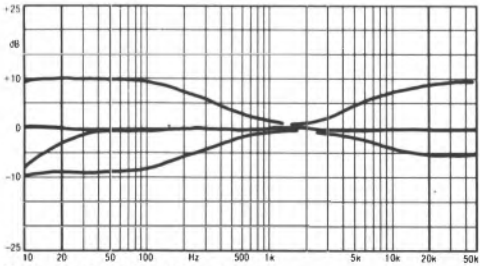
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			80W(= 19dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.2dBW	20.3dBW	20.1dBW
Both channels, 4ohm load	17.4dBW	17.8dBW	17.5dBW
One channel, 2ohms, pulsed	14.6dBW	14.6dBW	14.4dBW
Instantaneous peak current		+9 A	−9 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−90dB	−93dB	−87dB
Intermodulation, 19/20kHz, rated power, aux input			> −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			> −80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−84dB
Disc (mc) input (IHF, CCIR weighted)			−76dB
Aux/CD input (IHF, CCIR weighted)			−104dB
Residual, unweighted (volume control at min)			−75dB
DC output offset			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	30dB	29dB
Disc (mc) input (IHF)	26dB	26dB	26dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−92dB	−91dB	−72dB
Aux input	−92dB	−91dB	−70dB
Output impedance (damping)	0.12ohm	0.12ohm	0.19ohm
Channel balance, disc, at 1kHz			0.5dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.5dB	0.7dB	0.7dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.26mV	42kohms, 210pF
Disc (mc) input	Phono	0.019mV	101ohms
Aux input	Phono	18.9mV	38kohms, 100pF
Disc equalisation error, 30Hz-15kHz			+0dB, −0.2dB
Size (width, height, depth)			43 x 34 x 12.5cm
Typical price inc VAT			£190



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Sugden C128/P128

J E Sugden & Co Ltd, Valley Works, Station Lane, Heckmondwike, West Yorks WF16 0NF
Tel (0924) 404088

Sugden's latest amplifier combination consists of the unusual *C128* pre-amplifier and the *P128* power amp. The review sample *P128* was a production item, but at the time of writing the only *C128* available was in what appeared to be a rather rough pre-production form, and so this report can only be provisional.

The *P128* is a double-mono unit, constructed as two power amps literally strapped together under a cosmetic top cover. With heatsinks dominating the front and rear aspects it has no real front panel as such. Rated at 130W per channel it employs MOSFET output stages and each channel has double mains transformers, making four in all.

The *C128* interior was also rather messy and I would have thought rather hard to make. Discrete transistor 'op amp' stages are used with a special selection of component types, and high quality separate supply regulators are used. Input buffers are employed for both mm and mc, inputs, and the volume control is a top quality model.

Sound quality

On the review sample, the mc buffer stage gave problems and so the amp was not auditioned via moving-coil, as a replacement was not supplied by press date. The moving-magnet input was fine, and from the system design should actually be representative of both disc inputs. As a combination, the *C128/P128* scored a respectable 'good plus' on audition, the mid tonal balance proving pleasantly sweet and lacking the usual hard or brittle quality so often encountered. Stereo focus and image precision were fine and good ambience and depth were also heard. The sound was well detailed, bass good and the treble better still.

Via auxiliary a neutral, musical sound emerged with only a mild restriction of depth. Auditioned separately, the power amplifier sounded slightly bandlimited with a mild lack of crispness and a slightly in articulate exposition of transients and dynamics. It proved to be a 'powerhouse' reaching 107dBA into the normal speaker and 104.5dBA into the adverse load, making it one of the most powerful models tested. It also sounded pleasant in mild clip and could get very loud indeed.

The pre-amplifier, tried separately, proved capable of a still better-focused and defined sound, and is potentially in the 'very good' class with a most musical overall character.

Lab results

The 8ohms continuous output over the power bandwidth was close to specification at 21.5dBW. A good bandwidth and level was maintained into 4ohms on continuous drive. A quite good peak current capacity was measured at + 21, – 23A, this reflected by the good peak level delivery. A substantial peak 22.8dBW into 8ohms (nearly 200W) fell to 21.5dB 4ohms, and a still reasonable 18.0dBW

RECOMMENDED

into 2ohms. At full power to 20kHz, harmonic distortion was worsening but elsewhere both IM and harmonic distortion levels were very good. Signal-to-noise ratios were also satisfactory. The power amp dc offset was satisfactory but that from the pre-amp was not — beware using it with a dc-coupled power amp, if this sample is representative.

Input overload margins were exemplary and while stereo separation was satisfactory it was measured as strangely constant over the spectrum. Channel balance and volume tracking were fine. All the input and pre-amp output characteristics were entirely satisfactory, while the power-amp sensitivity was compatible with direct line source connection via a passive control.

Perhaps contributing to the sweet sound via disc, the RIAA equalisation rolled off above 10kHz, to −3dB at 20kHz, which was a trifle premature. The bass rolloff sensibly follows the IEC practice, and the response was otherwise very flat.

Conclusion

Taking the *P128* first, this very powerful unit is sweet-sounding, and produces good stereo, offering quite good value for money. Where wide dynamic range is required with an output of 200W and good load tolerance, the *P128* can be recommended.

The *C128* partners it well and the pair make a worthwhile combination. Although judged here in pre-production form the *C128* promises more, and could be a front rank product in its own right in its chosen price category. It can certainly do justice to a smaller but superior power amplifier but only trial of a production sample could finally determine its abilities.

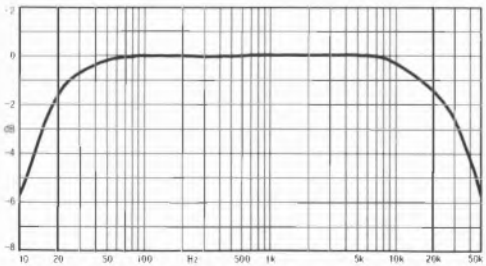
Test measurements

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

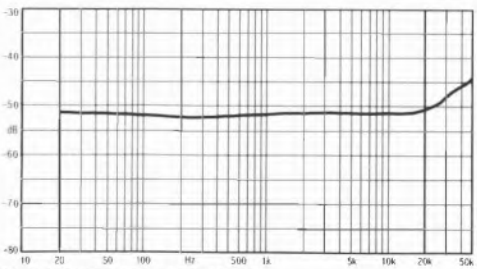
GENERAL DATA Pre- and power amplifier

Power output			
Rated power into 8ohms, maker's spec	130W(=21dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	21.9dBW	22.0dBW	21.5dBW
Both channels, 4ohm load	19.7dBW	20.0dBW	19.4dBW
One channel, 2ohms, pulsed	17.2dBW	18.0dBW	17.4dBW
Instantaneous peak current		+21 A	−23 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−78dB	−77dB	−55dB
Intermodulation, 19/20kHz, rated power, aux input			> −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −80dB
Intermodulation, 19:20kHz, at 0dBW, disc (mc)			> −80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−74dB
Disc (mc) input (IHF, CCIR weighted)			−72dB
Aux/CD input (IHF, CCIR weighted)			−97dB
Residual, unweighted (volume control at min)			−64dB*
DC output offset			11mV
DC offset, pre-amp			35mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	36dB	36dB	36dB
Disc (mc) input (IHF)	35dB	36dB	30dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−51dB	−51dB	−51dB
Aux input	−50dB	−50dB	−50dB
Output impedance (damping)	0.2ohm	0.22ohm	0.3ohm
Channel balance, disc, at 1kHz			0dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.1dB	1.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.17mV	50kohms, 150pF
Disc (mc) input	Phono	0.017mV	1kohm, 0.1nF
Aux input	Phono	16.5mV	18kohms
Power amp	Phono	53mV	50kohms
Output, pre-amp (tape)			16.1V max, 48ohms
Disc equalisation error, 30Hz-15kHz			+0dB, −1dB
Size (width, height, depth)			22.5 x 26 x 12.5cm, 47 x 31 x 7.5cm
Typical price inc VAT			£275, £385

* *This residual originates in power amplifier.*



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Tandberg 3012

B&W Loudspeakers Ltd, Meadow Road, Worthing, West Sussex
Tel (0903) 205611

Tandberg's revisions to the *3012* integrated amplifier were completed just in time for the latest *A* version to be included here. A high quality, upmarket model, rated at 100W per channel, this slimline design is well finished in satin alloy and comes well equipped. Speaker connections are via 4mm socket/binding posts (removal of the black caps exposes the sockets) while the signal connections are via phono sockets. A headphone jack is also provided. Inputs available are disc (moving-coil and moving-magnet) tape 1 and 2, tuner and aux/CD, while the bass and treble controls have a defeat switch. The balance control is concentric with the volume knob. Large slots in the cover allow free airflow to the inboard heatsinks, which run fairly hot after extended listening. This amplifier also benefits sonically from a good warm-up period.

Inside, a large toroidal transformer is fitted (producing some mechanical hum) while the output stages are direct coupled complementary with Hitachi MOSFET output devices type K175/J355. Relay muting protection is employed and the construction uses a number of high-quality components, particularly in the signal-carrying area. This is where the most significant improvements in *3012* sound quality have occurred.

Sound quality

Reference to an earlier *3012* sample confirmed that with the *3012A* Tandberg had indeed made some significant advances in the clarity and depth of reproduction. Rated 'good' on audition, the amplifier showed a distinctive character with a rather clinical 'coldness' this ameliorated slightly when it was (physically) well warmed up. This factor together with some 'feathery grain' in the treble, were the main weaknesses in what was in other respects a very good sound. It appeared sharp and alive with exceptional percussive and transient effects. Bass was powerful and extended, with a dynamic, almost tactile attack. Stereo depth and focus were both well portrayed, while musical detail was also pretty good, especially via the aux input.

A mild veiling of information was detected via the mc and mm disc inputs, which were in other respects to the required standard, and the *3012* could play loud, reaching 105dBA normally, but only 102dBA into the adverse load, where it seemed less comfortable.

Lab results

Rated at 20dBW, 100W per channel, the *3012A* provided 21.7dBW minimum over the 8ohm power bandwidth. Into 4ohms, continuous, the

loss was a little higher than expected at 3dB, while high frequency peaks into 2ohms were shunned. The peak current capacity was somewhat restrictive, at ±15A, in view of the 22.2dBW peak level available and this shows in the fall of 6.6dB from 8 to 2ohms.

Both harmonic and intermodulation distortion results were fine and input overload levels exemplary. Noise levels were good, while dc output offset was satisfactorily low. Stereo separation was well above average and power-amp output resistance negligible. Channel balances were fine and well maintained throughout the dynamic range. Input characteristics were pretty standard though with the high mm sensitivity allowing direct connection of some of the highest-output mc cartridges. The tone controls offered dual-frequency turnover points as shown on the graph, while the auxiliary response was very wide band, deviating very little from 10Hz to 50kHz. RIAA equalisation was very uniform.

Conclusion

One's opinion of this finely crafted and generously powered amplifier depends on the importance placed on the idea of a neutral, relaxed tonal balance. We found the *3012A*, even when fully warmed up, to be rather 'clinical' and 'cold' in general character; conversely, with tonally-rich speakers and/or cartridge this may represent a positive factor in aiding system balance. Placed in the 'worth considering' category, on the grounds of its other considerable merits, this model would need careful auditioning in view of room and system requirements; it could just meet your particular needs.

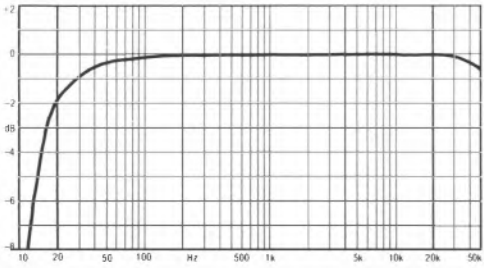
Test measurements

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

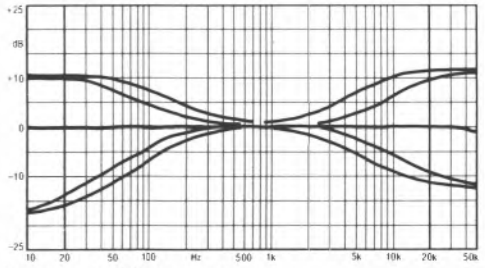
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			100W(= 20dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.8dBW	21.4dBW	21.3dBW
Both channels, 4ohm load	18.1dBW	18.5dBW	18.4dBW
One channel, 2ohms, pulsed	15.2dBW	15.6dBW	9.8dBW
Instantaneous peak current		+ 15 A	– 15 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 77dB	– 79dB	– 76dB
Intermodulation, 19/20kHz, rated power, aux input			> – 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			– 79dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			– 75dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 81dB
Disc (mc) input (IHF, CCIR weighted)			– 76dB
Aux/CD input (IHF, CCIR weighted)			– 74dB
Residual, unweighted (volume control at min)			– 80dB
DC output offset			17mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	37dB	34dB	34dB
Disc (mc) input (IHF)	34dB	33dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 76dB	– 76dB	– 53dB
Aux input	– 80dB	– 77dB	– 54dB
Output impedance (damping)	0.06ohm	0.06ohm	0.11ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0.1dB	0.8dB	0.2dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.177mV	47kohms, 90pF
Disc (mc) input	Phono	0.01mV	149ohms
Aux input	Phono	15.86mV	97kohms, 18pF

Disc equalisation error, 30Hz-15kHz + 0dB, – 0.9dB
Size (width, height, depth) 43 x 38 x 8.5cm
Typical price inc VAT £520



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Tandberg 3002/3006A

B&W Loudspeakers Ltd, Meadow Road, Worthing, West Sussex
Tel (0903) 205611

Developed from an earlier series of separates that did well in *HFC* over two years ago, this top-line Tandberg amplifier system comprises the *3002A*, a versatile pre-amplifer, and the *3006A*, a large 150W per channel power amplifier. These sell at over £900 for the pair, and this price level, a decent standard of performance is obviously required.

The pre-amplifier offers multiple input selection from tape 1 and 2, tuner, aux/CD and disc. Moving-magnet and moving-coil are both catered for, with various mm loading options giving 100k, 47k and 33kohms, with additional capacitance of 20, 120 350pF. The sensitive moving-coil input has a 150ohm input resistance. A headphone socket is provided and this has its own volume control. Other facilities include a subsonic and loudness filters, bass and treble adjustment and a mono switch.

No controls are provided on the power amplifier, the panel bare except for on/off and the two peak clipping indicators. Speaker connections are 4mm socket/binding posts, while signal connections are phono.

The power amplifier uses a massive toroidal transformer with generous reservoir capacitors. The output stages are direct-coupled complementary using Hitachi MOSFET devices and as with the *3002*, recent updates include the use of selected high quality components in the signal coupling stages. Constructional quality is to a very high standard in both units.

Sound quality

Scoring 'average plus', the audition results must however be regarded as a serious shortfall from the required standard. It was undoubtedly inferior to the *3012A* integrated model. An over-riding impression was of a 'hard' tonal quality which 'thinned' the reproduction of vocal passages as well as compressing stereo depth effects. The bass register was in fact quite good, but it lacked the lean attack of the *3012*, while the mid focus and image precision were also inferior. Via moving-coil, the sound seemed somehow dulled, with muted transient, yet the treble appeared a trifle 'obvious' and 'brash'. This aspect improved somewhat via the moving-magnet input. The amplifier did not seem particularly happy driven to mild clipping nor was the adverse load handled too well at the highest levels. Nevertheless, substantially loud peak sound levels were attained of 107dBA into 8ohms, with 105dBA into the 3.5ohm load, the latter level one of the highest recorded for the group.

Lab report

Meeting specification by a small margin, the amplifier produced 22dBA over the 8ohm

loaded power bandwidth and it held up well into 4ohms, both channels driven.

The peak current available was pretty good at ± 20amps, and helped to maintain good output levels into the 2ohm load, measuring a reasonable 3.5dB lower than the generous 23.4dBW peak programme 8ohm level (this is over 200W per channel).

Harmonic and intermodulation distortion results were particularly good, as were the input noise levels. The dc offset was negligible both at the speaker terminals and at the pre-amp output. Input overload margins were ample while the stereo separation was about average, particularly at the higher frequencies. Power amp output impedance was negligible, as usual. Channel balance was accurate via the tested inputs over a wide volume control range. The inputs were in my view excessively sensitive, particularly the CD input which only required 30mV or so (IHF); However, the good overload margins suggested that no problems will result. The pre-amplifier was capable of driving most power amps and the power amp input presented no problems.

RIAA equalisation showed a touch of excess IEC rolloff of −4dB at 10Hz, but was otherwise commendably uniform. No ultrasonic rolloff was incorporated, though this can be helpful in many designs.

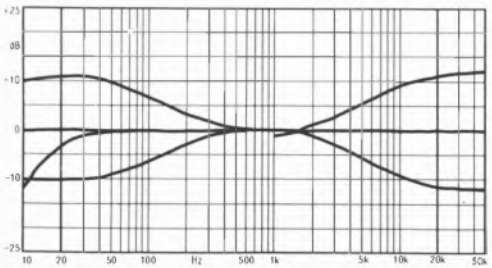
Conclusion

Despite some recent upgrades, the *3000* series has not held up well against new competition. Recent lower priced products including Tandberg's own integrated model show these more costly products to be at a disadvantage, and no recommendation can apply here.

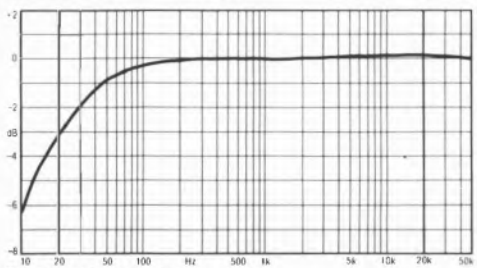
Test measurements

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

GENERAL DATA			Pre- and power amplifier
Power output			
Rated power into 8ohms, maker's spec			150W(= 21.5dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	22.4dBW	22.9dBW	22.0dBW
Both channels, 4ohm load	20.2dBW	21.0dBW	20.2dBW
One channel, 2ohms, pulsed	18.9dBW	19.9dBW	19.3dBW
Instantaneous peak current		+ 20 A	− 20 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	− 91dB	− 92dB	− 87dB
Intermodulation, 19/20kHz, rated power, aux input			> − 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> − 80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)			− 77dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			− 84dB
Disc (mc) input (IHF, CCIR weighted)			− 75dB
Aux/CD input (IHF, CCIR weighted)			− 87dB
Residual, unweighted (volume control at min)			− 78dB
DC output offset			4mV
DC offset, pre-amp			1mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	39dB	36dB	34dB
Disc (mc) input (IHF)	33dB	33dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	− 70dB	− 60dB	− 42dB
Aux input	− 73dB	− 61dB	− 44dB
Output impedance (damping)	0.04ohm	0.04ohm	0.09ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	− 20dB	− 60dB
Aux input	0.1dB	0.9dB	0dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.13mV	variable
Disc (mc) input	Phono	0.009mV	149ohms
Aux input	Phono	9.8mV	80kohms, 130pF
Power amp	Phono	76.4mV	20kohms, 120pF
Output, pre-amp			11.0V max, 558ohms
Disc equalisation error, 30Hz-15kHz			+ 0.2dB, − 2dB
Size (width, height, depth)			43 x 38 x 8.5cm, 43 x 38 x 8.5cm
Typical price inc VAT			£415, £510



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Technics SU-V303

National Panasonic (UK) Ltd, 300-318 Bath Road, Slough, Berks
Tel (0753) 34522

Previous-generation Technics models have done well in *Choice* and it was therefore something of a challenge for one of their 'New Class A' models to see if the performance standard could be repeated, if not exceeded.

A compact modestly priced integrated amplifier, rated at 40W per channel, the unit is cleanly styled in satin silver. Facilities included a headphone outlet, rather wide-range bass and treble controls and A-plus-B speaker switching, together with the prefered type of 'record out' selector. Input selection was from disc (moving-magnet), tuner, CD/aux, tape 1 and 2. Subsonic and loudness filters complete the front panel details, while at the rear, barecable binding posts connect to the speaker cables, with the input connections exclusively in phono.

A key feature of the new range is the use of a small microprocessor to monitor and direct the optimum biasing levels for the output stage, the technique including dynamic biasing which results in the so called 'New Class A' system.

Inside, mains wiring was to a commendably safe standard, while much of the amplifier is constructed to a large printed circuit board. The disc amplifier is based on a dual integrated circuit with feedback equalisation, while the output amplifiers are direct-coupled complementary, with the usual Japanese electronic protection incorporated via a monitoring IC, this operating a muting/disconnect relay.

