

HI-FI CHOICE

AMPLIFIERS & STEREO TUNERS

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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 Edi-

son 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.

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Published by SportsScene Publications Ltd,
14 Rathbone Place, London W1P 1DE
Tel: 01-631 1433
Distributed by Seymour Press Ltd,
334 Brixton Road, London SW9 7AG
Typesetting by In-Step Ltd,
33-41 Dallington Street, London EC1V 0BB
Printed by H E Warne & Co Ltd, St Austell

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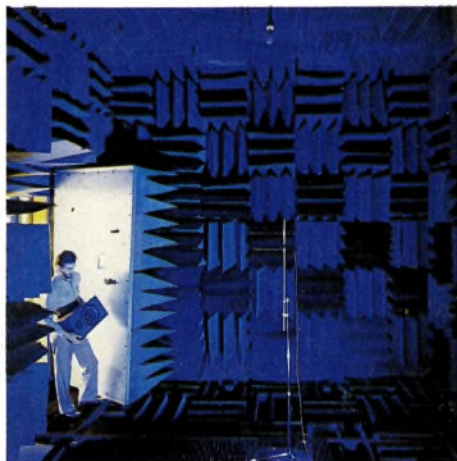
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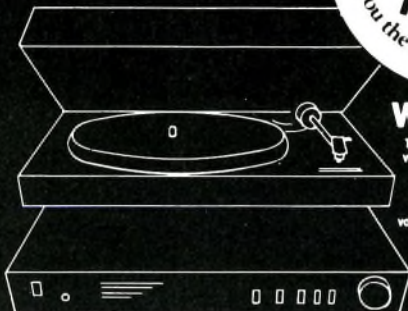


AR
System



In recent years the development of hi-fi generally has led to improved sound quality, which in turn, has increased the expectations of the listener for an even better sound from his system. The much acclaimed Rotel range is the result of our on-going research and design programme in the UK to constantly improve the quality, performance and visual appeal of our hi-fi systems whilst maintaining our reputation of value for money.

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Rotel RA820B voted best amplifier under £250.

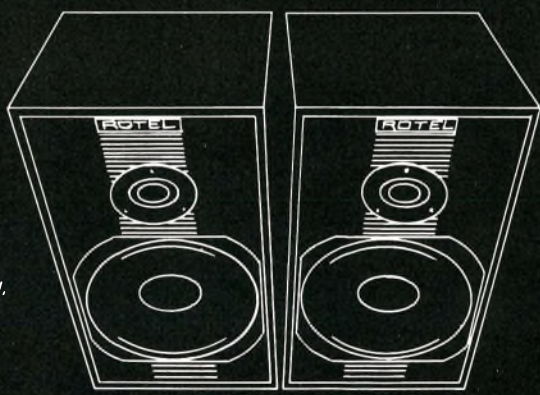
ROTEL SIMPLICITY

RP830. Overall the Rotel RP830 is an unusually good turntable for the price... you are going to have to spend a lot more money to better it. **Hi-Fi for Pleasure.**

RA820BX. This remarkable little amp shows the competition a clean pair of heels. It's a gem that can only further enhance Rotel's reputation. **Hi-Fi for Pleasure**
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ROTEL *hi-fi*
25 HEATHFIELD, STACEY BUSHES, MILTON KEYNES

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.

In the last couple of years there has been a renaissance in amplifier design. Our last *Amplifiers* issue covered a number of designs which succeeded in producing very good sound at moderate cost. This development has continued and intensified to the point where some quite cheap amplifiers sound amazingly good. This state of affairs has come about partly because manufacturers now feel that the market will accept amplifiers of 'straight line' design, that is where all tone controls and unnecessary extra bits of circuitry and switching are omitted. This allows the manufacturers to spend more on the essential parts of the amplifier, using good quality components. There are, of course, still some very good models with tone controls and other extra facilities for those who want them.

Over the last few seasons the ranks of Japanese hi-fi amplifiers have thinned a little, as some of the large manufacturers have concentrated entirely on integrated audio systems, and no longer sell separate hi-fi components. Nonetheless, there was no shortage of new product this year, from East or West. Some specialist firms have continued to fine-tune their existing products this year, and in many cases our retests of current samples have shown a worthwhile improvement over previous ones, though the appearance and even the measured performance may be unchanged.

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.

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 assessment 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.

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 to 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 reviews analysis. We have tried to include pointers to successful matching wherever appropriate.

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

WHAT ON EARTH WITH TODAY'S

When Sansui took a radical look at amp noise and distortion, we found the answer outside the amp itself. In fact, right under our feet.

We put our ear to the ground.

On conventional amps, the circuitry is unbalanced. The inputs, the power supply and the outputs all share a common earth. And that's where things can turn nasty. For instance: as a speaker cone moves, it sends out soundwaves and also feeds back counter electro-motive current into the amp. Simultaneously, the power supply is creating ripple current

They both meet at the earth and you end up with Interface Hum Modulation (IHM). Which is a real pain in the ear.

X-Balanced amplifiers. The Sansui solution.

There is a way round ground based distortion: using a balanced transmission line, as professional studios have done for years.

Yet even their system has a big drawback for the listener. Because they use a transformer to amplify the signals along the line: there's a big drop off in sound quality and frequency response.

Sansui's answer is to balance, purely electrically, the whole amp by amplifying and transmitting the signal along the whole of its journey. The input, output, power supply, drive circuit and even the negative feedback loop are all fully balanced.

All parts of the amp operate independent of the ground, effectively neutralising dirty currents. But without affecting sound quality in any way.

And because input and power supply have their own separate grounds, no matter how much power you pump through, the signal remains as pure as driven snow.



IS THERE ANYTHING ON EARTH'S WRONG WITH YOUR AMPLIFIERS?

We call this the X-Balanced system. It's unique to Sansui. Free from distortion, you'll find your music sounds markedly more natural.

Lots of watts for the power you need to handle digital.

Nothing can bring out the dynamic contrasts in music volume like digital transcription.

So your amp needs to take everything a CD can throw at it.

Without enough current in reserve, you could lose more than just your high and low frequencies; severe clipping can seriously damage your tweeter's health.

Thanks to their chunky power supply Sansui's X-Balanced amplifiers feed sufficient current to the output transistors even when the speaker load becomes as low as 2 ohms. For example the 130 watts per channel AU-G90X has a dynamic power output of 360 watts at 2 ohms.

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You'll find our unique X-Balanced system on a whole range of amps. From the 25w. per channel AUG 11X, to the state-of-the-art matching power and pre amp; the B2101 and the C2101.



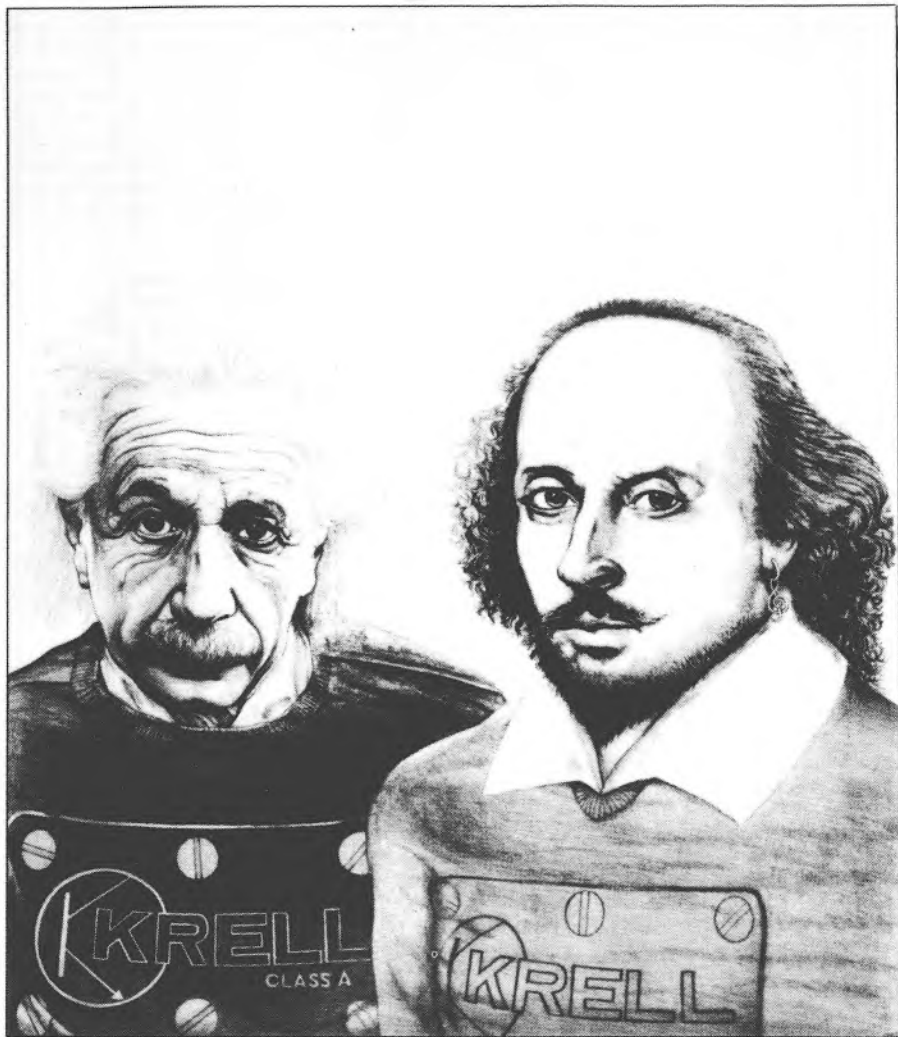
X
BALANCED AMP

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CONSUMER INTRODUCTION

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 conventional wisdom 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

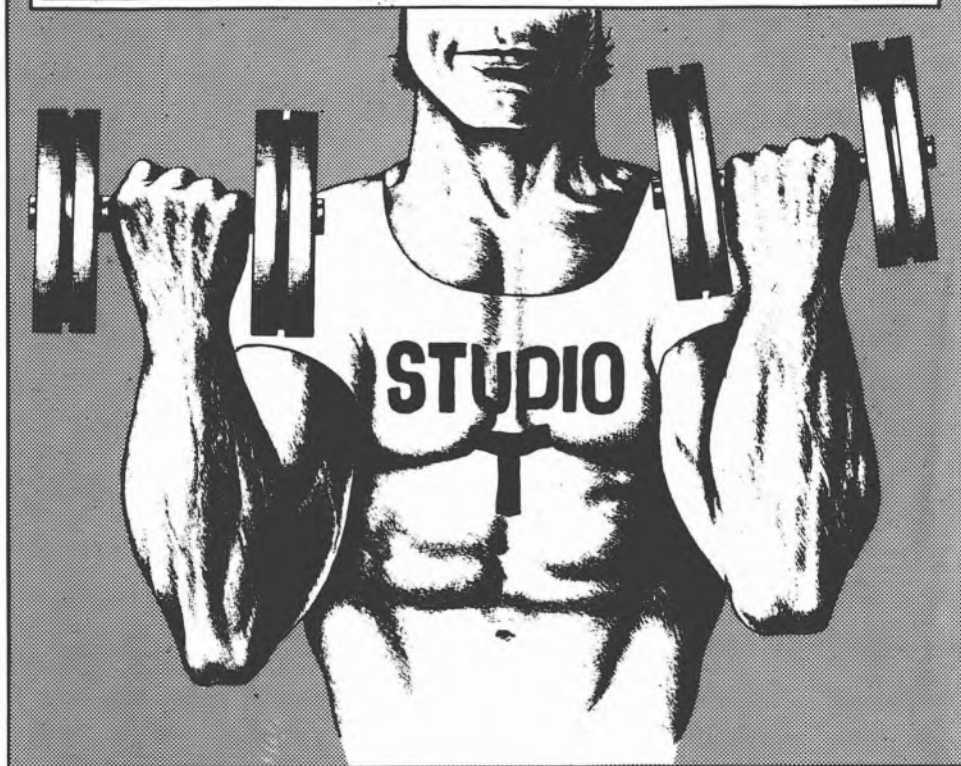
A pre-amplifier, or the pre-amplifier section of an integrated amplifier, will need to have the ability to accept signals from record deck, cassette deck, tuner and perhaps a Compact Disc player, a second cassette deck or a reel-to-reel tape deck. It should also provide a suitable output signal for recording 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.

MUSCLE CONTROL.



It's all very well to talk about watts per channel in power amps.

But where Studio T lifts itself right into the heavy-weight class, is in its authority and control over power.

The imaging, for example, feels so realistic, it's uncanny.

Immense power reserves mean that Studio T won't bottom out.

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CONSUMER INTRODUCTION

cartridges do produce measurably more output than others, the difference is not great enough to produce problems for a well-designed amplifier 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 pre-amp has to cope with resonances beyond the audio bandwidth in both directions, *i.e.* infra- and ultrasonic.

Until fairly recently, most moving-magnet cartridges incorporated an automatic HF roll-

off (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 comparisons 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.

CONSUMER INTRODUCTION

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 unnecessary 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 be into fashion was the 'click stop' type, which while actually using an ordinary potentiometer, 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 asymmetrical 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 'mis-tracking' 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 is '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



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CONSUMER INTRODUCTION

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

CONSUMER INTRODUCTION

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.

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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 forth 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

CONSUMER INTRODUCTION

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 (V_e 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. If 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.

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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 $\frac{1}{4}$ amp at 240volts will give 60watts, whereas 5amps will be necessary at 12volts to give 60watts ($\frac{1}{4} \times 240 = 5 \times 12 = 60$). 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 $\frac{1}{4}$ 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 conservatively 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

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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, typically 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 indestructible, 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

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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 80hm 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 electronically. But even so, it is worth checking to see that the elegantly-simple controls of an 'audiophile'

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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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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, $\pm 25A$ 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* spectrum 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.

Supply modulation

A new test was adopted in this issue to test the supply rejection of the amplifiers under load. Run at two-thirds of their rated output level, with a 4ohm load, a spectral analysis was made from 0-500Hz to assess the degree of supply hum modulation and breakthrough to give a sort of 'mud' index. Analyser resolution extends to -90dB relative to the fundamental.

Transient balance

Another test concerned the summation of an identical phase input at the amplifier's output terminals under 4ohm loading. The difference between the channels was then assessed. This test examines transient channel balance (auxiliary input). Due to production pressures this test could not be applied to all the review models.

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

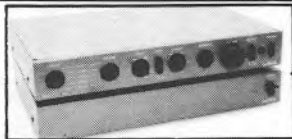
In general these were checked using an automatic RLC bridge but where the input conditions (biasing, overload etc) gave erroneous results, the loss produced over a 600ohms source resistance was computed to loading factor for 1kHz and 20kHz.

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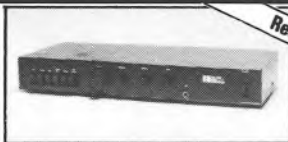
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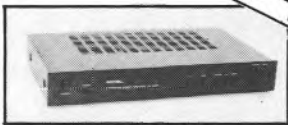


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SPALDINGS

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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 appraisal

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 prejudice.

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; ancillary 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.

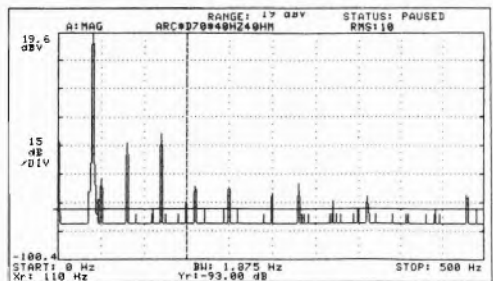
Where the pre- and power-amps from a given manufacturer could logically be separated, these were assessed as individual components, and if appropriate, individual ratings may appear in the conclusions.

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 Spondor *SP1*.

For auditioning the top class amplifiers, the Magneplanar *MGIII II* loudspeakers proved invaluable, due to their extended frequency response and high power capacity.

Great care was taken to ensure the high quality of the source material, this including the use of isolating platforms for the turntable and the CD units, as well as the optimum adjustment of the CD player and the use of balanced twin monocrystal interconnects, both for the sources, and, where desirable, for the pre/power amp combinations under test.

Less critical moving magnet disc auditioning employed a Technics *EPC 205III*L cartridge specially fitted to an *SL7* turntable, but for the bulk of the tests, a Koetsu *Black* moving coil



Spectral analysis of power supply hum modulation and breakthrough. The 40Hz signal is at two-thirds rated power, 4ohm load, unless otherwise stated. This example is the Audio Research D70 II power amplifier.

TECHNICAL INTRODUCTION

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 linear crystal 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 control unit.

Reference power amplifiers; Krell KSA50, Mission 777BU.

Disc inputs: Lux PD300 (special), Zeta arm, Koetsu Black and Red Level cartridges; Heybrook TT2, Rega RB300, van den Hul MC1000. Technics SL7 with EPC20511IL cartridge.

Aux inputs: Sony PCMF1 and PCM701 for digital mastertapes; Yamaha CD-2, Meridian MCD Compact Disc players; Mission Isoplat mounting.

Loudspeakers: Quad ESL63, Spendor SP1, Magneplanar MGIII II, 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'

James Newton Howard and Friends (Sheffield)

Respighi: Pines of Rome (Decca)

Phil Collins: 'Hello I Must Be Going'

Mahler: Symphony No 2, Slatkin (Telarc)

Analogue discs:

Rickie Lee Jones: 'Pirates'

'Dave Grusin Revisited' (Sheffield)

Ry Cooder: 'The Slide Area'

Berlioz Symphonie Fantastique (Reference Recordings)

Carol Kidd (Aloi Records)

Laboratory Test Equipment

For this issue, the new lab tests were carried out by the author using the following equipment:

HP 7025 digital vector plotter

HP3561A spectrum analyser

HP Thinkjet printer

Technics SH9000 series parametric equaliser

HP 3582A FFT

HP 8093 analyser

JP 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

Tests for earlier reviews which are reprinted in this issue were carried out by Camtech Ltd under the supervision of Stan Curtis, using the following equipment:

HP 8903A Analyser

HP 3314A Function Generator

HP 3590A Spectrum Analyser

HP 334A Analyser

Sound Tech 1700B Analyser

Gould 054040 Digital Storage Scope

Wavetek Sweep Generator

CSC Pulse Generator

Wayne Kerr B424 Automatic Bridge

B&K 2305B Recorder

J. J. Lloyd PL4 Plotters (two)

Thurby & Fluke Precision Programmable DVMS

HP 85C Controller

Radiometer BKLF10 low-distortion Oscillator

B&K Tracking Multiplier 1901

B&K Band Pass Filter 2020 (two)

Acknowledgements

Thanks are due to Stan Curtis for his aid in the original test measurements for the earlier reviews and to Marianne Colloms who checked and typed the manuscripts. 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

$2 \times 10000\mu\text{F}$ 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 grain, and the bass lacked real definition. It could however produce a healthy output and proved tolerant of the taxing special load, reaching 99dB 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 ± 7 amps, 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: -1.5 dB at 20kHz and -4.5 dB at 20Hz. The auxiliary response was wider, while the tone controls have perhaps over-generous control ranges.

Conclusions

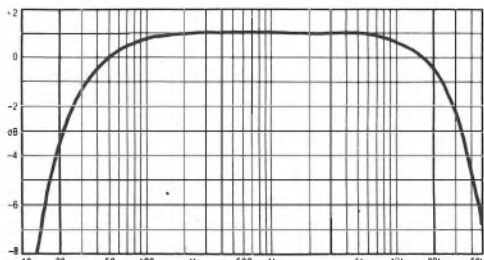
The A60, while in my view no longer gaining a high commendation, nonetheless remains worthy of consideration. Consistency is perhaps, this model's keynote; it can be relied upon to give a competent result in many systems, and is both well built and finished with versatile inputs and good facilities.

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.

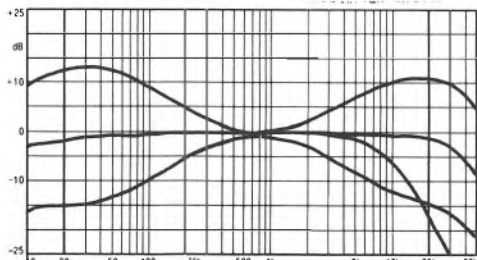
Test measurements

To show how well the amplifier sustains its 80hm 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			
Disc (mm) input (IHF)	20Hz	1kHz	20kHz
Disc (mc) 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	-20dB	-60dB
Volume/balance tracking			
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, satisfactory bass and pleasant 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 $\pm 11\text{A}$. 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 performer 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 makes them worthy of serious consideration.

Test measurements

To show how well the amplifier sustains its 80hm 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 19.5dBW 18.8dBW
One channel, 2ohms, pulsed	19.7dBW 19.8dBW 19.0dBW
Instantaneous peak current	+11 A -11 A

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	-80dB	-81dB	-76dB
Intermodulation, 19/20kHz, rated power, aux input	-76dB	-76dB	-76dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)	-77dB	-77dB	-77dB
Intermodulation, 19/20kHz, at 0dBW, disc (mc)	-70dB	-70dB	-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

Disc (mm) input (IHF)	36dB	35dB	20kHz
Disc (mc) input (IHF)	30dB	30dB	35dB
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

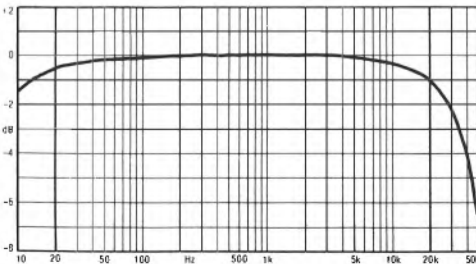
Disc (mm) input	socket type	sensitivity	loading
Disc (mc) input	DIN/Phono	0.27mV	50kohms, var pF
Aux input	DIN	0.015mV	340ohms, var nF
Power amp	DIN/Phono	11.1mV	14kohms, 170pF

Output, pre-amp (tape) 8.9V max, 350ohms

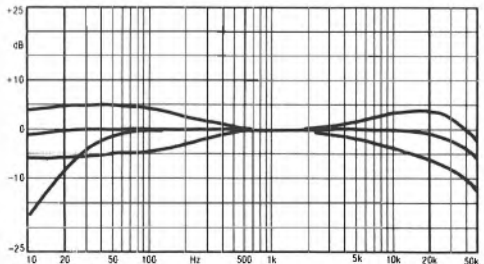
Disc equalisation error, 30Hz-15kHz +0dB, -0.6dB

Size (width, height, depth) 43 x 30 x 5cm, 43 x 34 x 10cm

Typical price inc VAT £280, £375



Disc input: RIAA equalisation accuracy



Tone control/filter responses

AR Amplifier

Acoustic Research, High Street, Houghton Regis,
Beds LU5 5QJ Tel (0582) 603151



Originally supplied as a Cambridge Audio model, in traditional livery, this AR unit is nonetheless a completely up-to-date 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 phone sockets.

For this edition a sample was provided by Acoustic Research. Under their banner the finish has been altered, the amplifier now coming in satin black with silver-grey lettering, but the dark wood end cheeks remain. Accordingly, we were able to give a thorough assessment based on a full production AR model, updating the earlier prototype tests.

Internal construction was clearly to fair standards, using two main epoxy 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 base-plate of the case itself forms the heatsink.

Sound quality

The current model achieved most respectable scores in the listening sessions, and if anything showed an improvement over the original, being well above average.

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 $\pm 19A$. Distortion was satisfactory, with the 1M 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 amplifier is now well established under its new name and was felt to give a clear, versatile performance with good dynamic range. Musical yet lively, it also proved tolerant of adverse speaker loadings. With the inclusion of tone controls as well as good external appearance, the overall performance would have again merited Best Buy classification but in view of its increased price, is now Recommended.

(Note: the distributor informs us that this model may now be available at just under £175, in which case a 'Best Buy' rating applies.)

Test measurements

To show how well the amplifier sustains its 80hm 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.	+ 19 A - 19 A

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).	- 61dB
Residual, unweighted (volume control at min).	- 77dB
DC output offset.	34mV

Input overload

Disc (mm) input (IHF).	20Hz 1kHz 20kHz
Disc (mc) input (IHF).	34dB 32dB 30dB
Aux/CD 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.	0dB
Volume/balance tracking	0dB - 20dB - 60dB
Aux input.	0.1dB 0.1dB 5.8dB

Input data

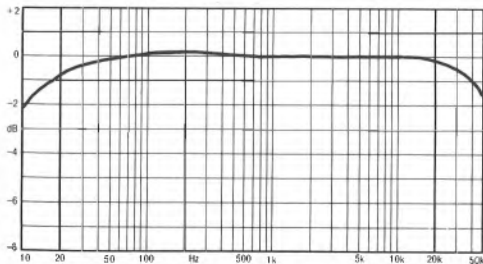
	socket type	sensitivity	loading
Disc (mm) input.	Phono	0.52mV	47kohms, 150pF
Disc (mc) input.	Phono	0.032mV	47kohms, 150pF
Aux input.	DIN	24.2mV	10kohms, 50pF

Disc equalisation error, 30Hz-15kHz. + 0. 2dB, - 0. 3dB

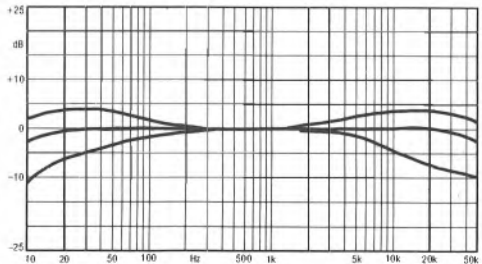
Size (width, height, depth). 43 x 7 x 28.5cm

Typical price inc VAT. £200

* Fuse blows at this level



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



Now a well established model, the 8000A was the first 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 phono, and include disc (mm and mc), tape 1 and 2, plus tuner and CD/aux. A proper 'record out' selector matches the input selector. A headphone socket is provided, which mutes the two sets of speaker outputs via a high-quality relay. A small dealer modification provides for pre/power amp use if this is required by the user, but note that in this mode the circuitry which prevents switch-on thumps will not operate.

As well engineered internally as it is finished externally, the amplifier uses a large 250VA toroidal transformer specially mounted to reduce mechanical hum. The output stages are 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 'good plus', 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 40hm continuous delivery was also pretty good, while its $\pm 28A$ peak current capability was more than sufficient for the rated power. Peak level approached 100W per

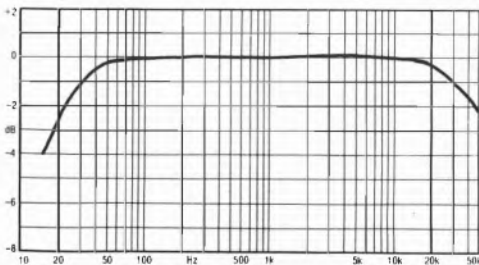
channel, at 19.8dBW, holding well into 4ohms at 18.6dB and still very strong at 18dBW, 2ohms.

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.

Accurate, powerful, load tolerant and with fine sound quality, this amplifier has set a reference standard. In its latest form, with higher-current output stage, it is again strongly recommended, though now priced above our £250 limit for the Best Buy category.



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	50Wl = 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	+ 27A - 28A

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	- 90dB	- 95dB	- 80dB
Intermodulation, 19/20kHz, rated power, aux input			- 65dB
Intermodulation, 19/20kHz, at 0dBW, disc (mm)			- 65dB
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

Aux input	0.0dB	- 20dB	- 60dB
	0.04dB	0.0dB	3.6dB

Input data

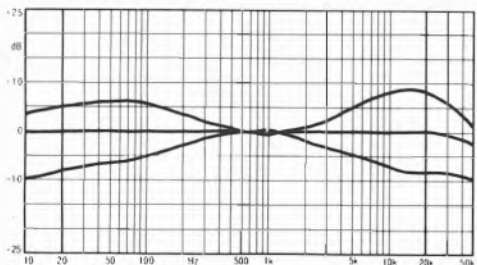
	socket type	sensitivity	loading
Disc (mm) input	DIN	0.3mV	47kohms, 35pF
Disc (mc) input	DIN	0.007mV	100ohms, 4.7nF
Aux input	DIN	12mV	20kohms, 70pF

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



Tone control/filter responses

Audiolab 8000C/8000P

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



In development terms, these two recently released units were actually begun before the successfully launched 8000A integrated amplifier, which first made an appearance in 1983. The overall design plan included the use of a matching range of cases, and hence the 'C' preamplifier closely resembles the integrated 'A'. However while there are common sections, the 'C' has been significantly upgraded by the use of improved components, wiring and power supplies, using the space vacated by the big power transformer. Allocated its own case, with a still larger transformer than before, the power amplifier has blossomed into a 100W (20dB/W) unit with generous reserves of current as well as an ability to drive adverse loads.

These modern all transistor designs offer impeccable specifications, and yet much care has also been devoted to how they sound. The 800C pre-amp in particular is extremely versatile — for example, it includes low noise moving coil inputs as well as moving magnet. Sensible tone controls are fitted, which are virtually inaudible in terms of their effect on the sound quality, while two tape decks and many inputs may also be accommodated. A headphone outlet fed by its own small power amplifier, is also provided in the pre-amp.

Eminently sensible in general design, the equipment is well built, well finished, well

styled and well lettered in a legible print. No silly gimmicks such as power level indicators or flashing lights are present. The power amplifier has no controls bar the on/off switch, while speaker connection is via standard 4mm socket/binding posts.

Discrete transistor circuits are used in carefully designed 'op-amp' configurations, and interestingly a single rail power supply is used for the pre-amplifier allowing high quality electrolytic coupling capacitors to be fitted, these properly polarised. A direct coupled dual rail supply is fitted to the power amplifier, the output stage a paralleled complementary array with specially fast thermal tracking for the output biasing to minimise crossover effects and provide a rapid warm-up.

Sound quality

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

The good standard of stereo depth was maintained, and interestingly, that slightly cold 'clinical' quality of the 8000A was also preserved, this better suited to mildly rich speakers and cartridges. Precise and detailed with a clean articulate bass, the Audiolab

achieved competitive scores which set them apart in their price territory.

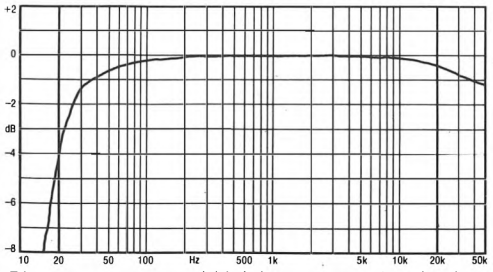
Lab results

Covering the power amplifier first, this was clearly a very 'gutsy' performer with immaculate figures for power bandwidth, adverse load delivery and peak current, here to the test limit of $\pm 40A$! The pulsed delivery into 2ohms corresponded to 400W per channel into this load. All distortions were very low, in fact negligibly so, while dc offsets were also microscopic, thanks to the special dc servo in the amplifiers. The power amp needed just over a volt input to give full output, while input loading was mild, at 47ohms/320pF.

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

Conclusion

Both components performed in textbook fashion under lab testing, as the results testify. Pre and power amplifier are well matched, being fully compatible on both technical and sonic grounds, yet they are easy to drive and would interface with a wide range of other equipment, this versatility extending to almost any cartridge or loudspeaker. As regards sounds quality and overall performance, they are both competitive modern products, and secure a full *Hi-Fi Choice* recommendation.



Disc eq accuracy and (right) power supply rejection

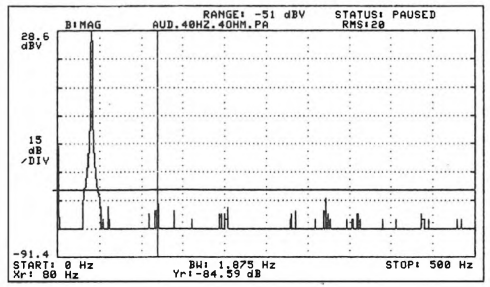
Test measurements

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.....	21.6dBW 21.8dBW 21.4dBW
Both channels, 4ohm load.....	19.6dBW 20.0dBW 19.6dBW
One channel, 2ohms, pulsed....	-dBW 20.3dBW -dBW
Instantaneous peak current.....	+40A -40A
Distortion	
Total harmonic distortion, 20Hz 1kHz 20kHz	
at rated power, aux input.....	< -90dB -93dB -74dB
Intermodulation, 19/20kHz, rated power, aux input...<	-100dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-82dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-83dB
Noise	
Disc (mm) input (IHF, CCIR weighted).....	-70dB
Disc (mc) input (IHF, CCIR weighted).....	-67dB
Aux/CD input (IHF, CCIR weighted).....	-70dB
Residual, unweighted (volume control at min).....	-80dB
DC output offset.....	left<1mV, right <1mV
DC offset, pre-amp.....	left<1mV, right <1mV
Input overload	
Disc (mm) input (IHF).....	20Hz 1kHz 20kHz
Disc (mc) input (IHF).....	26dB 31dB 30dB
Disc (mc) input (IHF).....	30dB 26dB 25dB
Aux/CD input (IHF).....	<20dB 20dB 20dB
Stereo separation	
Disc input.....	82dB 78dB 66dB
Aux input.....	-dB -dB -dB
Output impedance (damping)...	
0.025ohm 0.028ohm 0.084ohm	
Channel balance, disc, at 1kHz.....	
-0.1dB	
Volume/balance tracking	
Aux input.....	0dB -20dB -60dB
Aux input.....	0.15dB 0.2dB 0.4dB
Input data	
socket type	sensitivity loading
Disc (mm) input.....	Phono 0.28mV 47kohms 50pF
Disc (mc) input.....	Phono 0.018mV 10kohms -nF
Aux input.....	Phono 15/52mV 20kohms -pF
Power amp.....	Phono 1100mV 47kohms 320pF
Output, pre-amp (tape).....	
>5V <600ohms	
Disc equalisation error, 30Hz-15kHz.....	
+0dB, -2dB	
Size (width, height, depth).....	
45 x 8 x 34cm, 45 x 8 x 34cm	
Typical price inc VAT.....	
£275, £420	



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.

Retested for 1985 in the light of the newer *SP10*, the '8 has an improved circuit board and a number of detail changes. ('Old' *SP8s* can in fact be rebuilt to the new standard at a cost of around £400.)

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.

The overall quality closely approached that of the magnificent *SP10* and proved highly involving, with excellent rendition of subtle detail. Mild microphony was noted, however, and an isolating support gave further improvement. Again the test sample was marred by audible mechanical hum from the transformer and a siting well away from the listening position is recommended.

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.

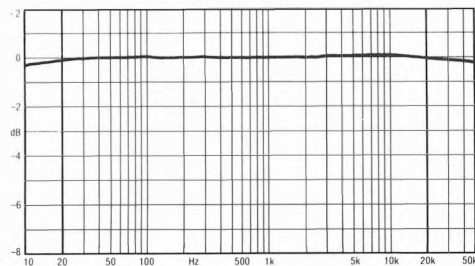
Stereo separation was satisfactory via disc but surprisingly weak via auxiliary, here tending to compromise the high separation available on PCM programme.

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/cart-ridge combinations giving excessive subsonic resonance output are to be avoided.

Conclusion

In revised form, this new *SP8* puts even last year's version in the shade. Definition, **sparseness**, focus and 'believability' have all taken a major step forward, and the *SP8* now offers first class quality at a comparatively realistic price; in context, it can even be said to offer fine value for money! For those appreciative of such quality, the *SP8* is strongly recommended.

Perhaps a low gain x3 or x4 step-up unit of comparable quality can be found to properly match Koetsus and the like. As it stands, the *SP8* partnered the Robertson and Krell power amps well, and perfectly matched that excellent Audio Research power amplifier, the *D70 II*.



Disc input: RIAA equalisation accuracy

GENERAL DATA

Pre-amplifier

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at aux input.....	-90dB	-92dB	-86dB
Intermodulation, 19/20kHz, aux input.....			-88dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....			-85dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....			-dB

Noise

Disc (mm) input (IHF, CCIR weighted).....			-75dB
Disc (mc) input (IHF, CCIR weighted).....			-dB
Aux/CD input (IHF, CCIR weighted).....			-78dB
Residual, unweighted (volume control at min).....			-77dB
DC output offset.....	left	-mV, right	-mV
DC offset, pre-amp.....	left	-mV, right	-mV

Input overload

	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	40dB	43dB	42dB
Disc (mc) input (IHF)*.....	60dB	63dB	62dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB

Stereo separation

Disc input.....	45dB	57dB	40dB
Aux input.....	70dB	61dB	35dB
Channel balance, disc, at 1kHz.....			0.12dB

Volume/balance tracking

	0dB	-20dB	-60dB
Aux input.....	0.03dB	0.15dB	0.25dB

Input data

	socket type	sensitivity	loading
Disc (mm) input.....	Phono	0.2mV	47kohms
Disc (mc) input*.....	Phono	0.2mV	adjust
Aux input.....	Phono	28mV	50kohms

Output, pre-amp.....	50V max,	971ohms
Disc equalisation error, 30Hz-15kHz.....	+0.1dB,	-0.1dB

Size (width, height, depth).....48 x 13.4 x 26cm

Typical price inc VAT.....£1780

*Same input used for moving-coil

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Audio Research D70

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



This valve power amplifier has received very good notices in 1983-84. Including it for the first time in *HFC*, we were lucky to get a sample of the latest version, (improvements can be retrofitted) and what a good example it turned out to be. In company with a brief experience of the *D250* (not reviewed here) the *D70 II* forced a rescaling of the top end power amp classifications for the issue, much as the *SP8 II* has done for the preamplifiers.

Descended from a long line of valve power amplifiers, the US-built *D70* is rated at 65W (18dB/W) per channel, which is a fair spec for a reasonably sized single chassis unit such as this. Screw terminals are present for speaker connection, with 4, 8 and 16 ohm matching taps. In almost all cases, the '8' was found to be the best, even with the Magneplanar speakers, and this was also borne out by the lab results.

The advanced design transformers have excellent bandwidth and are driven by output pentodes operated with regulated screen grids. The output cathodes are cross coupled to a balanced feedback signal taken from the transformer secondary, this grounded at the centre tap. Power supply regulators are used for earlier gain stages, with excellent quality audio components. Supplied as a chassis, wooden cases are available, and a rack system is also possible.

Sound quality

Initially, testing appeared to show a very good but 'bounded' performance. It transpired that the amplifier was in fact limited by the sources, and extended comparative listening showed it capable of revealing the full musical potential of the components connected to it, from loudspeaker to cartridge. The bass was extended and very revealing, if slightly warm and softened, while the mid and treble were sweet and open, with an uncanny, lifelike quality on vocals and acoustic instruments.

Stereo images showed good width and focus with exceptional spaciousness, depth and ambience, plus convincing layered effects. Tonally it was first rate, and also proved highly transparent as well as revealing of low level detail.

Lab results

As is often the case with valve equipment, the lab results were unexceptional, though they were fairly good for a valve design. The output met spec over the full power bandwidth and the unit showed a very wide frequency response. Mismatched into lower impedances, the output fell quickly by nearly 5dB into 4ohms, and by 10dB into 2ohms. Peak current was a modest $\pm 5A$. Distortion was satisfactory at full level, improving quickly at lower powers, while the high frequency intermodulation result was

particularly good. It was also easy to drive, requiring just under 1 volt into a high impedance, and while its output impedance was higher than usual, this should not cause any trouble with the majority of speaker systems.

Conclusion

Unsuited to really trying loads, the *D70* nonetheless made a fair stab at the Magneplanar *MG III*, and drove normal 8ohms and sensible electrostatic loads very well. The sound was exceptionally good and would do justice to the finest ancillaries. Above all, its great dimensionality and musicality place it in the highest category. Informed opinion indicates that the 1985 *D115* (115W/channel) will be at least as good, while the legendary *D250* is itself recently improved, offering an ultimate standard, albeit at an ultimate price!

GENERAL DATA

	Power amplifier		
Power output			
Rated power into 8ohms, maker's spec.....	65W (= 18dBW)	1kHz	20kHz
Power output.....	20Hz	1kHz	20kHz
One channel, 8ohm load.....	18.6dBW	18.8dBW	18.5dBW
Both channels, 4ohm load.....	13.9dBW	14.0dBW	11.0dBW
One channel, 2ohms, pulsed....	-dBW	8.0dBW	-dBW
Instantaneous peak current.....		+5A	-5A
Distortion			
Total harmonic distortion,.....	20Hz	1kHz	20kHz
at rated power, aux input.....	-48dB	-58dB	-48dB
lw power, aux input.....			-68dB
Intermodulation, 19/20kHz, at rated power.....			-60dB
Intermodulation, 19/20kHz, at 0dBW.....			-75dB
Noise			
Aux/CD input (IHF, CCIR weighted).....			-74dB
Residual, unweighted (volume control at min).....			-68dB
DC output offset.....		left 0mV, right 0mV	
Stereo separation			
PA input.....	-80dB	80dB	60dB
Output impedance (damping)...	0.75ohm	0.75ohm	1.1ohm
Volume/balance tracking	0dB	-20dB	-60dB
Aux input.....	0.3dB	-dB	-dB
Input data	socket type	sensitivity	loading
Power amp.....	Phono	900mV/115kohms	80pF
Size (width, height, depth).....			48 x 17 x 42cm
Typical price inc VAT.....			£1970



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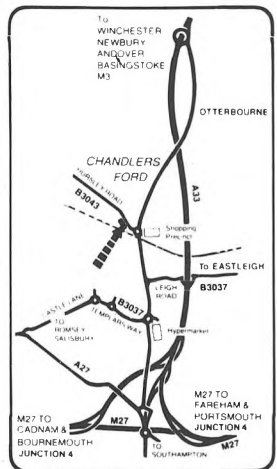
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Beard P505/P100

Beard Audio Systems Ltd, Unit B1, Askew Crescent Workshops, London W12 9DP
Tel 01-749 1214



Bill Beard has been refining his valve pre-power combination for several years now, and its present flowering is represented by a pair of massively built units finished in a sombre satin black and devoid of the spurious extras found on early models. The pre-amplifier is comprehensively equipped, and the latest versions have sufficient gain (dealer adjustable) to cater for moving magnet and the higher output moving coil cartridges. It does not have a true mc input, so as with several other valve preamps, input noise levels are something of a compromise.

The power amp is a weighty item, rated at 90W (19.5dB/W) per channel. The circuit is an ultra-linear type, with the output matching optimised for around 6ohm loads, thus giving a good compromise between 4 and 8ohms. Speaker output is via Michell gold 4mm socket/binding posts. This valve amp is reputed to have more adverse load tolerance than usual

The two units do stack reliably, but the hum level in the pre-amp suffers somewhat if they are used in this way.

Sound quality

In combination a presentable standard of sound quality was produced — as it should be, considering the price. A distinctive feature was the good resolution of low level detail, coupled with a pleasing transparency to the stereo

image, as well as a good depth impression. Further tests showed in other respects the pre-amps' performance was nearer to an average level with some tonal thinness, and a lack of real definition in both bass and treble registers. The image also seemed too narrow, with a slight 'tunnel' effect imposed on the middle region where the most depth was apparent.

The power amplifier was seen to improve markedly when used with certain alternative pre-amps such as the Counterpoint. Here it showed an improved image scale and dimension, with quite solid bass. It was also pretty dynamic and achieved 104dB levels into the standard load (101dB on the adverse loading).

Driven hard, it sounded less 'valve-like' and revealed some of the tonal thinning more common with transistor electronics, while the treble seemed to be muted; lacking in air or sparkle.

Lab results

The power amp met specification over the entire bandwidth. The latter was pretty good, even on the 4ohm load. Down to 2ohms, the output had fallen to 13.6dB/W, a loss of nearly 7dB over the 8ohm level, which is not however uncommon where a valve model is concerned. Peak current was comparatively healthy at a maximum of $\pm 12.5A$, though some doubt must be expressed as regards the validity of this

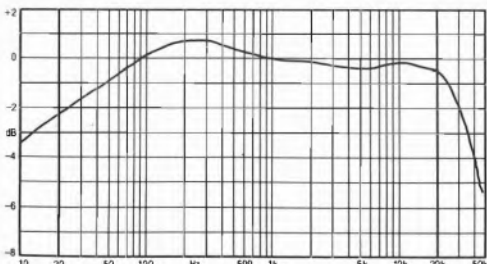
reading, since this burst power rating showed signs of serious distortion. At 40Hz, 4ohms, a good 80dB of ripple rejection was shown, with the visible lines representing the harmonics of the 40Hz fundamental totalling around 1%. This -40 to -45dB level was also typical at full power, 8ohms, and improved at lower levels. Intermodulation distortion was fairly good.

Noise levels were satisfactory; how much so will depend on the listener as well as the chosen speaker and cartridge. Overload levels were fine, but stereo separation was rather weak at middle and high frequencies, being down to 18dB at 20kHz via disc. Balance and volume tracking were fine. Auxiliary sensitivity was rather high for CD but correct for other sources. Only 600mV was required for full output from the power amp, this an easy load.

Disc equalisation was rather wild by today's standards, with some treble imbalance, though just reasonable as +0.7, -1.7dB limits sufficed for the quoted range; an IEC rolloff is incorporated but commences too early.

Conclusion

This interesting UK design showed some weaknesses, particularly with regard to the pre-amplifier. Better disc equalisation and closer matching, plus improved separation could work wonders here. The power amp is the more secure performer of the two, and offered good dynamics with a pleasing transparency and depth. The overall performance set against price indicated that it is worthy of consideration, particularly for aficionados of tubed amplification.



Disc eq accuracy and (right) power supply rejection

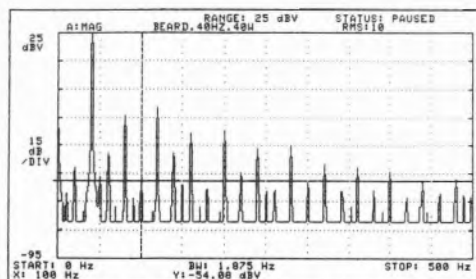
Test measurements

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

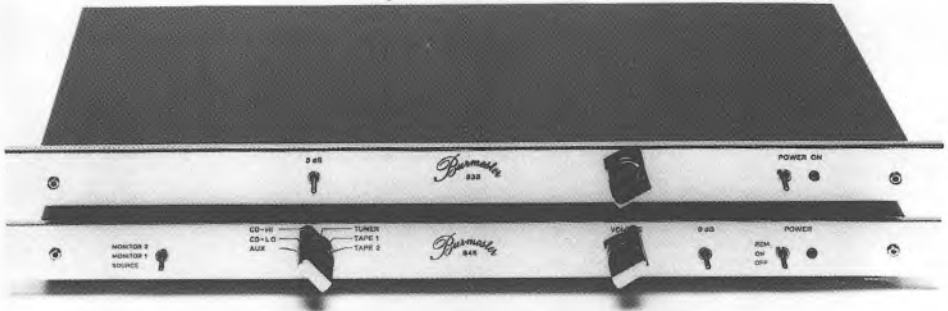
Pre- and power amplifier

Power output			
Rated power into 8ohms, maker's spec	90W (= 19.5dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	20.3dBW	20.4dBW	19.8dBW
Both channels, 4ohm load	15.0dBW	15.8dBW	15.8dBW
One channel, 2ohms, pulsed	-dBW	13.6dBW	-dBW
Instantaneous peak current		+12.5A	-12.5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	-40dB	-45dB	-42dB
Intermodulation, 19/20kHz, rated power, aux input			-63dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm)			40.5dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc)			-40.5dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			-dB
Disc (mc) input (IHF, CCIR weighted)			54dB
Aux/CD input (IHF, CCIR weighted)			75dB
Residual, unweighted (volume control at min)			-80dB
DC output offset		left 0mV, right 0mV	
DC offset, pre-amp		left 0mV, right 0mV	
Input overload			
Disc (mm) input (IHF)	20Hz	1kHz	20kHz
Disc (mc) input (IHF)	-dB	-dB	-dB
Disc (mc) input (IHF)	33dB	30dB	24dB
Aux/CD input (IHF)	20dB	20dB	20dB
Stereo separation			
Disc input	53dB	35dB	18dB
Aux input	71dB	42dB	22dB
Output impedance (damping)	0.65ohm	0.3ohm	0.7ohm
Channel balance, disc, at 1kHz			0.5dB
Volume/balance tracking	0dB	-20dB	-60dB
Aux input	0.12dB	0.9dB	0.9dB
Input data	socket type sensitivity loading		
Disc (mm) input	Phono	2mV	47kohms
Disc (mc) input	Phono	0.15mV	47kohms
Aux input	Phono	5mV	47kohms
Power amp	Phono	600mV	110kohms
Output, pre-amp (tape)		>5V max,	610ohms
Disc equalisation error, 30Hz-15kHz		+0.7dB,	-1.7dB
Size (width, height, depth)		53 x 9 x 39cm,	53 x 17 x 39cm
Typical price inc VAT		£595,	£890



Burmester 838/846

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



Arriving just too late for the previous issue, this modular pre-amp unit began as the 838, a slim, high-precision disc input device with a high level output and an associated attenuator volume control. Via a relay switchover operating when the 838 is switched off, the output of a conventional pre-amplifier may be switched into the power amp circuit. If other sources are not required then the 838 may be all that is needed to fulfil a pre-amp function; indeed if a power amplifier of reasonable 0.5-7.0V sensitivity is available then an inexpensive passive control unit such as the Sondex PCU or the PS Audio device can be used to complete the output control requirements.

Moving-coil or moving-magnet versions of the 838 are available, but both are very similar, apart from the input matching details and circuit change to optimise the performance.

The 846 is a matching control unit originally conceived in the same way as the 838, in that when used, either the 846 or 838 would drive the power amp via the relays. In production however the 846 has the benefit of a superior output stage including a facility for balanced drive to some active loudspeakers. Thus it is recommended that the 838 work through the 846 with the additional complication (although Burmester claim it an advantage) of two volume controls and two gain control switches, all of which are uncalibrated.

When complete the two units come with a remote transformer pack each, and total around the £1700 mark. They are built to the highest standards, the circuitry employing

specially selected integrated circuits, and the equipment should enjoy a long life.

Sound quality

The 838 was first auditioned alone, via a moving-coil cartridge. A decent sound was obtained, which is no less than one would expect for the price. It was clearly better than the earlier 785 with a more transparent, spacious sound. Strong points were its extreme neutrality, clean dry bass, and notably sharp stereo focusing, this true of the mid-range. The treble however was not quite so good with a hazy effect noticeable when compared for example with a good tube pre-amp.

Adding in the 846 softened the treble, imparting a more musical quality, but ultimately neither unit proved capable of revealing the full texture and dimensional quality present in the test programme. At this overall price level, such capability is considered mandatory.

Lab results

Disc equalisation was very uniform, with excellent balance and little attempt at band tailoring. Set to the 0.33mV sensitivity for 1 volt output, the mc input level was 0.45mV which was coupled to a fine signal to noise ratio. This unit will be silent with most mc cartridges. Overload margins were sufficient but must be augmented by an appropriate choice of sensitivity; this should be set as low as possible (that is, for lowest gain). Offsets, balance, distortion and separation were all



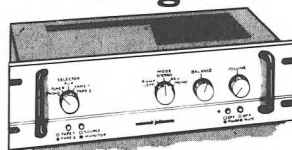
Conrad Johnson

. a name to conjure with

At long last the superb range of Conrad Johnson equipment is available in the UK. Acoustic Arts are proud to be the first UK appointed dealer and having had the pleasure of living with CJ (as it is known in the USA) for the past months we can only endorse all the good things that has preceded this very fine equipment, it has truly been a rewarding sonic experience. We now know why it is raved about all over the world and is so highly recommended by Hi-Fi Choice in this issue. The range covers affordable products like the PV4 pre-amp at £715 and the MV45A-1 power amp. at £1,290 to the mighty premiere range. If you love music and are in the market for an amplifier up-grade you owe it to yourself to audition this marvellous equipment which has drawn comments from the American press like "Let's just close by saying that the MV-75A, either singly or in bridged mode, is my reference amplifier now" or "you will find this amplifier darned near perfect".

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exemplary, and typical of the best lab test equipment.

Conclusion

Undoubtedly very fine equipment, the 838/846 is a rather costly pre-amplifier which did not really fit into the territory occupied by say the CJ PV-5, or the ARC SP8, even though the Burmester's measured characteristics were far superior to both these devices. It is nonetheless worthy of consideration especially for systems with solid state power amplifiers with an emphasis on power, bass precision, low noise and stability.

GENERAL DATA

Pre-amplifier

Distortion

Total harmonic distortion, 20Hz 1kHz 20kHz
aux input.....> -100dB > -100dB > -100dB
Intermodulation, 19/20kHz, aux input.....aux input...> -100dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm)..... -dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc)..... -87dB

Noise

Disc (mm) input (IHF, CCIR weighted)..... -dB
Disc (mc) input (IHF, CCIR weighted)..... -73dB
Aux/CD input (IHF, CCIR weighted)..... -99dB
Residual, unweighted (volume control at min).....> -100dB
DC output offset.....left -mV, right -mV
DC offset, pre-amp.....left 0.2mV, right 0.3mV

Input overload

20Hz 1kHz 20kHz
Disc (mm) input (IHF)..... -dB -dB -dB
Disc (mc) input (IHF)*..... 15dB 15dB 15dB
Aux/CD input (IHF)..... -dB 12dB -dB

Stereo separation

Disc input.....>100dB 91dB 85dB
Aux input.....>100dB >100dB 100dB
Channel balance, disc, at 1kHz.....>0.1dB

Volume/balance tracking

0dB -20dB -60dB
Aux input.....>0.1dB >0.1dB >0.1dB

Input data

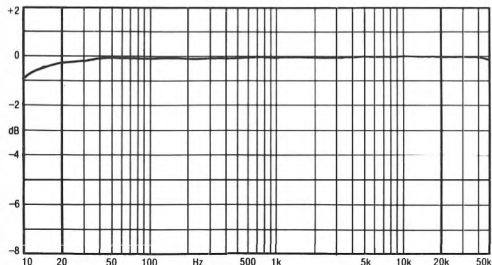
socket type sensitivity loading
Disc (mm) input.....Phono adjust adjust adjust
Disc (mc) input*.....Phono 0.045mV adjust adjust
Aux input.....Phono 180mV 20kohms -pF

Output, pre-amp.....9.5V max, <10hms

Disc equalisation error, 30Hz-15kHz.....+ 0.05dB, - 0.25dB

Size (width, height, depth).....48 x 4 x 21cm

Typical price inc VAT.....£1780 (each unit £890)



Disc eq accuracy and (right) power supply rejection

Conrad Johnson PV5/MV45

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



Conrad Johnson is a long established US company which specialises in valve amplifiers. They offer a range of products from about £600 upwards, and these have just recently become available here in the UK. These review models occupy the middle price range though at around £3000 a pair, they are clearly 'high end' audiophile products as far as the UK is concerned.