Sound quality

Scoring a little below average, the sound quality was rather unexceptional, which was 'about right' for the price.

Via the moving-magnet input, the amplifier was felt to be in good control, in a well balanced manner. The vocal balance was a touch 'thin' and nasal sounding but the stereo image showed promising width, with some impression of depth and ambience. Stereo focus was felt to be reasonably sharp.

Via the auxiliary input, some of the detail present in the original programme was judged to be absent, the vocal lines seemed to lack full expression and immediacy. It sounded slightly 'hard', this worsening toward full power and noticeably so into mild clipping. Quite good peak levels of 102dBA were recorded, and the adverse load tolerance was

fairly good, the amplifier reaching 99.5dBA before entering clipping or overload.

Lab results

Rated at 16dBW, the *303* reached 17.1dBW over the whole 8ohm power bandwidth. The reduction at 4ohms, both channels driven was reasonable, and with a symetrical peak current capability of ± 8A it made a good attempt at the extreme loading of 2ohms.

Both total harmonic and high frequency intermodulation distortion results were very good, and input signal-to-noise ratios were also impressive. The dc output offset was negligible as was the output impedance at the speaker terminals. Input overload margins were ample and the stereo separation about average. Channel balance and volume control tracking was also very good. The disc input had a surprisingly high input capacitance of 310pF, and if a typcial 130pF is added by the tonearm, the 440pF total may need to be considered when choosing a suitable cartridge. The graph shows the subsonic filter, a slow-slope design measuring −3dB at 40Hz, which is rather high up the band. The tone control responses showed broader lift in the bass than in the treble but this was of little significance. The disc input had a sensible subsonic rolloff on the RIAA equalisation in any case, with −3dB at 20Hz and −13dB at 10Hz.

Conclusion

This is an ordinary, straightforward and inexpensive integrated amplifer, and while the sound is nothing to write home about, it is nonetheless of sufficient quality to suggest that this model is worth considering.

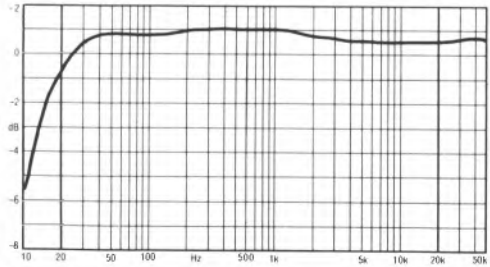
Test measurements

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

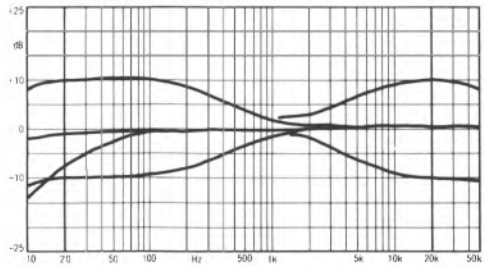
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec.			40W(= 16dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	17.6dBW	17.7dBW	17.1dBW
Both channels, 4ohm load	15.2dBW	15.6dBW	14.9dBW
One channel, 2ohms, pulsed	14.0dBW	14.3dBW	14.0dBW
Instantaneous peak current		+8 A	−8 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−82dB	−86dB	−81dB
Intermodulation, 19/20kHz, rated power, aux input			> −80dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−82dB
Aux/CD input (IHF, CCIR weighted)			−87dB
Residual, unweighted (volume control at min)			−81dB
DC output offset			2mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	33dB	32dB	32dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−62dB	−60dB	−43dB
Aux input	−67dB	−61dB	−42dB
Output impedance (damping)	0.04ohm	0.04ohm	0.06ohm
Channel balance, disc, at 1kHz			0.6dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.3dB	0.7dB	0dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.42mV	44kohms, 310pF
Aux input	Phono	24.2V	60kohms, 240pF

Disc equalisation error, 30Hz-15kHz . . . . . +0dB, −0.5dB
Size (width, height, depth) . . . . . 43.5 x 28 x 11cm
Typical price inc VAT £129



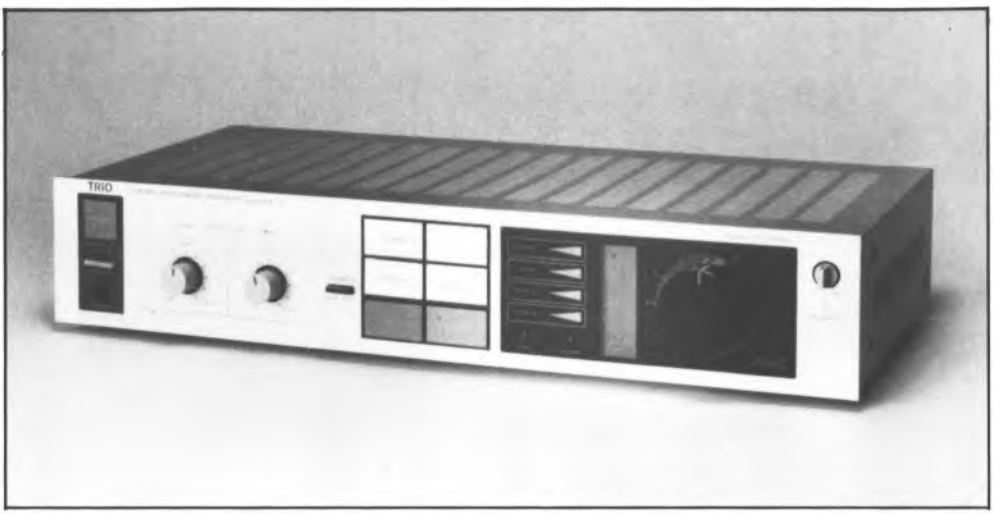
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Trio KA-31

Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD
Tel (0753) 716911



Selling for under £100, this budget integrated model is rated at 30W per channel, or 15dBW. Styled in silver alloy and blue, with a tidy front panel, it is quite well equipped — for example, two sets of speakers may be connected and both muted as required for headphone listening. Bass and treble controls are included with a quoted ± 10dB range. Inputs include tuner, disc, aux and tape, selected via a touch panel with electronic switching; two tape decks may be used, with a dubbing connection for 'A' to 'B'. The amplifier also sports fluorescent power level indicators.

Examining the interior, this amplifier was found to be neatly constructed, offering a fine exercise in product engineering. In typcial Japanese style, it uses several printed circuit boards, these joined by ribbon cable, with an integrated circuit type AN6555 responsible for the disc input. Standard series RIAA feedback equalisation is used, followed by another '6555, this dual IC used in the tone control/buffer section.

The 'short' power amplifier is of simple design, with a modest, direct-coupled and fully complementary output stage. The smallish mains transformer supplies 2 × 4700μF reservoir capacitors.

Sound quality

Judged as generally below average on sound quality grounds, nonetheless, the *KA31* appeared reasonably neutral and was fortunately low in 'fatigue-inducing' properties. Conversely, it appeared to compress musical dynamics, thereby making the music sound 'flat' and less interesting.

Via the moving-magnet disc input, the bass showed some softness and a mild boom. The midrange was reasonably focused in stereo terms, although fine musical detail appeared masked. More serious was the weak performance on subjective transparency, while stereo depth was barely reproduced.

Via the auxiliary input, the amp sounded fairly smooth and sweet, although still compressed in dynamic terms with generally average definition, and below-average rendition of depth and ambience. Images were in consequence rather two dimensional. It behaved quite well into clip, reaching 100.5dBA, this fairly well maintained into the adverse load, peaking 98dBA here.

Lab results

With a 30W (15dBW) rating, this amplifier showed an impressive power bandwidth of

15.9dBW for 8ohms. The small size of the transformer was reflected by the shortfall into 4ohms on continuous loading. Notably asymmetric at +11, −16A, this amplifier's peak current capability was more than sufficient and the 2ohm load was consequently quite well handled on peaks. With 16.7dNW available into 8ohms, value dropped by 3.8dB into 2ohms.

Harmonic distortion figures were good but some two-tone high-frequency intermodulation was present towards full power. At lower levels via the disc input, the corresponding result was fine. Noise levels were good and the dc output offset satisfactory. Disc overload levels were fine, while the stereo channel separation was about average, and although higher than usual, the 0.3ohm output impedance was of no significance.

Channel balance and volume tracking was fine, and the input parameters in order, noting the 220pF of disc input capacitance. The tone controls are shown; the bass curve peaks higher in the band than usual at 110Hz. Sensibly bandlimited, the curve for RIAA equalisation showed a mild rolloff in the treble. In fact this roll off is probably not a bad thing in view of the bright sound of some inexpensive cartridges.

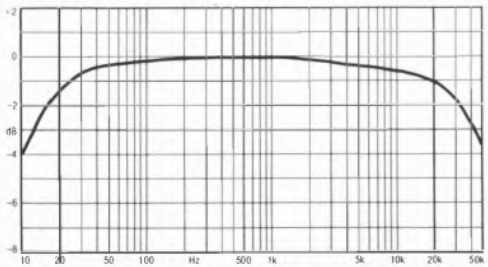
Conclusion

While this amplifier has a normal performance and a reasonable sound quality it has nothing special to offer. By the best standards of the review group at the price, this budget Trio amplifier lacked clarity, and more especially stereo depth; on this basis, it could not be considered for recommendation.

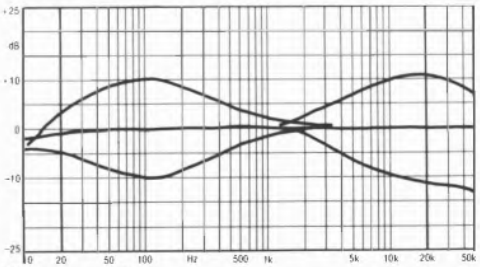
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			30W(= 15dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.2dBW	16.2dBW	15.9dBW
Both channels, 4ohm load	12.9dBW	13.6dBW	13.3dBW
One channel, 2ohms, pulsed	12.1dBW	12.9dBW	12.9dBW
Instantaneous peak current		+11 A	−16 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−83dB	−85dB	−70dB
Intermodulation, 19/20kHz, rated power, aux input			−58dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−77dB
Aux/CD input (IHF, CCIR weighted)			−84dB
Residual, unweighted (volume control at min)			−79dB
DC output offset			31mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32dB	30dB	25dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−62dB	−63dB	−43dB
Aux input	−72dB	−67dB	−45dB
Output impedance (damping)	0.30ohm	0.30ohm	0.31ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0dB	0.3dB	1.5dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.41mV	48kohms, 220pF
Aux input	Phono	26.4mV	31kohms, 150pF
Disc equalisation error, 30Hz-15kHz			+0dB, −0.8dB
Size (width, height, depth)			44 x 23 x 9cm
Typical price inc VAT			£95



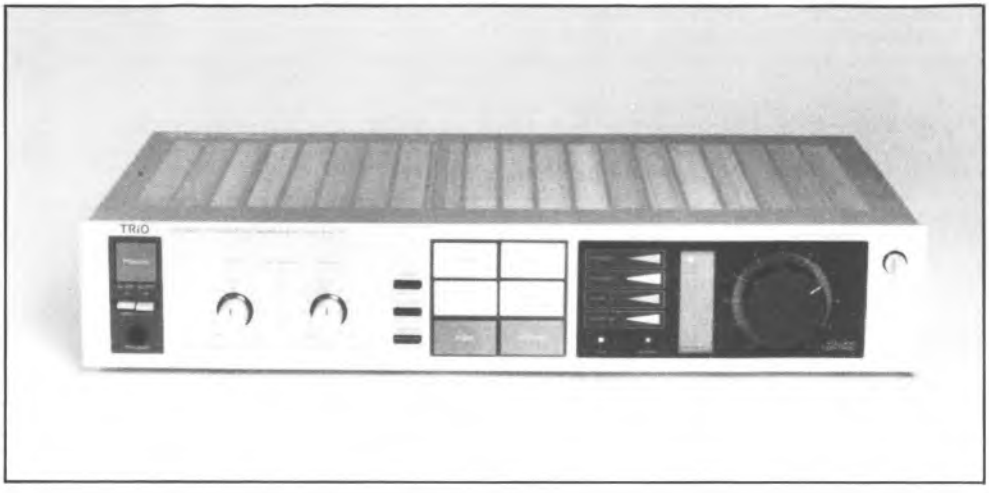
Disc input: RIAA equalisation accuracy



Tone control/filter responses

Trio KA-71

Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD
Tel (0753) 716911



Related to the *KA-31*, this Trio amplifier sells for around £150, and provides a considerable increase in power to a rated 65W (18dBW). Its feature line-up is much the same as the *'31*, and includes a headphone socket, two sets of speakers, bass and treble tone controls, a mono switch, loudness and subsonic filter plus inputs for tuner, disc (moving-magnet only), with tape units A and B. The case styling is straightforward in a silver aluminium alloy, with blue on some fascia areas. The speaker cables connect to binding posts at the rear. Signal input terminals are all in phono.

A very substantial mains transformer is fitted, well screened magnetically to reduce hum induction. It feeds 2 × 7500μF reservoir capacitors. Well heatsinked, the direct coupled complementary output stage uses massive Sanken C2871/A1215 output transistors. Strangely a switch is mounted on the rear panel which alters the transformer secondary supply voltage, and is marked 4 or 16 ohms, the latter position intended presumably to reduce the possibility of overheating with very low impedance loads.

The mains wiring was none too tidy, with unshrouded parts fairly close to the amplifier's metal lid. Otherwise the construction quality is pretty good, and the low level circuitry is much the same as in the *KA-31*, with a similar use of integrated circuits.

Sound quality

Rated about 'average' the *KA71* represents yet another rather ordinary integrated amplifier. Via the moving-magnet disc input, the stereo focus was unspectacular while depth effects were only superficial. The treble range was of reasonable quality and clarity, but the bass sounded lumpy and lacked definition, as well as attack. Generally, however, it sounded fairly pleasant with freedom from listener fatigue.

Via auxiliary, there was some improvement notably in the depth department, while the bass lines sounded more tuneful, and the stereo focus also sharpened up a little. It remained vaguely lightweight however and showed increasing hardness at higher levels.

Its 8ohm delivery was quite loud at 104dBA, reducing to 102dBA into the adverse load, which was a respectable result. Unfortunately it didn't sound so good into the lower impedance loads, and its clipping performance was rated as only average.

Lab results

Rated at 65W per channel or 18dBW, the *KA71* comfortably reached 18.8dBW over the 8ohm

power bandwidth. The loss on 4ohm continuous rating was more than anticipated, the result here 3dB lower at 20Hz. The amplifier did have a generous peak current capacity, somewhat asymetric at + 25, – 30A. Peak programme level into 8ohms measured 19.5dBW (approaching 100W) and held well into 2ohms at 16.4dBW.

Distortion was good at moderate powers while towards full power and the high frequency limit the results were poorer. Signal-to-noise ratios were fine but the dc offset at the speaker terminals was too high to be acceptable at over 100mV.

Input overload margins were fine, while stereo separation was about average. Output impedance was low while the channel balance and volume tracking were very good. Input characteristics were normal, though the disc input capacitance was fairly high at 290pF, which could be a factor in the choice of a moving-magnet cartridge.

The RIAA equalisation was quite well balanced with a mild treble rolloff and sensible tailoring at the band edges. The tone controls gave the usual results with an approximate range of ± 12dB.

Conclusion

This straightforward amplifier provided a load-tolerant and substantial output level for the price. Conversely, its sound quality was pretty average and certainly not interesting enough for a recommendation here. It seems that established brands such as Trio will have to make real advances in sonic engineering if they are to keep a competitive hold on the future market.

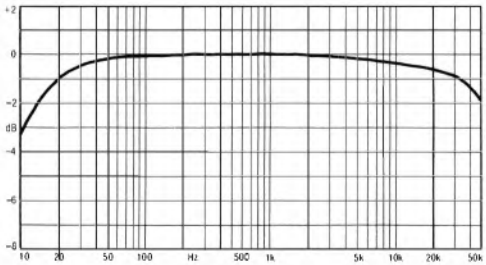
Test measurements

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

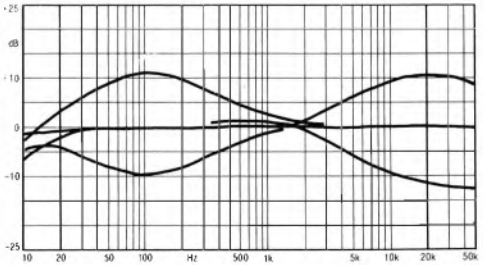
GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			65W(= 18dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	18.8dBW	19.0dBW	19.0dBW
Both channels, 4ohm load	16.0dBW	16.5dBW	16.5dBW
One channel, 2ohms, pulsed	15.5dBW	16.4dBW	16.4dBW
Instantaneous peak current		+ 25 A	– 30 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	– 75dB	– 83dB	– 71dB
Intermodulation, 19/20kHz, rated power, aux input			– 69dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> – 80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			– 77dB
Aux/CD input (IHF, CCIR weighted)			– 82dB
Residual, unweighted (volume control at min)			– 73dB
DC output offset			117mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32dB	30dB	24dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	– 60dB	– 56dB	– 33dB
Aux input	– 62dB	– 56dB	– 34dB
Output impedance (damping)	0.19ohm	0.20ohm	0.24ohm
Channel balance, disc, at 1kHz			0.1dB
Volume/balance tracking	0dB	– 20dB	– 60dB
Aux input	0dB	0.5dB	1.0dB

Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.26mV	49kohms, 290pF
Aux input	Phono	17.0mV	51kohms, 120pF

Disc equalisation error, 30Hz-15kHz + 0dB, – 0.5dB
Size (width, height, depth) 44 x 23 x 9cm
Typical price inc VAT £149



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Yamaha A-300

Natural Sound Systems Ltd, Unit 7, Greycaine Road, Watford WD2 4SB
Tel (0923) 36740

A budget amplifier in a smart satin-black case, the *A300* offers the usual set of facilities on its well laid-out front panel — switching for A and B speaker sets, a headphone socket, bass and treble rotary controls plus a fully variable loudness control. Input selection is for tape/aux, tuner and disc (moving-magnet). The speaker cables connect to rather light-duty spring clip terminals while all inputs are via the usual phono sockets.

Internally the *A300* was very tidy, partially reflecting a need to minimise the internal circuitry and components to meet a cost target. A single printed circuit board is used with a large aluminium 'U' bracket as a heatsink. The common power supply is modestly sized, and the pre-amp, usual line buffer stage is omitted. The power amplifier section has a higher than normal gain, and has the tone control circuits incorporated in its feedback loop. The output stage is direct coupled complementary, with a relay for switch on muting. Disc amplification for the moving-magnet input is carried out by the usual dual integrated circuit with series feedback equalisation.

Construction is to the usual Yamaha standard and is of good quality overall.

Sound quality

The *A300* scored 'above average' on the listening test sessions, this a fine result at the price. While it demonstrated a slightly 'hard' tonal quality, tending to place the stereo image rather up front, at the same time it showed promising depth and ambience and good stereo focus.

Via the disc input, the bass was a little soft but not seriously so, and programme dynamics were portrayed with greater faithfulness than usual at this price level.

Via the auxiliary input the rendition of depth and space was encouraging, with once again a reasonably solid central image focus. Detail was good with a pleasing separation of complex musical strands. In the bass it lacked the real power and definition of the larger models, but performed quite well nonetheless. It sounded satisfactory into mild clipping, providing 100dBA into the standard load, and a modest 97dBA into the adverse load.

Lab results

Rated at 25W (14.5dBW), the amplifier specifications were cut a little fine, the amplifier just reaching 13.9dBW over the single-channel

8ohm power bandwidth. On the plus side, the level held up well on 4ohms continuous dual-channel duty. For the size, the peak current available was quite generous at ±9A. Into 8ohms, the peak output level reached 15.1dB, falling very little into 4ohms, and a reasonable 3.6dB into 2ohms; a pretty tolerant amplifier, this.

Both harmonic and intermodulation results were low and good signal-to-noise ratios were also demonstrated. The dc offset at the output terminal was satisfactory. Input overload margins were ample, while stereo channel separation was rather better than average, and channel balance and volume control tracking were in fact very good.

Disc input capacitance was on the high side at 260pF, though this is now quite a common feature. The other input characteristics were fine. The tone control responses were a little odd showing mild shelf cut, and stronger narrower boost at the frequency extremes. RIAA equalisation was essentially uniform, with a hint of treble lift above 10kHz, and no band-limiting or tailoring was evident.