Well finished with distinctive satin gold alloy fascias, the internal construction is workman-like, but not up to the standard of the Burmester or ARC's for example. Mechanical hum levels thankfully are low. The *PV5* is a rough equivalent of the *SP8* at a similar price, its facilities including a moving magnet input stage which has sufficient gain to work with higher output mc cartridges at the expense of some background noise. Ideally a good stepup transformer is required (at extra cost). Well equipped, the *PV5* offers a good range of inputs and an output characteristic compatible with most power amplifiers.

The *MV45* is a compact valve power amplifier of fairly traditional design and rated at 45W (16.5dBW) per channel. Transformer taps are provided for 4, 8 and 16ohms; our testing was primarily undertaken on the 8ohm tap, which also gave optimum results on the speakers used. The '45 was not found to be that load tolerant, and while the matching taps may help, the output level into 4ohms is not very high under any matching condition.

Sound quality

In combination, the CJs proved to offer a very pleasant and musical sound, almost what one might have been led to expect from traditional tube gear. At low to moderate power levels there was a feeling of delicate grace about the sound, with a tonal richness and spacious perspective which beguiled the panel.

Assessed separately, the *PV5* was undoubtedly the better performer of the two, possessing qualities of fine stereo precision and depth, tonal accuracy and detail, which allowed its inclusion in the top rank.

The *MV45* had undeniable virtues, chiefly its transparency and excellent is slightly narrowed depth. However it showed a significant bass softness and lack of 'poke'. Driven to higher levels, the power amplifier distorted in a soft but audible fashion with a notable compression of depth due to intermodulation effects. Indeed at near to full power the depth was audibly modulated by programme dynamics. It was at its best on relaxed classical programme, where the standard was high.

Lab results

Rated power was exceeded at mid and high frequencies, but the low frequency delivery was weak, even for the 1% distortion limit; it could only produce 20W at 20Hz. The story was still poorer into 4ohms, with a 9dB drop in level, falling still further by 12dB at 20Hz, and by 17dB by 20kHz.

Harmonic distortion results (dominated by the power amp) showed that at rated power the frequency extremes were poor. An improvement to satisfactory distortion levels was seen at lower powers.

For the pre-amp, noise levels were satisfactory (only just for mc) while overload levels were exemplary. Stereo channel separation was about average, with volume tracking and balance both excellent. Disc equalisation was essentially flat, bar a mild lift at the extreme low frequencies. Power amp output impedance was rather high especially the 3.2ohms measured at 20Hz. This is likely to affect speaker damping as well as the overall response of a speaker.

Conclusion

The PV5 performed well and offered a very high standard of sound quality; it was much liked on test and was only pipped to the post by the latest SP8. Input and output matching characteristics were both fine while mechanical noise levels were low. For optimum results on this score, some sort of head amplifier or transformer is ideally required for mc cartridges, though this may compromise the sound slightly.

We felt the MV45 power amplifier to be significantly flawed although it also was liked on audition. It was not a strong performer on load matching grounds but it can deliver much musical satisfaction using a well matched speaker such as the Spendor SP1. A reserved recommendation is given here and the prospective purchaser should seek his own audition.

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.....	13.0dBW 18.2dBW 17.3dBW
Both channels, 4ohm load.....	5.8dBW 9.5dBW 0dBW
One channel, 2ohms, pulsed....	-dBW 11.1dBW -dBW
Instantaneous peak current.....	+6A -5.5A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	-32dB -45dB -32dB
Intermodulation, 19/20kHz, rated power, aux input.....	-62dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-63dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-63dB

Noise

Disc (mm) input (IHF, CCIR weighted).....	-62dB
Disc (mc) input (IHF, CCIR weighted)*.....	-53dB
Aux/CD input (IHF, CCIR weighted).....	-68dB
Residual, unweighted (volume control at min).....	-68dB
DC output offset.....	left nilmV, right nilmV
DC offset, pre-amp.....	left nilmV, right nilmV

Input overload

Disc (mm) input (IHF).....	36dB 40dB 34dB
Disc (mc) input (IHF)*.....	56dB 60dB 54dB
Aux/CD input (IHF).....	>20dB >20dB >20dB

Stereo separation

Disc input.....	52dB 60dB 40dB
Aux input.....	65dB 57dB 34dB

Output impedance (damping)...

	3.2ohm 1.6ohm 1.0ohm
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Channel balance, disc, at 1kHz.....

	0.2dB
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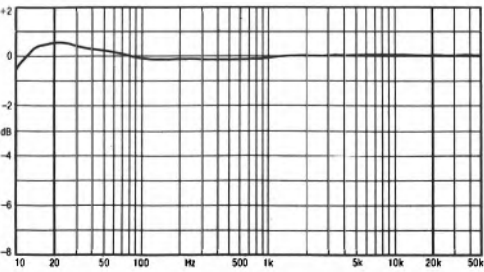
Volume/balance tracking

Aux input.....	0.3dB 0.04dB 0.3dB
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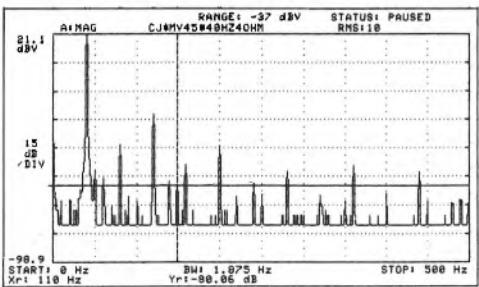
Input data

Disc (mm) input.....	Phono 0.041mV 47kohms 60pF
Disc (mc) input*.....	0.041mV 47kohms 60pF
Aux input.....	Phono 5.2mV 43kohms 85pF
Power amp.....	140mV/100kohms 30pF
Output, pre-amp.....	>20V max, 140ohms
Disc equalisation error, 30Hz-15kHz.....	+0.43dB, -0.1dB
Size (width, height, depth).....	48 x 10 x 27
Typical price inc Vat.....	£1735, £1160

*Same input used for moving coil.



Disc eq accuracy and (right) power supply rejection



Counterpoint SA-7

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



Built in California, this American product comprises an elegantly simple valve pre-amplifier, offering a minimum of facilities. Its most obvious feature is its unusually high gain on what is nominally a moving magnet disc input. When launched last year in the UK, this compact black-cased unit had an elongated satin alloy front panel in silver grey. It has since been revised to provide reduced hum levels by enlarging the case, and this now physically matches the fascia, which also has a new finish in satin black.

Set for IHF 0.5V out, the disc sensitivity is just under 0.2mV, which is sufficient for use with a number of moving coil cartridges (this producing satisfactory noise levels). In fact when used as a mm input, its overload levels are so poor that mc use is encouraged.

Fascinating details include the use of no feedback throughout with all triode circuitry. RIAA equalisation is entirely passive and the first two valves (ECC83) are run under low noise, grid leak operation. A reasonably low output impedance is provided by a cathode follower, but the tape output is a high impedance when on disc, and should not be loaded, even by a cable, when not in use. Phono sockets provide for disc, tape, CD and tuner inputs, selected by lever switches.

Appearance is good, and fine quality components have been used inside. Regulated supplies feed both the valve heaters and the high tension rails and the supply reservoir capacitors are substantial.

Sound quality

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

On balance it clearly offered a near audiophile standard at a comparatively modest price. Experiments showed that it suited the Robertson power amplifier very well, though the latter could also benefit from an even better pre-amp than this, if funds allow. The Counterpoint SA3 was also tried briefly, and results indicated that it was sweeter and more subtle than the SA7 but probably not quite such good value.

Lab results

While an output of up to 20V was available into a 100K ohm load, only 50mV was allowed into 600ohms. Several volts are possible with output loads of 20K ohms. At rated power, distortion was moderate and of low harmonic order. At moving magnet levels, the high frequency intermodulation was severe, improving to a barely acceptable -41dB at moving coil input levels. This was reflected by

the poor overload levels, as a moving-magnet pre-amp. Signal to noise ratio was satisfactory, and indeed, as an mc input, disc noise was rather lower than for several other valve pre-amps of this type. Stereo separation was most presentable, while channel balances were good except at the very lowest volume settings.

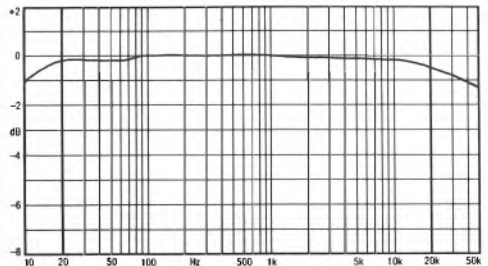
With a fairly high impedance output load (>50K) the frequency response was very wide, and the RIAA equalisation was also pretty accurate with just a hint of rolloff by 20kHz. The output impedance was moderate at 860ohms, though long cable runs are not recommended — say in excess of 1000pF total capacitance including the power amplifier. Some crosstalk was noted between inputs and unused sources are best left switched off.

Conclusion

While this compact design suffers from some interfacing difficulties, in my view it is well worth the effort expended in trying to accommodate it. Its sound has a fair proportion of the musical and dimensional magic present

in audiophile products and if a mildly constricted view is taken of an audio 'heaven' then the SA7 represents fine value, and can be warmly recommended.

(Note: if any odd noises occur, persevere, valve replacements will generally sort them out!)



Disc input: RIAA equalisation accuracy

GENERAL DATA		Preamplifier	
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
aux input.....	-65dB	-66dB	-56dB
Intermodulation, 19/20kHz, aux input.....			-58dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....			-41dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....			-41dB
Noise			
Disc (mm) input (IHF, CCIR weighted).....			-72dB
Disc (mc) input (IHF, CCIR weighted).....			-58dB
Aux/CD input (IHF, CCIR weighted).....			-74dB
Residual, unweighted (volume control at min).....			-78dB
DC offset, pre-amp.....	left 0mV, right 0mV		
Input overload			
	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	-2dB	12dB	11dB
Disc (mc) input (IHF)*.....	18dB	32dB	37dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	70dB	60dB	47dB
Aux input.....	80dB	76dB	55dB
Channel balance, disc, at 1kHz.....			0.3dB
Volume/balance tracking			
Aux input.....	0dB	-20dB	-60dB
Aux input.....	0.17dB	0.58dB	2.95dB
Input data			
	socket type	sensitivity	loading
Disc (mm) input.....	Phono	0.17mV	45kohms
Disc (mc) input*.....		0.17mV	45ohms
Aux input.....	Phono	31mV	28kohms
Output, pre-amp.....		>15V max,	860ohms
Disc equalisation error, 30Hz-15kHz.....		+ 0.1dB,	- 0.3dB
Size (width, height, depth).....		48 x 5.6 x	18cm
Typical price inc VAT.....			£655

* Same input used for moving coil.

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Merseyside Acoustic Developments,
 Merseyside Innovation Centre,
 131 Mount Pleasant, Liverpool L35 7F.

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

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 amplifier 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.

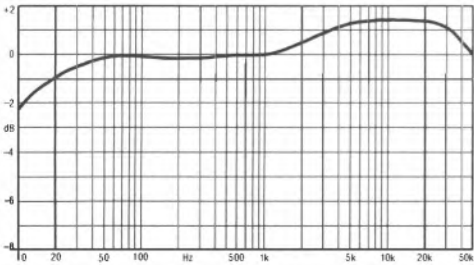
Note

Creek Audio Systems do not accept the validity of our disc input overload measurements, stating that the overload 'problem' we refer to does not exist in actual practice.

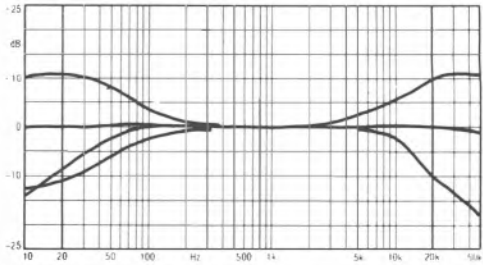
GENERAL DATA

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			
Aux input	0dB	-20dB	-60dB
	0.6dB	0.2dB	5.1dB
Input data			
	socket type		sensitivity
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			
			£125



Disc input: RIAA equalisation accuracy



Tone control/filter responses

Denon PMA-717

Hayden Laboratories Ltd, Hayden House, Chiltern Hill Chalfont St Peter, Bucks SL9 9UG
Tel (0753) 888447



Denon's latest low-cost contender, the 717 comes with an impressive array of front panel controls. The fascia sports an interesting label 'Real Time Audio Technology', whatever that means; perhaps it is just there to indicate analogue rather than digital electronics!

Rated at 40W (16dBW) per channel, the amp's many input facilities include both moving-coil and moving-magnet inputs. Tone controls are also provided. Most inputs are in phono, but the tape connections are also duplicated in DIN. The well laid out front panel is clearly labelled, and the whole unit well finished in satin black.

Inside, construction was of good quality though the mains wiring was not properly shrouded. A single power supply is shared between the two channels, this a split rail type with two 5600 μ F reservoir capacitors. The power transformer is generously sized. High current plastic output transistors are fitted in a completely direct coupled configuration with the drive function provided by an integrated circuit, type μ PC 1225H. The tone control circuitry is also associated with this chip.

On the disc side, a low-noise differential input amplifier is followed by an integrated circuit responsible for gain and RIAA equalisa-

tion. The input may be switched for gain and input loading impedance.

Sound quality

Judging from the listening test results, the 717 was not impressive. Scoring rather below average via auxiliary, the stereo was presentable with reasonable focus and a degree of space, but it was weak in other areas. The bass was lumpy, and poorly differentiated while the treble was grainy and sibilant. Fine detail was also rather muddled. Tonally the mid register sounded pinched while dynamics were compressed and uninvolving.

Via disc, the stereo was notably two-dimensional, lacking both space and depth. Detail was suppressed with the general impression of the sound similar to that via auxiliary; mc and mm inputs were similar.

Lab results

At half power the 40Hz 4ohm test showed a fairly clean result, with the 100Hz component suppressed by 80dB. Output power happily exceeded specification into 8ohms, and the power bandwidth was also fine. The output fell significantly into lower impedances, in fact by 6.4dB into 2ohms. Peak current was modest at

±7.5 amps, electronically limited. The 4ohm 20Hz delivery was a little weak.

Distortions were very low throughout the tests, at typically -85dB, noise levels were also good, while dc offset was satisfactory. Input overload margins were fine, but the channel separation showed some distortion at higher frequencies — down to as little as 35dB via aux which is rather a constraint on CD, for example. Output impedances were negligible. Channel balance was quite good while volume tracking over the control range was satisfactory. The RIAA equalisation was a bit scrappy, with an early bass suckout and some imbalance in the treble range, with one channel almost 0.5dB up between 4kHz and 16kHz. Input sensitivities and loadings were to standard practice, and healthy levels were available from the tape output.

Conclusion

A straightforward and versatile amplifier, the 717 has few real weaknesses apart from marginal channel separation and a limited ability into adverse loads. However these were not sufficient to account for the lacklustre sound quality, which in our view precludes it from 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.....	40W (= 16dBW)
Power output	20Hz 1kHz 20kHz
One channel, 8ohm load.....	17.1dBW 17.5dBW 17.3dBW
Both channels, 4ohm load.....	13.8dBW 15.3dBW 15.2dBW
One channel, 2ohms, pulsed.....	-dBW 11.1dBW -dBW
Instantaneous peak current.....	+7.5A -7.5A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	> -75dB -88dB -70dB
Intermodulation, 19/20kHz, rated power, aux input.....	-85dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-80dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	> -80dB

Noise

Disc (mm) input (IHF, CCIR weighted).....	-73dB
Disc (mc) input (IHF, CCIR weighted).....	-66dB
Aux/CD input (IHF, CCIR weighted).....	-71dB
Residual, unweighted (volume control at min).....	-75dB
DC output offset.....	left 20mV, right 21mV
DC offset, pre-amp.....	left -mV, right -mV

Input overload

Disc (mm) input (IHF).....	20Hz 1kHz 20kHz
Disc (mc) input (IHF).....	30dB 28dB 24dB
Disc (mm) input (IHF).....	29dB 27dB 27dB
Aux/CD input (IHF).....	>20dB >20dB >20dB

Stereo separation

Disc input.....	58dB 58dB 40dB
Aux input.....	58dB 51dB 35dB

Output impedance (damping)... 0.21ohm 0.18ohm 0.32ohm

Channel balance, disc, at 1kHz..... 0.1dB

Volume/balance tracking

Aux input.....	0dB -20dB -60dB
socket type sensitivity	0.1dB 0.45dB 1.95dB

Input data loading

Disc (mm) input..... Phono 0.45mV 47kohms 310pF

Disc (mc) input..... Phono 0.032mV 100ohms 1.3nF

Aux input..... Phono 30mV 57kohms 150pF

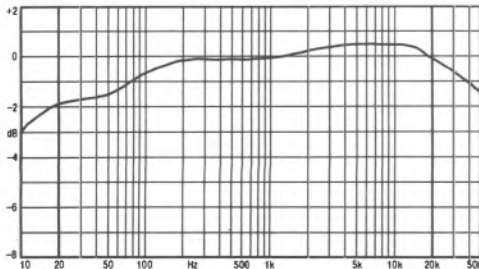
Power amp..... Phono -mV -kohms -pF

Output, pre-amp (tape)..... 8.9V max. 350ohms

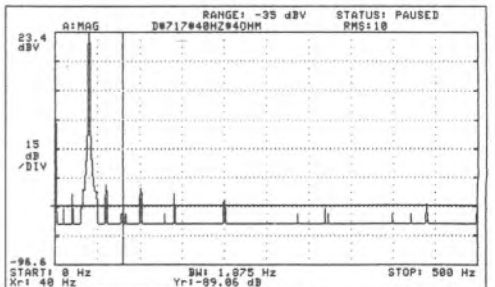
Disc equalisation error, 30Hz-15kHz..... +0.43dB, -1.6dB

Size (width, height, depth)..... 43 x 10 x 29cm

Typical price inc VAT..... £100



Disc eq accuracy and (right) power supply rejection



DNM 2A Series (Primus)

DNM Suppliers, Ros Trevor, Canterbury Tye, Doddinghurst Rd, Brentwood, Essex
Tel (0277) 225865



DNM is a small British company founded by Dennis Morecroft, a designer dedicated to sound quality and specialising in a range of pre-amplifiers, now well established.

At present packaged in a rather bluff looking alloy case, the range is founded on a basic chassis/motherboard providing signal and power supply interconnection. The various circuit boards plug into this chassis and allow expansion of input and output facilities; linking plugs may also be removed from the back to allow connection of additional power supplies.

Thus the least expensive pre-amp, the *Primus*, supplied with a single power supply unit, forms the heart of the system, and may be expanded internally as well as via additional supplies to a total of three (each of these twin regulated and costing around £350) to become the most expensive model.

The *Primus* is equipped with disc input a choice of mm or mc, plus an auxiliary or direct CD input and the line output amplifiers. Extra input cards may also be fitted plus tape buffer output cards.

Sound quality

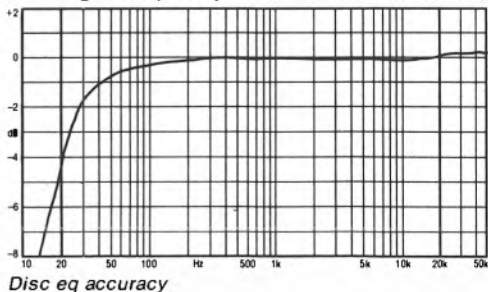
Although the *Primus* version is the cheapest in the series there was no doubt concerning its high audio quality. It sounded confident and clear via the CD input, with a fine exposition of detail throughout the frequency range. Stereo depth and width were well presented. Via mc, the sound was of similar quality. The mid

register was pleasantly accurate in tonal balance, rivalling the finest semiconductor pre-amps in this respect, and only in the treble did we note some imprecision, where a touch of fuzz was heard but not judged serious.

Moving up the range the addition of more power supplies in the first 2A form provided an all-round improvement, in fact the maximum available for the CD input. Still more power supplies progressively improved the analogue disc input performance, with the sound showing more control and confidence, also with an enhancement of dimensional quality. The treble also showed improvement.

Lab results

Up to 4 volts output was available from a low source resistance, which is enough for any power amplifier. The total harmonic distortion and high frequency intermodulation results



RECOMMENDED

were very fine, and were associated with good input overload margins. Channel separation was also very good and given the dual volume controls, channel balance was also good. Noise levels were fine and sufficient by low for all but the least sensitive of moving coil cartridges. All in all these results confirm the simple but highly competent circuit design. The RIAA equalisation was most uniform, equipped with a sensible subsonic rolloff.

Conclusion

This interesting range of pre-amplifiers can be confidently recommended from the basic £450 *Primus* upwards. The designer's commitment to improving standards should also allow relatively easy upgrading as desired. Inherently musical in character, they also convey a feeling of quiet neutrality, coupled with well focused dimensional stereo images.

GENERAL DATA	Preamplifier		
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
aux input.....	- 78dB	- 87dB	- 76dB
Intermodulation, 19/20kHz, aux input.....	- 100dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	- 95dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	- 95dB		
Noise			
Disc (mc) input (IHF, CCIR weighted).....	- 64dB		
Aux/CD input (IHF, CCIR weighted).....	- 88dB		
Residual, unweighted (volume control at min).....	> - 90dB		
Input overload			
Disc (mc) input (IHF)*.....	20Hz	1kHz	20kHz
Aux/CD input (IHF).....	26dB	27.5dB	29dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	89dB	80dB	67dB
Aux input.....	95dB	90dB	60dB
Channel balance , disc, at 1kHz.....	0.03dB		
Input data			
	socket	type	sensitivity loading
Disc (mm) input.....	Phono	- mV	- kohms - pF
Disc (mc) input*.....		0.1mV	47ohms - nF
Aux input.....	Phono	85mV	13kohms - pF
Output , pre-amp.....	4V max, 33ohms		
Disc equalisation error , 30Hz-15kHz.....	+ 0dB, - 1.8dB		
Size (width, height, depth).....	22 x 11.5 x 13.5cm		
Typical price inc VAT	£450 (Primus); see text for options		
<i>mm input available to order.</i>			

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Hafler DH110/DH220

HW International Ltd, 3-5 Eden Grove, London N7 8EQ

Tel 01- 609 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 10000 μ F 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.

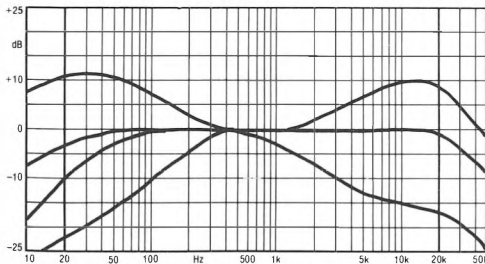
Lab results

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 -67 dB 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 close consideration.



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

Pre- and power amplifier

Power output

Rated power into 8ohms, maker's spec.	115W (= 21dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load d.	22.1dBW	22.4dBW	22.0dBW
Both channels, 4ohm load d.	20.0dBW	20.9dBW	20.3dBW
One channel, 2ohms, pulse d.	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

Disc (mm) input (IHF).	20Hz	1kHz	20kHz
Aux/CD 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

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

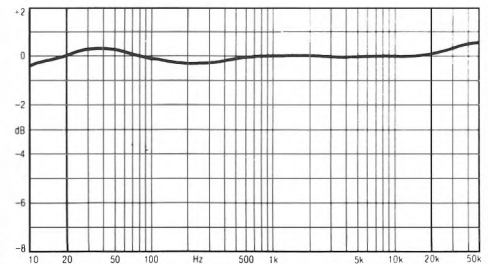
Output, pre-amp. 15.3V max, 330 ohms

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)

when reviewed, now £360, £420 (in kit form £295, £355)



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 ancillary 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	20Hz	1kHz	20kHz
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

Aux input.	0dB	-20dB	-60dB
	0dB	0.1dB	12 dB

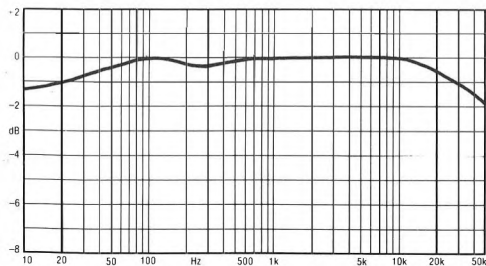
Input data

	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

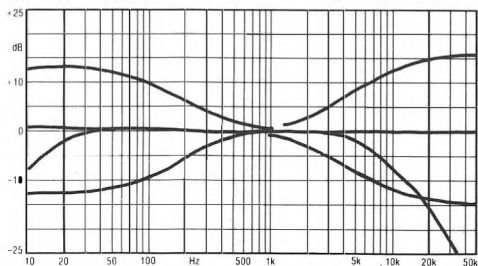
Disc equalisation error, 30Hz-15kHz. +0dB, -0.8dB

Size (width, height, depth). 44 x 40 x 14cm

Typical price inc VAT. £240



Disc input: RIAA equalisation accuracy



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Hitachi HA-6

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



A medium-priced Japanese integrated amplifier, the HA6 carries a substantial power rating of 100W (20dB/W) per channel, which is a lot for the money. Finished in satin black, the sombre front panel furnishes an wide array of features but unnecessary frills have been omitted.

All the inputs are in phono format, with CD, disc and tuner sockets all gold plated. The phono input may be switched from moving-magnet or moving-coil operation and in addition to the tape inputs and outputs, two further auxiliary sources may be employed. Controls include stereo/mono, a 30Hz subsonic filter and a 8kHz treble filter, plus loudness button, a 20dB volume mute and channel balance. Bass and treble tone controls are present and may be cancelled via a defeat switch. A headphone socket is included, while two sets of speakers may be switched separately or in combination. Speaker connection is made via substantial binding posts.

Internal construction is to a good commercial standard, but is not very tidy and has unshrouded contacts at mains potential. Mains switching is only single pole. Disc input circuitry is positioned sensibly close to the

relevant sockets, with a low noise differential input amplifier followed by a standard IC phono pre-amp/equaliser, this predictably enough, the Hitachi HA12017. Further ICs are used in the line amplifier and tone control circuitry.

The power amplifier has low noise differential inputs while the output uses high power Hitachi MosFets in a complementary direct coupled format. Electronic protection is fitted and the single split rail power supply is shared between the channels. Heatsinking is internal, the required thermal output being achieved via a massive radiator and heat pipe assembly.

Sound quality

Via auxiliary it scored about average for the price. Stereo images were not properly focused, but the amplifier did attempt to convey some ambience and depth. Overall the sound was fairly pleasant but mild aberrations were noted in many areas. For example, tonally the mid sounded thin, while the bass was soft, lacking in definition and the treble showed an odd 'concentrated' effect, with a touch of grain. Subtle detail was not too well conveyed.

Via the two disc inputs, the audible standard deteriorated a little, with a tonal darkness

evident in the lower mid register. Bass was barely average. High sound levels of 105dBa were possible into 8ohm loads.

Lab results

Even over the full bandwidth, the HA6 comfortably exceeded spec with a peak 8ohm level approaching 200W and a cruising power of 150W. Some high frequency loss was noted, this due to premature protection. The loss of 5dB to 2ohms loading did not indicate particularly good load tolerance while peak current was limited to a modest (for the power) $\pm 12A$. All distortions were so low as to be irrelevant, measuring typically $-95dB$ throughout! Input noise levels were low, and dc offsets negligible. Overload margins were fine, while stereo separation was also very good, and no problems appeared with balance or channel tracking. The moving-coil input was particularly sensitive but did not compromise other aspects of the performance; even Ortofon mcs are suitable here. The RIAA equalisation was flat mid band, with acceptable tailoring at the band edges, and excellent ripple rejection can be seen from the 40Hz power spectrum — better than $-105dB$!