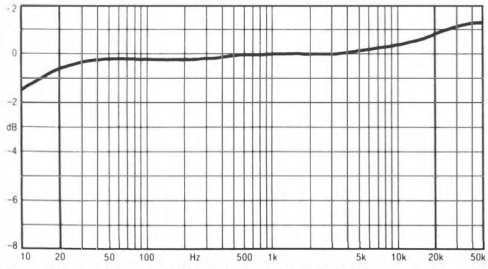
Conclusion

This attractive budget amplifier offered good value for money. The sound was clear, well focused and compared with favourably with many designs at higher prices. It also provided a well-balanced overall performance, with good build quality and finish, plus a versatile set of facilities, and at a price rather under the £100 level; such a performance indicated a Best Buy rating.

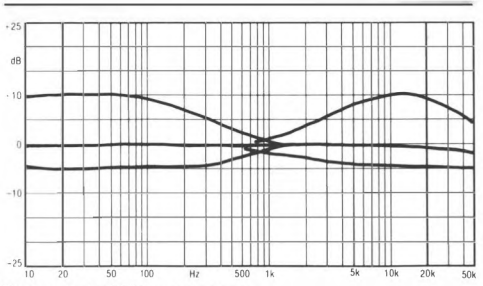
Test measurements

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

GENERAL DATA			Integrated amplifier
Power output			
Rated power into 8ohms, maker's spec			25W(= 14dBW)
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	14.3dBW	14.5dBW	13.9dBW
Both channels, 4ohm load	12.9dBW	13.2dBW	12.7dBW
One channel, 2ohms, pulsed	11.4dBW	11.7dBW	11.5dBW
Instantaneous peak current		+9 A	−9.4 A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	−82dB	−85dB	−73dB
Intermodulation, 19/20kHz, rated power, aux input			−73dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			> −80dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			−81dB
Aux/CD input (IHF, CCIR weighted)			−82dB
Residual, unweighted (volume control at min)			−75dB
DC output offset			24mV
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	32dB	31dB	31dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	−69dB	−67dB	−53dB
Aux input	−72dB	−68dB	−53dB
Output impedance (damping)	0.06ohm	0.06ohm	0.12ohm
Channel balance, disc, at 1kHz			0.3dB
Volume/balance tracking	0dB	−20dB	−60dB
Aux input	0.3dB	0.6dB	0.1dB
Input data	socket type	sensitivity	loading
Disc (mm) input	Phono	0.44mV	46kohms, 260pF
Aux input	Phono	29.5mV	38kohms, 40pF
Disc equalisation error, 30Hz-15kHz			+0.5dB, −0.2dB
Size (width, height, depth)			44 x 30 x 10cm
Typical price inc VAT			£90



Disc input: RIAA equalisation accuracy



Tone control/filter responses

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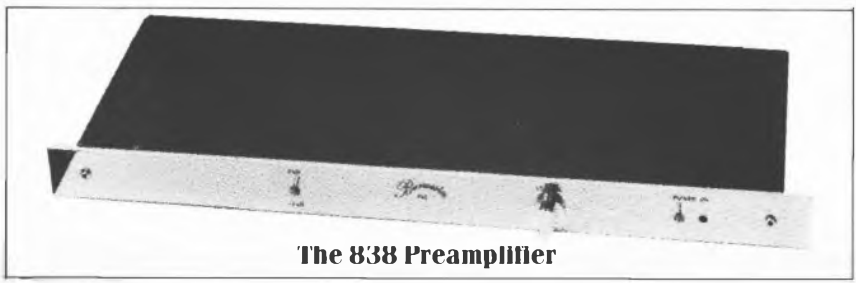
The 785 is the mainstay of the range of Burmester electronics. The sound quality of this preamplifier is superb. It is a true audiophile product that will complement some of the finest audio systems available. And yet the 785's elegance, its versatility, its reliability and even its price justify its inclusion in a variety of quality audio systems. The 785 is also well suited for use with active loudspeakers, including the latest range from Meridian.

The 785's reception in Europe has been unequivocal. It is considered to rank among the best preamplifiers currently available. In the short time that it has been distributed in the UK the 785 has built up a substantial reputation and has been favourably compared to preamplifiers costing considerably more. A *Hi-Fi for pleasure* test report (May 1982) rated the 785 very highly: "A worthy contender for a place at the top table." And in *Practical Hi-Fi* (Dec. 1982): "Sonically it is excellent . . . Very good indeed by any standards and comparable with the Audio Research SP-8 I use, which is an incredible act to follow." While the review in *Hi-Fi News & Record Review* (Oct. 1983) concluded, "Its high sound quality rating makes it eligible for inclusion in the élite audiophile group of products, and it can be recommended for upmarket purchasers seeking a very high standard of build quality, versatility and finish, as well as fine sound and an immediate compatability with digital master program."

Of course for those seeking an even better sound quality, there are the 808 and 838 preamplifiers. The 808 is acknowledged as a bench-mark in preamplifier design. It joins a select group of 2 or 3 world-class preamplifiers that define the state-of-the-art. Many of the 808's specifications are at the theoretical limit and its sound quality is truly remarkable.

The 808 is very costly. But it is now possible to enjoy the sound quality of the 808 for a fraction of the cost. The 838 disc preamplifier utilizes the same advanced electronics and massive external power supply of the 808. The 838 can also be externally connected to your current preamplifier for use with high level inputs such as tape, tuner, CD. Of course, later you may wish to purchase the 838 high level preamplifier.

The 828 monoblock power amplifier has recently entered production after more than 3 years in development. As with the 808 it is quickly establishing itself as a bench-mark.



The 838 Preamplifier

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CONCLUSIONS: AMPLIFIERS

With the test programme complete, it is possible to sum up the general findings of the project, as well as to give specific conclusions on current amplifier designs.

This edition was my first *Choice* on the subject of amplifiers, and in retrospect I must say that it was an arduous as well as a rewarding undertaking! All the reviews in this issue are completely new, there being no reassessments of products previously tested, and the total includes over 50 amplifiers (many of which are comprised of separate pre- and power amplifiers) and nearly 20 tuners — which even in *HFC* terms is a very large number of reviews. There is no doubt that in recent years, and certainly since the last issue, the buying public has become more discerning over their choice of amplifier. We considered it essential that the auditioning be conducted in such a way so as to produce solid, clear-cut ratings, obtained under conditions of low stress; that is, as naturally as possible. Small listening panels were far more more closely in tune with the product sounds than, for example, the larger assembly used during the 'double blind' behind the curtain tests for the auditioning of loudspeakers. We did crosscheck a number of the test amplifiers under controlled conditions, in order to verify the ratings obtained under the less formal conditions. Those who believe that most if not all, amplifiers sound the same, and that in any case any differences could only be shown under very stringent listening conditions, will probably part company with us here! My experience is that amplifiers *do* sound substantially different, that these differences are often not exposed or even hinted at in the results of lab tests, and that the audible differences can themselves vary according to a number of factors.

Test conditions

Test conditions do play a part. For example, some models do not perform at their best when first switched on, and a warm-up period of some minutes is often desirable. This may be as short as five minutes duration with some, but much longer, even hours with models such as Mission *777*, Tandberg *3000* series and several others. This is because their output bias settings are adjusted for best operation when warm, and will not regain that adjustment until fully warmed up again.

Another factor is electrical matching, both in and out. For the latter, the ability to meet the demands of an awkward speaker load is important, depending on the type of speaker used. A 'kind' load may not expose the output weakness of some models. Conversely at the input, the disc stage is also important, whether moving-magnet and/or moving-coil. The first priority is for a decent match of sensitivity, noise level and overload margin to the chosen cartridge source. The overload problem is rarely encountered today, but there are exceptions, as the test results for the Creek, Nytech and to a lesser extent the Sondex, show. Insufficient sensititivity can spoil the signal-to-noise ratio; and listening test results are affected to a suprising degree by the presence of background noise, which can alter the perception of stereo depth and treble response balances.

Another factor is electrical load matching — is the amplifier input of the resistance and capacitance considered ideal for the cartridge? Although with a good moving-coil cartridge, loading effects may be mild, the story is different for moving-magnet cartridges, where noticeable changes in treble balance and measured response occur with variations in total input resistance and capacitance. A number of amplifiers showed more than 200pF of mm disc input capacitance, which would be influential. For the purposes of the listening tests, a low-impedance cartridge was used which effectively moved this variable. Where CD was used as a signal a source, its output (up to 2V rms) was sufficiently high to dictate rather low volume control settings. Where this was felt to have a possible bearing on the results, a 12dB RTJ attenuator was used in the CD signal lead to produce signal levels nearer normal, say 500mV.

Signal-to-noise and crosstalk

Interestingly very few of today's amplifiers can match the signal-to-noise ratio of the best CD players. The latter have been measured at 100dB, relative to full output for 1kHz ref CCIR/ARM weighting (better still with pre-emphasis.) The amplifier test results show figures in the 75-85dB range for a 1W output, IHF reference. Only if the figure for noise measurement was primarily due to power amplifier input noise could the quietest amplifier designs recover the full CD dynamic range in noise terms, at a 100W output (this being of course 20dB above the IHF level of

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1W).

Historically, amplifiers have not needed a particularly high stereo separation and indeed even now the case for high separation is unproven in subjective terms. Nonetheless CD sources provide 80dB and more over the whole band, which makes the separation results achieved for a number of amplifiers via their auxiliary inputs look rather silly — some were as poor as 35dB at 20kHz.

Frequency responses

Most amplifiers' auxiliary inputs were sufficiently uniform in terms of frequency response for this factor to be ignored, and with a few exceptions this was also true of the disc inputs, whose main variation was due to the presence or absence of the IEC-recommended low-frequency rolloff. Even here, subjective evaluation of bass tonal balance, transient quality, tightness and so on rarely correlated with the low-frequency equalisation differences.

Amplifiers often showed differences in sound via each class of input — disc mm, discs mc, and aux/CD and each therefore needed careful subjective consideration. Where the pre-amp was itself in doubt an alternative was often substituted, to give the matching power amplifier every chance. Total judgement with these varying input results was necessarily complicated.

As the work on the issue progressed new amplifiers were introduced, and some of these were of quite outstanding performance in their respective categories. It was quite a surprise to hear a Rotel *RA820* for example, having become accustomed to the average run of the mill sound obtained at the £80-£200 level. The best models excepted, the average score for subjective sound in this category was 4.5 out 10, while the Rotel (the cheapest), scored a clean 6. Extending the comparision further, and excluding for the moment any consideration of the value of the extra facilities offered by up-market designs, it is worth noting that a number of well respected component systems in the £400-£700 range achieved a group score of 6.6 out of 10. Thus the Rotel, in company with its other lower priced 'Best Buy' colleagues, demonstrated that good sound is possible without resort to elaborate technology or expense.

Tone controls

Our results also appeared to deny certain audio legends, or perhaps more accurately folklore suspicions, concerning the necessarily deleterious effect of tone controls and integrated construction. Both the Audiolab and the Rotel have proved that neither factor need be a constraint, and the subjective preference for their performance in fact exceeded that of many separate component amplifiers without tone control facilities. Nonetheless I feel the designers of both models would probably agree that given a larger budget and a higher customer price, they could make further improvements, notably resulting from separate pre-and power amp construction, but it is hard to say whether the end results would wholly justify the costs entailed.

Amplifiers *do* matter. They affect the sound in a different way to other components, but because their influence may be less obvious, it does not necessarily follow that it is less important. The amplifier can often be the very component which influences the long term 'listenability' of a system.

Overall ratings

During the two years since the last issue of *Amplifiers* there has been a dramatic improvement in the performance of the less expensive models on the market; so much so, in fact, that the established ratings of some well known models has been seriously disturbed.

So for some readers and even some manufacturers, this new issue's product ratings may come as something of a shock. Nevertheless, these listings have been drawn up with great care, and given the conditions of test, they should be more accurate than before, since every review here printed has from start to finish been undertaken specifically for this issue — there are no reviews based on revisions of earlier work. However, as with every *Hi-Fi Choice* the judgement standards are to a great degress self-regulating, being determined by the overall standard of the product entry.

In addition to the mainstream of products, a sprinkling of what can only be called 'super-fi' models was included, these top-end designs helping to establish a perspective for the issue, as well as adding much interest; we took several monuments to fidelity off their pedestals and they too were submitted to all our rigorous test procedures.

In a sense therefore this edition of *Choice* can be seen as presenting a two tier analysis;

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in the first place, it principally covers the broad market and seeks to provide helpful 'Best Buy' ratings up to a £250 price level. At higher price levels however the 'law of diminishing returns' applies to amplifiers as it does to other hi-fi items, and 'Best Buy' ratings become inappropriate. Instead, a 'recommendation' at the higher price levels indicates a fine performance where value considerations are of declining importance. With this in mind, we can 'recommend' a £1500 model providing that we considered its performance to be of sufficient merit.

Models are also recommended in the under £250 category, the rating here influenced by particularly favourable combinations of power, style, facilities and specific price of availability as well as sound quality. In some systems or circumstances, a 'Recommended' unit may suit better than one which is a 'Best Buy' in the same class.

Throughout the product group here tested there is a third category also listed, namely 'worth considering.' Here the product shows merit, but in the reviewer's opinion its strong points are unevenly spread, resulting in a less well-balanced performance.

The remainder which receive no special comment we considered to be below par on grounds of value and/or performance.

A brief word on the review criteria. Sound quality of course comes first, followed by a weighted mix of technical performance, build quality and ergonomics ('feel', ease of use, and style). Below the £250 price level, we have not attached too much importance to the provision for moving-coil cartridges but above this price level they assume increasing importance and the sound quality via this input plays a commensurately greater part in the value judgements.

Where pre- and power combinations are concerned, these are in the main assessed primarily as a combination, but where it was considered appropriate, separate ratings are also given. In the 'Best Buys' and 'Recommendations' listing, separates follow in a section after the integrated and combined results.

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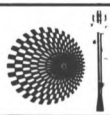

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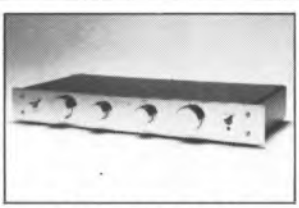

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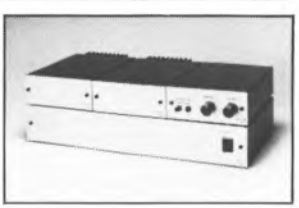

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BEST BUYS AND RECOMMENDATIONS: AMPLIFIERS

Here we have attempted to summarise the strong points of those models we have picked out as 'Best Buys', Recommended' and 'Worth Considering' in each price category; but please note that the full picture is only obtained by reading the reviews themselves.

Products which we have rated as 'Best Buy' are deemed to have shown themselves exceptional value for money in their price bracket, up to a maximum of £250. We feel that above this price level, sheer value for money is no longer so clearly definable or strictly relevant, and have accordingly restricted ourselves to 'Recommended' and 'Worth Considering' ratings on the £250-plus models.

BEST BUYS: UNDER £100

Rotel RA820 (£80)
A remarkable little amplifier of true high fidelity sound and bearing comparison with models up to twice the price. Output power is realistic and this load tolerant design is quite complete in all respects, offering great value.

Onkyo A22 (£85)
This tidy amplifier is well equipped and finished, offering above average sound quality as well as a good output level for the price. It is also quite load tolerant.

Yamaha A300 (£90)
This well finished amplifier in satin black, did well throughout the testing. It is reasonably load tolerant and has flexible tone controls, representing fine value for money.

RECOMMENDED: UNDER £100

Sansui AUD 101 (£99)
This amplifier has been improved notably since first introduced and provides a well-built and complete package. Sound levels are generous with normal speaker loads, but it is still rather intolerant of the more difficult speakers.

BEST BUYS: £100-£175

Cambridge Audio P35 (£160)
Subject to last minute testing of a production sample, this is a sweet sounding, musical amplifier offering a good dynamic range and good versatility and including a moving-coil input.

RECOMMENDED: £100-£175
There were six models in this group, listed in ascending price order.

NAD 3020A (£110)
Possessing good load tolerance and dynamic range, as well as a generally good performance and versatility, this model also gave an above-average sound quality.

Creek CAS 4040 (£115)
An amplifier with a measured disc input overload weakness, the Creek will require careful choice of matching cartridge. However it did so well in other respects, particularly on sound quality that recommendation was assured.

Rotel RA820B (£120)
An 'audiophile' version of the *RA820*, which is listed above.

Quantum IA 100 (£120)
This recently improved UK model now sports a veneered case and moving-coil option at the additional cost of a further £10. A good all-round performance was established from this promising design.

Nytech 202 (£125)
A lively sounding, above average performer with good ergonomics this model was held back by a modest output as well as some input headroom limitations.

Harman-Kardon PM-640 (£170)
A tidy design, the *'640* returned a fine technical performance and generous output levels with good sound quality and exemplary load tolerance.

WORTH CONSIDERING: £100-£175
In this category were the **Akai AMU-3,** (£109) and the **Technics SUV 303** (£129).

BEST BUYS: £175-£250

Naim Nait (£179)
A compact, well built model. Choice of matching system is important if the 'Best Buy' sound of this modestly priced amplifier is to be obtained. Load-tolerant, it provided a highly competitive sound quality full of musical detail and life.

Sondex S230 (£179)
Another compact unit, this one is unusual in offering a range of no extra cost input options for cartridge sensitivity and loading, including moving-coil. While the easier 8ohm speakers work best, it can provide good sound levels, of pleasing quality.

Rotel RA870 (£220)
A fine all-rounder from the straight-line school, no tone controls being included. The *RA870* offered a good sound with decently high volume levels and a fine load tolerance.

Mission 778 (£230)
This is a compact, cleanly styled model, with the option of a power booster to improve load delivery and bass power response. It provided high peak sound levels as well as a fine subjec-

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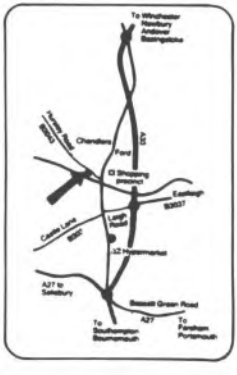

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tive quality, and moving-coil facilities are included.

Audiolab 8000A (£250)

This remarkable UK design offers a very good all round performance with good dynamic range, fine load tolerance and considerable versatility. It looks good too!

RECOMMENDED: £175-£250

Rotel RA860 (£180)

This model is equipped with tone controls and is a slightly 'downmarket' version of the *RA870*, offering fine value for money.

Luxman L230 (£180)

A beautifully finished and highly versatile amplifier from a respected brand name, the *L230* is a trifle load-intolerant but makes up for this with a good sound quality and fine all round performance, with suitable speakers.

Myst Tma-3 (£250)

This integrated amplifier has much in common with Myst's larger *G-ohm* system; its classification here remains provisional, as the *Tma-3* did not arrive in time for the full test procedure. Why not try it for yourself?

WORTH CONSIDERING: £175-£250

These models are headed by the trusty **A&R A60**, (£200), a well equipped, versatile and established UK design.

The **Fisher CA275** (£180) was meritorious for its remarkably high output power and generally satisfactory overall standard. Sony's **TA-AX500** (£180) is another highly versatile Japanese design, rather like the Luxman but of somewhat lower sonic attainment.

RECOMMENDED: ABOVE £250

Best Buy ratings do not apply here, and these models are included on the basis of their good value and/or sheer performance attainment. Taking the integrated models first we have:

Luxman L430 (£325)

A big brother to the *L230*, this model offers better sound, a substantial output power, good flexibility and a highly competant performance.

Meridian MCA-1 (£375-£500)

With this amplifier, price is dependent on the facilities purchased; the lowest figure secures only one mm input! Sound quality is very fine, with a lovely, relaxed and spacious stereo. Output power is modest for the price, though it is very load-tolerant.

Myst G-ohm (£439)

Exquisitely finished, this 'gathering of modules' provides a good sound, good load tolerance and a fine dynamic range at a reasonable value. It sounded well controlled and nicely balanced.

A&R C200/SA200 (£615)

The pre-amplifier accompanying this good power amplifier has recently been much improved, and now sounds notably more transparent. Together these units provide a versatile, load tolerant combination of good stereo sound and decent power output, the pair comfortably justifying the price asked.

Hafler DH110/DH220 (£670)

A powerful and highly load tolerant system, the Haflers gave fine all round performance worthy of approval. A moving-coil facility is extra.

Sugden C128/P128 (£670)

This amplifier is very powerful and also load-tolerant. The combination gives a sweet sound of great, relaxed power, but the unfinished state of the prototype sample pre-amp qualifies it for cautious approval only.