Conclusion

The HA6 was a strong performer in many respects. It showed a fine lab performance, with a generous output particularly into normal loads, and offered a wide range of facilities. In engineering terms it is good value. However such are the high sound quality standards set these days that in this respect, the HA6 is only average. It cannot be written off however, and 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.....	100W (= 20dBW)
Power output	20Hz 1kHz 20kHz
One channel, 8ohm load.....	21.7dBW 21.9dBW 20.6dBW*
Both channels, 4ohm load.....	18.8dBW 19.0dBW 17.0dBW*
One channel, 2ohms, pulsed....	-dBW 17.0dBW -dBW
Instantaneous peak current.....	+12A -13A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	> -95dB -100dB -90dB
Intermodulation, 19/20kHz, rated power, aux input...>	-100dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-98dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-95dB

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).....	-80dB
DC output offset.....	left <1mV, right <1mV
DC offset, pre-amp.....	left -mV, right -mV

Input overload

Disc (mm) input (IHF).....	20dB 30dB 16dB
Disc (mc) input (IHF).....	30dB 30dB 16dB
Aux/CD input (IHF).....	>20dB >20dB >20dB

Stereo separation

Disc input.....	>88dB 73dB 60dB
Aux input.....	74dB 72dB 59dB

Output impedance (damping)... 0.11ohm 0.1ohm 0.2ohm

Channel balance, disc, at 1kHz..... 0.06dB

Volume/balance tracking 0dB -20dB -60dB

Aux input..... 0.02dB 0.07dB 0.8dB

Input data socket type sensitivity loading

Disc (mm) input..... Phono 0.32mV 47kohms 140pF

Disc (mc) input..... Phono .0032mV 100ohms -1F

Aux input..... Phono 19mV 47kohms 580pF

Power amp..... Phono -mV -kohms -1F

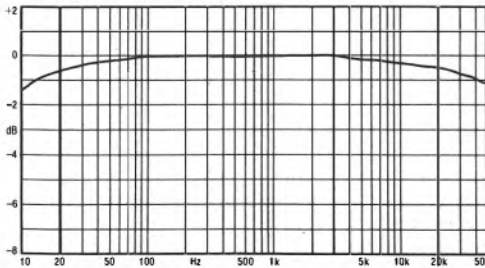
Output, pre-amp (tape)..... >5V 500ohms

Disc equalisation error, 30Hz-15kHz..... +0dB, -0.4dB

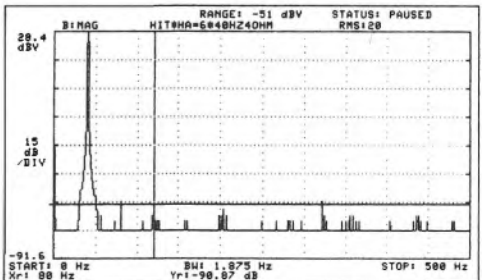
Size (width, height, depth)..... 43 x 8 x 26cm

Typical price inc VAT..... £220

*protection relay trips



Disc eq accuracy and (right) power supply rejection



Hitachi HCA8500/HMA8500 Mk II

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



Now in *Mark II* form and extensively revised, these Hitachi separates retail at £500 and yet nominally they offer a very similar specification and 100W rated power to the *HA-6* integrated amplifier, which comes at less than half the price! Well, separates do cost more, and in any case Hitachi have extensively upgraded the power supplies and circuitry for these two components. In particular the power amplifier is equipped with a beautiful pair of massive power level meters, well lit and scaled; I can see some customers being swayed by this feature alone!

In fact, in market terms, the £175 preamp is not expensive these days, and comes well equipped with a wide variety of inputs including mc and mm. All socketry is in phono, while the usual features are all included; there are double turnover frequency tone controls, subsonic filter (15Hz), stereo/mono, loudness and muting. Two tape decks may be used plus CD/aux, tuner and disc. The latter has switchable sensitivity plus variable impedance for mm cartridges.

Inside, the layout is tidy though once again, unshrouded single pole mains switching is present. The circuitry is concentrated on one single board. The disc input employs thermally isolated differential fet inputs, optimised for

low noise. An integrated circuit RIAA equaliser chip follows. The volume control is a cascode type, one section of high impedance present at the input selector and another of low impedance placed near the preamp output. This provides minimum noise throughout as the results testify.

Turning to the power amplifier, this is a direct coupled MosFet type, with variable impedance matching at the output and the facility for bridge mode operation, theoretically quadrupling the output power.

Sound quality

The bridge mode was not auditioned, since a second power amp was not available; in any case, the test results show it was too weak for any sensible load.

In 8 ohm 'normal' mode, the system was first auditioned via the auxiliary input. Judged rather above average, a 'dark' tonal character was observed, with the stereo sounding somehow shut-in. Over the frequency range it was fairly clear and articulate, with reasonable positional focus as well as adequate depth; overall it was considered quite passable.

Via disc, the bass deteriorated noticeably while the mid register sounded pinched with some sibilance on vocals. Depth and ambience

were reduced, and here it was just average.

As a straight power amplifier it rated above average, though with a mildly thickened grainy treble. Overall it was considered competent but uninspiring, and the adverse-load loudness was also poor.

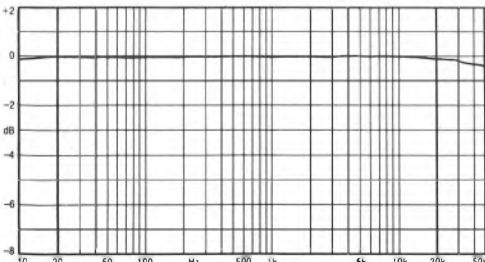
Lab results

The power results tell a story of limited output current and a poor handling of low impedances, namely a fall in level of 9.5dB from 8 to 2 ohms. In bridge mode over 200W was available which was rather less than predicted and with the 4 ohm delivery still poorer than in normal mode! On the other hand the bulk of the remaining performance characters were fine. Predictably, distortion was very low, both harmonic and intermodulation, and seen from the power spectrum, the supply ripple components were well suppressed.

Noise levels were good except via the mc input, which was clearly too sensitive. Overload levels were fine, while stereo separation was good via disc and satisfactory via auxiliary. Both channel balance and volume tracking were very good. The preamp output impedance was very low at 0.5 ohms, and the power amp proved easy to drive. Stability margins were excellent for the combination, and the RIAA equalisation was also very accurate.

Conclusion

This combination is marred by a weak sounding disc input on the pre-amp, and a load-intolerant power amplifier. Under the right conditions it can give a pretty good account of itself, but the standard achieved does not justify recommendation at the price level.



Disc eq accuracy and (right) power supply rejection

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.....	21.0dBW 21.3dBW 21.1dBW*
Both channels, 4ohm load.....	18.2dBW 18.3dBW 18.2dBW*
One channel, 2ohms, pulsed.....	-dBW 11.9dBW -dBW
Instantaneous peak current.....	+7A -6.5A

Distortion

Total harmonic distortion,.....	20Hz 1kHz 20kHz
at rated power, aux input.....	-93dB -93dB -83dB
Intermodulation, 19/20kHz, rated power, aux input.....	-105dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-85dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-75dB

Noise

Disc (mm) input (IHF, CCIR weighted).....	-79dB
Disc (mc) input (IHF, CCIR weighted).....	-52dB
Aux/CD input (IHF, CCIR weighted).....	-81dB
Residual, unweighted (volume control at min).....	-92dB
DC output offset.....	left 1mV, right 1.5mV
DC offset, pre-amp.....	left <1mV, right <1mV

Input overload

Disc (mm) input (IHF).....	20Hz 1kHz 20kHz
Disc (mc) input (IHF).....	32dB 33dB 33dB
Aux/CD input (IHF).....	25dB 26dB 23dB
Aux/CD input (IHF).....	>20dB >20dB >20dB

Stereo separation

Disc input.....	>85dB 82dB 65dB
Aux input.....	>80dB 65dB 38dB

Output impedance (damping)..... 0.042ohm 0.048ohm 0.06ohm

Channel balance, disc, at 1kHz..... 0.16dB

Volume balance tracking..... 0dB -20dB -60dB

Aux input..... 0.2dB 0.2dB 0.5dB

Input data socket type sensitivity loading

Disc (mm) input..... Phono 0.25mV 50kohms 150pF

Disc (mc) input..... Phono 0.013mV 100ohms 2.2nF

Aux input..... Phono 15mV 46kohms 190pF

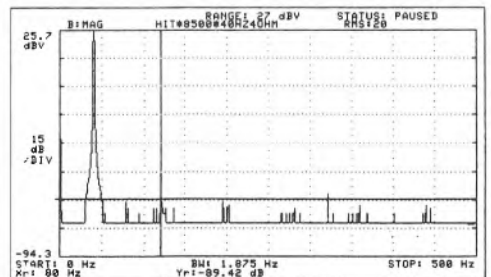
Power amp..... Phono 125mV 47kohms 290pF

Output, pre-amp (tape)..... 75V max, 600ohms

Disc equalisation error, 30Hz-15kHz..... +0dB, -0.03dB

Size (width, height, depth)..... 43 x 29 x 8cm, 43 x 16 x 32cm

Typical price inc VAT..... £175, £325



JVC AK-100

JVC (UK) Ltd, JVC House, 12 Priestley Way, Eldonwall Trading Estate, Staples Corner, London NW2 7AF
Tel 01-450 2621



A cheerfully inexpensive amplifier, the JVC A-K 100 is rated at 27W (14dBW) per channel. Despite the low price, it features a crude bar graph display which shows total peak output level. Tone controls and a loudness button are fitted, along with a standard headphone outlet. One pair of speakers can be connected, via rather flimsy clip connectors. The phono input sockets provide for tape, tuner, disc (mm) and CD/Aux.

Styled in silver and grey, the external finish is good. Inside however, the mains wiring is unshrouded, and the power switching is only single pole. Despite the amplifier's overall simplicity, no less than seven printed circuit boards are used, most for interconnection and support purposes.

The disc input is handled by a single IC, common to both channels. Equalisation is left to a later stage, this followed by the line selectors and the tone controls. The power amplifier is a simple design yet it employs a complementary output stage with direct coupling to the load. A single power supply is used and shared between the two channels with modest 3,300 μ F reservoir capacitors. The mains transformer is however a generous size, and overall, the construction was to normal commercial quality.

Sound quality

Auditioned via the auxiliary input, with good quality CD sources, the amplifier was rated well below average. The bass was almost boomy, vocals showed added hardness and the overall effect was 'slow' as well as lacking in transient definition. Mid range imaging was fine but the rest sounded defocused and phasy, with poor depth effects.

Progressing to the disc input, a further mild loss of quality was observed, with added sibilance noted on singing and speech. In its favour it did sound comparatively pleasant but it lacked real interest. Peak sound levels were 101dB into an 8 ohm load, with 99dB into the average load, which was fair enough.

Lab results

This amplifier demonstrated an average power bandwidth at 8 ohms, with a typical output of 16.5dBW which is almost 50W per channel. On lab testing at 4 ohms, output fell considerably due to actuation of the protection circuits, but the healthy pulsed output at 2 ohms confirmed that this limitation would not be felt on music signals; peak current was quite generous at ± 12 amps. Distortion levels were satisfactory in the main, although the disc intermodulation result was marginal.

Via disc, the input overload was sufficient if a little close to the bone at 20Hz. Stereo channel separation was quite weak, with only 23dB at 20kHz via disc. Even so it was probably better than the cartridge likely to drive it. Via auxiliary, the 27dB recorded result was less excusable. Channel balances and volume tracking were very good, and the input and output parameters were fine.

The RIAA equalisation (with the tone controls at zero) showed an early treble rolloff, with a touch of bass lift — enough to subjectively sweeten the tonal balance via disc.

Conclusion

This modest amplifier packs quite a healthy punch in power output terms, and would drive a wide variety of loudspeaker loads. The rest of the lab performance was also tidy enough and while it was no disaster on sound quality grounds, considering the price range involved, it unfortunately fell too far behind the established winners in its category to be recommended.

Test measurements

To show how well the amplifier sustains its 80hm 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.....	27W(= 14dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load.....	15.9dBW	16.7dBW	16.6dBW
Both channels, 4ohm load.....	11dBW	11.0dBW	12dBW*
One channel, 2ohms, pulsed....	-dBW	14dBW	-dBW
Instantaneous peak current.....		+ 12A	- 12A

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.....	-50dB	-51dB	-56dB
Intermodulation, 19/20kHz, rated power, aux input.....			-68dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....			-43dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....			-dB

Noise

Disc (mm) input (IHF, CCIR weighted).....	-69dB
Disc (mc) input (IHF, CCIR weighted).....	-dB
Aux/CD input (IHF, CCIR weighted).....	-70dB
Residual, unweighted (volume control at min).....	-84dB
DC output offset.....	left 14mV, right 21mV
DC offset, pre-amp.....	left -mV, right -mV

Input overload

Disc (mm) input (IHF).....	20Hz	1kHz	20kHz
Disc (mc) input (IHF).....	19dB	27dB	26dB
Aux/CD input (IHF).....	-dB	-dB	-dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB

Stereo separation

Disc input.....	55dB	41dB	23dB
Aux input.....	58dB	53dB	26.8dB
Output impedance (damping)...	0.45ohm	0.4ohm	0.45ohm

Channel balance, disc, at 1kHz

Volume/balance tracking	0dB	-20dB	-60dB
Aux input.....	0.4dB	0.62dB	0.4dB

Input data

Disc (mm) input.....	Phono	socket type	sensitivity	loading
Disc (mc) input.....	-	-mV	-ohms	-nF
Aux input.....	Phono	-mV	60kohms	230pF
Power amp.....	-	-mV	-kohms	-pF

Output, pre-amp (tape).....

-V max, 1kohms

Disc equalisation error, 30Hz-15kHz.....

+ 0.3dB, -1dB

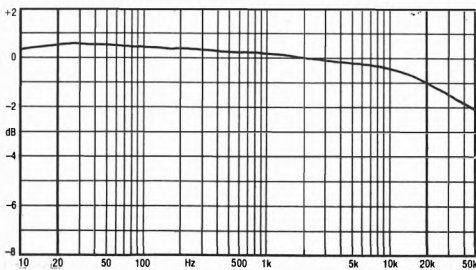
Size (width, height, depth).....

43 x 12 x 32cm

Typical price inc VAT.....

£80

* protection relay trips



Disc eq accuracy

JVC AK-300

JVC (UK) Ltd, JVC House, 12 Priestley Way, Eldonwall Trading Estate, Staples Corner, London NW2 7AF
Tel 01-450 2621



The *AK-300* is housed in a more substantial case than the *'100*, and upgrades on the latter by adding more facilities as well as more power. The same silver and grey styling is employed and, as usual with JVC, the exterior finish is very good.

The simple power meter of the *'100* is much revised here and now has separate left and right channels with wide dynamic range indication, and is sensitive, the smallest reading set at 3 milliwatts. Two sets of speakers can be connected via clamp type binding posts and the number of inputs is extended to six, covering disc, CD, aux, tuner, Tape 1 and Tape 2. A loudness filter is also provided together with balance, bass and treble controls, these last three slider action. All the socketry is in phono bar Tape 1, which is duplicated in DIN. No moving coil input is provided.

Inside, the layout is none too tidy and no less than twelve printed circuit boards are used, interconnected by complex wiring harnesses, which I would not have thought possible given the price level! The mains wiring is properly shrouded, and the power supply is a substantial one, with 8,700 μ F reservoir capacitors. High current output transistors are used in a direct coupled fully complementary circuit. Inputs are

electronically switched with an LC7815 chip while the disc pre-amp uses yet another IC. Separate low power regulators help isolate the pre-amp section from the unregulated power amplifier supply. Heatsinks are internally mounted with effective through flow ventilation within the case.

Sound quality

Via auxiliary the *AK-300* was judged notably below average, proving quite disappointing. Stereo images were presented in a flat, two dimensional manner while focusing was weak with a 'mono' impression lacking in ambience. The bass showed poor definition while the treble was grainy and the mid region hard and nasal in tonal balance.

Via disc it was even poorer with the treble now acquiring a metallic edge. Low level detail was muddled and the stereo soundfield was notably flat and lacking both space and ambience. It was however quite powerful, delivering 103dB into the 8ohm load, with a creditable 101.5dB into 4ohms.

Lab results

A healthy output was obtained of almost 19.5dBW on peaks, this close to 100W. Over the

power bandwidth, 18.8dBW was maintained, which was rather better than specified, though the output fell more than usual into 4 ohms. The 2 ohm pulse result was however quite good, and agreed with the above average peak current delivery of ± 18 amps.

Harmonic and high frequency intermodulation distortion levels were insignificant, with disc noise satisfactory. At the speaker terminals the dc offset was very low and the output impedance negligible. Input overload margins were fine, with stereo separation about average. Good tracking was observed for the volume control with a very close channel balance even via disc. The RIAA equalisation showed a touch of treble rolloff, but was otherwise quite uniform, and both input loadings and sensitivities were sensible. The power spectrogram indicated that supply line ripple was very well rejected at better than 105dB down.

Conclusion

In many respects this is a substantial amplifier for the money. Output was generous, with a fine adverse load capability plus a healthy peak current capacity. Unfortunately the sound quality was well below average, and quite precluded recommendation. I am sure that this amount of basically good engineering could result in an improved sound if it were better organised.

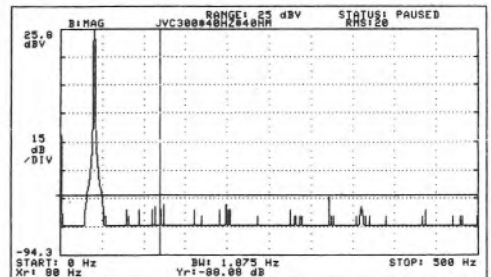
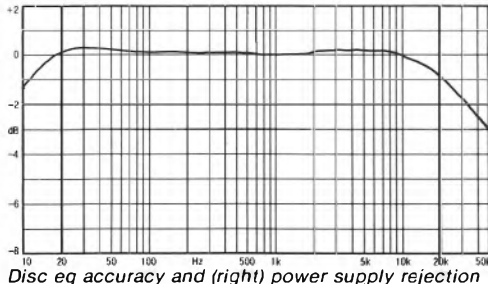
Test measurements

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.....	19.0dBW 19.2dBW 18.8dBW
Both channels, 4ohm load.....	16.3dBW 16.5dBW 16.3dBW
One channel, 2ohms, pulsed.....	-dBW 16.9dBW -dBW
Instantaneous peak current.....	+ 18A - 19A
Distortion	
Total harmonic distortion,.....	20Hz 1kHz 20kHz
at rated power, aux input.....	- 88dB - 89dB - 85dB
Intermodulation, 19/20kHz, rated power, aux input.....	- 90dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	- 70dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	- dB
Noise	
Disc (mm) input (IHF, CCIR weighted).....	- 60dB
Disc (mc) input (IHF, CCIR weighted).....	- dB
Aux/CD input (IHF, CCIR weighted).....	- 70dB
Residual, unweighted (volume control at min).....	- 83dB
DC output offset.....	left 1mV, right 0.51mV
DC offset, pre-amp.....	left -mV, right -mV
Input overload	
Aux input.....	20Hz 1kHz 20kHz
Disc (mm) input (IHF).....	33dB 34dB 23dB
Disc (mc) input (IHF).....	-dB -dB -dB
Aux/CD input (IHF).....	>20dB >20dB >20dB
Stereo separation	
Disc input.....	75dB 70dB 42dB
Aux input.....	67dB 64dB 40dB
Output impedance (damping)...	
	0.12ohm 0.12ohm 0.13ohm
Channel balance, disc, at 1kHz.....	
	0.33dB
Volume/balance tracking	
Aux input.....	0dB -20dB -60dB
	0.7dB 0.5dB 0.4dB
Input data	
	socket type sensitivity loading
Disc (mm) input.....	Phono 1.0mV 49kohms 150pF
Disc (mc) input.....	- mV -ohms -nF
Aux input.....	Phono 70mV 70kohms 200pF
Power amp.....	- mV -kohms -pF
Output, pre-amp (tape).....	>5V max, -ohms
Disc equalisation error, 30Hz-15kHz.....	
	+ 0.3dB, -0dB
Size (width, height, depth).....	
	43 x 12 x 32cm
Typical price inc VAT.....	
	£100



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! Mechanical hum levels and fan noise have been improved since the last edition 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 x 40000 μ F high-current reservoir capacitors!

Sound quality

This top-notch amplifier delivered a very fine sound, placing it clearly in that very select gathering of true audiophile products. Access to a *KSA-100* and '200 was also obtained and these were considered to build further on the already good standard of the '50.

With a wide, open character, demonstrating precise focus and control throughout the frequency range, a major strength was the musical and naturally balanced midrange. Here the amplifier was detailed, but also showed fine stereo perspectives with very good space and depth. Its sound was exciting and involving, and proved unfatiguing over long periods. True, if compared with the finest references, some mild loss of precision was

detected in the treble, which could sound a touch forward and glassy, but few other amplifiers can approach it, even in this respect. Bearing the overall standard in mind, very high quality pre-amps are needed if the '50 is to give of its best, Krell's latest PAM-3 is reckoned to be the man for the job!

Lab results

Rated at only 17dBW, the Krell typically produced on continuous ratings a 19.9dBW output level, and such was the extraordinary power bandwidth that no significant fall occurred from 20Hz to 20kHz, relative to 1kHz. Likewise the loss into 4 and 2ohms was small. Peak output was approaching 100W, reading 19.9dBW, with 18.2dBW still provided into 2ohms, the Krell proving to have one of the 'stiffest' output and power sections measured. Peak power into 2ohms exceeded 250W. Peak current output was symmetrical at a substantial ± 32A, 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.

It was rewarding to find this amplifier slightly improved second time around, so that its competitive standard had not been eroded. A firm recommendation still applies.

GENERAL DATA

Power amplifier

Power output

Rated power into 8ohms, maker's spec	.50W(-17dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	19.9dBW	19.9dBW	19.9dBW
Both channels, 4ohm load	19.7dBW	19.7dBW	19.65dBW
One channel, 2ohms, pulsed	-dBW	18.2dBW	-dBW
Instantaneous peak current	+32A -32A		

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 3mV, right 2mV

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..... £1795



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Luxman L230

HW International Ltd, 3-5 Eden Grove, London N7 8EQ
Tel 01-609 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 $2 \times 10000\mu\text{F}$ 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

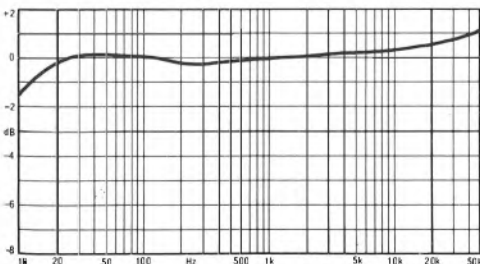
Rated at 60W, 17.5dBW, the L230 could produce a continuous full-bandwidth output into 8ohms happily exceeding 19dBW, and on peaks it reached 20dBW (100W). Lower load impedances were however handled less well, with a fall of 3dB on 4ohm peak, and a serious 10.5dB into 2ohms. The maximum current limits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



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.	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).	>70dB	>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

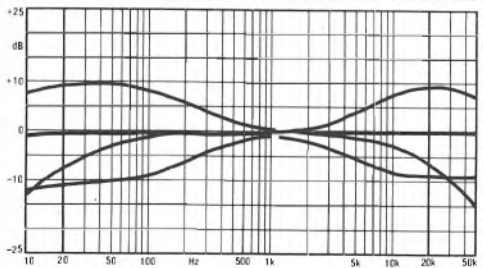
Input data

	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 when reviewed, now £193



Tone control/filter responses

Magnum P100/A100

Pure Gain Ltd, 27A Eaton Park Road, Palmers Green, London N13
Tel 01-882 4646



Though a relatively young company, Magnum have rapidly evolved a range of upmarket transistor amplifiers designed by Colin Wonfor. We were given the most expensive models for review, including the hefty A100 amplifiers, which had already been used in the last *HFC*: *Loudspeakers*, chosen for their awesome dynamic headroom.

Finished in satin and black with fine gold trim lines, this equipment is substantial in size, especially the power amp units. Fortunately I found these could be stacked for domestic use without overheating, and mechanical hum levels were relatively low in view of the power rating. The power amp has phono inputs and massive, large contact area binding posts for the loudspeakers. Each double power amp within is powered by its own 1KVA toroidal transformer, which accounts for the great weight involved. The output configuration employs parallel complementary MosFets and its bridged design imposed special difficulties on test. In particular the pre- and power amps were separately assessed, and many of the figures relate to a pre-amp output of 0.5V IHF.

The pre-amp is a straight-line type with no tone controls or filters. Phono sockets provide for disc (both mm and mc, these in gold plate), plus tape, CD, and tuner inputs.

For both units the quality of construction

was thought uneven, both as regards the soldering, choice of components (eg the cheap volume controls) and the assembly. In commercial terms our samples had a distinct hand-made pre-production quality.

Sound quality

Rated alone, the power amplifier scored well. The bass was powerful and tuneful if slightly overblown. Mild thinning was noted in the mid-range with a touch of grain in the treble while some subtle detail was veiled. However the stereo stage was big and ambient, with good depth, and respectable positional focus. For the power offered, it was possibly the best yet, and could get very loud — an astonishing 110dBA or so was produced into 8 ohms, with a still amazing 107dBA, 4 ohms.

Via auxiliary the pre-amplifier showed a comparable quality though with a mild loss of depth, though this was balanced by good focusing of the stereo image. The disc inputs were of lesser quality and here the bass lost definition, the mid showing further tonal thinning. Depth was also reduced and the treble took on a slightly 'electronic' quality.

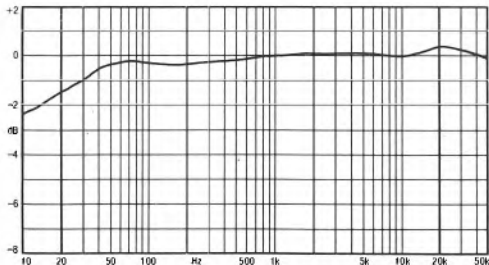
Lab results

With a peak 8 ohm delivery of a massive 440W/channel, the amplifier will cruise over the

power bandwidth at 25.2dBW level, meeting the spec. The loss into 4 and 2 ohms was surprisingly small, and output equivalent to 700W peak 4 ohms and 900W peak 2 ohms per channel was obtained! Peak current was just sufficient at $\pm 35A$ and with so much voltage headroom, it should in practice be hard to clip. Harmonic distortion was low but the disc inter-modulation results were less impressive. Noise levels were very good, overload margins fine and stereo separation well above average. Output impedance was negligible, and even slightly negative at 20kHz. Stability seemed to be OK, however. Balance was closely matched, but volume tracking deteriorated at low settings. Overall, the input sensitivities and loadings were useful though via auxiliary the input impedance was rather low at 14k, and the power amp was just 4.5k ohms. Watch out for some pre-amps with such a load, especially valve models. Pre-amp output impedance was higher than spec, reaching a nonetheless still low 82 ohms. RIAA equalisation was satisfactory with a hint of LF loss plus a slight 'tip up' at 20kHz, and a mild subsonic filter was built in. Ripple harmonics were well rejected in the 40Hz power spectrum.