Musical Fidelity The Pre-amp/Dr Thomas (£740)

Moving into the higher price territory, this combination offers an exciting dynamic sound, a trifle forward and bright, but with a powerful 'slam', especially in the bass.

PS Audio IV/Two C (£980)

An up-market product at a price to match, the US-built PS Audio combination does provide a genuine up-market sound. With excellent bass, fine load tolerance and surprisingly high subjective output levels, this is an impressive product.

Naim Audio NAC32 (SNAPS)/NAP250 (£1130)

Quietly and confidently justifying its high reputation, the Naim provides a musical, well-controlled performance rated as 'very good' on test. Highly load tolerant it can also be relied upon for a consistent and accurate sound.

Electrocompaniet Pre-Ampliwire II/Ampliwire II (£1560)

While this combination did return a high sonic quality, it would appear to be rather expensive in the light of its limited versatility and moderate output power.

WORTH CONSIDERING: OVER £250

Some models not listed above are also well worth considering; for example, the **Quad 34/405 II** (£500). This is a versatile model (but no headphone socket is included) of fine build quality and appearance offering a respectable sound. Another is the **Tandberg 3012** (£530), a high quality and very powerful integrated

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BEST BUY PRICE?

model offering comprehensive facilities and making for convenient operation in a complex audio system.

RECOMMENDED PRE-AMPLIFIERS

The following is a selection of pre-amplifiers which were found worthwhile and which we recommend for separate trials.

Musical Fidelity The Pre-amp (£250)

A compact 'straight-line' model, this provides slightly 'bright' but clean audio with a fine midrange and pleasing focus. A 'no-fuss' product offering realistic value.

Sugden C128 (£250)

With an awkward construction and, for me an old-fashioned appearance, the new *C128* (as reviewed in prototype form) was nonetheless most promising. Its sound was clean and tight, free of false perspectives or hardness, and compared favourably with units at twice the price. Given a good production standard I would like to recommend this one.

A&R Cambridge C200 (£300)

Now a good performer, this model scores with its high versatility (including a headphone socket) and compatible all-round matching ability.

Meridian MCP-1 (£175-450)

This designation covers the pre-amp of the MCA-1 'Component Amplifier', so prices are according to the number of modules purchased. This gives potentially the finest single-input pre-amplifier at the price, if that is all you need. With more modules to give the usual input arrangements, the price lifts to the audiophile range but the sound quality can take the strain!

Burmester 785 (£790)

A 'straight-line' exotic of superb build quality and finish, this unit offers a good input/output level versatility for matching, with a high level of sound quality, this being little removed from that of some of the most costly units made. Neutrality is its hallmark.

Audio Research SP8 (£1400)

An audio legend, this superbly built valve pre-amplifier is very costly (since it also needs a good head amplifier) but rewards the purchaser with beguiling stereo images full of impact, clarity, space and ambience.

We also tried the **Krell PAM-1** (£1700) which showed every sign of sonic compatibility with the very fine Krell power amplifier. The PAM-1 has mc and mm facilities, as well as flexible tape dubbing. The **Burmester 808** (£3000-£4000 the price once again dependent on the choice and number of input modules), also proved to be a very worthy near-ultimate reference, which could conjure up remarkably musical and involving performances of great accuracy, given the appropriate ancilliary equipment. Finally, not included in the *Choice* test programme but again recently assessed by the author, comes the **Sony Esprit 900** (£1700), a model offering fine sound quality.

RECOMMENDED POWER AMPLIFIERS

Rotel RB870 (£180)

This modest stereo amplifier is of double-mono construction and gives a solid, sweet sound, decent power output and excellent load tolerance. Having bought one, you can later buy another, set them both to 'bridge' and enjoy nearly four times the power output.

A&R SA200 (£350)

A relaxed, powerful, and gutsy peformer with a reliable sound and good load tolerance, the *SA-200* provides a particularly nice depth impression in the stereo sound field.

PS Audio Two C (£370)

With a modest specified power, this one gets louder than you think, and has genuine 'super-fi' bass. The rest is good too, and it is very load tolerant. It deserves wider notice. Again, if you want more power, a second unit can be added in 'bridge' mode, to give 200W/channel peak.

Mission 777BU (£770)

It was hard choosing from the larger and most costly power amplifiers. This one is a lusty performer, pretty neutral-sounding with powerful bass, good treble, a clean midrange and well-developed stereo depth. Its double-mono construction also provides for near-zero crosstalk between the two channels.

Krell KSA50 (£1400)

A true 'reference' product, this model was clearly head and shoulders above the rest. Bass, mid and treble were all excellent, while stereo focus and depth were exceptional. Musically, it proved sweet and unfatiguing. It was revealing, in a 'kind' manner.

Special mention

Finally, given the above recommendations I feel it is also still worth pointing out those few products which were felt to be notably star performers in their particular categories. These were as follows: the Rotel *RA820* (£80) and Audiolab *8000A* integrated amplifiers; the PS Audio *Two C* (£370) and the Krell *KSA-50* (£1400) power amplifiers. The *Sugden C128* pre-amplifier is also provisionally included.

OVERALL COMPARISON CHART: AMPLIFIERS

	Power output Continuous power, 8ohms, one channel		Peak Power			Disc input Moving-magnet		Moving-coil		Tape/aux/CD input	
			8ohms	4ohms	2ohms	noise, CCIR/ ARM	RIAA response 30Hz-50kHz	sensitivity	noise	sensitivity	noise IHF
	watts (spec)	dBW (test)	dBW	dBW	dBW	– dB			– dB		– dB
A&R Cambridge A60	35W	16.5dBW	17.5	16	7.7	– 78	+ 0, – 2.4dB	17.2μV	– 72	18.7mV	– 84
A&R Cambridge C200/SA200	100W	20.1dBW	21.3	20.8	19.8	– 76	+ 0, – 0.6dB	15μV	– 72	11.1mV	– 78
Akai AMU3	45W	18.1dBW	18.6	18	14.2	– 77	+ 0.6, – 0dB	—	—	23mV	– 85
Akai AMU5	60W	18.0dBW	18.6	18.2	15.8	– 79	+ 0.3, 0.7dB	7μV	– 74	19Mv	– 81
Audiolab 8000A	50W	19.0dBW	19.8	18.6	18.0	– 78	+ 0.3dB	7.5μV	– 73	12mV	– 82
Audio Research SP8 (pre)		Pre-amplifier			—	—	+ 0.1dB	—	—	—	—
Burmester 785 (pre)		Pre-amplifier			—	72*	+ 0.3, – 0.1dB	30μV*	– 67*	45mV*	– 96*
Cambridge P35	35W	18.8dBW	19.4	18.0	15.6	– 79	+ 0.2, – 0.3dB	32μV	– 75	24.2mV	– 81
Creek 4040	35W	15.5dBW	16.5	15	12.0	– 74	+ 1.4, – 0.5dB	—	—	70.4mV	– 75
Crimson 610/630‡	80W	18.9dBW	20	19	16.9	– 81	+ 0.5, – 0.5dB	10μV	– 72	15.5mV	– 88
Denon PMA-750	80W	20.3dBW	21	18.5	15.5	– 84	0, – 0.1dB	13μV	– 76	16.9mV	– 85
Electrocompaniet	50W	17.3dBW	18.3	17.5	N.A.	– 81	0.2, – 0.8dB	variable	– 76	10.8mV	– 89
Fisher CA 275	75W	22.6dBW	23.5	22	14	– 73	+ 0.4, – 0dB	—	—	14.1mV	– 76
Hafler DH110/DH220	110W	22.0dBW	23	22	18.8	– 76	+ 0.2, – 0.2dB	—	—	14.3mV	– 80
Harman-Kardon PM640	30W	17.4dBW	18	16.8	15.5	– 83	+ 0, – 0.2dB	—	—	24mV	– 87
Harman-Kardon PM650	50W	18.4dBW	19.5	18.5	17.0	– 80	+ 0, – 0.8dB	8μV	– 68	18.4mV	– 80
Hitachi HA2	50W	17dBW	19.5	17.2	10.3	– 76	+ 0.5, – 0.3dB	—	—	23mV	– 86
JVC AK-22	38W	17.6dBW	18.5	17.5	9.0	– 75	+ 0.7, 0.4dB	—	—	25mV	– 80
JVC AX-40	50W	18.4dBW	19.2	16	8.8	– 76	+ 0, – 0.1dB	—	—	19.4mV	– 79
Krell KSA-50 (power)	50W	19.1dBW	19.3	19.0	18	—	—	—	—	110mV	– 103
Luxman L230	60W	19.1dBW	20	17	9.5	– 82	+ 0.3, – 0.2dB	23μV	– 70	24mV	– 84
Luxman L430	105W	21.1dBW	21.6	21.2	14.1	– 84	+ 0.5, – 0.15dB	3μV	– 71	21mV	– 85
Marantz PM-230	30W	15.4dBW	16	14.1	12.1	– 74	+ 0.3, – 0.6dB	—	—	32mV	– 82
Marantz PM-330	35W	16.8dBW	18.3	15.9	14.2	– 76	+ 0.2, – 0.5dB	—	—	25mV	– 82
Meridian Component Amplifier	35W	14.2dBW	15.5	15.0	14.7	– 84	+ 0.2, – 0.3dB	Cart. dep.	– 76	25mV	– 94
Mission 778	50W	17.9dBW	19	17.5	14	–77	+ 0, – 1.8dB	20μV	– 68	17mV	– 79
Mission 777 BU (power)	100W	20.8dBW	20.9	20.4	19.4	—	—	—	—	—	– 91
Musical Fidelity Pre-amp/DrT	120W	22.0dBW	23	21.8	19	– 79	+ 0, – 0.3dB	16μV	– 78	19mV	– 82
Myst G-Ohm	80W	19.7dBW	20	14.1	15.0	– 76	+ 0.3, – 1.4dB	Cart. dep.	– 70	38mV	– 75
NAD 3020A	20W	15.6dBW	16.6	14.8	13.0	– 83	+ 0.8, – 0.2dB	33μV	– 70	34mV	– 88
Naim NAIT	15W	13.0dBW	13.5	12.2	11.3	– 78	+ 0.5, – 1.5dB	—	—	21mV	– 80
Naim 32/250	70W	19.0dBW	19	18.6	16.5	– 79	+ 0, – 0.7dB	10μV	– 72	10.3mV	– 80
Nytech 202	20W	13.4dBW	15.5	14	10.6	– 76	+ 0.5, – 0dB	—	—	16.8mV	– 82
Onkyo A22	35W	16.8dBW	17.7	16	13.1	– 77	+ 0.3, – 0.4dB	—	—	25mV	– 83
Pioneer A80	100W	21.7dBW	22.5	20.0	15.5	– 83	+ 0.15, – 0dB	5μV	– 69	12.1mV	– 84
PS Audio IV/Two C	50W	17.6dBW	18.2	17.5	16.3	– 80	+ 0, – 0.2dB	10μV	– 72	33mV	– 82
Quad 34/405	100W	20.3dBW	21	19.6	13.2	– 80	+ 0, – 0.35dB	13μV (var)	– 74	11.3mV	– 81
Quantum IA100	25W	16.1dBW	17	15.8	12.6	– 77	+ 0.2, – 0.2dB	see text	—	26mV	– 83
Revox B251	100W	21.3dBW	22.2	21	15	85	+ 0.2, – 2.0dB	20μV (var)	– 76	24mV (var)	– 100
Rotel RA820	20W	15.4dBW	16.3	15.1	13	– 70	+ 0.2, – 1dB	—	—	53mV	–71
Rotel RA870 (and RB870)	50 (200)W	18.3dBW	19.3	18.5	16.5	– 80	+ 0.2, – 0.5dB	13μV	– 78	20mV	– 86
Sansui AUD-101	30W	17.7dBW	18.5	16.5	9.4	– 81	+ 0.4, – 0.2dB	—	—	36mV	– 83
Sansui AUD-55X	70W	20.2dBW	21	18	10.6	– 83	+ 0, – 0.3dB	5μV	– 71	22mV	– 86
Sondex S230	30W	15.1dBW	16.5	14.7	11	– 80	+ 0.2, – 2.6dB	44μV (var)	– 76	82mV	– 75
Sony TA-AX500	80W	20.1dBW	20.8	19.0	14.6	– 84	+ 0, – 0.2dB	20μV	– 76	19mV	– 104
Sugden C128/P128	130W	21.5dBW	22.8	21.5	18.0	– 74	+ 0, – 1.0dB	17μV	– 72	16.5mV	– 87
Tandberg 3012	100W	20.8dBW	22.2	21.3	15.6	– 81	+ 0, – 0.9dB	10μV	– 74	16mV	– 74
Tandberg 3002/3006A	150W	22.0dBW	23.4	22.6	19.9	– 84	+ 0.2, – 2dB	9μV	– 75	9.8mV	– 87
Technics SU-V303	40W	17.1dBW	18.3	16.8	14.3	– 82	+ 0, – 0.5dB	—	—	25mV	– 87
Trio KA31	30W	15.9dBW	16.7	14.9	12.9	– 77	+ 0, – 0.8dB	—	—	26mV	– 84
Trio KA71	65W	18.8dBW	19.5	18.4	16.4	– 77	+ 0, – 0.5dB	—	—	17mV	– 82
Yamaha A300	25W	13.9dBW	15.1	14.3	11.7	– 81	+ 0.5, – 0.2dB	—	—	29.5mV	– 82

* *rel 0.5V output. Do not compare with pre/power amplifier results*

§ *Myst Tma-3 integrated, 102 and 97.5dBA*

‡ *Listening results and programme power, Crimson 610/620 II*

OVERALL COMPARISON CHART: AMPLIFIERS

Maximum subjective sound level		Stereo qualities		Midband tonal balance	Musical detail	Bass precision	Treble quality	General sound quality via aux input/ power amp direct	Typical price/ rating *		
8ohm load	4ohm load	stereo depth and ambience quality	stereo focus and precision								
dBA	dBA										
101.5	99	average	good	sl. hard	good	average	average +	average	£200	W	A&R Cambridge A60
105	104	good	good	f. neutral	good +	good +	good	good +	£615	R	A&R Cambridge C200/SA200
102	99	average –	average –	f. neutral	average	average –	average	average	£119	W	Akai AMU3
102	100.5	average	average	thin	average +	average	average –	average –	£255	—	Akai AMU5
103	102	very good	very good	sl. clinical	very good	very good	good +	very good	£250	B	Audiolab 8000A
—	—	excellent	very good	neutral	very good	very good	excellent	excellent	£1400	R	Audio Research SP&
—	—	very good	excellent	neutral	very good	excellent	very good	excellent	£800	R	Burmester 785
102	100	average +	average +	neutral	average +	average +	good	good	£160	R	Cambridge P35
101	99	average +	average +	sl. thin	average +	ave	average +	average +	£99	R	Creek 4040
101‡	98.6‡	good	average +	f. neutral	good	average	average	average +	£325	—	Crimson 610/620
105	103	average	average	sl. hard	average +	average	average	average	£235	—	Denon PMA750
102	100	very good	very good	sl. hard	very good	good	very good	very good	£1570	R	Electrocompaniet
107	102	average	average	f. neutral	average +	average	average	average	£180	W	Fisher CA275
106	105.2	good	good	sl. hard	good +	good +	good	good +	£670	R	Hafler DH110/DH220
101.5	100.5	good +	good	sl. clinical	good	good	good	good	£169	R	Harman-Kardon PM640
104	103.5	good +	good	neutral	good	good +	good +	good +	£240	R	Harman-Kardon PM650
102.5	101.5	average –	average –	sl. hard	average –	average –	average	average –	£120	—	Hitachi HA2
102	98.5	average –	average –	f. neutral	average –	average –	average +	average –	£90	—	JVC AK22
101.5	96.5	average	average –	sl. hard	average	average –	average –	average –	£154	—	JVC AX40
103	102	excellent	excellent	neutral	excellent	excellent	excellent	excellent	£1400	R	Krell KSA50 (power)
103	102	average +	good	sl. thin	good	average +	good	good	£180	R	Luxman L230
105	104	good	good	sl. thin	good	average +	good	good +	£325	R	Luxman L430
101	97.5	average –	average –	neutral	average	poor	average –	average –	£80	—	Marantz PM230
101.4	98.5	poor	average –	sl. hard	poor	average –	poor	poor	£110	—	Marantz PM330
100	97.5	very good	good +	sweet	good +	very good	good +	good +	£350 +	R	Meridian Component Amplifier
104	102	good +	good +	sl. hard	good +	good	very good	good +	£230	B	Mission 778
105	103.5	very good	very good	sl. hard	very good	good + +	good +	very good	£750	R	Mission 777 BU (power)
106	104.5	good +	good +	sl. 'bright'	very good	good +	good +	good +	£740	R	Musical Fidelity Preamp/Dr T
104§	102§	good +	good +	sl. hard	good +	good	good	good +	£439	R	Myst G-Ohm
100	99	average +	average	sl. rich	average	average	average +	average +	£110	R	NAD 3020A
97.5	96.3	very good	good +	sl. thin	very good	good	average +	good +	£180	B	Naim NAIT
103	101	good +	very good	sl. hard	very good	very good	very good	very good	£1130	R	Naim 32/250
98	96	average +	good	sl. thin	good	average	average	average +	£125	R	Nytech 202
101	100	good	good	sl. hard	good	average +	average	average +	£85	B	Onkyo A22
106.5	103.8	average –	average +	sl. thin	average +	average	average	average	£390	—	Pioneer A80
101.3	100	good +	very good	sl. thin	very good	very good	good +	very good	£980	R	PS Audio IV/Two C
105	104	average	average	neutral	average +	average +	average +	average +	£490	W	Quad 34/405
99	97	average +	average	sl. thin	average +	average	average +	average +	£120	R	Quantum IA100
106	104.5	average	average +	f. neutral	average –	average	average +	average	£880	—	Revox B251
99	97	good	average +	sl. hard	good	average +	average +	good	£80	B	Rotel RA820
103	102	good	good	sl. hard	good +	good +	average +	good +	£220	B	Rotel RA870 (and RB870)
101	97	average	average	sl. thin	average	average +	average	average	£99	R	Sansui AUD-101
105	102	average	average –	neutral	average	average	average	average –	£239	—	Sansui AUD-55X
100.8	99	good +	good	neutral	good +	average +	average +	good +	£180	B	Sondex S230
104.5	103	average	average	neutral	average	average	average	average	£190	W	Sony TA-AX500
107	104.5	good	good +	sweet	good	good	good +	good +	£670	R	Sugden C128/P128
105	102	good	good +	clinical	good +	very good	average +	good	£520	W	Tandberg 3012
107	105	average +	average +	hard	average +	good	average	average +	£925	—	Tandberg 3002/3006A
102	99.5	average	good	sl. thin	average	average +	average +	ave	£129	W	Technics SU-V303
100.5	98	average –	average	f. neutral	average –	average	average	average –	£95	—	Trio KA31
104	102	average	average	f. neutral	average	average	average	average	£149	—	Trio KA71
100	97	average +	average +	sl. hard	average +	average +	average +	average +	£190	B	Yamaha A300

*Rating B — Best Buy R — Recommended W — Worth Considering

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"On changing over to The Preamp the improvements were stunning and obvious... I know of no other pre-amplifier at this price that could look at The Preamp." *Dave Berriman, Practical HiFi, Nov. '82*

The Dr. Thomas **"is a clean, sharp and very powerful-sounding amplifier with tight, articulate bass, excellent imaging and clear, extended treble... at a very approachable price."** *J. M. Hughes, HiFi Answers, May '83*

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Liverpool: W. A. Brady & Son, 401 Smithdown Road, 051 733 6859
London: Grahams HiFi, 88 Pentonville Road, N1, 01 837 4412
Subjective Audio, 2-4 Camden High Street, NW1, 01 387 8281
Unilet Products, 14 Bute Street, SW7, 01 589 2586.
Unilet Products, 35 High Street, New Malden, 01 942 9567
Norwich: Basically Sound, The Old School, School Road, Bracon Ash, 0508 70829
Radlett: Radlett Audio, 141 Watling Street, 09276 6497
Stirling: HiFi Corner, 73-75 Murray Place, 0786 5053
Tonbridge: HiFi Consultants, 19-21 Quarry Hill Road, 0732 366 767

CONSUMER INTRODUCTION: TUNERS

Stereo radio broadcasting at its best offers very high standards of sound quality, though a good tuner and a suitable aerial are needed to realise the potential at home.

A live music broadcast on BBC radio gives you better fidelity to the original than almost any analogue disc system can, but FM radio is neglected by many hi-fi users – if you are one of these, give it another chance!

Nearly all tuners are supplied with a simple indoor wire aerial designed to be strung up on the picture rail, and you can 'get away' with this in very strong signal areas. However, such an aerial will never get the best sound from FM radio broadcasts, even if the reception appears adequate. For best results an outdoor or loft aerial will be needed.

The actual receiving element of an FM aerial array is the *dipole*. Parallel to this, in front of and behind it from the transmitter point of view, are other similar looking-elements called *directors* and *reflectors*.

A simple two-element aerial, then, has a dipole and one reflector, while a six-element type would consist of a dipole with one reflector and four directors. The extra elements make the aerial more directional – it can produce much stronger signals from the wanted direction, though at the expense of signals coming from other directions. The BBC recommend at least a two-element aerial in primary service areas (close to the transmitter), four-element types for secondary service areas or where signals reflected from buildings or hills ('multipath') causes distortion problems.

Aerial suppliers and riggers should have all the necessary knowledge of local reception conditions, but if in doubt, you can obtain reception area maps and advice from the BBC Engineering Information Department, Broadcasting House, London W1A 1AA, and for independent commercial stations, from the IBA Information Service, Crawley Court, Winchester, Hants SO21 2QA.

Despite the 'digital revolution' there are still plenty of 'analogue' tuners around, these using the traditional tuning knob, scale and pointer rather than an array of buttons. The digital type of tuner does not inherently offer better sound quality than the analogue type. However, in practice, actual sound quality is easily spoilt by inaccurate tuning, and so any system which helps avoid this ought to be a benefit.

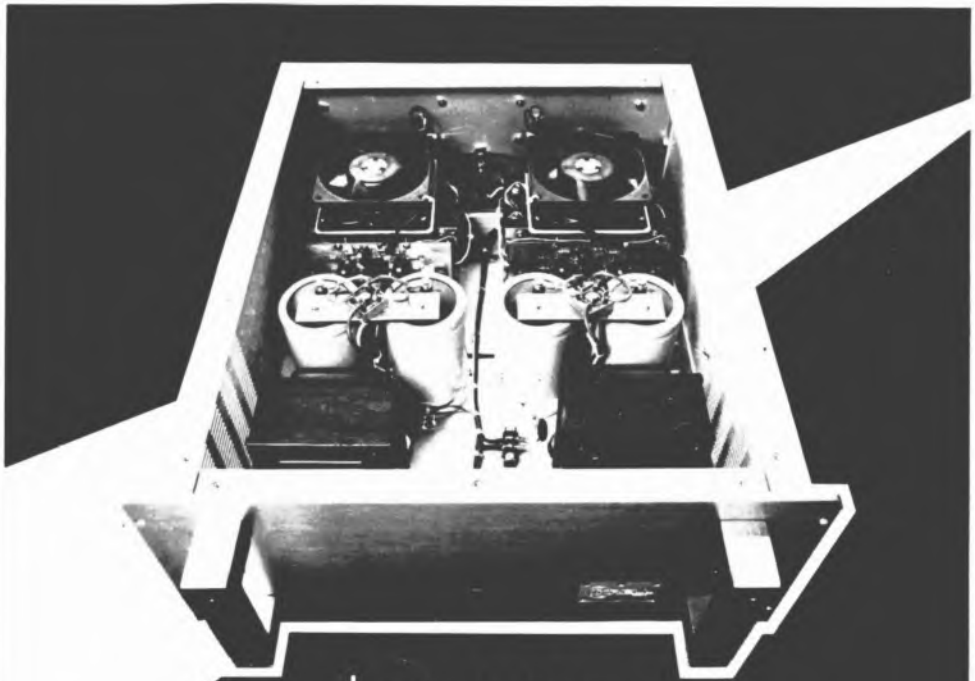
In a digital *synthesiser* tuner, the broadcast station frequencies are exactly copied quartz-controlled electronics in the tuner itself, hence the claims for greater 'accuracy'. The main advantages are ease of use (assuming good design!) and particularly the provision of pre-set station selection.

Conventional analogue tuners may have pre-sets, but these will be more cumbersome in that each will need its own manual tuning device to create the pre-set adjustment, and there will be no automatic scanning devices to help you find the stations in the first place.

One problem which has cropped up with some synthesiser tuners is the breakthrough of electronics noise into the audio channel, producing a background buzz or various annoying whistles; most manufacturers have overcome these problems now, but they should be watched for if you are considering an untried tuner of the digital type.

Finally, note that some tuners merely have a digital display, and are tuned conventionally, not by means of a synthesiser.

"A truly remarkable instrument..."



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TECHNICAL INTRODUCTION: TUNERS

All the tuners included in the test programme were subjected to laboratory analysis as well as listening tests to determine sound quality under various reception conditions.

Tests were carried out on a group of tuners which are the logical partners of a number of the amplifiers covered in this book. All were examined carefully in the laboratory and given thorough subjective tests, even though the reporting of these results is somewhat brief.

Listening tests

For the auditioning, the tuners were tried on a variety of local and regional stations at the author's North London address. Critical tests included the use of a studio quality stereo enoder and low distortion transmitter/generator, fed with master-quality digital PCM programme material. The degradation imparted by the tuners was assessed on a before-and-after transmission basis. In addition, the low-signal radio frequency and quieting performances were subjectively assessed, particularly with respect to the odd whistles which as still to be found on some digitally synthesised tuners. Stereo signal-to-noise was also assessed.

Laboratory testing

Lab testing included a number of distortion measurements, for example, at 100% modulation depth, 1kHz, with the results for both mono and stereo working. Response to overmodulation was subjectively assessed on programme as well as by a 130% modulated 1kHz tone, with distortion readings here in mono. Distortion was also assessed via a Curtis-designed test whereby one channel is fed 1kHz, and the other 5kHz, with the resulting crosstalk and dynamic intermodulation products analysed.

Output level quoted is for full modulation, those tuners producing over 700mV being potentially suited to direct connection to some of the more sensitive power amplifiers, such as Mission or Quad.

Muting levels were noted, these the signal strengths below which the designer considers that noise is excessive and the tuner output is therefore automatically muted.

AM rejection is a measurement allied to capture ratio, these seeking to quantify how powerfully the tuner can reject co-channel interference, multipath reflections, ignition and impulse breakthrough, unwanted radio signals from other transmitters or a weaker FM signal very close to the wanted one. Capture ratios of lower than 1.3dB are pretty good, the range generally between 0.6 to 3.0dB, the latter upper limit being regarded as poor. AM rejection ratios go from 50 to 80dB, the former an adequate result, the latter an excellent one.

Pilot tone rejection is the supression of unwanted stereo tones at 19 and 38kHz, which for most people are inaudible, but they nonetheless can disturb tape recordings. Better than 55dB is considered to be good for here.

Ultimate signal-to-noise ratios (CCIR ARM weighted with a 1kHz reference) for mono and stereo are also given, the latter rather more relevant. Some tuners do add a degree of audible hiss to broadcasts. Stereo separation is measured from 1 to 10kHz, with figures of 45dB, and 35dB, 10kHz considered pretty good.

Alternate channel selectivity quantifies how well the tuner can receive a weak distant transmission spaced closely on the dial to a strong station. Here 60dB is considered a good practical standard, with 80dB as very good.

Graphs of limiting and quieting were produced, these measured versus signal strength, the former showing how quickly the output level stabilises and the latter how quickly the noise level improves to a good subjective value. These determine how clean the tuner will sound on weaker stations, or in fringe areas where the signal strength is low.

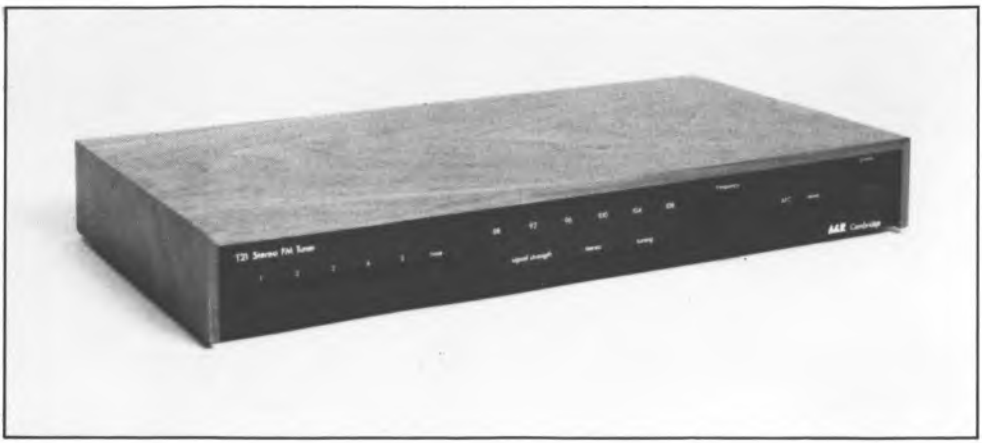
Finally, the frequency responses were measured, these charted from a low 10Hz to 20kHz; but most had pretty flat responses, which were therefore considered unlikely to be a major influence in the auditioning results.

Aerial considerations

FM reception conditions can vary considerably with quite small differences in district, address or local geography and buildings. When purchasing a tuner for use in a difficult area, it is worth having an arrangement with a dealer to return those models that prove unsatisfactory at your location. We cannot also stress too strongly the need for a good, preferably roof-mounted aerial for FM if a hi-fi performance is to be achieved from a good tuner — a poor or badly sited aerial with multipath effects can produce a constant 10-15% distortion on peak modulation. Fitting an aerial, if required, must therefore be included in the real cost of a tuner, and may influence or dictate the purchase of a cheaper or a more expensive model.

A&R Cambridge T21

A&R Cambridge Ltd, Denny End Industrial Centre, Waterbeach, Cambridge CB5 9PB
Tel (0223) 861550



An established British tuner which matches the A&R *A60* integrated amplifier, the *T21* is a slimline model with a walnut veneered surround sleeve. An analogue-tuned design, it has a varicap front end, and the coarse tuning dial is composed of a number of red LEDs. Up to five stations may be pre-set via a row of knobs on the rear panel, with the manual tuning set to a sixth station or used for further selection. A mono switch and afc button are both fitted.

The output terminal is a five pin DIN, while UK 75ohm and 300ohms balanced aerial inputs are provided. The audio output level is variable from 10mV to about 1 volt and could drive a power amp direct. Overall, the construction is very tidy.

Sound quality

Scoring a little below average on audition, the tuner was also not particularly sensitive in terms of stereo quieting, requiring over 1mV signal to attain the usual subjective quieting limit. Background noise was also poorer than usual.

The sound was described as lacking in full clarity, or indeed stereo depth; the bass appeared mildly soft, the treble a touch grainy and slurred, while the mid range could have done with more subjective detail. Tonally the response sounded quite uniform.

Lab results

Mono sensitivity was satisfactory, but for full quieting the stereo sensitivity was below average, as was the stereo signal-to-noise ratio. Alternate channel rejection was quite good, with reasonable AM rejection and a good capture ratio. Distortion results were below average as was the stereo separation. Pilot tones were however well suppressed. The output level reached almost 900mV. The *T21* handled overmodulation satisfactorily, while the muting function also worked well. Frequency response was very uniform, with just 1dB loss at 20Hz and 14kHz, with no peaking.

Conclusion

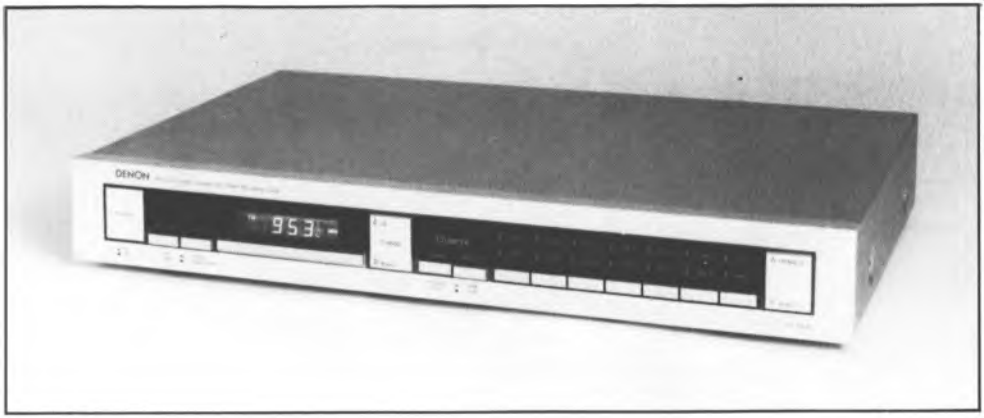
Though its price is not so far removed from the £200 level, the *T21* appears comparatively primitive when viewed against the latest generation of tuners. Its lab performance was at or below average, and the sound quality was judged to offer no real improvement over that level. Unfortunately this design cannot be said to offer good value and cannot be recommended.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	12μV/200μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	72dB/65dB
Muting threshold	– μV
Alternate channel selectivity	– 66dB
Pilot tone rejection	– 69dB
AM rejection	– 57dB
Capture ratio	1.5dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.33%/0.56%
Stereo separation, 1kHz/5kHz/10kHz	38dB/31dB/26dB
Output level, 100% mod	870mV
Dimensions (width, depth, height)	45 x 27 x 6cm
Typical price inc VAT	£190

Denon TU-750

Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG
Tel (0753) 888447

RECOMMENDED



The *TU750* sells at a moderate £150, and is a slimline design with a silver fascia and a brown case. Denon have chosen the digitally-tuned route whereby all controls are push button and a fluorescent numeric display shows tuned frequency for both AM and FM wavebands. This tuner offers a number of additional features such as a record level calibration signal, as well as manual and automatic station-seeking tuning, and a memory section which will store the settings for seven FM and seven AM stations. The intensity of the display has two settings to help accommodate different lighting conditions.

Screw terminals provide for 300ohm and 75ohm connection, while the AM loop aerial is demountable, on a short cable, and can be pinned up for the best reception. The fixed level output sockets are phono.

Sound quality

Clearly one of the better tuners in the group, the *TU750* provided a pleasant sound. Subjectively stereo background noise was low, and it was also sensitive enough to attain good noise levels on quite low signal strengths.

Stereo images were fairly sharply-focused, and a fair impression of depth was also given. Well balanced tonally, the subjective distortion was fine with good clarity, and the AM sound quality was rather better than average.

Lab results

A 150μV input sufficed for a 50dB stereo signal to noise ratio with the mono result at 7μV (1kHz ref, CCIR ARM).

Ultimate stereo signal to noise ratio was marginal at 63dB stereo improving to 67dB mono. Alternate channel selectivity was fairly good, while capture ratio and AM rejection levels were fine. Total harmonic distortion was satisfactory and did not deteriorate when the signal was overmodulated by a factor of 30%, while pilot tone rejection was just satisfactory at – 39dB. Output level was 500mV and stereo separation about average. Crosstalk intermodulation was unexceptional, while the frequency response showed a slightly rising level with increasing frequency, measuring 1dB up at 12kHz relative to 200Hz, and 2dB down at 20Hz.

Conclusion

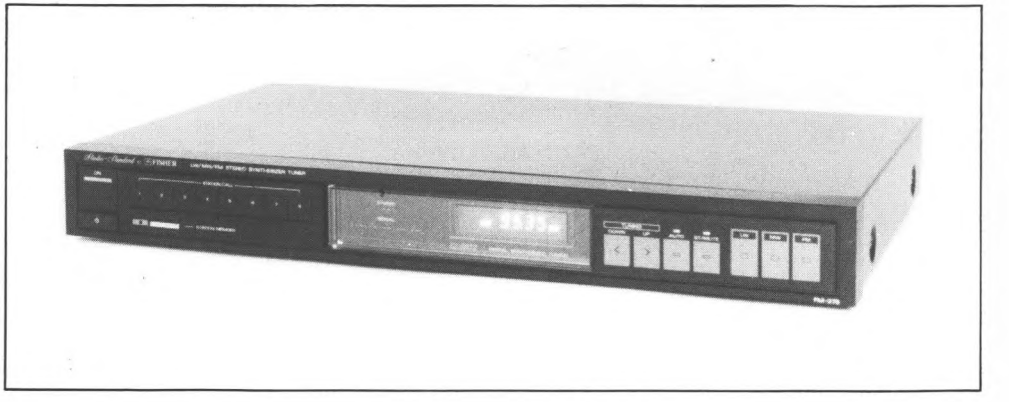
Though the sensitivity is quite good, and the background noise subjectively fine, free of the common spurious whistles, the overall technical performance was quite unexceptional. However the unit did sound well for the price on both AM and FM, and was also well equipped. It deserves recommendation.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	7μV/150μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	67dB/63dB
Muting threshold	5.5μV
Alternate channel selectivity	– 61dB
Pilot tone rejection	– 39dB
AM rejection	– 62dB
Capture ratio	1.0dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.37%/0.40%
Stereo separation, 1kHz/5kHz/10kHz	39dB/34dB/28dB
Output level, 100% mod	500mV
Dimensions (width, depth, height)	43 x 30 x 7cm
Typical price inc VAT	£150

BEST BUY

Fisher FM-275

Fisher Sales (UK) Ltd, 1-4 Walter Lawrence Estate, Otterspool Way, Watford, Herts
Tel (0923) 31974



Built by Sanyo for their Fisher division, this low-profile unit is styled in satin black to suit the 'super power' *CA-275* amplifier also reviewed in this issue. Selling at a budget £130, the unit uses the currently-popular set of digital tuner electronics, including the fluorescent numeric display of station carrier frequency. Three wave bands are provided – long, medium and FM – and the memories can store up to eight stations on each band, which is a comprehensive selection. Manual and automatic station seeking are provided, entering stations to the memory store proving straightforward. On the rear panel a small switch adjusts the synthesiser steps from '9kHz AM, 50kHz/FM' for the UK, to 10kHz/100kHz for other countries. Audio output is in phono, while FM aerial input is 75ohm (coax) only. AM reception is via a ferrite bar, with some limited adjustment. An external AM aerial could be used to get the best results from this model.

Sound quality

This tuner proved insensitive, in that a high signal level, of over 10mV was required for a full subjective suppression of spurious whistles in the audio background. It was then pretty quiet however, and gave a good stereo performance. The depth and clarity were well above average and the bass was also favoured, while stereo focus was fine, and the tonal balance appeared neutral. The AM sound was judged poor though, appearing noisy as well as coloured and muffled.

Lab results

Rated sensitivity was in fact to a good standard, with the stereo (1kHz CCIR/ARM) signal to noise ratio satisfactory at 200μV, although full stereo quieting did not occur until 15mV was reached, this due to the presence of 'birdies' or low level whistles in the audio. The RF parameters – capture ratio, selectivity and AM suppression – were pretty good, and pilot tone rejection was excellent. Output was a healthy 925mV and distortion levels were quite low under all modulation conditions, including the severe crosstalk intermodulation tests. The frequency response was quite flat mid-band, but drooped slightly at the band edges, reaching –1dB, 30Hz and 15kHz. Stereo separation was average.

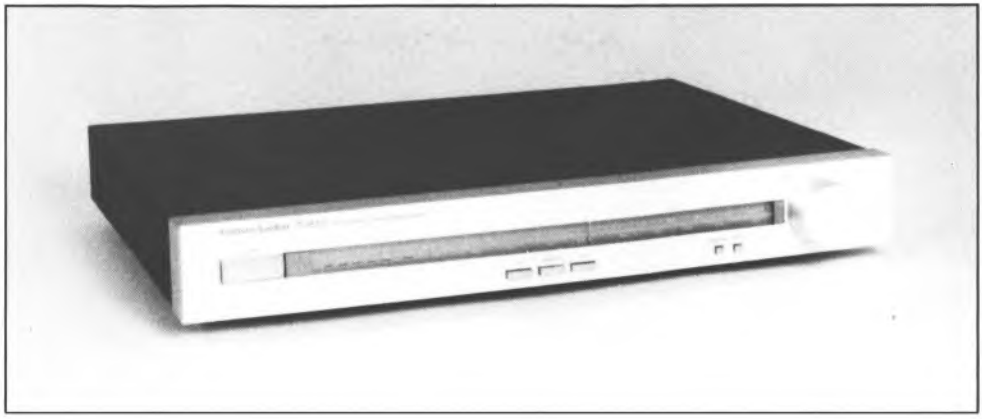
Conclusion

Highly rated for its sound on strong FM stereo signals, which was good for the price, it was rather poorer on AM, and may also show slight whistles from weaker FM stations on occasion. Fortunately, this tuner can produce a really competitive sound under good signal-strength conditions, and so is recommended.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	6μV/200μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	73dB/68dB
Muting threshold	5.5μV
Alternate channel selectivity	– 70dB
Pilot tone rejection	– 83dB
AM rejection	– 60dB
Capture ratio	1.1dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.17%/0.25%
Stereo separation, 1kHz/5kHz/10kHz	43dB/30dB/27dB
Output level, 100% mod	925mV
Dimensions (width, depth, height)	44 x 27 x 11cm
Typical price inc VAT	£130

Harman-Kardon TU-610

Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD
Tel (0753) 76911



This low-profile tuner matches the Harman-Kardon range of integrated amplifiers and sells for a modest £130. An analogue design, it is described as 'linear phase' on the panel which presumably refers to the type of pilot tone filtering. Off station, the long dial is illuminated in red, while accurate tuning causes a change to green. An LED bar type signal strength display is employed, and the tuning knob is well weighted, as well as smooth in action. FM and AM medium wavebands are covered and the muting and stereo/mono switching is separated. A high-blend function improves the signal to noise ratio on weak transmissions at the expense of treble separation.