Conclusion

Given their massive power rating, the pair of A100s are a fine power amp, ideal for high levels and with a wide dynamic range on digital programme. They really could drive the Magneplanar MG III speakers! However, the pre-amplifier is not quite in the same class, and is fairly expensive, although it is of very presentable quality. The power amplifier gains provisional recommendation.



Disc eq accuracy and (right) power supply rejection

Test measurements

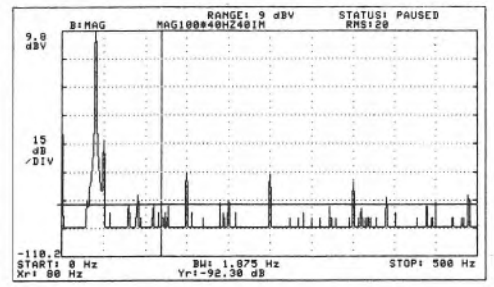
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA

Pre- and power amplifier

Power output			
Rated power into 8ohms, maker's spec.....	320Wl =	24.5dBW)	
Power output*	20Hz	1kHz	20kHz
One channel, 8ohm load.....	25.5dBW	25.6dBW	25.2dBW
Both channels, 4ohm load.....	24.5dBW	24.7dBW	24.4dBW
One channel, 2ohms, pulsed....	-dBW	23.6dBW	-dBW
Instantaneous peak current.....	+ 32.5A	- 32.5A	
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.....	> - 80dB	> - 80dB	> - 75dB
Intermodulation, 19/20kHz, rated power, aux input.....	-dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	- 65dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	- 55dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....	- 70dB		
Disc (mc) input (IHF, CCIR weighted).....	- 78dB		
Aux/CD input (IHF, CCIR weighted).....	- 81dB		
Residual, unweighted (volume control at min).....	- 90dB		
DC output offset.....	left 13mV, right 17mV		
DC offset, pre-amp.....	left 0mV, right 0mV		
Input overload			
Disc (mm) input (IHF).....	20Hz	1kHz	20kHz
Disc (mc) input (IHF).....	37dB	38dB	36dB
Disc (mc) input (IHF).....	30dB	30dB	26dB
Aux/CD input (IHF).....	20dB	20dB	20dB
Stereo separation			
Disc input.....	>90dB	88dB	68dB
Aux input.....	100dB	80dB	46dB
Output impedance (damping)...			
Channel balance, disc, at 1kHz.....	0.13ohm	0.12ohm	- .08ohm
Volume/balance tracking			
Aux input.....	0dB	- 20dB	- 60dB
Aux input.....	0.25dB	0.25dB	4.0dB
Input data			
Disc (mm) input.....	socket type	sensitivity	loading
Disc (mc) input.....	Phono	1.35mV	50.1kohm
Disc (mc) input.....	Phono	0.06mV	108ohms
Aux input.....	Phono	5.5mV	14kohm
Power amp.....	Phono	770mV	4.5kohm
Output, pre-amp (tape).....		15V max,	82ohms
Disc equalisation error, 30Hz-15kHz.....			
Size (width, height, depth).....		33 x 10.5 x 18cm	+ 0.2dB, - 1.0dB
Typical price inc VAT.....			
		£750, £1995 (pair)	

(Note: pre-amp tested separately due to bridged power amp)



Marantz PM-240

Marantz Audio (UK) Ltd, 15-16 Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middx UB7 0LW
Tel 01-897 6633



This tidy Marantz integrated amplifier sells for around £90 with a claimed power of 15dBW or 35W per channel. In practice, it proved rather more powerful than that, knocking out a substantial 75W (18.3dBW) into 8 ohms on typical programme.

Finished in the usual Marantz 'champagne' alloy, all the usual facilities are provided, with the input socketry in phono. Disc (mm), CD, tuner, video/aux and tape are all present, while loudspeaker connection is via flimsy clip terminals.

Features include a loudness and an optional subsonic filter (rather early at 50Hz) bass and treble controls and a headphone jack outlet.

Inside, the construction is to a tidy commercial standard. The disc input commences with the loading network, leading to a standard integrated circuit pre-amp/equaliser, the latter a normal series feedback type. Input source selection is electronic, the selected signals leaving the volume control for the IC line amplifier which includes the tone control circuitry. ICs are also used for most of the power amplifier circuit, their outputs fed directly to complementary transistor output stages, dc to the loudspeakers. Electronic overload protection is inbuilt, with a single

power supply used to feed generous 6800 μ F reservoir capacitors.

Sound quality

This amplifier was found to offer reasonable stereo with good apparent separation and stage width. In the far field, depth was restricted while focusing was clearly less confident. The bass was also weak and lacked both truthfulness and attack. The mid register however was relatively pleasant and neutral, but the treble showed a touch of fizz.

Via the disc input, the quality was felt to be very similar. Overall it rated below average but not seriously so, in view of its price. Into 8 ohms a maximum level of 103dBA was attained while into 4 ohms, some loss (to 100dBA) was noted.

Lab results

Cruising at a generous 18dBW, the '240 exhibited a good power bandwidth but the loss into 4 ohms was serious, suggesting too small a power transformer. By 2 ohms, the output had fallen to 11.8dBW due to the protection limit, which also set the peak output current at $\pm 7.5A$; though in fact this is probably sufficient for most purposes.

Both harmonic and intermodulation distortion levels were low, while input noise levels were fine. The dc offset at the speaker terminals was negligible. Input overload margins were satisfactory at high frequencies; for example, 27dB via the CD input. At full gain the channel balance was fine but volume/balance tracking was poorer than average at lower volume settings.

With an average sensitivity, the disc input capacitance was unusually high at 550pF and totalled 650pF with arm lead, and this may well need consideration when used with some cartridges. The RIAA equalisation revealed some mild loss of both bass and treble frequencies, with an additional imbalance, these errors due to tolerances in the tone control circuit.

From the 40Hz power spectrum, the output was pretty clean, with negligible ripple harmonics.

Conclusion

Marantz amplifiers are improving, but need to get even better if recommendation is to be achieved. This one offers fair value, and is at least 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 (= 16.5dBW)
Power output*	20Hz 1kHz 20kHz
One channel, 8ohm load.....	18dBW 18.23dBW 18.2dBW
Both channels, 4ohm load.....	14.2dBW 14.8dBW 14.7dBW
One channel, 2ohms, pulsed.....	-dBW 11.8dBW -dBW
Instantaneous peak current.....	+ 7.5A - 7.5A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	-88dB -85dB -75dB
Intermodulation, 19/20kHz, rated power, aux input.....	-90dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-74dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-dB

Noise

Disc (mm) input (HF, CCIR weighted).....	-70dB
Disc (mc) input (HF, CCIR weighted).....	-dB
Aux/CD input (HF, CCIR weighted).....	-75dB
Residual, unweighted (volume control at min).....	-84dB
DC output offset.....	left <1mV, right <1mV
DC offset, pre-amp.....	left -mV, right -mV

Input overload

Disc (mm) input (HF).....	27dB 1kHz 20kHz
Disc (mc) input (HF).....	-dB 26dB 26dB
Aux/CD input (HF).....	>20dB >20dB >20dB

Stereo separation

Disc input.....	71dB 45dB 36dB
Aux input.....	>80dB 43dB 27dB

Output impedance (damping)...

	0.2ohm 0.19ohm 0.16ohm
--	------------------------

Channel balance, disc, at 1kHz.....

	0.6dB
--	-------

Volume/balance tracking

Aux input.....	0dB -20dB -60dB
	0.3dB 1.23dB 4dB

Input data

	socket type	sensitivity	loading
--	-------------	-------------	---------

Disc (mm) input.....	Phono	0.41mV	44kohms	550pF
Disc (mc) input.....	-	-mV	-ohms	-nF
Aux input.....	Phono	43mV	55kohms	220pF
Power amp.....	-	-mV	-kohms	-pF

Output, pre-amp (tape).....

	>2V max, 300ohms
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Disc equalisation error, 30Hz-15kHz.....

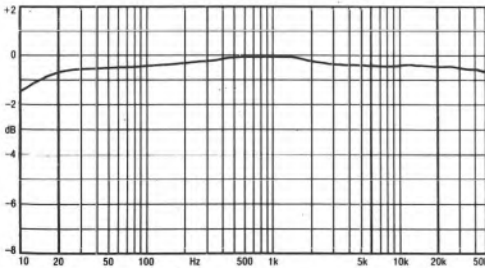
	+0dB, -1.15dB
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Size (width, height, depth).....

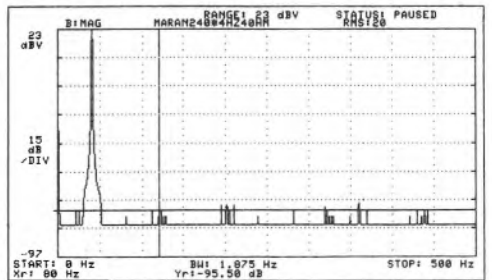
	43 x 9 x 23cm
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Typical price inc VAT.....

	£90
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Disc eq accuracy and (right) power supply rejection



Marantz PM-64

Marantz Audio (UK) Ltd, 15-16 Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middx UB7 0LW
Tel 01-897 6633



At around £230, this large integrated amplifier offers a versatile specification with a rated power of 100W (20dBW) per channel, both driven into 8 ohms. Oddly enough, the 4 ohm rating is the same, indicating severe current limiting, which indicates either poor load tolerance or a type of design where the power transformer is relatively undersized, and power delivery has thus been optimised for a maximum dynamic range on programme peaks. As such it is more orientated towards the demands of digital material, which would tie in with the company's CD involvement.

Front panel control facilities include disc (mm and mc) inputs plus provision for tuner, CD, aux and two tape decks. All rear sockets are phono while the two possible sets of speakers are connected by spring-clip terminals. Other features include loudspeaker switching and tone controls (with a defeat bypass) as well as a subsonic filter.

The interior is tidily built, but seems to employ an inordinate number of circuit boards. The disc input revolves around a dual op-amp IC whose noise performance is boosted by a discrete differential fet input. The mm and mc disc inputs differ in both gain and impedance. Normal selector switching follows, leading to the volume controls and loudness network. The line amplifier is also IC based, and includes the tone controls in a feedback circuit. IC ampli-

fiers are used for the early stages of the power amplifier.

A fully complementary layout is used for the output transistors, arranged as emitter follower triples. Using a single transformer, the power supply is substantial with 10,000 μ F reservoir capacitors running at $\pm 70V$.

Sound quality

Initially the '64 was tried via the auxiliary input using quality CD source material. While it sounded basically pleasant and inoffensive, it nonetheless scored below par, in fact rather below average. High sound levels were possible, with 105dBA into the normal load and a decent 103dBA into the adverse load.

In character it sounded a little on the dead and dull side. The bass showed a boomy effect lacking in real definition while stereo images were compressed with a noticeable loss of depth.

Via the mc disc input facility, the sound was if anything slightly worse. One felt the need to play it excessively loud, which it would allow, in order to recover the finer musical details. Overall it was considered rather uninspiring.

Lab results

More power line ripple was present than usual; for example, the 100Hz line on the power spectrogram at -83dB. Rated at 20dB/W, it

peaked at almost 200W (23dB/W) into 8 ohms with a full power bandwidth output at substantial 22.2dB/W. The loss into 4 ohms was moderate, but at 2 ohms, even on pulses, the output level had fallen by 8dB. Electronic circuit limiting at +12, -11A was the cause and these levels were a little too tight for the power level.

All measured distortion results were very good, and were coupled with the excellent input overload margins. DC offset at the speaker terminals was satisfactory while input noise levels reached a good standard. Channel separation was rather weak however particularly at high frequencies, and was clearly prejudicial to the excellent CD specification in this area. Channel balance and tracking were well maintained over a wide range of both frequency and level, and in addition, the RIAA equalisation was commendably accurate. Sensitivities and loadings were both satisfactory, while the output impedance was very low that is, damping factor was high, and will not affect any suitable loudspeaker.

Conclusion

The *PM-64* is a perfectly acceptable integrated amplifier. Its smooth nature is in fact quite well suited to CD sources, while its peak output power into sensible speaker loads was undoubtedly pretty high. However in our listening tests its intrinsic audio standard fell below average and as such puts it out of the recommended listings.

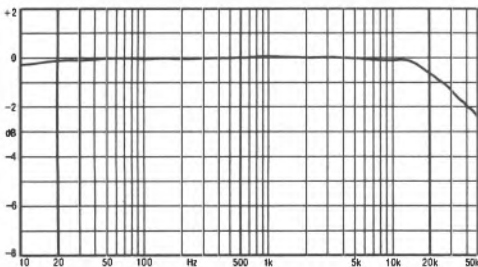
Test measurements

To show how well the amplifier sustains its 80hm 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.

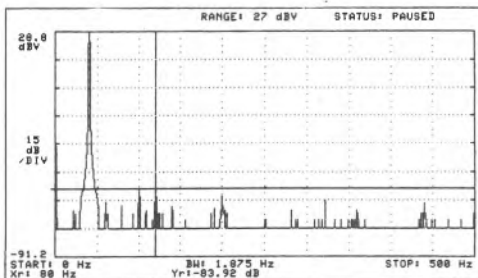
GENERAL DATA

Integrated amplifier

Power output			
Rated power into 8ohms, maker's spec.....	100W (= 20.0dBW)		
Power output*	20Hz	1kHz	20kHz
One channel, 8ohm load.....	22.3dBW	22.4dBW	22.2dBW
Both channels, 4ohm load.....	19.6dBW	20.1dBW	19.9dBW
One channel, 2ohms, pulsed.....	-dBW	14.6dBW	-dBW
Instantaneous peak current.....	+12A	-11A	
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.....	-87dB	-90dB	-80dB
Intermodulation, 19/20kHz, rated power, aux input.....	-88dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-85dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-80dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....	-70dB		
Disc (mc) input (IHF, CCIR weighted).....	-67dB		
Aux/CD input (IHF, CCIR weighted).....	-70dB		
Residual, unweighted (volume control at min).....	-84dB		
DC output offset.....	left 23mV, right 26mV		
DC offset, pre-amp.....	left -mV, right -mV		
Input overload			
	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	31dB	30dB	30dB
Disc (mc) input (IHF).....	31dB	30dB	30dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	67dB	52dB	28dB
Aux input.....	70dB	50dB	30dB
Output impedance (damping)...			
	0.09ohm	0.12ohm	0.125ohm
Channel balance, disc, at 1kHz.....			
	0dB	-20dB	-60dB
Volume/balance tracking			
Aux input.....	0.1dB	0.4dB	0.8dB
Input data			
	socket	type	sensitivity loading
Disc (mm) input.....	Phono	0.250mV	45kohms 300pF
Disc (mc) input.....	Phono	0.025mV	100ohms 1.5nF
Aux input.....	Phono	17mV	62kohms 120pF
Power amp.....	-	-mV	-kohms -pF
Output, pre-amp (tape).....			
	>5V max,	880ohms	
Disc equalisation error, 30Hz-15kHz.....			
	+0dB,	-0.2dB	
Size (width, height, depth).....			
	42 x 12 x 32cm		
Typical price inc VAT.....			
	£230		



Disc eq accuracy and (right) power supply rejection



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 97.5dB. 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 moderate at 1.4dB; a good 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

With the latest model tested for this edition, Meridian have continued to make slight improvements to sonic clarity, notably the aux/CD terminal. But despite this, the amplifier has been overhauled by other recent introductions at rather more competitive prices. The 'Component' serious remains a musical and spacious sounding system of considerable merit, but value considerations this time have placed it rather lower in the field, in the 'worth considering' 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	.....	35W (= 15dBW)		
Power output	20Hz	1kHz		
One channel, 8ohm load	.....	14.6dBW	15.5dBW	14.2dBW
Both channels, 4ohm load	.....	12.4dBW	12.8dBW	11.4dBW
One channel, 2ohms, pulsed	.....	14.2dBW	14.1dBW	14.0dBW
Instantaneous peak current	.....	+ 12 A	- 11 A	

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	.....	- 88dB	- 84dB
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
Disc (mc) input (IHF)	.....	24dB	23dB
Aux/CD input (IHF)	.....	>20dB	>20dB

Stereo separation

Disc input	.....	- 80dB	- 78dB	- 58dB
Aux input	.....	- 80dB	- 82dB	- 61dB

Output impedance (damping)	0.06ohm	0.06ohm	0.10ohm
Channel balance , disc, at 1kHz	.....	- 0.5dB	

Volume/balance tracking	0dB	- 20dB	- 60dB
Aux input	.....	0.1dB	0.1dB

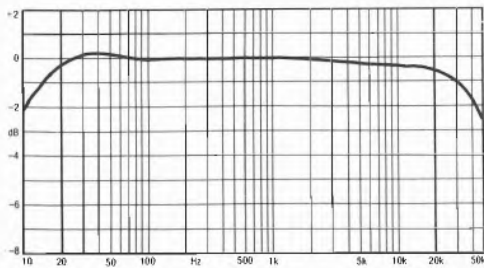
Input data socket type sensitivity loading

Disc (mm) input	.....	Phono	0.36mV	50kohms	100pF
Disc (mc) input	.....	Phono	*	12ohms	0nF
Aux input	.....	Phono	24.4mV	495kohms	130pF

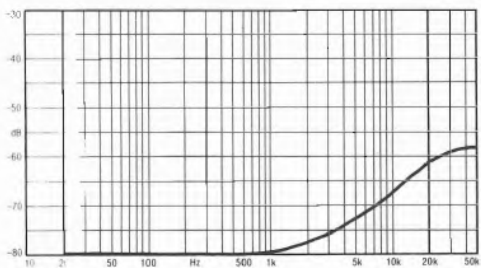
Output , pre-amp	.....	>6V	600/300ohms
Disc equalisation error , 30Hz-15kHz	.....	+ 0.2dB, - 0.3dB	

Size (width, height, depth)	.....	480 x 6 x 31cm
Typical price inc VAT	.....	£375 (disc only)

*Cartridge-dependent



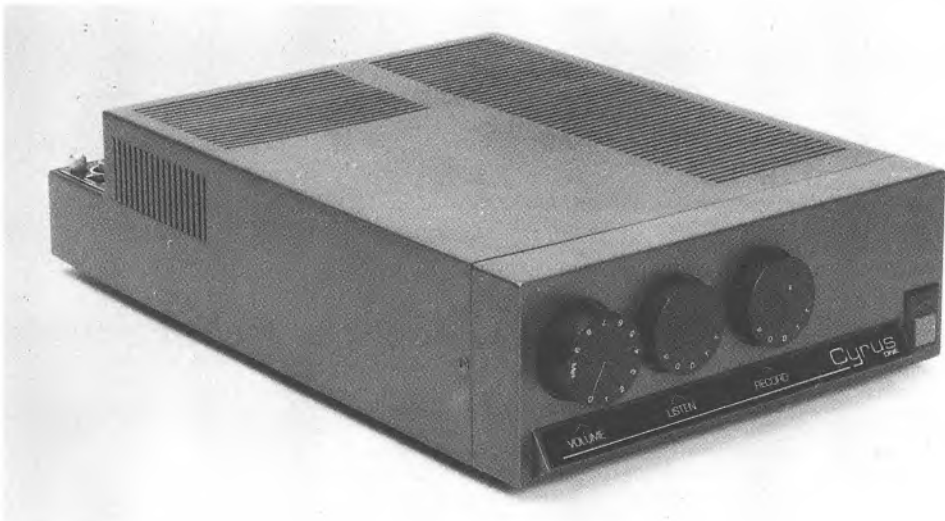
Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Mission Cyrus One

Cyrus Electronics Ltd, Stonehill, Huntingdon, Cambs PE18 6ED
Tel (0480) 57477



The distinct resemblance in appearance between the *Cyrus One* and the now deleted *778* is not accidental. However, almost nothing of the *778* remains as regards internal design, for the *Cyrus* represents a new approach on the part of Mission's designer, in returning to normal transistors (rather than MosFets) for the output stage. Rated output is a modest 30W (14.5dB/W) while the amplifier is also distinguished by the inclusion of a variable gain disc input that is quiet enough to carry out a reasonable job with medium output moving coil cartridges.

Largely constructed from plastic casings, this design is particularly compact. Input facilities are comprehensive (all phono sockets) and it also has a versatile 'record out' selector which can delete the recorder from the signal path when not in use.

Inside, the direct coupled complementary output amplifiers are fed from a single dual rail power supply energised by a good quality toroidal transformer.

Fast 15A output transistors are used with a 70MHz 'ft.' No line amplifier is present; instead the power amp is run at a higher than usual gain while the line inputs are fed directly to the

medium impedance volume control.

The disc amplifier is based on a 5334 integrated circuit, with evident use of high quality metal film resistors and selected audio grade coupling capacitors.

Sound quality

Almost from the outset, the high sound standard set by the *One* was well appreciated. Here was a musical, transparent amplifier of adequate size and which conveyed a decent measure of depth, space and ambience in the stereo sound stage. Focusing was good, and its overall character was relatively neutral, remaining so throughout its usable and surprisingly wide dynamic range. Moderate clipping overload seemed to hardly affect it.

Via disc, very little deterioration was noted. The clean, confident and slightly lightweight character remained; such a performance in fact came close to rivalling some of the costly recommended separates.

Lab results

The specified rating was comfortably exceeded, with a peak power of 17dBW into 8 ohms and a full power bandwidth 'cruising'

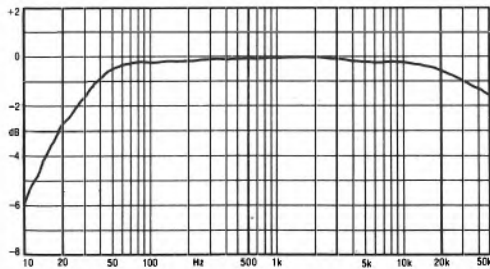
power of almost 16dBW (40W). Fully driven into 4 ohms, the power supply sagged with the level down to 13dBW overall. The 12.5dBW output into 2 ohms was reasonably healthy coupled with a decent +11, -10A peak current.

All the distortion results were exemplary. Input noise levels were generally good except on mc, where the -58dB recorded could be considered marginal; OK only for the healthier-output models such as the Ortofon MC10 Super. DC offsets were negligible, while input overload margins were fine. Channel separation was strangely and deliberately just average at around 45dB, though this did not appear to spoil the sound!

Channel balance was very good, with a uniform RIAA equalisation showing just a touch of bass and treble cut. A subsonic filter was included. Note that the disc input impedance remained constant regardless of the mc or mm operation. The auxiliary setting was well matched to CD sources. Ripple rejection was just average at -84dB judging by the 40Hz 4 ohm power spectrogram.

Conclusion

This amplifier was much liked on audition, its sound belying expectations of quality based on its modest price and specification. It really does make music, and helps establish yet another new standard in its strongly contested price category. Clearly it merits its Best Buy classification.



Disc eq accuracy and (right) power supply rejection

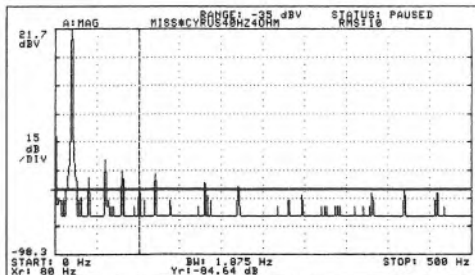
Test measurements

To show how well the amplifier sustains its 80hm 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.....	15.9dBW	16.5dBW	16.3dBW
Both channels, 4ohm load.....	13.0dBW	13.7dBW	13.4dBW
One channel, 2ohms, pulsed.....	-dBW	12.5dBW	-dBW
Instantaneous peak current.....	+11A	-10A	
Distortion			
Total harmonic distortion, 20Hz	1kHz	20kHz	
at rated power, aux input.....	-90dB	-92dB	-72dB
Intermodulation, 19/20kHz, rated power, aux input.....	-90dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-90dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-90dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....	-72dB		
Disc (mc) input (IHF, CCIR weighted).....	-58dB		
Aux/CD input (IHF, CCIR weighted).....	-77dB		
Residual, unweighted (volume control at min).....	-75dB		
DC output offset.....	left 6mV, right 7mV		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	31dB	28dB	28dB
Disc (mc) input (IHF).....	30dB	28dB	28dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	-47dB	-47dB	-48dB
Aux input.....	-42dB	-43dB	-42dB
Output impedance (damping)...	0.05ohm	0.05ohm	0.06ohm
Channel balance, disc, at 1kHz.....	-0.2dB		
Volume/balance tracking	0dB	-20dB	-60dB
Aux input.....	0.5dB	1dB	3dB
Input data	socket type sensitivity loading		
Disc (mm) input.....	Phono	0.4mV	47kohms 280pF
Disc (mc) input.....	Phono	0.04mV	47ohms 280pF
Aux input.....	Phono	64mV	-kohms -pF
Power amp.....	-	-mV	-kohms -pF
Output, pre-amp.....	-V max, -ohms		
Disc equalisation error, 30Hz-15kHz.....	+0dB, -1.6dB		
Size (width, height, depth).....	21 x 9 x 34cm		
Typical price inc VAT.....	£130		



Mission Cyrus Two

Cyrus Electronics Ltd, Stonehill, Huntingdon, Cambs PE18 6ED
Tel (0480) 57477



Mission's *Cyrus One* and *Two* look very similar but important internal differences distinguish them, as well as the matter of some £100 sterling! For the *Two*, the output level has been increased to 50W (17dBW) and output current has also been doubled. Higher quality components are used while the disc stage has also been extensively upgraded to produce a 11dB improvement in noise level via mc with optimised input loading.

As before, two large selector switches dominate the front panel, one for the sources and the other for record 'out'. No balance, tone or any other controls are present, save for volume.

The internal construction follows the '*One*', using a single printed circuit board, plus a large Holden and Fisher toroidal mains transformer. The direct coupled output uses fast complementary output transistors in classic class A/B mode while the single power supply is shared between the channels. Input connections are phono, the speakers joined by large 4mm socket/binding posts which are located rather too close together. Mains input is via an IEC socket and matching cable, while a headphone outlet is also present, this located on the back panel. This is not as inconvenient as it sounds, since the rear panel is an accessible horizontally disposed ledge.

Sound quality

One word sums up this remarkable amplifier, impressive! Good as the *Cyrus One* undoubtedly is, the *Two* was in another class altogether. The sound stage was spacious and deep, showing fine ambience, focus and breath. It was transparent and produced much fine detail, remaining neutral and highly confident over the whole frequency range. It could also be driven hard without audible distress.

Maximum sound levels of 103dBA and 101.5dBA into an adverse load were obtained and it also clipped well. Via disc the fine quality held up well. In tonal character it was slightly bright with a touch of mid thinness, but it lacked the usual hardness or brittleness often encountered with moderately priced gear. It could also do fair justice to some substantially good cartridges such as the van den Hul *MC1000*, costing as much as the amplifier!

Lab results

Producing close on 18dBW on peaks, the '*Two*' happily drove the 8 ohm load to 17.6dBW over the test power bandwidth. A significant 3dB loss in level was noted into 4 ohms, both channels driven, suggesting the transformer could be larger (a special booster pack will be available as an optional extra). The pulsed

rating on 2 ohms showed a little more than 2dB loss, confirming the worthwhile peak current rating of +22.5, -17.5A. The current asymmetry would be advantageous if reversed in polarity. It showed good load tolerance.

Both types of measured distortion were very low, particularly the high frequency intermodulation. Input noise levels were fine, including moving coil while the dc offset at the speaker terminals was held to a satisfactory level. Input overload levels were also ample, and the overall output impedance held to a negligible value. As with the 'One, channel separation was held at a constant but satisfactory average of 45dB, but a channel imbalance of 1.8dB was noted on disc, although this was said to be atypical.