The AM aerial is a large swivelling bar, and an external aerial may also be fitted. Three inputs are provided for FM – 300ohm balanced, 75ohm binding posts and a 75ohm (male) coax connector. Audio outputs are phono while an unshrouded US-type two-pin mains outlet was also fitted on our sample, this not strictly to the safety standard.

Sound quality

Subjectively, the *TU-610* seemed fairly sensitive and offered good stereo background noise levels by 1mV input, and did not suffer from whistles etc. One listener commented that it possesed a touch of the 'HK sound' with an above average bass definition. Inevitably some loss of detail and clarity was noted when it was compared with the original sound, but this was considered moderate, and the HK achieved quite a good rating for sound quality. The stereo was fairly well focused with reasonable depth, but on AM it was considered to be a little below average.

Lab results

Sensitivity was moderate, with 100μV required for the 50dB stereo quieting level, though it quieted quickly above this input attaining a good 69dB stereo signal-to-noise ratio by 1mV aerial input. The front-end performance was quite reasonable with a 67dB selectivity 1.3dV capture ratio and 60dB AM rejection. Distortion levels were just satisfactory and it did not respond too well to overmodulation. Output was quite healthy at 840mV and good channel separation results were recorded, while pilot tone rejection was fine at 60dB.

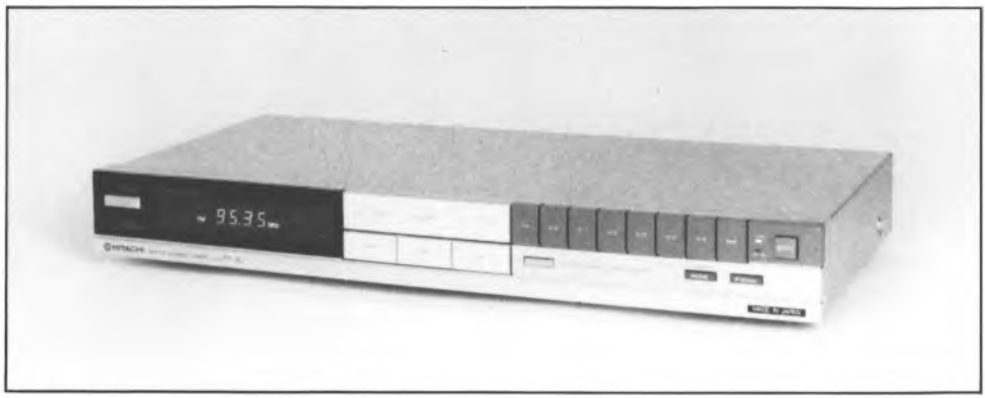
Conclusion

This neat tuner provided a good all round performance at a competitive price. The sound quality was sufficient to bring it into the 'Best Buy' category, and it can be warmly commended.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	8μV/100μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	74dB/69dB
Muting threshold	5.1μV
Alternate channel selectivity	–67dB
Pilottone rejection	–60dB
AM rejection	–60dB
Capture ratio	1.3dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.44%/0.47%
Stereo separation, 1kHz/5kHz/10kHz	40dB/39dB/36dB
Output level, 100% mod	840mV
Dimensions (width, depth, height)	44 x 38 x 7cm
Typical price inc VAT	£130

Hitachi FT-2L

Hitachi Sales UK Ltd, Hitachi House, Station Road, Hayes, Middlesex UB3 4DR
Tel 01-848 8787



One of the least expensive tuners in the survey, the *FT-2L* is styled to match the budget Hitachi amplifiers. It comes in a low profile silver and grey case, and uses the standard set of quartz-locked, digital synthesiser integrated circuits which give a fluorescent numeric frequency display. The fascia controls are all push button, with a row of eight of these being responsible, in conjunction with a slightly confusing 'shift' control, for a total of 16 memorised station settings. Automatic and manual tuning are incorporated, and in addition the 'P-Scan' button enables pre-sets to be stepped through automatically. FM, long and medium wavebands are covered. Aerial facilities are comprehensive, with an FM 75ohms (male) coax socket, 75ohm binding posts, AM binding posts and finally a demountable AM loop aerial on a cord which allows it to be pinned at a suitable orientation for the best results. Output is via phono sockets.

Sound quality

Although commonly used even on inexpensive tuners now, the synthesised tuning can cause its own problems, generally manifested as spurious low level whistles or tones in the audio output. The *FT-2L* is no exception to this, and only when 10mV of aerial signal was applied did the whistle vanish. The sound was below average, with flattened stereo perspectives, a dulled, slightly muddy mid quality and some treble lispiness. AM reception was reasonable.

Lab results

The basic mono sensitivity was quite good, but 500μV was required for 50dB, 1kHz weighted noise suppression in stereo, which was quite a poor result. 3mV was needed for full stereo quieting when the noise level was about average. Pilot tone rejection was fine however and the RF performance on capture ratio, AM suppression and indeed alternate channel selectivity were all pretty good, particularly at the price. Output was a perhaps too healthy 1.2V, while distortion levels were good, even under excess modulation. Stereo separation was about average, while the frequency response illustrated a flat midband, but with some droop at the higher frequencies; for example, – 2dB at 10kHz which could explain the 'dulled' effect on audition.

Conclusion

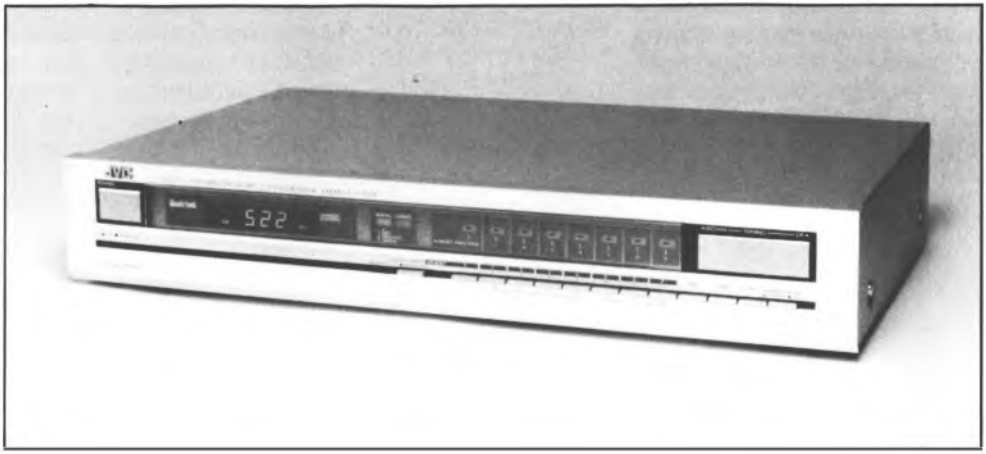
While this model performed quite well at the price, and did the job required, it would seem sensible to pay a little more for a tuner of rather better subjective sound quality; and as a result the *FT-2L* does not warrant recommendation here.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	5μV/500μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	71dB/66dB
Muting threshold	6.5μV
Alternate channel selectivity	– 72dB
Pilot tone rejection	– 69dB
AM rejection	– 57dB
Capture ratio	1.2dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.1%/0.2%
Stereo separation, 1kHz/5kHz/10kHz	38dB/38dB/24dB
Output level, 100% mod	1.2V
Dimensions (width, depth, height)	44 x 27 x 8.5cm
Typical price inc VAT	£100

JVC TX-22L

BEST BUY

JVC (UK) Ltd, 6-8 Priestley Way, Eldonwall Trading Estate, Staples Corner, London NW2 7AF
Tel 01-450 2621



Priced at just over £100, the *JX22L* tuner matches the correspondingly-priced JVC amplifiers. Styled in silver alloy with a blue fascia incorporating the usual fluorescent digital display, the tuner has no rotary controls, as it is digitally operated. It can store a total of 14 preset station frequencies – three for long wave, four for medium and seven for FM. Manual as well as automatic scan tuning is provided, with a mono button to mute stereo operation on noisy signals.

Aerial connection is via binding posts for 75ohms and 300ohm termination on FM, and also for auxiliary AM aerial; a hinged box aerial is for AM fitted but it is not possible to rotate this for optimum reception. Signal outputs are in phono.

Sound quality

As has been noted with other inexpensive digital tuners in this survey, the *JX22L* showed some minor whistles in the audio output at around levels below 1mV. Above a 5mV input the stereo output was decently quiet, and overall this tuner sounded above average, with a lively, open character and good clarity. Detail loss was mild, with reasonable treble, and it also responded well to overmodulation. It gave quite good stereo depth, and the AM sound was also above average, showing good clarity.

Lab results

The JVC was quite sensitive particularly on stereo where it achieved a 50dB, 1kHz weighted signal to noise ratio for 100μV of aerial input. 4mV was required for full quieting reaching a good 70dB stereo, 74dB mono. Output level was just over 1 volt. The RF parameters were to the usual standard, alternate channel selectivity about average, with AM rejection and capture ratio both good.

Total harmonic distortion was satisfactory on mono, but rather higher in stereo, reaching 0.85% on peak modulation. Stereo separation was better than average, with a good 34dB recorded at 10kHz.

Conclusion

On decent strength signals, this tuner provided a good sound quality on FM and to some extent, on AM as well. At lower FM signal strength levels it still worked well, but with some slight whistles, which may however not prove obtrusive in practice. This design offers good value for money and is rated as 'Best Buy'.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	7μV/100μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	74dB/70dB
Muting threshold	5.1μV
Alternate channel selectivity	– 62dB
Pilot tone rejection	– 65dB
AM rejection	– 59dB
Capture ratio	1.2dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.21%/0.85%
Stereo separation, 1kHz/5kHz/10kHz	42dB/39dB/34dB
Output level, 100% mod	1.15V
Dimensions (width, depth, height)	44 x 30 x 8cm
Typicalprice inc VAT	£115

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118 London Rd, Sevenoaks, Kent. Tel: (0732) 459555

LONDON SE18
162 Powis St, Woolwich, London SE18. Tel: 01-855 8016

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34 Mount Ephraim, Tunbridge Wells, Kent. Tel: (0892) 31543

CHATHAM
4 Railway St, Chatham, Kent. Tel: (0634) 46859

BRIGHTON
55 Preston St, Brighton, Sussex. Tel: (0273) 733338

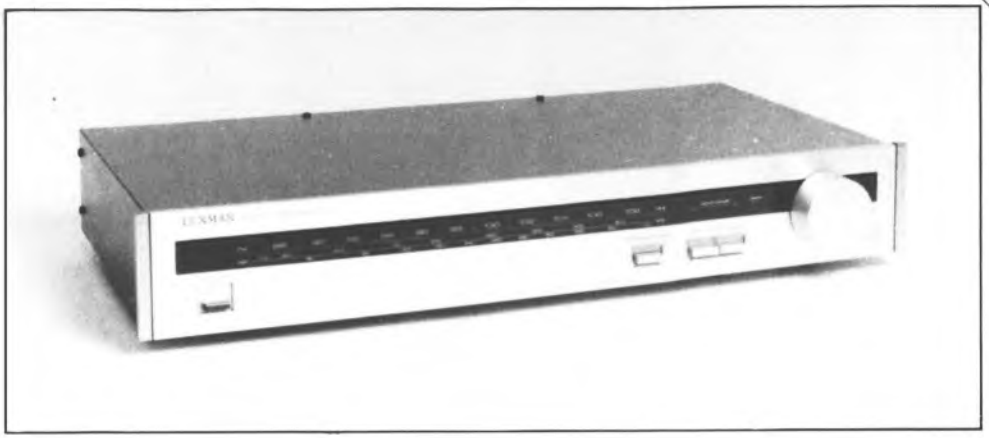
BECKENHAM
51 Beckenham Rd, Beckenham, Kent. Tel: 01-658 3450

NB: all branches are closed all day Wednesday.

Luxman T210L

HW International Ltd, 3-5 Eden Grove, London N7
Tel 01-607 2717

BEST BUY



This is an 'old-fashioned' design in its use of a conventional FM front end with a normal tuning dial and a nicely weighted, free-spinning rotary control. The fast and convenient action of this system for seeking a wide range of stations must be set against the digital alternative, where manual tuning is more awkward but pre-set station selection is instant.

Finished to high Lux standards, the open dial covers three wavebands, namely long, medium and FM. The final detail is the stereo/mono button, with rear connections including 75ohm coaxial (male) socket for FM, plus 300ohm balanced binding posts. A large detachable loop aerial is provided on a short cable for AM, while an external aerial can be connected if required. The standard of both finish and construction was high for the price.

Sound quality

This modest tuner gave a good account of itself. Good noise quieting was observed, with no spurious tones or whistles. The sound was quite 'open' with a decent quality shown in the bass and treble registers. The midrange was well balanced with reasonable stereo depth and focus, with only a slight hardness, while it was also reasonably good on AM and certainly above average in clarity on strong stations.

Lab results

The mono sensitivity was quite good at 6μV for our specially weighted result, and the 60μV for 50dB stereo was also OK. By 2mV input, a fine 70.5dB stereo quieting was attained. Its RF performance was also promising, with 67dB of alternate channel selectivity and reasonable values for AM suppression as well as capture ratio. Muting was rather late at 2μV; 10μV is a more realistic muting threshold value. Output was normal at 700mV, while stereo separation was to the usual standard. Distortion was suprisingly low, and well maintained over the range of tests including the overmodulation section. Pilot tone suppression was also fine at −78dB. The frequency response showed some premature bass rolloff, measuring −3dB at 50Hz, while the treble was slightly lifted, to +1dB at 14kHz, but with no peaking. A dry open sound is to be expected.

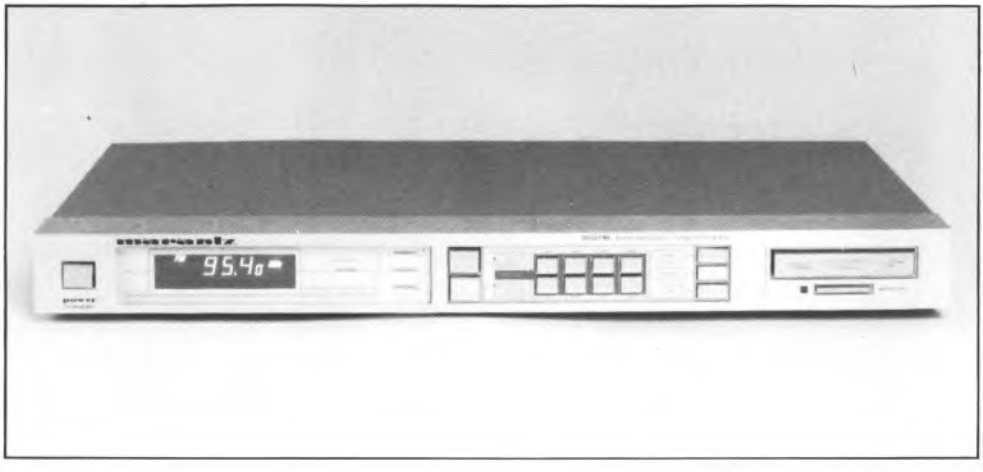
Conclusion

This tuner, though without the convenience of pre-set stations, offered a fine all-round performance at a very attractive price, and accordingly it happily qualifies for 'Best Buy' status.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	6μV/60μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	74.5dB/70.5dB
Muting threshold	2μV
Alternate channel selectivity	−67dB
Pilot tone rejection	−78dB
AM rejection	−58dB
Capture ratio	1.6dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.11%/0.12%
Stereo separation, 1kHz/5kHz/10kHz	42dB/38dB/28dB
Output level, 100% mod	700mV
Dimensions (width, depth, height)	45 x 24 x 8cm
Typical price inc VAT	£105

Marantz ST-430L

Marantz (UK) Ltd, 15-16 Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middlesex UB7 0LW Tel 01-897 6633



An ultra-slim tuner in Marantz's usual pale gold styling, the *430's* small control panel is almost too closely spaced, particularly the eight tightly-grouped station selector push buttons. Priced at a modest £90, this is a digitally synthesised tuner with no rotary tuning knob or dial. Frequency readout is via a fluorescent digital display and the usual manual and auto-scan tuning facilities are provided. A few years ago such technical sophistication was restricted to some of the costly designs ever marketed! Long and medium AM wavebands are included as well as FM stereo. Station setting is simple via the appropriate button. The AM loop antenna is detachable, and the aerial input facilities include a 75ohm coax, plus 300ohm binding posts for FM; outputs are via phono sockets.

Sound quality

Despite its modest price, this digital tuner showed less audible whistles than usual and was fully quiet by 500μV. It was however not very sensitive and for good stereo a decent signal input was required. The sound was unfortunately well below average, appearing thick, boomy and flat with poor clarity, and marginal stereo depth, while stereo focus was not much better. It was also judged below average on AM where it produced a brittle scratchy sound with audible distortion.

Lab results

For a moderate quieting level it was quite sensitive in radio frequency terms, with 60μV sufficient for 50dB of stereo signal-to-noise ratio, with full quieting at around 1mV input reaching 66dB. Selectivity was reasonable at 65dB as were capture ratio and AM suppression. Pilot tone rejection was however weak, at only 35dB down, though most Dolby cassette recorders have built in multiplex filters. So this should not be a problem. Distortion was just satisfactory, increasing to 0.6% mono when over-modulated. Stereo separation was average with a 500mV audio output level. Despite the dulled sound the response showed a mild treble shelf lift of 0.9dB in the upper octaves.

Conclusion

Noteworthy as the least expensive three waveband digital tuner we tested here, the *430's* below average sound quality precluded recommendation, though otherwise the performance was quite reasonable at the price.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	6μV/58μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	70dB/65dB
Muting threshold	—
Alternate channel selectivity	– 65dB
Pilot tone rejection	– 35dB
AM rejection	– 57dB
Capture ratio	1.3dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.33%/0.58%
Stereo separation, 1kHz/5kHz/10kHz	36dB/30dB/29dB
Output level, 100% mod	500mV
Dimensions (width, depth, height)	42 x 19 x 7cm
Typical price inc VAT	£90

HI-FI CHOICE

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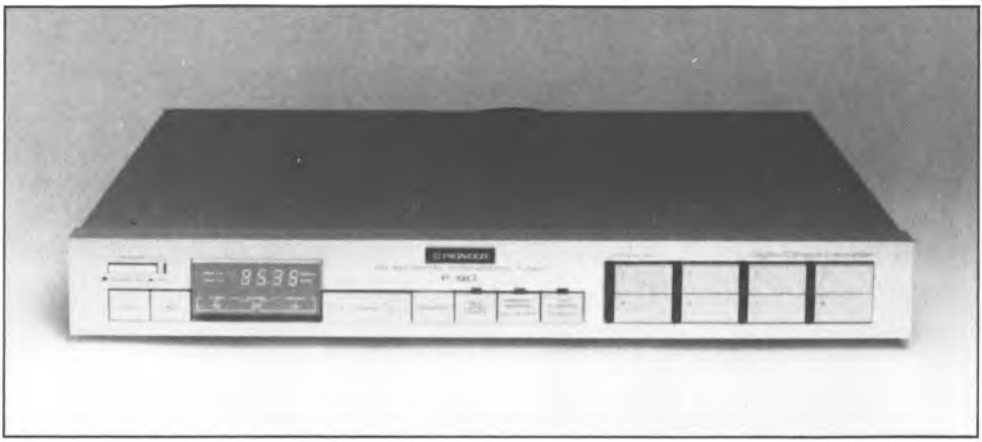
Pioneer F90

Pioneer High Fidelity (GB) Ltd, Field Way, Greenford, Middlesex UB6 8UZ
Tel 01-575 5757

BEST BUY



An advanced digital tuner, this Pioneer design offers the usual microprocessor-aided facilities such as preset tuning, power scan and so on. Extra features include AM medium waveband coverage, a record level calibration output signal and variable IF bandwith – narrow for congested reception with weaker signals and wide for clean well spaced stations to derive maximum sound quality. Eight preset buttons are provided, and the silver front panel is well laid out. Rear panel facilities include a 75ohm coaxial socket (UK female) with 300ohm binding posts and an unattached AM loop aerial which can be freely placed to get the best reception. Outputs are phono.

Sound quality

This tuner was sensitive and it 'limited' quickly, providing excellently quiet stereo backgrounds from 600μV up. Only the merest trace of digital whistles was apparent. The sound was considered quite good, with a slight dulling in transient attack, and it appeared open and clear, with quite good stereo depth and focus. It sounded tidy in the bass and treble extremes, as well as fairly presentable on the AM bands, a bonus in some reception areas.

Lab results

Very sensitive on mono, it also achieved 50dB stereo quieting by 60μV and an excellent 75dB stereo signal-to-noise figure by 2mV, reaching a subjectively good 65dB by 0.6mV. The RF performance was excellent (as we have come to expect from Pioneer) with an 86dB selectivity complemented by a 1dB capture ratio and an astonishing 80dB AM rejection. It can cope with severe reception conditions, from fringe to over-congestion, while muting was sensible at 6μV. Audio output measured 730mV. Pilot rejection was good, and distortion satisfactorily low, even when overmodulated. The best figures were attained on wide IF, but narrow was also pretty good, for example note the excellent stereo separation results. The frequency response was extremely flat to – 1dB, 15kHz, with accurate de-emphasis.

Conclusion

With a basically good, reliable, and accurate sound, the Pioneer also rewarded us with a superb lab performance and silent backgrounds. One of the best all round digital tuners at a realistic price, the *F90* therefore qualifies for 'Best Buy' status.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	5μV/60μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	81dB/75dB
Muting threshold	6.0μV
Alternate channel selectivity	– 86dB
Pilot tone rejection	– 58dB
AM rejection	– 80dB
Capture ratio	1.0dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.1%/0.15%
Stereo separation, 1kHz/5kHz/10kHz	68dB/62dB/57dB*
Output level, 100% mod	/30mV
Dimensions (width, depth, height)	42 x 32 x 6cm
Typical price inc VAT	£220

'Narrow' IF bandwidth setting

Quad FM4

BEST BUY

Quad Electroacoustics Ltd, St Peters Road, Huntingdon PE18 7DB
Tel (0480) 52561

A characteristically distinctive design from this famous British company, this middle-priced Quad tuner has been intelligently designed and works with a minimum of fuss. A large, well-weighted tuning knob gives manual station selection, the tuned frequency shown on the large digital display. A combined signal-strength/centre-tune bar graph is included in the display, and was found to work well. Seven pre-set stations may be automatically programmed, appropriately marked BBC 1 through 4; BBC LR (local radio); and ILR1/ILR2 for the local commercial stations.

Rear panel facilities include a three-pin IEC mains input, a shrouded IEC three-pin mains outlet, plus a 75ohm (female) coaxial aerial socket and a DIN audio output. Both finish and constructional standard are very high.

Sound quality

Despite digital tuning, the *FM4* had clean backgrounds free from the usual annoying whistles. By the time input reached 1mV, it showed decently quiet stereo backgrounds, and the sound quality was much favoured, scoring up with the best in this group. Stereo images were well focused, and pleasing depth was reproduced. Tonally it sounded quite neutral, and the treble was free of grain or harshness. Some mild loss of detail and bass attack was apparent when compared with the original sources, which was nonetheless a favourable result when the attainment of some of the other models is taken into account.

Lab results

The *FM4* was quite sensitive, reaching the 50dB stereo quieting (1kHz ref, CCIR/ARM) by 70μV and ultimate stereo signal-to-noise ratio by 2mV with a 66dB recorded which is a satisfactory result, and slightly better than the broadcast chain. This tuner was not at its best separating a weak from a nearby strong station with a selectivity of around 50dB, which was rather below average. Conversely AM rejection and capture ratio were quite good. Output level was lower than usual at 300mV but good pilot tone rejection was shown. Total harmonic distortion was about average with 0.25% mono and 0.5% stereo (full modulation, left or right channel only). It also responded well to overmodulation, and attained good stereo separation.

Conclusion

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

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	7μV/70μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	70dB/66dB
Muting threshold	—
Alternate channel selectivity	– 49dB
Pilottone rejection	– 63dB
AM rejection	– 61dB
Capture ratio	1.8dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.25%/0.35%
Stereo separation, 1kHz/5kHz/10kHz	48dB/38dB/30dB
Output level, 100% mod	300mV
Dimensions (width, depth, height)	32 x 21 x 6cm
Typical price inc VAT	£240

Quantum ST100

Sound Marketing Ltd, Halldore Hill, Cookham, Berks
Tel (06285) 22726

The Quantum tuner offers FM only, with manual tuning via a multi-turn knob and a coarsely calibrated moving coil meter display. Centre tuning is via two LEDs to be set to equal illumination; a trifle uncertain. In addition to manual tuning, 7 preset stations may be selected, these zeroed-in by a set of screwdriver adjustments at the rear. Output level is variable, for both channels separately. Audio output is via a DIN socket, with the FM aerial input a 75ohm (female) coax. No serial number was present on the model, bar the description 'DEM' so it is difficult to determine how far production has advanced. It was however distinguished from the other tuners by its appearance – a natural black ash wood veneered case has been used.

Sound quality

We experienced a number of problems when using the *ST100,* these commonly associated with an older generation of tuner designs. For example, there were severe 'thumps' from the speakers when operating the various controls and it also had some serious whistles in the noise background, the latter also rather poorer than average. Subjectively it sounded a touch bright and thin with some mid compression, while the stereo image was somewhat phasey with only moderate depth effects.

Despite these criticisms however there was a suggestion of a better sound waiting to be released by design improvements. Its behaviour on closely grouped stations however, suggested that it is safer for use in strong reception areas.

Lab results

Whistles at low signal levels produced false readings for the 50dB (1kHz CCIR/ARM) quieting for both mono and stereo. Conventional 50dB mono quieting was noted at a sensitivity of 4μV and the noise improved with decent signal levels, with a stereo quieting of 58dB reached by a 1mV input, which is not very good. Alternate channel sensitivity was also uninspiring though AM rejection and capture ratio were satisfactory. Pilot tone was well suppressed. Distortion was however rather high, just exceeding 1% in stereo while the muting threshold was set far too low at 2.2μV. Stereo separation was rather below average, and the frequency response showed a mild treble lift from 5 to 12 kHz, measuring +0.5dB due to de-emphasis error.

Conclusion

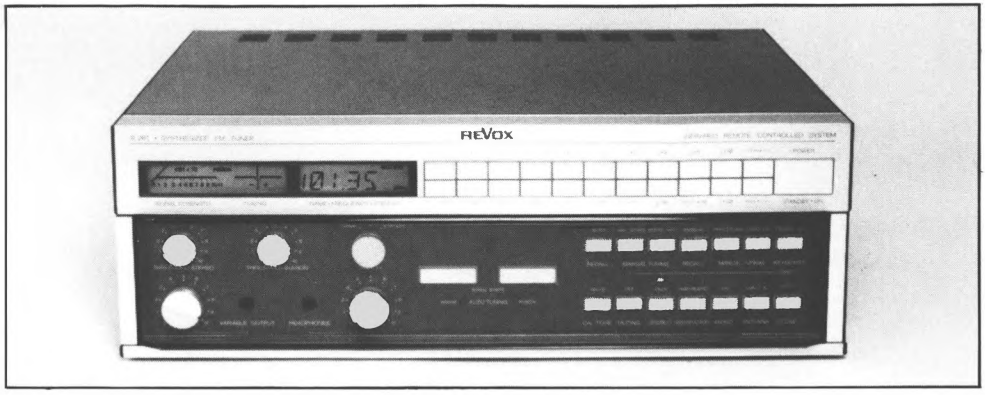
This somewhat primitive UK tuner has the merits of a low price but in my view has been inadequately developed. Competition is fierce these days, and perhaps they should have another go at it. With some further development Quantum could have a good-sounding tuner at the price, but at present it suffers from too many problems for any recommendation.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	3.8μV/40μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	58dB/58dB
Muting threshold	2.2μV
Alternate channel selectivity	– 59dB
Pilot tone rejection	– 65dB
AM rejection	– 59dB
Capture ratio	1.8dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.42%/1.05%
Stereo separation, 1kHz/5kHz/10kHz	32dB/30dB/28dB
Output level, 100% mod	650mV
Dimensions (width, depth, height)	32 x 26 x 6cm
Typical price inc VAT	£130

Revox B261

F W O Bauch Ltd, 49 Theobald Road, Borehamwood, Herts WD2 4RZ
Tel 01-953 0091

RECOMMENDED



This is a remarkable FM tuner, closer to a professional rather than a domestic receiver in terms of build quality. For FM only, it has a host of facilities ranging from auto aerial rotation to twin volume-adjustable headphone sockets. Digitally synthesised, the tuner has space for 20 preset stations whose names may be entered on a keyboard and displayed on selection. The signal-strength meter is highly accurate and all its many facilities worked well including the variable muting threshold and variable stereo threshold. Infra-red remote control is possible, and this model is also compatible with the new line of Revox electronics. Variable and fixed output level phono sockets are provided, while the aerial input is 75ohm coaxial (male). A DIN audio socket is also included.

Sound quality

This tuner was superbly engineered, and felt 'right' when setting up for the auditioning. It proved to be sensitive, with good quieting by 50μV and almost silent at 500μV with no spurious tones or whistles. The sound quality rated as 'good', if slightly subdued and softened when compared to the original source, but very pleasant nonetheless, with a clean treble. The mid tonal balance appeared a little thin, but not seriously so, while the stereo focus was good and depth satisfactory.

Lab results

The IHF mono 50dB quieting figure was impressive at 1.6μV with our 50dB stereo (1kHz ref CCIR/ARM) figure sustained at a good 45μV. This is a sensitive tuner suited to a wide range of reception conditions, particularly if the aerial rotation facility is taken into account. Alternate channel selectivity was very good and capture ratio excellent, as was the AM suppression at no less than 77dB. Distortion was low, particularly when overmodulated. Pilot tone suppression was excellent and the ultimate signal-to-noise ratios were also pretty good. Stereo separation rated as very good, reaching 60dB mid band, while audio output was ample at 2.2 volts, this variable to suit the matching amplifiers. The treble response was very flat from 100Hz to 2kHz but showed a very slight lift in the last two octaves at around 0.6dB, the output still at full level at 15kHz.

Conclusion

This comprehensive tuner was a most sophisticated and well executed example of modern broadcast design. For the FM enthusiast with a deep pocket it would be a logical choice, and can be expected to give years of service – on a hill site in southern England many of Europe's transmitters will be accessible.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	4μV/45μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	76dB/70dB
Muting threshold	variable
Alternate channel selectivity	– 82dB
Pilot tone rejection	– 82dB
AM rejection	– 77dB
Capture ratio	0.8dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.04%/0.15%
Stereo separation, 1kHz/5kHz/10kHz	60dB/51dB/39dB
Output level, 100% mod	2.2V
Dimensions (width, depth, height)	45 x 33 x 15cm
Typical price inc VAT	£897

Sansui TU-S55XL

Sansui (UK) Ltd, Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Middlesex
Tel 01-575 1133

Retailing at around £160, this slimline, satin black model from Sansui has much the same facilities as the other digital tuners, and from the outside one might expect a similar performance as well. However, Sansui have spent money on improving the standard of both the RF and decoder sections. A three waveband model, with FM, AM and LW, the usual fluorescent display (too bright!) shows the tuned frequency while eight well-spaced buttons allow station selection of eight FM stations and a combination of LW and MW stations. On the rear panel are a detachable AM loop antenna, and a set of binding posts for FM 300ohm and 75ohm aerial connection.

Sound quality

The Sansui achieved an above-average sound quality rating which was about right for the price, but nonetheless unexceptional. It sounded slightly 'shut-in' and dim, with the bass apparently softened and lightened. The mid showed some muddle, with a loss of stereo depth and focus. On the plus side, it was free of the usual whistles which plague some digital tuners, and subjectively rated stereo noise levels were good, particularly with a decent input signal of over 1mV. AM sound quality was fine, and well above average.

Lab results

Of average RF sensitivity, the *TU-S55XL* required 80μV for 50dB quieting (1kHz ref, CCIR/ARM). Ultimate quieting, at over 2mV inputs, reached 72dB stereo and 76dB mono, these both good results. Selectivity was average but capture ratio and AM suppression were both better than average. Pilot tone rejection was excellent.

Distortion levels were good and were maintained when the tuner was subjected to mild overmodulation. Output was 800mV, quite typical, while stereo separation was better than average. The frequency response was indeed dull, due to a de-emphasis error with the 8-14kHz band depressed nearly 2dB! With the right treble, it could sound rather better.

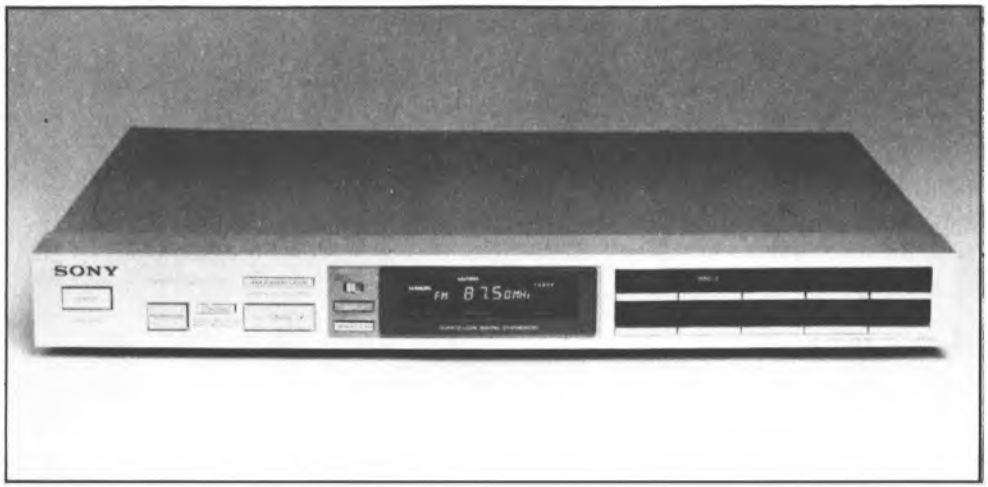
Conclusion

As supplied this tuner cannot be recommended as the sound quality fell short of the required standard. It might however just tip the balance in its favour with the right treble response, but this is up to Sansui to decide. In other respects it was quite a good design, with an above average AM performance.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	6μV/80μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	76dB/72dB
Muting threshold	6.0μV
Alternate channel selectivity	– 64dB
Pilot tone rejection	– 83dB
AM rejection	– 72dB
Capture ratio	1.1dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.1%/0.16%
Stereo separation, 1kHz/5kHz/10kHz	41dB/41dB/39dB
Output level, 100% mod	800mV
Dimensions (width, depth, height)	43 x 27 x 8cm
Typical price inc VAT	£160

Sony ST-JX500

Sony UK Ltd, Staines House, 158-162 High Street, Staines, Middlesex TW18 4AZ
Tel Staines 61600



Another model priced at around £160 this Sony is a digitally synthesised design. It has a useful and unusual feature seen on other Sony designs, namely a user-exchangeable indicator set for the array of 10 push buttons which give preset station selection. These can then carry the names of the required stations rather than arbitrary numbers codes. The usual push-button controls select the various modes such as FM, LW, and MW wavebands, manual tuning and power on off.

Nicely built, in a slimline silver case, the *ST-JX500L* is fitted with a bar antenna with some tilt and rotation adjustment. FM aerial input is via male 75mm coaxial socket, and 300ohm balanced terminals are present. An external AM aerial may also be connected if required.

Sound quality

This tuner provided a disappointing sound quality, well below average. Aside from some mild whistles close to the noise floor, the character was thickened and boomy, with a grainy effect in the mid band. The stereo sounded too forward with little depth representation, while the treble showed some lispiness, and the overall effect was not very detailed. AM was about average.

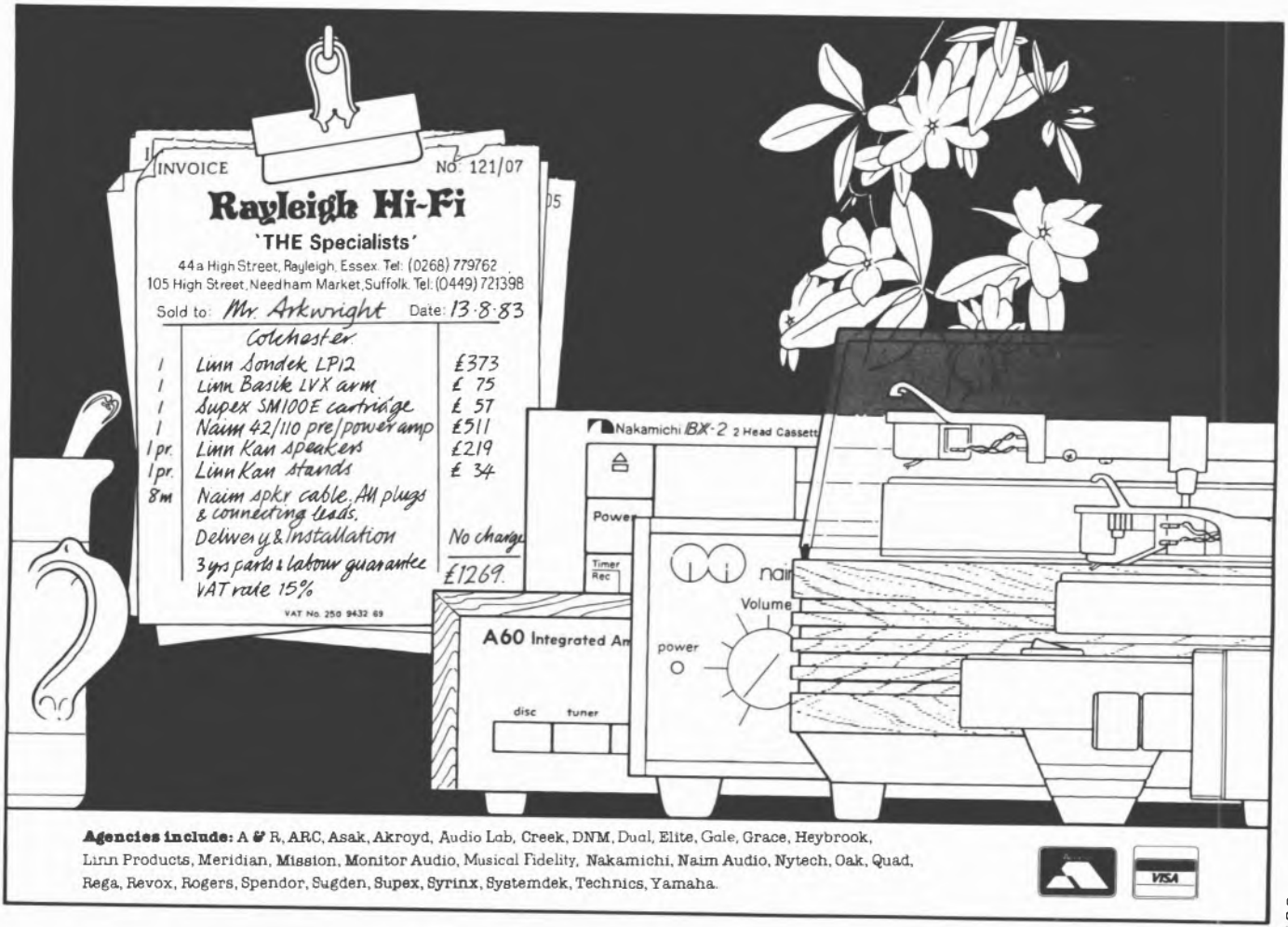
Lab results

This was a sensitive tuner requiring only 30μV to reach a 50dB stereo signal-to-noise ratio (1kHz ref CCIR/ARM). The radio frequency performance was pretty good, suitable for difficult reception conditions, with a good 72dB of selectivity, a 0.9dB capture ratio and a 70dB AM suppression. Pilot tone rejection was very good, and ultimate signal-to-noise ratios were reached by 1.5mV input, and were very good at 74dB stereo, 79dB mono. Good mid-band separation was achieved, but deteriorated a little by 10kHz. Audio output was healthy and the frequency response was very uniform, with just a hint of treble lift, belying the sound quality rating.