Volume tracking was fine except at low settings and a better potentiometer would be an advantage here. All input loadings and sensitivities were to a sensible standard, while disc equalisation was accurate with a subsonic rolloff plus a touch of HF rolloff.

The value of the 40Hz power spectrum is not yet well established, and here the *Cyrus Two* was unexceptional, showing a ripple rejection of around 77dB.

Conclusion

Despite a couple of minor lab test oddities, in the main the results suggest a clean, load tolerant amplifier with a healthy output.

It is well equipped in signal handling terms and offers a pretty accurate tonal balance. Sonically it excels, rivalling some very costly and highly rated separates in the £800 range. Accordingly a strong recommendation is mandatory, which at this price level, makes it immediate Best Buy material.

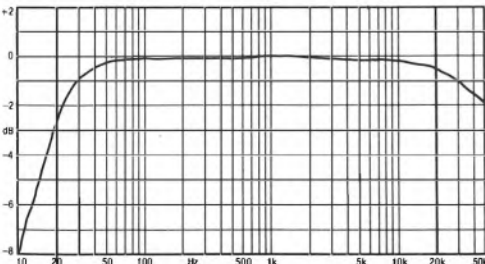
Test measurements

To show how well the amplifier sustains its 80hm 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.

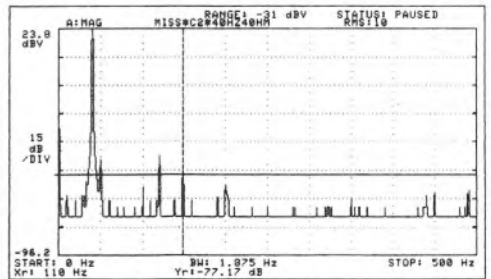
GENERAL DATA

Integrated amplifier

Power output			
Rated power into 8ohms, maker's spec.....	50W (= 17dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load.....	17.7dBW	17.8dBW	17.6dBW
Both channels, 4ohm load.....	14.4dBW	14.7dBW	14.6dBW
One channel, 2ohms, pulsed.....	-dBW	15.4dBW	-dBW
Instantaneous peak current.....	+22.5A	-17.5A	
Distortion			
Total harmonic distortion, 20Hz	1kHz	20kHz	
at rated power, aux input.....	-85dB	-80dB	-75dB
Intermodulation, 19/20kHz, rated power, aux input.....	> -90dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	> -90dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	> -90dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....			-76dB
Disc (mc) input (IHF, CCIR weighted).....			-69dB
Aux/CD input (IHF, CCIR weighted).....			-80dB
Residual, unweighted (volume control at min).....			-73dB
DC output offset.....	left 26mV, right	13mV	
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	38dB	36dB	36dB
Disc (mc) input (IHF).....	26dB	23dB	23dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	47dB	47dB	46dB
Aux input.....	43.5dB	43dB	42dB
Output impedance (damping)	0.15ohm	0.15ohm	0.15ohm
Channel balance, disc, at 1kHz			1.8dB
Volume/balance tracking	0dB	-20dB	-60dB
Aux input.....	0.06dB	0.1dB	5.0dB
Input data		socket type	sensitivity
Disc (mm) input.....	Phono	0.33mV	47kohms
Disc (mc) input.....	Phono	0.023mV	470ohms
Aux input.....	Phono	60mV	14kohms
Power amp.....	-	-mV	-kohms
Output, pre-amp (tape)		75V max.	700ohms
Disc equalisation error, 30Hz-15kHz		+0dB,	-1dB
Size (width, height, depth)		21 x 9 x	34cm
Typical price inc VAT			£230



Disc eq accuracy and (right) power supply rejection



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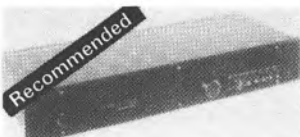
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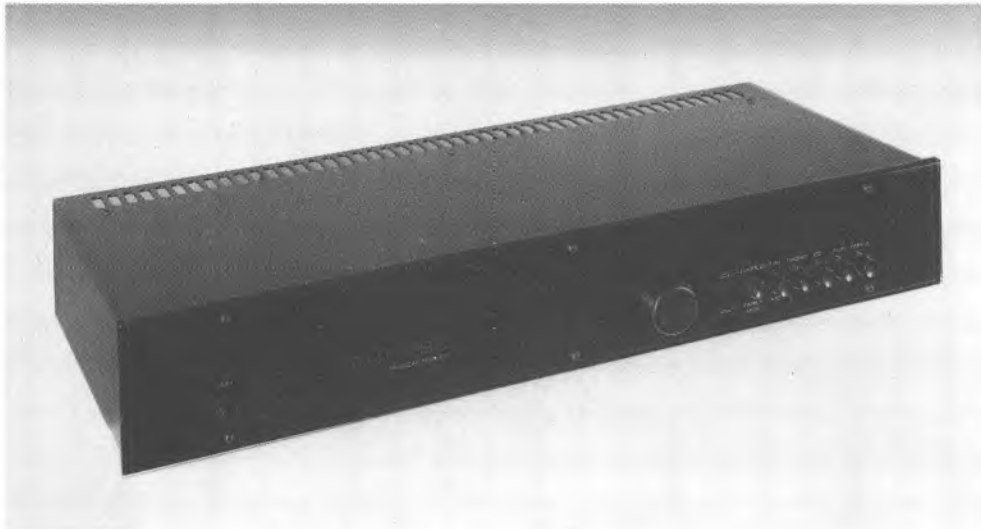
6 Market Street, Braintree, Essex CM7 6YA.

Tel: 0376 29060

Hours: 9.30-6.00 Monday-Saturday and evenings by appointment

Musical Fidelity Synthesis

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



Musical Fidelity's unusually-named integrated amplifier could, I suppose, be said to represent a 'synthesis' of their established separates, *The Preamp* and *Doctor T*. Selling for £345, it is rather cheaper than the cost of the two separate components, and the main compromise involved appears to be in the size of the power supply. Some advantages accrue though, namely simplified internal wiring, and the rated power is 75W (18.5dBW). No tone controls or filters are present, with the accent being on a simple, direct sound path.

Input facilities are varied and include disc (mm and mc) plus aux/CD, tuner and two tape decks. All are in phono format except for the tape 2, which is in DIN.

On our sample the wiring was faulty resulting in a channel reversal via moving magnet. The amplifier was removed somewhat prematurely, in fact before we had time to investigate the circuitry. We do know that it follows *The Preamp* quite closely in this respect. The single power supply uses a decent toroidal transformer, with ample reservoir capacity but the volume control is a cheap one, and I feel the *Synthesis* deserves better. Exterior finish is in black with a visually

unbalanced layout, but it is said that this is to be improved in 1985.

Sound quality

Using CD sources the *Synthesis* proved to be a strong performer. A plausible, coherent and focused sound was produced with a well defined stereo image of natural dimensions. Tonally it was quite neutral, even sweet, though some loss of definition was noted at the band edges, for example in the low bass and upper treble.

It remained eminently civilised with moving coil disc input. Stereo depth was present in good proportion, while dynamics were well portrayed. Compared with the best examples, a slight loss of low level detail and ambience was noted.

Driven hard, the sound developed a brittleness which lent a 'sharp' effect. Peak sound levels on the normal load were high at 104dBA, falling more than usual to 101.5dBA (still loud!) into the adverse load.

Lab results

Despite its compact dimensions the *Synthesis* produced well over 140W peak on 8 ohm loads,

with a full bandwidth power that was very well maintained at 20.2dBW. Some loss was evident into 4 ohms (with real power increase here) but the bandwidth was still very good. However current limiting was shown in the 2 ohm pulsed power which was almost 9dB down, and indeed the peak current measured + 12.5, - 10.5A, insufficient for the high output level.

No problems were encountered during the distortion tests although some deterioration was apparent at higher frequencies. Input noise levels were very satisfactory and input overload margins exemplary. Channel separation was generally good, but with some deterioration via disc as well as at higher frequencies. Tracking was good except at low settings.

RIAA equalisation was very accurate, coupled with a mild subsonic rolloff. Impedance and sensitivities were fine via the various inputs, including the special sensitivity for CD.

Conclusion

If restricted to sensible 8 ohm speaker loads (no Linn Saras here!) the *Synthesis* will be found to be a competent and musical performer of good input versatility as well as ample peak loudness. The overall standard it achieved indicates a good value rating with a consequent recommendation.

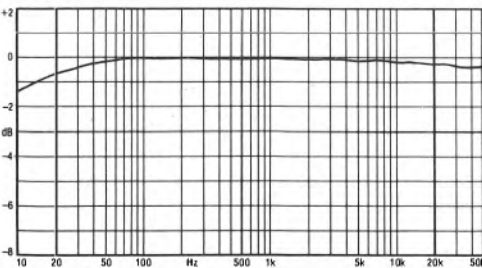
Test measurements

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.

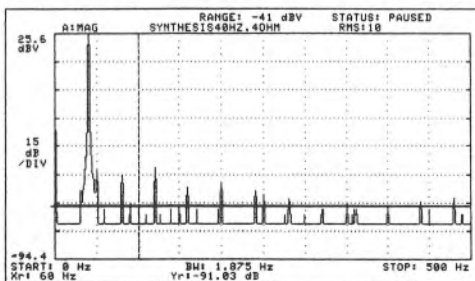
GENERAL DATA

Integrated amplifier

Power output			
Rated power into 8ohms, maker's spec.....	70W(= 18dBW)		
Power output.....	20Hz	1kHz	20kHz
One channel, 8ohm load.....	20.2dBW	20.5dBW	20.2dBW
Both channels, 4ohm load.....	17.05dBW	17.3dBW	17.1dBW
One channel, 2ohms, pulsed.....	-dBW	11.8dBW	-dBW
Instantaneous peak current.....	+ 12.5A	- 10.5	
Distortion			
Total harmonic distortion,.....	20Hz	1kHz	20kHz
at rated power, aux input.....	- 83dB	- 84dB	- 63dB
Intermodulation, 19/20kHz, rated power, aux input.....	- 70dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	- 75dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	- 73dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....	- 77dB		
Disc (mc) input (IHF, CCIR weighted).....	- 66dB		
Aux/CD input (IHF, CCIR weighted).....	- 82dB		
Residual, unweighted (volume control at min).....	- 88dB		
DC output offset.....	left 46mV, right 1mV		
Input overload			
.....	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	35dB	34dB	27dB
Disc (mc) input (IHF).....	35dB	34dB	31dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input (mc).....	62dB	44dB	39dB
Aux input.....	84dB	82dB	57dB
Output impedance (damping).....	0.16ohm	0.17ohm	0.15ohm
Channel balance, disc, at 1kHz.....	0dB	- 20dB	- 60dB
Volume/balance tracking			
Aux input.....	.08dB	0.66dB	4dB
Input data	socket type sensitivity loading		
Disc (mm) input.....	Phono 0.45mV 55kohms	85pF	
Disc (mc) input.....	Phono 0.24mV 103kohms	20pF	
Aux input.....	Phono 20mV* 55kohms	75pF	
Power amp.....	- mV - kohms	- pF	
Output, pre-amp (tape).....	>3V, 2.3kohms		
Disc equalisation error, 30Hz-15kHz.....	+ 0dB, - 0.4dB		
Size (width, height, depth).....	.60 x 7.6 x 20.5cm		
Typical price inc VAT.....	£345		
* CD input, 68mV			

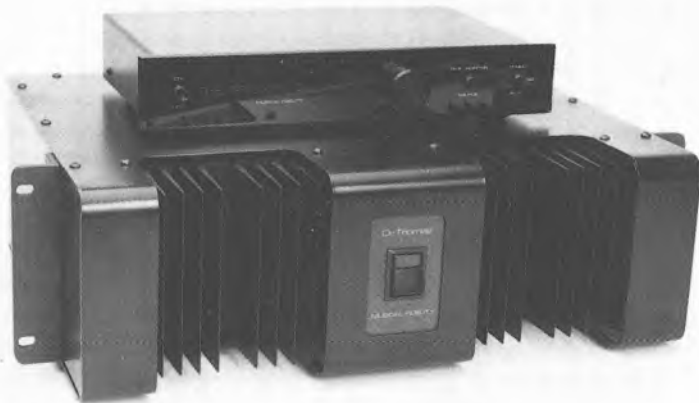


Disc eq accuracy and (right) power supply rejection



Musical Fidelity The Preamp II/Dr Thomas II

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 changing input characteristics.

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

The original elongated case of the *Dr Thomas* power amplifier has been replaced by a large rounded-edge enclosure, also used for the *Studio T* version. The basic power amplifier is rated at 120W (21dBW) and while the *Studio T* is similar, it exploits the extra reserve provided by separate power supplies for each channel, giving 150W (22dBW) per channel.

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
96

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.

Channel balance at low volume settings is now much improved, due to a better control. Stereo separation is also much better.

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 consideration 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.

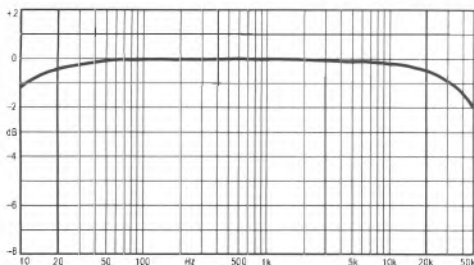
Test measurements

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.

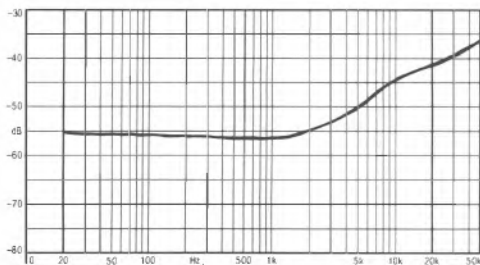
GENERAL DATA

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			
Disc (mm) input (IHF)	.....	20Hz	1kHz 20kHz
		32dB	32dB 32dB
Disc (mc) input (IHF)	.....	24dB	25dB 14dB
Aux/CD input (IHF)	.....	>20dB	>20dB >20dB
Stereo separation			
Disc input	.....	- 90dB	- 79dB - 60dB
Aux input	.....	- 100dB	- 91dB - 65dB
Output impedance (damping)			
	.....	0.04ohm	0.04ohm 0.12ohm
Channel balance, disc, at 1kHz			
	.....	0dB	- 20dB - 60dB
Volume/balance tracking			
Aux input	.....	0dB	0.1dB 10dB
Input data			
	.....	socket type	sensitivity loading
Disc (mm) input	.....	Phono	0.35mV 47kohms 65pF
Disc (mc) input	.....	Phono	0.016mV 100ohms 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			
	.....		£241, £590



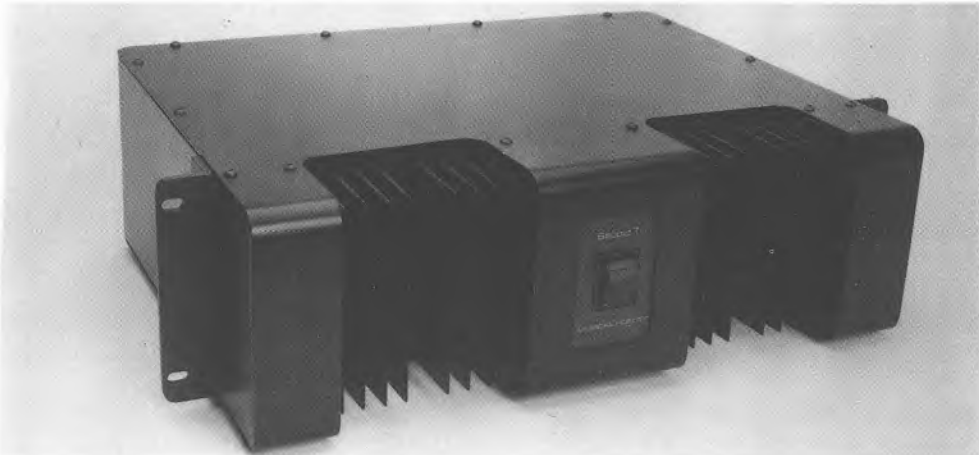
Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Musical Fidelity Studio T

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



The massive curvilinear case of Musical Fidelity's *Dr T* power amp is roomy enough to allow the installation of a larger split power supply with a greater current capacity and this, with some other changes, forms the basis for the *Studio T*. Musical Fidelity also produce a version under the Studiocraft brand name for the Bose Corporation.

The specification claims a 150W output, both channels driven, over a 20Hz to 20kHz bandwidth with an increase to 220 watts at 4ohms. A peak current of 20A is quoted, which is unexceptional considering the power level.

A Class A/B coupled amplifier, the design uses complementary Hitachi MosFet output devices, characterised by an excellent overload performance. Loudspeaker protection fuses are used, these located inside and included in the amplifier's negative feedback loop to negate their adverse effects on sound quality.

The power amplifier has a rather low input impedance of 10kohms, rendering it unsuitable for direct connection of CD players and it may also prejudice the performance of some pre-amplifiers, especially valve models.

Sound quality

Initial tests were carried out with MF's latest *The Preamp II* which suited it well in many respects. Some further improvements can

understandably result from the use of more costly pre-amplifiers.

The *Studio T* offered a robust sound, with good dynamics and a solid bass 'slam'. Tonally, a touch of hardness was detected in the middle range, and this increased at higher powers. The treble was above average but not particularly well focused; on occasion it seemed a little coarse. Stereo images were quite solid, and a fair proportion of programme depth was resolved. Up-front detail and transients were good, but more subtle detail showed some masking. It could be driven hard, reaching high peak sound levels of 105dBA into the standard load, with 103.5dBA into 4ohms. It did become somewhat aggressive at full power, which was fine for rock, but a little wearing on classical material.

Lab results

On tests a peak 8ohm power output of 23dBW (200W) was attained. Rated power was happily sustained over the 20Hz to 20kHz power bandwidth and the loss into 4 and 2ohms was quite small, showing good adverse load tolerance. Peak current was as specified at +21, -19A, and should be enough for all but the worst loads. Distortion levels were low, well within spec, while offsets were negligible, and output noise low, though some power transformer

mechanical hum was present. Output impedance was held to negligible levels.

Input impedance was even lower than claimed, at 8.5kohms, 300pF and the matching pre-amp should be chosen with care. The frequency response was wider than specified, with the 4dB points noted at 9Hz and 33kHz.

Conclusion

Here is a powerful and lusty performer, with a programme output close to 200W per channel and an ability to sustain it over a range of loads and duties. The sound quality was above average for the type, and this amplifier should suit many systems, particularly where a healthy output is an important factor. Unfortunately the price for all this has got to be paid, and in some respects the MF separates line is pre-empted by the competitive performance of their own *Synthesis* model.

GENERAL DATA

Power amplifier

Power output

Rated power into 8ohms, maker's spec.....	150W(= 22dBW)
Power output	20Hz 1kHz 20kHz
One channel, 8ohm load.....	22.5dBW 22.5dBW 22.3dBW
Both channels, 4ohm load.....	21.1dBW 21.3dBW 21.0dBW
One channel, 2ohms, pulsed....	- dBW 20.6dBW - dBW
Instantaneous peak current.....	+ 21A - 19A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	- 98dB - 88dB - 70dB
Intermodulation, 19/20kHz, rated power, aux input.....	- 77dB

Noise

Residual, unweighted.....	- 85dB
DC output offset.....	left 6mV, right 8mV

Output impedance (damping).... 0.11ohm 0.12ohm 0.15ohm

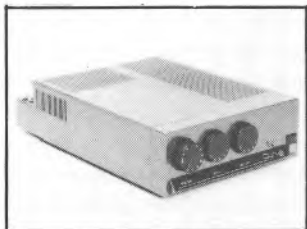
Input data socket type sensitivity loading

Power amp.....Phono/XLR 1350mV 8.5kohms 300pF

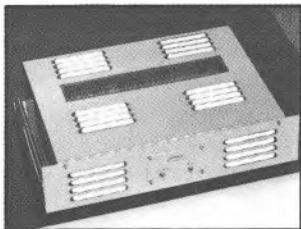
Output, pre-amp.....-V max, -ohms

Size (width, height, depth).....48.5 x 14 x 46cm

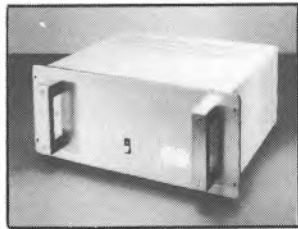
Typical price inc VAT.....£800



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Myst TMA3

Myst Ltd, The Old Surveyor's Office, Weobley, Hereford
Tel (05445) 8611



With the price held to £250 for 1985, the *TMA-3* is an example of an amplifier built to very high standards but in low production volumes. The company concerned is a small but dedicated one, and have designed this no-frills, low-line integrated amplifier to give a normal-use output of 40W per channel.

Appearance is distinctive, with a cobalt blue case complemented by a satin silver alloy front panel. The controls are reduced to a bare minimum, namely power, volume and just two selector buttons whose various combinations produce tape, tuner, CD and analogue disc. All inputs are in DIN except for disc.

Internal construction is a model of its kind with neat cabling, clear layout, and fully shrouded mains wiring and contacts. Both moving coil and moving magnet cartridges are catered for by plug-in boards, and various loading requirements may be readily met.

A combination of integrated circuit and discrete transistor technology is employed, each where considered appropriate. Via mc the input is a virtual earth or shunt feedback current input, considered by many to be the ideal loading, and an input buffer is placed

before the RIAA equaliser stage. The moving-magnet offers the normal cartridge loading.

The CD input bypasses the line buffer and is fed directly to the power amplifier via the volume control. The impedance here is a satisfactory 12k ohms while the normal auxiliary input is higher at 17k ohms.

Remarkably simple, the power amplifier is based on a classic Hitachi circuit, with only five transistors. The output is direct coupled complementary with Hitachi 2SU226/2SJ82 MosFet output devices coupled to the speakers via a 2.5amp quick blow fuse.

Sound quality

Scoring above average the *TMA-3* sounded a trifle lean, even bright in tonal balance terms, but this did not impart noticeable brittleness. Tidy and well integrated in character, it provided moderate depth to the stereo images, and above average focus. The bass was found to lack some definition, and did not throw full 'weight'.

Via disc (mm) the quality held up well, but via mc some additional loss of definition and clarity was observed. It behaved well at full

power into the normal load, providing 102.5dBA, with 101dBA into the adverse load.

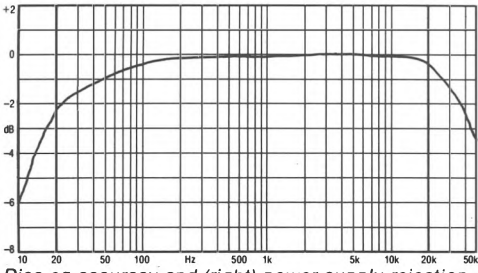
Lab results

Rated output was comfortably exceeded, with the peak programme output near to 17dBW (50W) per channel with an excellent power bandwidth shown at 16.7dBW. The output held well into 4 ohms, while the 2 ohm pulsed level was only 2dB below the 8 ohm result. The ±12A peak current was sufficient for the rating, and overall it showed good load tolerance.

Harmonic distortion had deteriorated by 20kHz, here only -50dB at full power with considerable crossover effects. The high frequency intermodulation results were fine however, so distortion was not considered a real cause for concern. Input noise levels were fine while input overload levels were satisfactory. Note that the mc figures relate to EMF at the input and in practice, the shunt design implies much better figures using a real cartridge. Channel separation was above average, while volume tracking was excellent. Above 200Hz, the RIAA equalisation was most uniform, but the subsonic filter rolloff incorporated rolls off a little early in the audible bass register, and may account for the 'light' character via disc.

Conclusion

This excellently constructed, compact integrated amplifier, offers well matched inputs, no frills and a dependable performance. Good load tolerance is also demonstrated. It should offer a long life, and this taken in conjunction with the above average sound quality, merits a recommendation.



Disc eq accuracy and (right) power supply rejection

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.....	16.7dBW 16.7dBW 16.7dBW
Both channels, 4ohm load.....	14.2dBW 14.3dBW 14.3dBW
One channel, 2ohms, pulsed....	-dBW 14.6dBW -dBW
Instantaneous peak current.....	+ 12A - 12A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	- 80dB - 68dB - 50dB
Intermodulation, 19/20kHz, rated power, aux input.....	- 75dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	- 77dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	- 74dB

Noise

Disc (mm) input (IHF, CCIR weighted).....	- 66dB
Disc (mc) input (IHF, CCIR weighted).....	- 66dB
Aux/CD input (IHF, CCIR weighted).....	- 72dB
Residual, unweighted (volume control at min).....	- 78dB
DC output offset.....	left 13mV, right 6mV
DC offset, pre-amp.....	left niimV, right niimV

Input overload

Disc (mm) input (IHF).....	20Hz 1kHz 20kHz
Disc (mc) input (IHF)*.....	20dB 20dB 20dB
Aux/CD input (IHF).....	10dB 6dB 6dB
Aux/CD input (IHF).....	>20dB >20dB >20dB

Stereo separation

Disc input.....	>70dB 70dB 64dB
Aux input.....	77dB 71dB 55dB

Output impedance (damping)... 0.095ohm 0.09ohm 0.11ohm

Channel balance, disc, at 1kHz..... 0.4dB

Volume/balance tracking 0dB - 20dB - 60dB

Aux input..... 0.3dB 0.2dB 0.1dB

Input data socket type sensitivity loading

Disc (mm) input.....Phono 63mV 47kohms 200pF

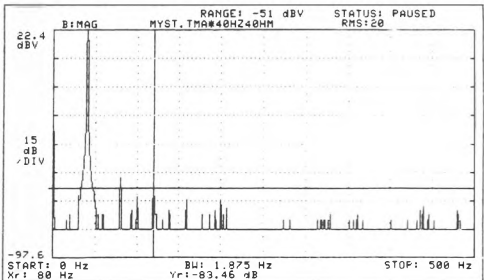
Disc (mc) input*.....Phono see text see text

Aux input.....DIN 40mV 17kohms 110pF

Disc equalisation error, 30Hz-15kHz..... + 0.08dB, - 0.55dB

Size (width, height, depth)..... 43 x 21.5 x 6cm

Typical price inc VAT..... £250



NAD 3020B

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 3020B offers increased output, a 4ohm/8ohm load matching switch (see 3120 review) and better speaker terminals.

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 'work-horse' 3055/2955 transistors on an aluminium-bracket heatsink. Commercial quality 4400 μ F

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 101.5BA and falling only 1.5dB 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.

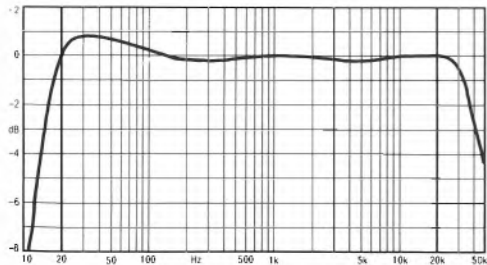
Lab results

Rated at 14dBW, the amplifier produced 17.2dBW 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 a healthy 50W (17.6dB) available into 8ohms, falling only by 4dB 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 3020B 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.