Conclusion

This was a sensitive tuner with good RF performance but let down by an unsatisfactory sound, the causes of which are not obvious from the measurements. No recommendation is possible here for this otherwise promising design.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	2.5μV/32μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	79dB/74dB
Muting threshold	10.2μV
Alternate channel selectivity	– 72dB
Pilot tone rejection	– 77dB
AM rejection	– 70dB
Capture ratio	0.9dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.06%/0.15%
Stereo separation, 1kHz/5kHz/10kHz	52dB/39dB/32dB
Output level, 100% mod	1V
Dimensions (width, depth, height)	43 x 26 x 6cm
Typical price inc VAT	£165



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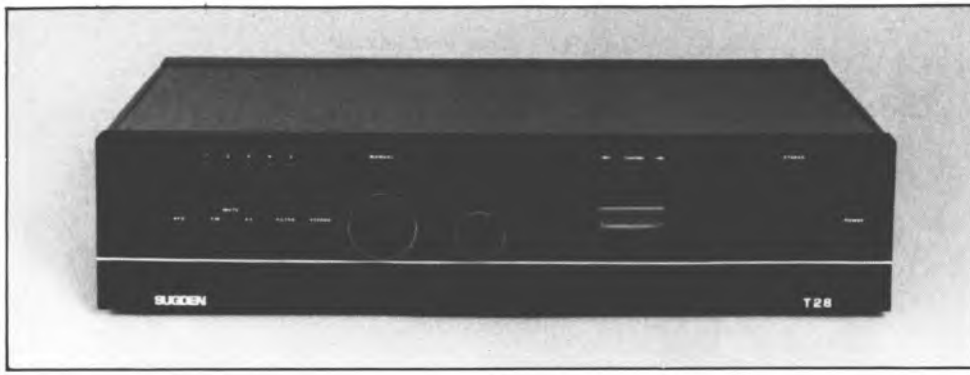
Sugden T28

J E Sugden & Co Ltd, Valley Works, Station Lane, Heckmondwike, West Yorks WF16 0NF
Tel (0924) 404088

RECOMMENDED



Two versions of this British-made tuner are available – the *T28* here reviewed and the *DT28*, which adds a digital tuning readout at some extra cost. The *T28* is in the traditional Sugden styling. The front panel is not properly labelled, and the designer has chosen to use a rotary switch for up to five pre-set stations, these adjusted via a set of screwdriver slots at the rear. No tuning meter is fitted; instead, there is a red-green-red lamp system, which can be confusing. A moving-coil meter gives a rough indication of tuned frequency. Manual tuning is by an unweighted knob coupled to a 10-turn potentiometer.

Signal output is via a permanently-connected phono lead, with aerial input via a 75ohm coax (female) with rather inaccessible screws provided for a 300ohm unbalanced connection.

Sound quality

While this tuner seemed quite sensitive and showed a rapid quieting, it was plagued by 'birdies' or whistles until a signal level as high as 5-10mV was reached. Stereo background was reasonably quiet at this level though this was still poorer than average. However, the sound was liked, and a reasonable impression of depth as well as a clean, lively character was noted. It also seemed capable of above average musical detail, sounding tonally neutral.

Lab results.

The *T28* was fairly sensitive, with 60μV sufficient for 50dB stereo noise quieting (1kHz ref CCIR/ARM). 1mV input was required for full stereo quieting, this levelling out at 61dB, which is poorer than average. Normally weighted, the mono sensitivity was 3.5μV. The RF performance was not very strong, with a selectivity of 52dB, a 55dB AM suppression and a 2.1dB capture ratio. Total harmonic distortion was worse than average at up to 0.65% stereo, full modulation with a similar figure for mono overmodulation. Pilot tone rejection was fine however at –72dB. Stereo separation was good in the mid band but deteriorated at higher frequencies to 21dB at 10kHz. Output level was 620mV while the muting threshold was ridicuously low at 2μV. Frequency response was quite uniform, with just a mild 1dB shelf down in the first half octave in the treble.

Conclusion

At £172 the *T28* could do with some refinements such as better RF performance, as well as better suppression of spurious tones at moderate signal levels. Conversely the sound quality was quite good, sufficient in fact for a cautious recommendation to be in order; but we hope that the company will improve overall product quality.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	6μV/65μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	65dB/61dB
Muting threshold	2μV
Alternate channel selectivity	–52dB
Pilot tone rejection	–72dB
AM rejection	–55dB
Capture ratio	2.1dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.39%/0.64%
Stereo separation, 1kHz/5kHz/10kHz	40dB/28dB/21dB
Output level, 100% mod	620mV
Dimensions (width, depth, height)	43 x 23 x 9cm
Typical price inc VAT	£172

Tandberg 3011

B&W Loudspeakers Ltd, Meadow Road, Worthing, West Sussex
Tel (0903) 205611

Styled and sized to match the *3000* amplifier range, both integrated and separate models, the *3011* is a larger FM-only tuner with rather deeply-recessed dial. It has a reasonably well-weighted tuning, providing normal manual operation as well as a preset facility for up to eight stations. Variable output level and independent mono/stereo switching are provided, as well as muting buttons. A wide dynamic range signal strength meter is fitted, while the centre-zero tuning meter is also calibrated in kHz deviation or setting error.

Rear panel facilities include a 75ohm coaxial aerial socket (male), with silver-plated outputs for the audio, and switchable de-emphasis of 25, 50 and 75μS for use in various locations (50μS for the UK). A detachable two-core mains cable is used as with other Tandberg and Revox gear, and both the finish as well as the constructional standard were very good, as they should be considering the price.

Sound quality

While the Tandberg sounded relatively uniform in frequency response, subjective transients seemed dulled. In the stereo image, focus was good but with a noticeable loss of depth, and tonally the *3011* could sound a trifle 'thin'. Its output was free of spurious tones or whistles, and overall it was ranked above average, but not by a significant degree.

Lab results

A high sensitivity design, our tough mono quieting level was achieved by 4μV with 35μV required for stereo. Ultimate signal to noise ratio was achieved by 2mV at a good 70dB stereo and barely improved at 71dB in mono. Its RF performance was exceptional, with better than 90dB selectivity plus a fine capture ratio, and excellent AM suppression. Clearly it is a model for difficult reception conditions. Distortion levels were moderate, even under overmodulation conditions, while stereo channel separation was fine, still measuring 39dB at 10kHz. Pilot tone rejection was very good, while the output level was high at a maximum of 2.3 volts, front panel adjustable. Muting was set at a sensible 7μV. The frequency response was very uniform with extended bass and negligible treble rolloff up to 14kHz.

Conclusion

This is clearly a high quality product with an excellent radio frequency performance as well as a good if not outstanding sound quality. It does not in our view represent very good value for money, but could come into its own in fringe reception areas.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	4.2μV/35μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	71dB/70dB
Muting threshold	7μV
Alternate channel selectivity	– 90dB
Pilot tone rejection	– 75dB
AM rejection	– 78dB
Capture ratio	0.9dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.14%/0.25%
Stereo separation, 1kHz/5kHz/10kHz	46dB/43dB/39dB
Output level, 100% mod	¿.2V
Dimensions (width, depth, height)	43 x 38 x 8.5cm
Typical price inc VAT	£410

Yamaha T-500

Natural Sound Systems Ltd, Unit 7, Greycaine Road, Watford WD2 4SB
Tel (0923) 36740

This attractive tuner in satin black is nicely styled to complement the budget Yamaha amplifiers. Selling at a modest £119, it is a digitally synthesised type with five preset buttons useable over three wavebands FM, LW and MW. The stereo/mono muting switch is combined, and the tuning is manual, via a pair of push buttons used in conjunction with the usual fluorescent digital frequency display.

On the rear panel an AM loop antenna is clipped and may be detached and sited at a moderate distance from the unit for better reception. These leads and the 300ohm unbalanced FM connections are made via neat spring clips, and a 75ohm FM input is also provided (male). Signal outputs are in phono.

Sound quality

Some mild whistles were heard in the output of this model at moderate signal levels and were not reasonably suppressed until a 2mV RF input level was reached. Normal background noise was fairly good. The sound was considered quite smooth with a pleasant tonal balance on voice as well as decent bass. On loud sections some hardness was evident and it did not seem particularly transparent. Not much depth was shown, though stereo focus was fine, but the AM sound was rather poor, appearing very thick and boomy.

Lab results

The tuner's basic sensitivity was high, with 50mV sufficing for the stereo 50dB signal-to-noise ratio (1kHz ref, CCIR/ARM). Ultimate quieting in stereo was 66dB at around 1·2mV input, a reasonably good result. The RF performance was surprising with a selectivity of 79dB making it suitable for crowded station areas. AM rejection and capture ratio were pretty good, and pilot tone suppression satisfactory. Distortion was moderate even when overmodulated, while stereo separation was about average. Measured frequency response fell within close tolerances, with no significant error up to 14kHz.

Conclusion

The overall performance was fairly respectable with a satisfactory sound quality and quite good sensitivity as well as selectivity. The value for money was thus fair enough, but unfortunately, we felt, insufficient to merit election to the recommended category.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	5μV/50μV
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	71dB/66dB
Muting threshold	4μV
Alternate channel selectivity	– 79dB
Pilot tone rejection	– 53dB
AM rejection	– 59dB
Capture ratio	1.4dB
Total harmonic distortion	
At 100% mod, 1kHz, mono/stereo	0.13%/0.33%
Stereo separation, 1kHz/5kHz/10kHz	37dB/35dB/31dB
Output level, 100% mod	550mV
Dimensions (width, depth, height)	44 x 30 x 10cm
Typical price inc VAT	£130

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BEST BUYS AND RECOMMENDATIONS: TUNERS

The selection of tuners included for test in this edition has been made primarily to help those looking for a tuner to partner one of the amplifiers covered in the amplifer review section. Although we have been able to include models from most of the major manufacturers, we can claim only a limited coverage of the market, and it must be pointed out that other good tuners are available which we were unable to include.

Here the tuners chosen as 'Best Buys' or 'Recommended' are listed in ascending order of price.

BEST BUYS
These five models are those which we regard as offering exceptional value for money.

BEST BUYS
Luxman T210L (£105)
A tidy product with good manual tuning and an AM waveband included. This Luxman model is a sensitive model, with fine quieting, while the overall RF and distortion performance is also quite good, especially for the price. Very good value.
JVC JX22L (£115)
This inexpensive model gives suprisingly good sound, particularly on the stronger, local stations when some whistles were well suppressed. Its audio and RF performance is well balanced, the unit offering fine value. The AM sound is also above average, with both MW and LW bands covered.
Fisher FM-275 (£130)
Another model needing a decent signal to avoid some minor whistles, given this it performed well subjectively with a fine dynamic range. Its lab performance is above average though the AM sound is poor; still good value though.
Harman Kardon TU610 (£130)
A good-sounding tuner with superior low level signal performance and fine quieting. This model has reasonable AM reception and offers a good all round balance: A fine non-digital tuner.
Pioneer F90 (£220)
This tuner provides an immaculate performance suited to the most difficult reception areas. Quieting, separation and so on are excellent. The sound quality is good too, only a little behind that offered by this issue's best. AM performance is tolerably good and for the more difficult reception areas this is a logical choice.
Quad FM4 (£239)
A well-balanced technical performer, with a silent background and no whistles, this model offers really good sound quality and intelligent ergonomics. A fine product, offering FM only.

RECOMMENDED
The following models are recommended on grounds of general merit or value compared with the group as a whole.

Denon TU750 (£150)
A pleasant sounding tuner of good appearance and solid quieting on reasonably strong signals. No whistles were observed on FM, while the AM performance is distinctly above average.
Sugden T28 (£172)
This sensitive tuner offers very good sound quality for the price, but is marred by a weaker RF performance. In addition some whistles are apparent, these varying with input level. If these were cured, this tuner could be really good value. Perhaps you should try one yourself?
Revox B261 (£897)
Recommended for merit rather than value, this exceedingly sensitive tuner is an excellent performer with a wealth of facilities for the enthusiast including auto aerial rotation. The sound quality revealed in the listening tests was pretty good too.

Reception conditions
When choosing a tuner, you must consider its ability to deal with prevailing reception conditions as well as its actual audio sound quality given good reception. If you are interested in long-distance reception (DX'ing) you will need to look even more closely at the tuner's RF capabilities.

For a DX broadcast enthusiast, the Revox *B261* is without peer, as even its signal strength meter can be relied upon over a wide dynamic range, A good-sounding modern tuner bristling with modern technology is the Pioneer *F90*, which is an exceptional performer in fringe reception conditions as well as in town.

If reception conditions are reasonable, the Quad *FM4* provides a very good sound. At a small sacrifice in fidelity some much cheaper tuners will also fit the bill, particularly where reception conditions are kinder; examples worth trying here are the Lux *210L* or the JVC *TX22L*.


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AFC: Automatic Frequency Correction; a special circuit that compensates for slight mis-tuning or tuning drift.
AM: Amplitude modulation; a form of radio transmission appropriate nowadays to information rather than hi-fi music (see *MW, LW, SW*).
AM rejection: Ability of an FM tuner to discriminate against unwanted AM interference signals.
Amplitude: Size or magnitude, and hence level or loudness of a signal, for example.
Bandwidth: A range of frequencies with presumed defined upper and lower limits.
'Birdies': A form of FM radio interference, caused by a strong signal near the frequency of a weaker, wanted station.
Capacitance: An element of electrical impedance that is particularly important when matching pickup cartridge, arm leads and amplifier input characteristics to achieve a flat frequency response from discs.
Capture ratio: The ability of a tuner to reject an unwanted station in favour of a slightly stronger wanted one on the same broadcast frequency.
Clipping: This is the state reached when a circuit is overloaded and overdriven, resulting in bad waveform distortion and audibly unpleasant effects.
Coloration: A general term used to describe the audible effects of distortions, particularly in loudspeakers and record players. These are usually caused by frequency response irregularities and/or resonances.
Compatibility: The selection of interdependent components to achieve optimum system performance; notably arm/cartridge mass/compliance matching, cartridge electrical loading, or loudspeaker/amplifier matching.
Crosstalk: The leakage from one channel to the other in a two channel stereo system.
dB: See decibel
Decibel (dB): A logarithmic unit of relative loudness, or relative strength of electrical signals. In general use for specifying sound pressure level (SPL), the figure given in **dBA** will be relative to the threshold of hearing. Thus 0dBA is the threshold of hearing, 120dBA the threshold of pain. In equipment tests for noise, hum and rumble, separation etc. the wanted signal is at a level defined as 0dB and the unwanted signal (noise) is quoted as a minus figure, i.e. so many dB below. In these measurements the larger the figure, the better. See also 'weighting'. **dB/W** or 'decibels for one watt' is used to define loudspeaker sensitivity. If one watt is defined as 0dB, amplifier power ratings can be given as **dBW**, for example, 100W = 20dBW.
Decoder: The circuit in a tuner which separates the left and right signals from an FM multiplexed (stereo) transmission.
DIN: German standards body, responsible amongst other things for a popular range of standard plugs and socket specifications.
Distortion: Usually refers to 'total harmonic distortion' which is the percentage of unwanted frequency components (harmonics) present in a wanted signal. Strictly, distortion can mean any unwanted change in the signal, introduced by the equipment.
DX (DX-ing): Code/jargon to describe long-distance radio reception.
Dynamic range: The range between the quietest and loudest sounds which a system or component is capable or reproducing.
Equalisation: The deliberate modification of frequency response, usually in response to some engineering limitation or deficiency in the component (*eg* loudspeakers) or the information medium (*eg* disc and tape).
Farad (F): Unit of capacitance.
FM: Frequency modulation; the technique used to encode audio information for transmission with good fidelity using very high frequency (VHF) transmission.
Ferrite rod: :A short rod type aerial used for AM reception; may be fitted internally or externally to tuner or receiver.
Filter: A circuit (normally) used to restrict the bandwidth of a system; may be fixed or switchable.
Frequency: The rate of a cyclic (repeated) vibration.
Frequency response: Abbreviated from amplitude/frequency response, this prime graphical measurement examines whether all frequencies across the spectrum are reproduced or generated at the same relative level.
Harmonic distortion: The addition of unwanted harmonics to a signal. Because the structure of music is already rich in harmonics, the audible effects of moderate levels of harmonic distortion are rarely objectionable, but may be evidence of engineering limitations.
Hertz (Hz): Unit of frequency; 1Hz equals one cycle per second, 1kHz one thousand cycles per second.
Hum: Self explanatory and onamataopoeic; caused by interference of mains frequency or harmonics (50Hz etc in UK), perhaps as a result

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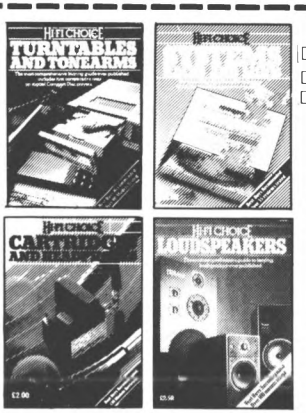

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HI-FI CHOICE

of poor earthing arrangements.
IHF: American Institute of High Fidelity, and important standards body, many of whose recommendations on measurement techniques have been adopted in this book.
IM (Intermodulation): Interference between two or more single frequency tones can cause non-harmonic distortion components such as sum, and difference frequency signals to occur.
Impedance: The measure of an electrical load when using alternating currents as in audio, combining resistance, capacitance and inductance.
Jack plug/socket: Post Office style plug/socket standard, widely used for headphone and microphone connections both in mono and stereo formats.
Kilo- (k-): Prefix for units meaning $\times 1000$ (*eg* 1kHz = 1000Hz).
LED: Light Emitting Diode; an indicator light.
LF: Low frequencies; the bass end of the audio frequency range.
Load or Loading: The impedance (including resistive and reactive components) seen by one component looking back to its interconnected component; of importance in compatibility of cartridge/amp and amp/speaker.
'Loudness': An equalisation circuit frequency switchable on amplifiers which is designed to compensate for presumed hearing characteristics at low listening levels by boosting bass and treble.
Medium wave: An AM transmission band incapable of high fidelity signals.
Micro- (μ): Prefix for units meaning one millionth of (*eg* seconds, Facads).
Midrange: The middle part of the audio frequency band.
Milli- (m): Prefix for units meaning one thousandth of (*eg* volts, etc.).
Moving-coil (mc): Type of transducer, used in some cartridges and widely in loudspeaker drive units.
Moving-magnet (mm): Type of transducer widely used in cartridges.
Multi-element aerial: FM aerial consisting of dipole *plus* one or more additional elements (called director and reflectors). This sort of aerial is more directional than an FM dipole and provides signal gain in the forward direction. Useful for discriminating against interfering signals and for 'boosting' weak signals.
Muting: In FM tuners, circuit technique which mutes the audio section while tuning between stations thereby eliminating the loud inter-station hiss.
Muting threshold: Threshold point at which the muting is released. This should not be above weak stations otherwise these will not be received. It should be above very weak stations, however, because the background noise on these makes them unsuitable for listening to. Some tuners are equipped with adjustable or switchable threshold level.
Noise: Random unwanted low level signals generated fundamentally through thermal excitation on the molecular level. Poor system design may make it intrusive.
Ohm: (also *eg* kohm): measure of the load presented by a device to an electrical source.
Phono: The most commonly-used plug/socket combination in audio components.
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: The upper-midband/lower treble part of the frequency spectrum, emphasised by frequency response characteristics, makes human voice sound more forward — hence the term 'presence band'. Conversely, a dip in frequency response in this area makes the sound appear more distant, irrespective of actual overall volume.
Sensitivity: The amount of signal input required to generate a specified signal level output, or *vice-versa*.
Signal-to-noise, signal/noise, S/N: The difference in total output when an applied signal is removed.
Step-up: A transformer or head amp used to boost or match the output of a moving-coil cartridge to a normal moving-magnet amplifier disc input.
Transducer: Device transforming energy from mechanical to electrical form or *vice-versa*.
Transient: Signal of very short duration.
Volt (V): A measure of the amplitude of a signal.
Watt (W): A measure of electrical power, combining the voltage (amplitude) with the current required to drive the 'motor' of a loudspeaker.
Weighting: Derived from psycho-acoustic or engineering considerations, this is a bias applied to a test method to improve its subjective relevance (hence also *unweighted*).

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