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.	20W (= 13.5dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load.	17.2dBW	17.4dBW	17.3dBW
Both channels, 4ohm load.	13.2dBW	14.6dBW	14.4dBW
One channel, 2ohms, pulsed.	-dBW	13.5dBW	-dBW
Instantaneous peak current.	+ 17 A	- 14 A	

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.	-	90dB	
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.		left 3mV, right 6	

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

Aux input.	0dB	- 20dB	- 60dB
	0.1dB	0.1dB	0.3dB

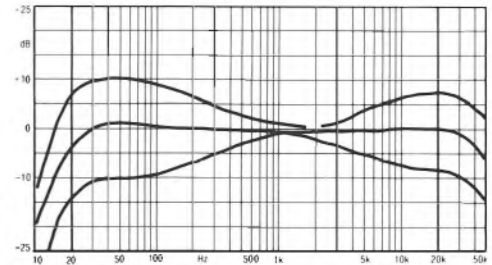
Input data

	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. £129



Tone control/filter responses

NAD 3120

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



Following Rotel's lead, the NAD designers have taken a close look at their 3020A, and have obtained a reduction in cost plus improvement in sound quality by throwing some parts away and simplifying the wiring. Essentially therefore the 3120 is a version of the 3020A with the tone controls omitted, as well as the LED power level indicators and the balance control.

Refinements include the fitting of decent 4mm socket/binding posts for speaker connection, while output has been increased into 8 ohm loads. If the load is known to be more arduous, a reduced 4 ohm power setting can be selected but in practice, unless such a load were to be driven flat out indefinitely, the switch might just as well be left on the 8 ohm setting, with the attendant benefits of increased headroom. However if two sets of speakers are to be used in parallel, the 4 ohm setting is advisable.

A nominal moving coil facility is now included, in addition to the usual moving magnet cartridge input, the impedance remaining high for both.

Robustly constructed, this amplifier is built to normal commercial standards. The output remains a direct coupled complementary with

metal cased 2N3055/2955 output transistors. Gross thermal overload results in protection via thermal circuit breaker, which is self resetting.

Sound quality

Scores indicated a well above average performance which was a fine result for the price. Via auxiliary it gave an open and lively impression; dynamics were well presented, with a pleasing contrast shown between soft and loud passages. Channel separation was stable and wide, while the transparency was sufficient to portray reasonable depth. On the debit side the bass showed a touch of boom while the mid seemed a little hard tonally and the treble was mildly grainy.

Via disc, a very similar standard was achieved. The stereo focus remained good, while recorded ambience was nicely reproduced despite some observed forwardness in the treble register. Overall it was considered to show a significant improvement over last year's 3020A.

Lab results

Maximum subjectively assessed sound levels

were noted as 102 and 99.5dBa which tied in well with the lab measured output power, well above the conservative 20W (13.5dBW) specification. Peak 8 ohm power exceeded 50W with a fine power bandwidth seen at the 17.1dBW level. The loss into 4 ohms was mild while the 2 ohm pulsed output was quite generous, and still well above specification. Substantial ± 14 A current peaks were allowed so the design remained as load tolerant as ever.

Distortions, both harmonic and intermodulation were negligible. Noise levels were also very good, surprisingly so in fact, via mc. The dc offset was satisfactory while the amplifier's output resistance was typically low. Input overload margins were ample, but stereo separation was at a pretty average level.

Channel balance was fine even on the RIAA equalisation which was also commendably accurate. Channel tracking held to a close tolerance over a wide range.

Input sensitivities and loadings were satisfactory. Assessing the 40Hz spectrogram, the grounding was clearly very good as no mains ripple components could be seen down to the instrument resolution of -100dB.

Conclusion

The 3120 performed well on test and re-establishes NAD's competitive position in this price area. It proved quite powerful with a good adverse load tolerance and could produce well focused ambient stereo images. The price is moderate and in conjunction with its above average quality, indicates that a Best Buy classification is appropriate.

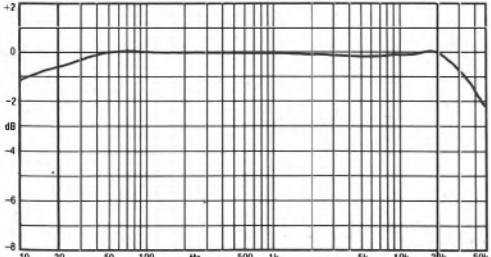
Test measurements

To show how well the amplifier sustains its 80hm 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.

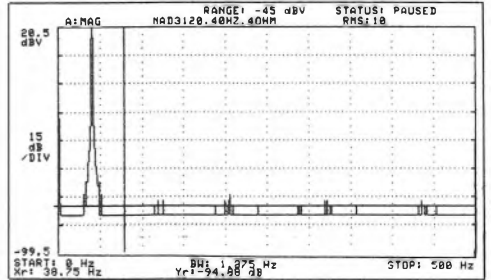
GENERAL DATA

Integrated amplifier

Power output			
Rated power into 8ohms, maker's spec.....	20W (= 13.5dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load.....	17.1dBW	17.2dBW	17.2dBW
Both channels, 4ohm load.....	13.7dBW	14.8dBW	14.6dBW
One channel, 2ohms, pulsed.....	-dBW	14.8dBW	-dBW
Instantaneous peak current.....	+14A	-14A	-14A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.....	-83dB	-91dB	-76dB
Intermodulation, 19/20kHz, rated power, aux input.....	-80dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-84dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-83dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....	-80dB		
Disc (mc) input (IHF, CCIR weighted).....	-73dB		
Aux/CD input (IHF, CCIR weighted).....	-80dB		
Residual, unweighted (volume control at min).....	-84dB		
DC output offset.....	left 22mV, right 24mV		
DC offset, pre-amp.....	left nilmV, right nilmV		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	34dB	30dB	35dB
Disc (mc) input (IHF)*.....	32dB	33dB	32dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	50dB	46dB	38dB
Aux input.....	50dB	50dB	45dB
Output impedance (damping)	0.19ohm	0.19ohm	0.22ohm
Channel balance, disc, at 1kHz	-0.2dB		
Volume/balance tracking	0dB	-20dB	-60dB
Aux input.....	0.5dB	0.3dB	1.6dB
Input data	socket type sensitivity loading		
Disc (mm) input	Phono	0.55mV	47kohms 110pF
Disc (mc) input*	Phono	0.038mV	21kohms -pF
Aux input.....	Phono	28mV	33kohms 100pF
Power amp.....	Phono	-mV	34kohms 1000pF
Output, pre-amp (tape) 11/DIN	5V max	1.7kohms	
Disc equalisation error, 30Hz-15kHz	+0.1dB	-0.4dB	
Size (width, height, depth)	42 x 10 x 24cm		
Typical price inc VAT	£110		



Disc eq accuracy and (right) power supply rejection



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 106

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 loud-speaker 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 40hm loading on continuous duty. The \pm peak current delivery was fine for the size of amplifier, with the 80hm peak output level



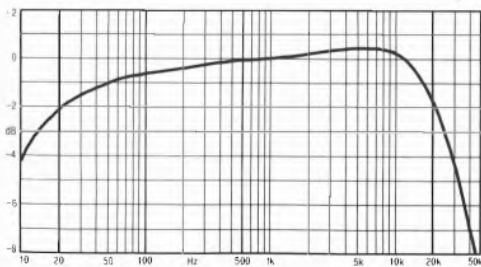
measuring 13.5dBW and still holding up well at 11.3dBW for the 'extreme' 2ohm load.

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 stood up well to 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 recommendation. We were not, however, impressed by the switch-on thumps from the loudspeakers!



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	20Hz	1kHz	20kHz
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, at rated power, aux input	20Hz	1kHz	20kHz
	-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

Disc (mm) input (IHF)	20Hz	1kHz	20kHz
	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
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Channel balance, disc, at 1kHz

	-0.3dB
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Volume/balance tracking

Aux input	0dB	-20dB	-60dB
	0dB	0.3dB	8.1dB

Input data

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

Disc equalisation error, 30Hz-15kHz

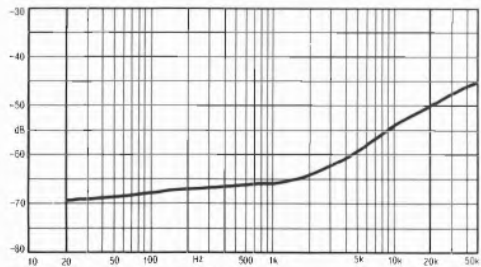
	+0.5dB
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Size (width, height, depth)

	28 x 22 x 7.5cm
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Typical price inc VAT

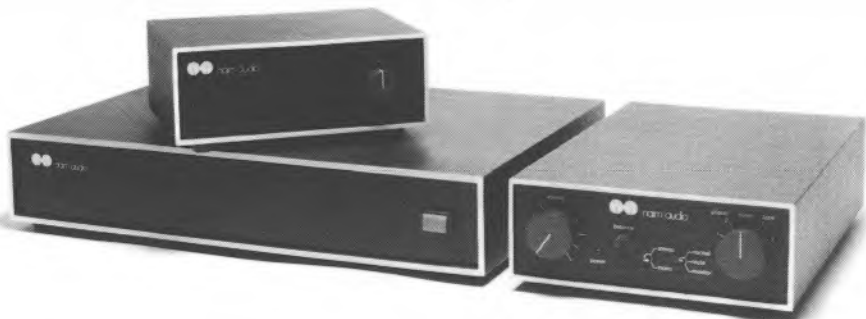
	£180
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Disc input: Stereo separation

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 toroidal 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 $\pm 16A$ 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.	- 75dB	- 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 0.18ohm 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

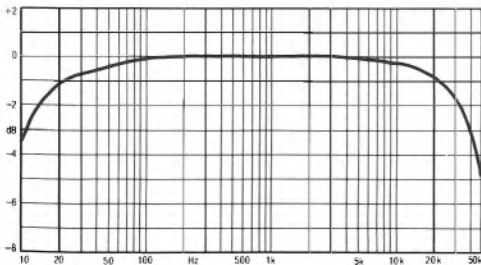
Disc (mm) input.	Phono	0.20mV	46kohms, 100pF
Disc (mc) input.	Phono	0.01mV	1kohm
Aux input.	DIN	10.3mV	20kohms, 220pF
Power amp.	XLR	105.4mV	18kohms, 190pF

Output, pre-amp (tape).7.7V max, 4.9ohms

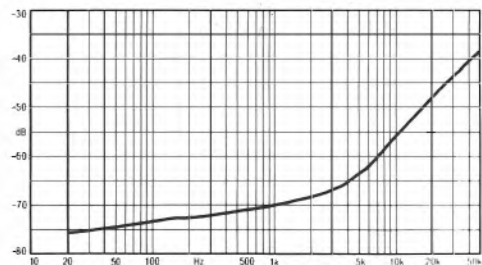
Disc equalisation error, 30Hz-15kHz. + 0dB, - 0.7dB

Size (width, height, dept h). .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

Naim NAP135

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



Review also covers NAC32/Hi-Cap pre-amp (not illustrated)

For some time, Naim have felt the need for a top of the range power amplifier to come in above the *NAP250*. Research suggested that in consideration of the important matching speakers (particularly Linn *Isobarik*) the best route lay not in increasing the rated level, but in improving the power supply and thermal capacity of the existing design. An *NAP 250* can be readily operated in bridge mode (use one channel as an inverter and feed back to the second) but this does not improve the overall capacity, rather it merely doubles the output voltage, actually making it less suitable for *Isobariks*.

Accordingly, the *NAM135* is a slightly updated *NAP250* but with only one channel per case. The generous toroidal transformer now serves one channel while the thermal capacity is enhanced by a fan cooled heat tunnel within the amplifier. This fan only comes in when the temperature rises to a pre-set limit, and being dc operated, its speed is made proportional to the temperature and the required thermal output.

Noise problems were noted with the *M135*, which suggested siting it at the speakers rather than near the listener. In my location, both transformers produced mechanical hum, easily audible at low sound levels, and if driven hard the cooling fan also emitted a variable pitch whine like a quiet hair dryer. I would stress that they do have to be driven really hard for this to happen — into adverse loads, in fact.

At ordinary programme levels they would be inaudible except during pauses or quiet programme passages.

Internally, the *M135* is beautifully constructed to the usual Naim standard. Signal inputs are unbalanced XLR, with double inputs allowing simple connection to the second amplifier channel. Circuitry is essentially that for the *NAP250*, namely direct coupled quasi-complementary, with very fast, selected Naim-specified output transistors.

Matching pre-amps must have their own power supplies and we took the opportunity to use the *M135* with the latest *NAC32*, plus *Hi-Cap* power supply, the latest 'Karma' boards and the special *SNAC* interconnecting cable.

Sound quality

The Naim amplifier system remains one of the greats and the performance of this latest combination will only serve to maintain the company's already good reputation.

The distinctive 'Naim sound' was there, a slightly narrow, bandlimited frequency range, a highly precise up-front stereo image and a dry character. They worked very well with a variety of speakers and cartridges, but one was nonetheless left with the distinct impression that this amplifier system had been optimised for a Linn *LP12/Ittok/Karma* front end, and *Isobarik* speakers. In this specific context, the performance rises to a level where very few other designs can compete.

Despite the constraint on perceived depth, the stereo images were stable and well focused, and in particular the *M135* gave a feeling of confident, coherent authority. It was both musical and involving, while programme detail was well conveyed throughout the frequency range.

On the pre-amplifier side, improvements in clarity and immediacy with firmer bass were noted, especially when used with the better cable and power supply.

Lab results

With a peak output approaching 100W, the *M135* exhibited an excellent power bandwidth both on 8 and 40hm loads. The dip using 4ohms was very small, while the 2ohm power held up well. Peak current was sufficient at ± 14

amps, electronically limited, and in practice, it drove adverse loads pretty well.

Distortion was mild, with improving high frequency intermodulation results at reducing levels. Note that the input impedance is relatively low at 18ohms, shunted by a sizeable 1000pF. Electrical noise and dc offsets were both fine.

Conclusion

It is arguable whether at twice the price, the 135 is actually twice as good as the 250. However they do have an application for top end systems where the user wishes to extract the maximum from a Linn/Naim system. The NAC32 continues to improve with new boards, power supplies and cables, and is maintaining its strong market position. Taken as a whole, Naim equipment remains well worth recommending.

GENERAL DATA

Power amplifier (mono)

Power output			
Rated power into 8ohms, maker's spec.....	75W(= 18.2dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load.....	19.3dBW	19.3dBW	19.2dBW
Both channels, 4ohm load.....	18.6dBW	18.7dBW	18.6dBW
One channel, 2ohms, pulsed....	-dBW	17.5dBW	-dBW
Instantaneous peak current.....		+14A	-14A
Distortion			
Total harmonic distortion, 20Hz		1kHz	20kHz
at rated power, aux input.....	-76dB	-75dB	-57dB
Intermodulation, 19/20kHz, rated power.....			-77dB
Intermodulation, 19/20kHz, at 0dBW.....			-92dB
Noise			
PA input (IHF, CCIR weighted).....			-88dB
Residual, unweighted.....			-82dB
DC output offset.....			left 13mV, right 9mV
Stereo separation			
PA input.....	-dB	>100dB	-dB
Output impedance (damping)...	0.21ohm	0.22ohm	0.24ohm
Input data	socket type sensitivity loading		
Power amp.....	XLR	970mV	18kohms 1000pF
Size (width, height, depth).....			.43 x 7.5 x 30cm
Typical price inc VAT.....			£790

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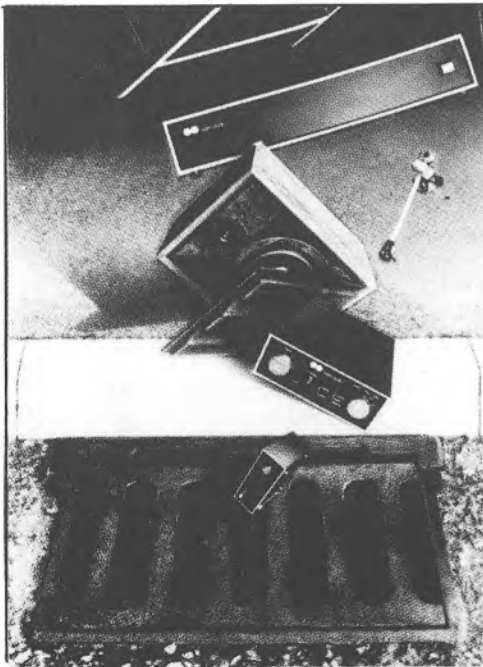
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Pioneer SA-301

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



This bargain priced integrated amplifier can be obtained for around £70 and is possibly available for even less than this at some outlets. Can a product that costs so little really be worthwhile in audio terms? Well, judging by the performance of the 301, it certainly can, since this model happily took on a number of rather more costly ones.

Rated at 32W per channel, it offers a reasonable power output. Nothing obvious seems to have been omitted, with the facilities including inputs (via phono sockets) for disc, tuner and tape, bass and treble controls, balance and a headphone socket as well. Spring clips are fitted for loudspeaker connection.

On test we did note some errors with the tone controls. The RIAA response given was obtained with the bass at -2; at the '0' position additional bass lift is present. My view is simply to adjust the controls to suit the final system balance.

Understandably, the interior construction was spartan. The generous power transformer is wired on the mains or primary side in unshrouded connections. A single split rail

power supply is used, feeding 3,300 μ F reservoir capacitors. The disc input is via a standard stereo IC op amp including feedback RIAA equalisation. Following the volume control comes the tone control section, linked to the final thick-film power stage. This carries all the functions for the rest of the amplifier as well as the line amplifier and the power output for both channels! The whole is constructed on a single sparsely populated printed circuit board.

Sound quality

Perhaps because of its simplicity, the 301 gave a presentable sound quality via auxiliary input. It scored below average, which was nonetheless good for the price. Essentially inoffensive, it demonstrated moderate clarity with modest stereo depth. Definition was a bit woolly at the frequency extremes. Via disc input, it was blander still, with a loss of stereo focus but again, it remained quite acceptable.

Lab results

Peak sound levels of 101dBA into a normal load, and 98dBA into the adverse load were produced. Specified at 14.5dBW, the 301

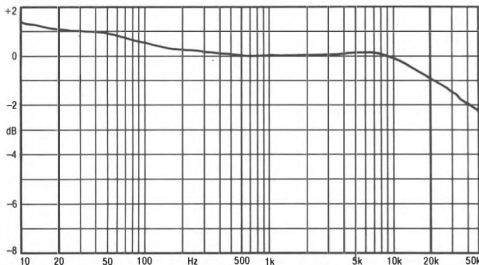
actually cruised at the 16dBW level peaking at not much under 50W, 8 ohms. The power bandwidth was quite good at 8 ohms, but the output fell rapidly down at the 2 ohms loading. The 4ohm continuous test tripped the protection relay, disconnecting the amp. Peak current was quite reasonable nonetheless.

Harmonic distortion was satisfactory and we had no complaint about the intermodulation reading. Input noise and DC output offsets were all very satisfactory while input overload was fine, and stereo separation rather better than usual. Channel balance was good and was also maintained over a wide dynamic range. Output impedance was moderate.

Supply ripple rejection was poorer than average and the power spectrogram shows many line harmonics at around -85dB relative to the 40Hz tone. Despite some correction vis the bass tone control the RIAA equalisation showed mild bass lift; however this is probably of little consequence in this market sector.

Conclusion

Despite the modest price and construction standard, the 301 has a respectable output power, and offered a cheerful, primarily vice-free sound of near average quality. As such it represents bargain-basement value and achieves recommendation in this issue. Note that the matching tuner has also done pretty well!



Disc eq accuracy and (right) power supply rejection

Test measurements

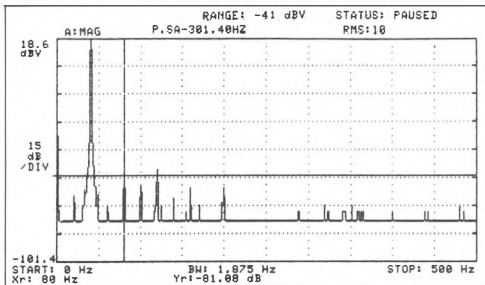
To show how well the amplifier sustains its 8ohm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

GENERAL DATA

Integrated amplifier

Power output			
Rated power into 8ohms, maker's spec.....	32W(= 14dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load.....	15.8dBW	16.3dBW	16.2dBW
Both channels, 4ohm load.....	-dBW	-dBW	-dBW*
One channel, 2ohms, pulsed....	-dBW	10.5dBW	-dBW
Instantaneous peak current.....	+ 10A	- 8A	
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.....	- 63dB	- 63dB	- 58dB
Intermodulation, 19/20kHz, rated power, aux input.....	- 71dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	- 70dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	- dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....	- 68dB		
Disc (mc) input (IHF, CCIR weighted)*.....	- dB		
Aux/CD input (IHF, CCIR weighted).....	- 73dB		
Residual, unweighted (volume control at min).....	- 84dB		
DC output offset.....	left 6mV, right 8mV		
DC offset, pre-amp.....	left -mV, right -mV		
Input overload			
Disc (mm) input (IHF).....	20Hz	1kHz	20kHz
Disc (mc) input (IHF).....	27dB	27.5dB	26dB
Disc (mc) input (IHF).....	-dB	-dB	-dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	67dB	60dB	53dB
Aux input.....	61dB	61dB	51dB
Output impedance (damping)...			
	0.35ohm	0.32ohm	0.4ohm
Channel balance, disc, at 1kHz.....			
	0dB	- 20dB	- 40dB
Volume/balance tracking			
Aux input.....	0.1dB	0.8dB	0.3dB
Input data			
	socket type	sensitivity	loading
Disc (mm) input.....	Phono	-mV 59kohms	230pF
Disc (mc) input.....	-	-mV -ohms	-pF
Aux input.....	Phono	30mV250kohms	70pF
Power amp.....	-	-mV -kohms	-pF
Output, pre-amp (tape).....			
		>5V max,	-ohms
Disc equalisation error, 30Hz-15kHz.....			
		+ 1dB,	- 0.4dB
Size (width, height, depth).....			
		43 x 10 x 23cm	
Typical price inc VAT.....			
		£70	

* see text



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-sunked, 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

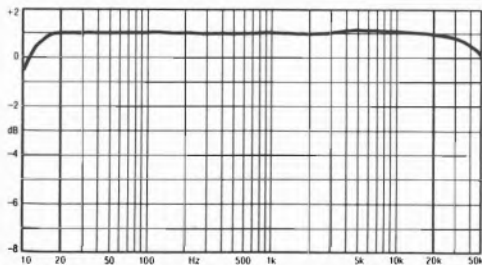
The 20dBW specification was comfortably met at 21.7dBW, 8ohms, over the entire power bandwidth. The large power supply maintained

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 $\pm 11A$ 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.



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.	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	>	>	>
Intermodulation, 19/20kHz, at 0dBW, disc (mm)	>	>	>
Intermodulation, 19/20kHz, at 0dBW, disc (mc)	- 80dB	- 80dB	- 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

Disc (mm) input (IHF)	20Hz	1kHz	20kHz
Disc (mc) input (IHF, CCIR weighted)	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

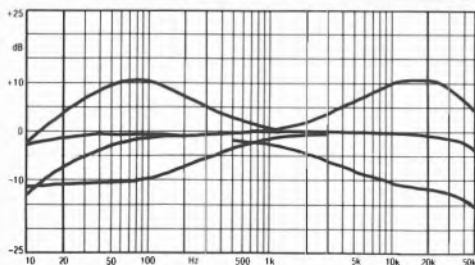
Input data

	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

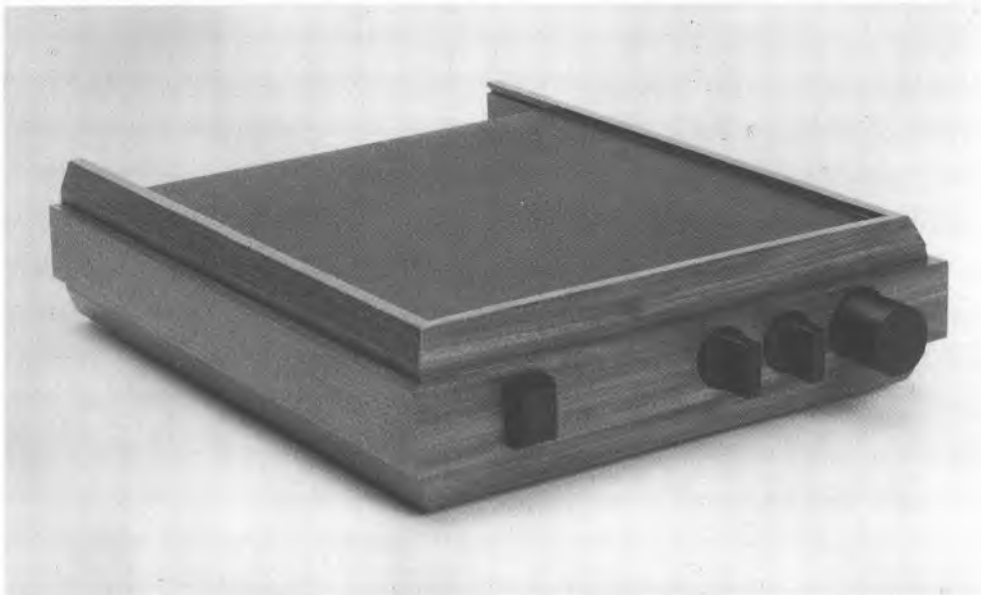
Typical price inc VAT £390



Tone control/filter responses

Pink Triangle Pip

Pink Triangle Products Ltd, Unit 3, 122 Maidstone Road, Fooks Cray, Kent
Tel 01-300 1918



Noted for their high-quality subchassis turntable, Pink Triangle now also produce a matching preamplifier, and a power amp will also eventually be marketed. Unusually, the *Pip* case is formed from the same wood as the turntable plinth, and a minimum of decoration has been applied — no legends for example on the controls. The panel labelling is positioned on the reversible cover fitted towards the rear section.

Built to modern specifications, the unit may be optimised for moving coil or moving magnet cartridges via a small plug in unit fitted below, and this adapter is included in the price. Other inputs are for tuner, tape and aux/CD. Disc inputs are in phono and DIN, while the rest, including the outputs are in DIN.

A particular feature of this model is the facility for dc arming the output connection — worth doing if the power amplifier is suitable. With the inputs also armed the result is that a harmlessly small dc current flows around the connecting loops. This is said to improve the sound quality, by biasing the contact diodes in

the system into a more linear region. DC arming is also used within the pre-amp and has at least one consequence — if the volume control is rotated too quickly subsonic surges appear at the output, together with audible track rotation 'swish'. The designer does however reckon that this will not impair control life.

Built with high quality components the circuit is interesting in its use of highly linear discrete stages, eschewing negative feedback loops. RIAA equalisation is imparted by a passive network.

Sound quality

Auditioning commenced with the disc input using the mc module installed. The *Pip* was characterised by an open, airy sound, with a lightened effect in the tonal balance terms. However, neither mid hardening nor treble brightness were evident as such — if anything it sounded less 'electronic' than usual. Good transparency was demonstrated as well as fine depth and space in the stereo images.

These properties were maintained via auxiliary with the bass noted as firm and detailed and the treble clearer than usual in this preamp category. CDs were truthfully reproduced.

Lab results

Despite the absence of feedback, the harmonic distortion results were very good. Only the high frequency intermodulation test showed any limiting, this a rather crude test for the mc input. Signal to noise ratios were good and input overload levels more than satisfactory.

GENERAL DATA

Pre-amplifier

Distortion

Total harmonic distortion,	20Hz	1kHz	20kHz
aux input.....	> -90dB	> -90dB	> -82dB
Intermodulation, 19/20kHz, aux input.....			-90dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....			-85dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....			-48dB

Noise

Disc (mm) input (IHF, CCIR weighted).....	-72dB
Disc (mc) input (IHF, CCIR weighted).....	-68dB
Aux/CD input (IHF, CCIR weighted).....	-90dB
Residual, unweighted (volume control at min).....	> -90dB
DC offset, pre-amp.....	left 0mV, right 0mV*

Input overload

	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	29dB	30dB	21dB
Disc (mc) input (IHF).....	32dB	26dB	26dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB

Stereo separation

Disc input.....	>80dB	96dB	88dB
Aux input.....	85dB	94dB	89dB

Channel balance, disc, at 1kHz.....0.02dB

Volume/balance tracking

	0dB	-20dB	-60dB
Aux input.....	0.1dB	0.03dB	0.8dB

Input data

	socket type	sensitivity	loading
Disc (mm) input.....	Phono/DIN	1.61mV	47kohms
Disc (mc) input.....	Phono/DIN	0.151mV	100ohms
Aux input.....	DIN	50mV	20kohms

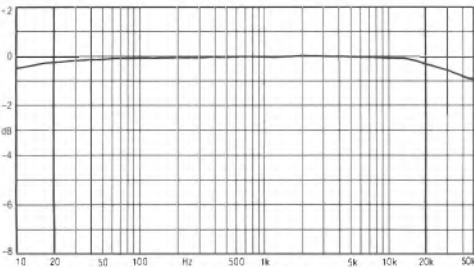
Output, pre-amp.....5V max, 600ohms

Disc equalisation error, 30Hz-15kHz.....+0dB, -0.15dB

Size (width, height, depth).....36 x 8 x 25cm

Typical price inc VAT.....£360

* but may be dc armed



Disc RIAA equalisation accuracy

Stereo separation was exemplary, channel balance and tracking both fine, while the input sensitivities and impedances were set at sensible levels. Source resistance was a moderate 600 ohms, while up to 5V output levels were available. The RIAA equalisation was exceeding accurate, the graph showing that of the mc input fed from a 60hm source.

As supplied the *Pip* was capacitor coupled with no output offset, though the supplied output lead may be readily rewired to provide arming if required.

Conclusion

An unusual if mildly idiosyncratic design, the *Pip* preamplifier was inherently a highly truthful, musical and transparent performer. Its sound quality was rather above average and it was also well built and finished; as such I have no hesitation in recommending it.



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Proton 520

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



Proton is another market-orientated brand roughly comparable with the NAD series; thus at £130 the 520 is a rough equivalent of the NAD 3020B. The tidy styling results in an appearance somewhat reminiscent of Yamaha products, and the feel of the equipment is rather better than one might expect for the price. It also comes very well equipped; for example, the selector switch offers a choice from video, CD, tuner and disc, both moving magnet and moving coil. The latter is selected via rear push button, and can be set at two positions, while the moving magnet input offers a choice of three loadings namely 100, 200 and 320pF.

One tape deck is handled by the source/monitor switch with other features including bass and treble controls, switching for two sets of loudspeakers, a subsonic filter plus loudness and a mono mode. A headphone socket is also provided on the front panel.

All input socketry is in phono, with the disc inputs actually gold plated! The NAD-style soft clipping feature is included, called 'ACC'; it was left in the 'off' position for most of the normal testing for this review. Pre- and power sections are linked by external bars, which may be detached for the easy insertion of an external filter or equaliser. Speaker connection

is provided by pretty strong spring clips.

Inside, the mains wiring is quite well executed with double-pole line switching. One printed circuit dominates the design, but seven other boards are also used, these linked by various harnesses; overall the interior is a little cramped and untidy. Interestingly the circuitry is all discrete using traditional circuit and component technology. Following the variable gain and impedance disc stage which includes normal feedback RIAA equalisation, the signals meet at the volume control and buffer stage. Filter plus tone control circuits follow, leading to the ACC soft clipping stage, and thence to the power amplifier. The latter is complementary direct coupled and uses miniature circuit breakers for overload protection. Hints of the NAD design are clearly present, and the 520 in common with the NAD is made in Taiwan, but the two units do differ greatly in their execution.

Sound quality

Via the disc input both mc and mm sources were reproduced with similar quality and both were above average. The bass was reasonably tuneful and some atmosphere as well as depth was present. A touch of sibilance was noted in the treble, but the tonal quality seemed

pleasantly neutral. Slight hum was apparent on mc. Via auxiliary it sounded a degree poorer. Somehow it appeared less interesting, giving a softer impression with a loss of definition, and here it scored fractionally below average. Sound levels of 101 and 99dBA were produced into 8 and 4 ohm speaker loads.

Lab results

Easily meeting the rated output, peak 8 ohm levels reached 16dBW. Power bandwidth was satisfactory at 8 ohms, but showed some weakness at 4, falling to 11.7dBW at 20Hz. The peak capacity was good with a substantial 15.7dBW still being raised into 2 ohms, this backed by a fine +14, -15A peak current. The 520 will not prove too fussy over choice of speaker! All measured distortion results were more than satisfactory while input noise levels were also good. DC offset was negligible while input overload margins were exemplary. Channel separation was surprisingly good, with a fine channel balance that held through a wide range of volume control settings. Input sensitivities and loadings were fine, while the RIAA equalisation was pretty accurate. The subsonic filter could also be useful. Basically good behaviour can be seen from the 40Hz power spectrogram, with the spurious signals well suppressed.

Conclusion

Overall this well presented amplifier provided a close to average performance. With its pleasant sonic character, it did well in the lab tests and proved both input versatile as well as output load-tolerant. At a price that is rather below average, it represents good value, and gains a recommendation.

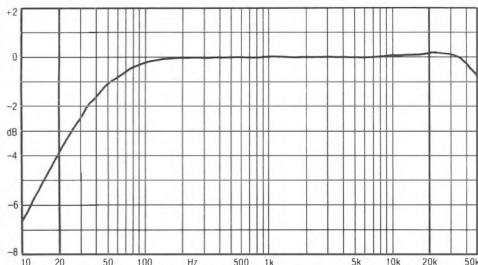
Test measurements

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.

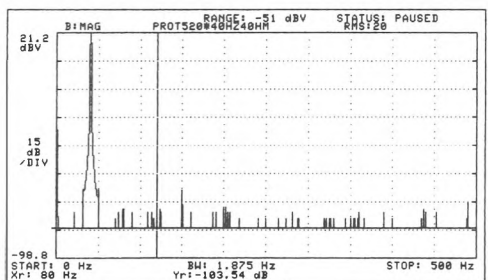
GENERAL DATA

Integrated amplifier

Power output			
Rated power into 8ohms, maker's spec.....	20W (= 13.5dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load.....	14.6dBW	15.5dBW	14.7dBW
Both channels, 4ohm load.....	11.7dBW	13.3dBW	12.2dBW
One channel, 2ohms, pulsed....	-dBW	15.7dBW	-dBW
Instantaneous peak current.....	+14A	-15A	
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.....	-85dB	-90dB	-73dB
Intermodulation, 19/20kHz, rated power, aux input.....	-80dB		
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).....	-68dB		
Aux/CD input (IHF, CCIR weighted).....	-80dB		
Residual, unweighted (volume control at min).....	-73dB		
DC output offset.....	left 6mV, right 9mV		
Input overload			
Disc (mm) input (IHF).....	35dB	34dB	35dB
Disc (mc) input (IHF).....	30dB	32dB	40dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	>65dB	70dB	60dB
Aux input.....	70dB	64dB	55dB
Output impedance (damping)...			
	0.08ohm	0.08ohm	0.095ohm
Channel balance, disc, at 1kHz.....			
	0dB	-20dB	-60dB
Volume/balance tracking			
Aux input.....	0.1dB	0.5dB	0.5dB
Input data			
	socket type	sensitivity	loading
Disc (mm) input.....	Phono	0.6mV	46kohms
Disc (mc) input.....	Phono	0.040mV	98ohms
Aux input.....	Phono	40mV	38kohms
Output, pre-amp.....			
	>5V max	-	-ohms
Disc equalisation error, 30Hz-15kHz.....			
	+0.4dB,	-	-0dB
Size (width, height, depth).....			
	42 x 8 x 26cm		
Typical price inc VAT.....			
	£130		



Disc eq accuracy and (right) power supply rejection



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 Darling-ton type power transistors, and no electronic protection is provided bar simple speaker line fuses which are not feedback corrected.

While neither specification nor measured performance has altered, the units were re-assessed in *Mk II* form. Both were distinguished by larger power supply transformers and by internal detail changes.

Sound quality

The preamp set a high standard via moving coil with low background noise, pleasing stereo depth and a solid well focused image. Good musical detail was preserved even on quiet signals, a noted improvement over the original. As expected it was better still with the output stage in 'passive' mode. It suited the fine power amplifier, which offers its own blend of qualities. The bass was very fine with both speed and good articulation. Tonally, there was a touch of 'transistor' hardness noted in the upper mid register, but overall it gave a general impression of sweetness and clarity with fine transient definition evident over the whole audible range. It continued to improve as it warmed up, and since it consumes so little power, it could be left on almost indefinitely.

Good sound levels up to 101.3dBa were possible these increasing to 106dBa in bridge mode, where the overall quality held up well.

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 40hms continuous deliv-

ery, both channels driven. It also possessed a very generous current capacity for its output level, at $\pm 25A$, 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

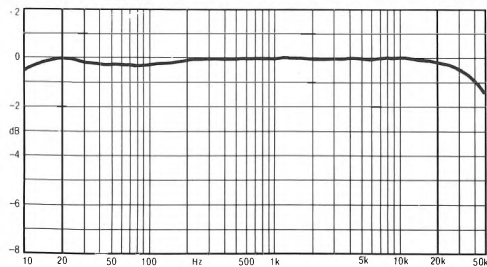
Overall this combination was bigger and better than its specification might suggest. Despite the 'clinical' character noted, the sound quality was nonetheless very good, with a consistently open and transparent sound, a fine articulate bass, sharp stereo focus plus good ambience and image depth. Of the 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.

A less expensive version of the pre-amp, consisting of RIAA equaliser and passive control unit, is also recommended.

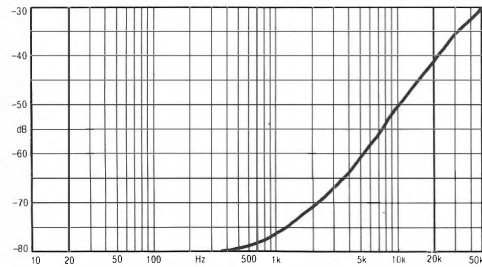
Test measurements

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		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			
Disc (mm) input (IHF)	20Hz 1kHz 20kHz		
Disc (mc) 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			
Volume/balance tracking			
Aux input	0dB -20dB -60dB		
	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-amp 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 10000 μ F 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 pleas-

antly 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 $\pm 8A$ 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

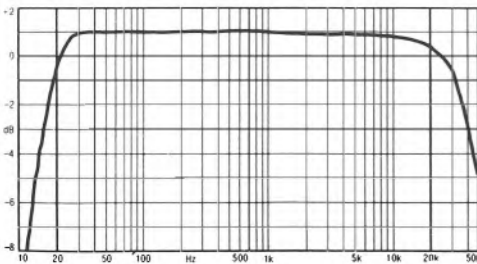
offset was very low. Disc overload margins were also satisfactory; the reduced 10kHz figure still within the required margin. Stereo separation was above average and channel balance highly accurate over the whole operating range.

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.



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

Pre- and power amplifier

Power output

Rated power into 8ohms, maker's spec.	100W (= 20dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	26.4dBW	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

Disc (mm) input (IHF)	20Hz	1kHz	20kHz
Disc (mc) input (IHF)	30dB	30dB	19dB
Aux/CD 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

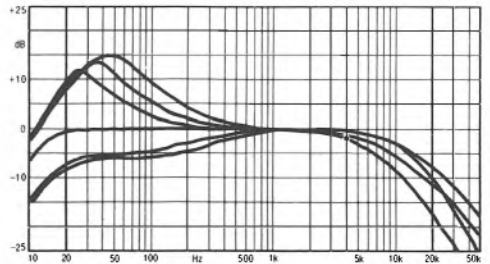
	socket type	sensitivity	loading
Disc (mm) input	Phono	0.30mV	48kohms, 277pF
Disc (mc) input	Phono	0.013mV	100ohms, 22nF
Aux input	DIN	11.3mV	kohms, pF
Power amp	DIN	53.0mV	37kohms, 300pF

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



Tone control/filter responses

QED A230

QED Audio Products Ltd, Unit 12, Ashford Industrial Estate, Shield Road, Ashford, Middlesex TW15 1AU
Tel Ashford 46236



This recently introduced amplifier designed and built in Britain has the distinction of just breaking the £100 barrier. It retails for around £99, a price which has previously been considered uncommercial so far as UK manufacture is concerned. In fact the A230 forms part of a complete QED system, including turntable, tuner and a cassette deck.

The amplifier is cased in a serviceable Nextel finished cover although for an extra £20 this can be replaced by a real veneer sleeve of fine quality. Front panel facilities include selector buttons for disc (moving magnet) tuner and tape. Disc socketry is in phono, the rest in DIN. No tone controls are present, but a headphone outlet is, linked to one set of 4mm speaker connections on the rear panel. Another set of sockets is provided to bypass the headphones offering a more direct path and a claimed higher quality.

Interior construction was to a surprisingly good standard. Not only are a number of high quality parts used, but the mains wiring is properly switched as well as shrouded. A top quality toroidal mains transformer feeds a pair of selected 4700 μ F capacitors.

The disc stage employs an input buffer

followed by a passive filter for the high frequency part of the RIAA equalisation. An active stage follows, with the low frequency section plus subsonic filtering, using selected TLO 72 Fet op amps.

Employing Darlington complementary triples, the output stage is direct coupled to the load and series fuses are avoided. The differential input is filtered to prevent slew limiting or associated latching in the later amplifier stages.

Sound quality

Augmented via the auxiliary input, with selected CD sources, this little amplifier gave a lively, coherent performance. Clarity was fine, especially in the mid band, and some depth and ambience were present here scoring above average. The band extremes were a little untidy — there was some softness in the bass and a touch of 'zing' in the treble.

An equally promising standard was achieved via the disc input. Clean and articulate, mid detail was most presentable, and while the treble hinted at brightness this was not excessive. A touch of hardness did however creep in at higher listening levels. Maximum

sound levels of 100dBA (8 ohms) and 98.5dB (4 ohms) were obtained on the listening tests.

Lab results

Rated at 30W (14.5dBW) the A230 offered a healthy output on test, approaching 16.5dBW 8 ohms. A good 8 ohm power bandwidth was shown at 16dBW, with the loss in level at 4 ohms being typically slight at 1.6dB, though it had reached 4dB by 2 ohms. Peak current was generous for the size, reaching $\pm 12.5A$ and indicating a fine load tolerance. The 40Hz power spectrogram was less encouraging however, and showed a high content of spurious signals associated with the line frequency.

Distortion levels were satisfactory as were the input noise figures. DC offset should not cause any problems, while input overload margins were fine. Channel separation was better than average but channel balance was less satisfactory, and at low volume settings, level tracking seriously deteriorated. Input sensitivities and loadings were fine.

Our sample proved to be extraordinarily accurate on RIAA equalisation with nicely tailored rolloffs at the band extremes. From 70Hz to 15kHz it met amazing $\pm 0.06dB$ limits for both channels.

Conclusion

This load tolerant British amplifier was well made and passed the lab tests well. It produced a respectable output, and was also tolerant of a variety of speaker loadings. At its budget price, it demonstrated an above average sound, so confidently gains a Best Buy rating in this edition.

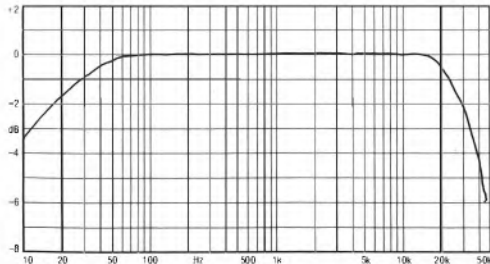
Test measurements

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.

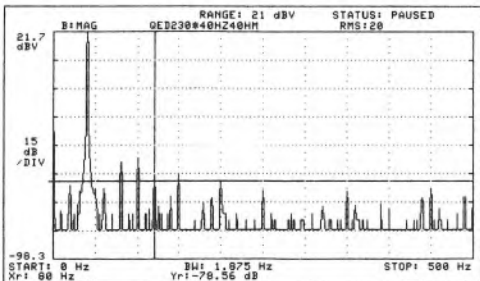
GENERAL DATA

Integrated amplifier

Power output			
Rated power into 8ohms, maker's spec	30W (= 14.5dBW)		
Power output	20Hz	1kHz	20kHz
One channel, 8ohm load	16.0dBW	16.3dBW	16.0dBW
Both channels, 4ohm load	14dBW	14.8dBW	14.6dBW
One channel, 2ohms, pulsed	-dBW	12.5dBW	-dBW
Instantaneous peak current		+ 12.56A	- 12.5A
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input	- 85dB	- 71dB	- 62dB
Intermodulation, 19/20kHz, rated power, aux input			- 67dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm)			- 65dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc)			- -dB
Noise			
Disc (mm) input (IHF, CCIR weighted)			- 67dB
Disc (mc) input (IHF, CCIR weighted)*			- -dB
Aux/CD input (IHF, CCIR weighted)			- 72dB
Residual, unweighted (volume control at min)			- 75dB
DC output offset		left 5mV, right 23mV	
DC offset, pre-amp		left -mV, right -mV	
Input overload			
Disc (mm) input (IHF)	20Hz	1kHz	20kHz
Disc (mc) input (IHF)	31dB	29dB	26dB
Disc (mc) input (IHF)	-dB	-dB	-dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB
Stereo separation			
Disc input	73dB	72dB	44dB
Aux input	65dB	66dB	54dB
Output impedance (damping) .. 0.55ohm 0.05ohm 0.06ohm			
Channel balance, disc, at 1kHz.....0.6dB			
Volume/balance tracking			
Aux input	0dB	- 20dB	- 60dB
Aux input	0.2dB	0.5dB	10dB
Input data socket type sensitivity loading			
Disc (mm) input	Phono	0.6mV	47kohms 70pF
Disc (mc) input	-	-mV	-ohms -pF
Aux input	DIN	40mV	52kohms 50pF
Power amp	-	-mV	-kohms -pF
Output, pre-amp		>5V max,	-ohms
Disc equalisation error, 30Hz-15kHz + 0dB, - 1dB			
Size (width, height, depth) 35.5 x 7 x 24.5cm			
Typical price inc VAT£100 (£120 with wood sleeve)			



Disc eq accuracy and (right) power supply rejection



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A/T

Robertson Forty Ten

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



Selling for a little under a grand, the Robertson 40-10 is a US designed transistor power amplifier built by the Singapore based David Tan company Robertson Electronics. It already enjoys a fine reputation in the States, which we found to be fully justified as the review progressed.

A compact design, it is finished in a black texture coating, and is built mainly of steel plates, bar the vertical heat sink fins which are in higher conductivity aluminium. No controls are present, aside from on/off. Signal input is via gold plated phonos, outputs via large gold plated 4mm socket/binding posts. Mechanical hum levels were satisfactorily low.

Rated at 60W/channel, it is claimed to be highly load tolerant, and is also easy to drive by any valve pre-amp.

The drive circuit is balanced for positive and negative signals, and is direct coupled throughout. The output stage is an array of plastic-case high current complementary transistors, operated in class A/B. Idle current is low, yet the amplifier sounds pretty good quite soon after power on. A single power transformer is used, this feeding separate rectifiers, and four high quality reservoir capacitors.

Construction is of excellent quality, though elements of its mechanical design do appear to be unnecessarily complex. A simple output fuse is used for protection, this unbypassed

and not subjected to any feedback correction.

Sound quality

The high sonic standard immediately put it into the front rank, well into Krell territory. It was as transparent and dimensional as the very best semi conductor amplifiers, as well as a number of valve amps to boot! It possessed lively dynamics, with a clean open character, while transients were effectively reproduced throughout the frequency range, and the bass was very firm with excellent extension.

Stereo images were very well focused particularly in the treble, where it was outstanding. It was good enough to show much of the merit of the *SP8 II*, in fact, and within its reasonably generous power compass is proved very tolerant and would drive practically anything.

Slightly clinical in total balance, it also proved unfatiguing, and most satisfying over long listening sessions.

Lab results

A superb power bandwidth was shown at a level somewhat greater than the claimed specification. A little over 19dB/W was available on programme peaks, which is some 100W, and the output fell very little into lower impedances. Pulsed power into 20hms measured 18dB/W or 240W into that load. The fuse blowing that we noted on 40hm

continuous loading will not occur on music signals.

Distortion was satisfactory at full power, rapidly improving at lower levels, while the high frequency intermodulation was excellent. The dc offsets were fine, noise levels low enough to be inaudible and stereo separation was excellent. Output impedance was negligible. The frequency response was very wide, measuring 1dB from 1.3Hz to around 100kHz.

Conclusion

Here is a neat little powerhouse which you can fit and forget. With a strikingly good lab and subjective performance, this relatively economical transistor design deserves to succeed, setting the standard for the state of the art in its price category, and indeed for many amplifiers above that! Warmly recommended, many audiophiles need go no further.

GENERAL DATA

Power amplifier

Power output

Rated power into 8ohms, maker's spec.....	60W (= 18dBW)
Power output	20Hz 1kHz 20kHz
One channel, 8ohm load.....	18.9dBW 19dBW 19dBW
Both channels, 4ohm load.....	Fuse Fuse Fuse
One channel, 2ohms, pulsed.....	-dBW 18.0dBW -dBW
Instantaneous peak current.....	+ 28A - 28A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	- 67dB - 18dB - 56dB
Intermodulation, 19/20kHz, rated power, aux input.....	- 90dB

Noise

PA input (IHF, CCIR weighted).....	- 82dB
Residual, unweighted (hum).....	- 75dB
DC output offset.....	left 13mV, right 6mV

Stereo separation

PA input.....	- 98dB - 95dB >70dB
---------------	---------------------

Output impedance (damping)...

	.03ohm .03ohm .06ohm
--	----------------------

Input data

	socket type sensitivity loading
--	---------------------------------

Power amp.....Phono 1200mV 51kohms 110pF

Size (width, height, depth).....43 x 10 x 19cm

Typical price inc VAT.....£990

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Rotel RA-820A

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 6800 μ F 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 $\pm 25A$.

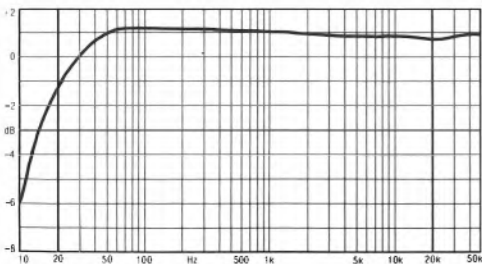
Harmonic and intermodulation distortion results were satisfactory and noise levels equally unspectacular. The dc output offset was a little high but probably not sufficient to do any harm. Input overload levels were fine and the output impedance moderate and consistent over the frequency range. Stereo 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.



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	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	+ 25 A		- 25 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

Disc (mm) input (IHF)	20Hz	1kHz	20kHz
Aux/CD input (IHF)	32dB	30dB	29dB
	>20dB	>20dB	>20dB

Stereo separation

Disc input	- 59dB	- 40dB	- 25dB
Aux input	- 60dB	- 39dB	- 27dB

Output impedance (damping)

	0.30ohm	0.30ohm	0.30ohm
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Channel balance, disc, at 1kHz

	0dB	0dB	0dB
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Volume/balance tracking

Aux input	0.4dB	1.3dB	3.2dB
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Input data

Disc (mm) input	socket type	sensitivity	loading
	Phono	0.58mV	48kohms, 150pF
Aux input	Phono	53mV	16kohms, 320pF

Disc equalisation error, 30Hz-15kHz

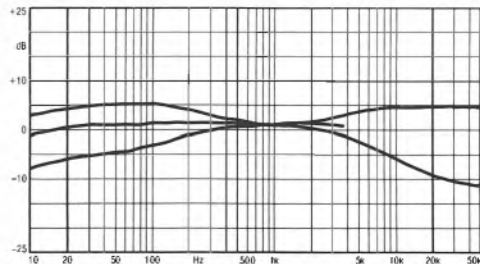
	+ 0.2dB	- 1dB
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Size (width, height, depth)

	43 x 27 x 6.5cm
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Typical price inc VAT

	£95
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Tone control/filter responses

Rotel RA-820BX

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



Each successive review appears to reflect a further suffix to this model's number. Now radically revised, this latest 'X' version of the *RA-820B* is a purist amplifier at a modest cost. Maximising sound quality has been the aim, and the intensive research done by Rotel's UK team in this direction would appear to have been rewarded. The *840BX*, though not reviewed here, is similar but with higher output and an mc disc input.

A compact integrated amplifier of low profile appearance, it comes in satin black, with a fairly low nominal power rating of 25W (14dBW). However, a good load tolerance is claimed, and this was confirmed on test.

Another no frills design, both tone controls and filters have been omitted, likewise fuses and protection circuits have been removed from the signal path. Inputs include tape, tuner, CD/aux and disc (mm only). Rear panel sockets are phono, gold plated for disc, while reasonably solid connectors are provided for speaker connection, these large enough to take a decent size of wire.

Inside, construction is very tidy, essentially a single board, with the mains wiring properly terminated and shrouded. Two 8200 μ F capacitors provide a sizeable reservoir, while the direct coupled complementary output stage uses paralleled pairs of transistors to increase the current capacity as well as the

overload margin. A 0.22 ohm resistor is placed in series with the output — a backstop against extreme overload such as a short circuit. ICs are used in the preamplifier stages together with selected audio components.

Sound quality

Aside from its moderate peak sound level, the panel rated this amplifier very highly. In fact its scores place it up among the select few, some of which cost as much as four times its price. Its trump card was a clear sound, sufficiently transparent to properly portray depth and ambience effects in stereo images. These were also of fine width and focus. It has an involving sound, yet is also musical and subtle. Bass was clean and quite firm, and the treble well controlled. Such a performance proved an embarrassment to many of the more costly separates included.

Via disc, only a marginal loss of sound quality was detected. Here it sounded a trifle lean and lightweight, but the depth, atmosphere, expressive power, focus and life all remained. This amplifier would justify a really good mm cartridge, even one which might cost as much as the 'BX' itself!

Lab results

The specified rating was comfortably exceeded with a fine power bandwidth shown of 15.7dBW

at 8 ohms. The reduction into 4 ohms was moderate, while the 2 ohm pulsed output exceeded rated level at 14.5dBW. This was equivalent to 100W into 2 ohms, while peak current was very generous at $\pm 15A$. Distortion levels were moderate, especially with respect to the high frequency intermodulation. Input noise levels were good, and coupled with excellent input overload margins. The dc offsets at the speaker terminals were poorer than average but in practice should not give trouble.

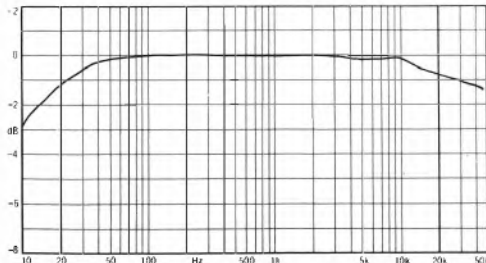
Channel separation was satisfactory via the disc input but should be much better via auxiliary particularly at 20kHz. Volume tracking and channel balance were both pretty good, while output impedance to the speakers was constant as well as moderate.

Input sensitivity and loading characteristics were sensible, (0.7mV disc, 45mV tuner). Over a 50Hz to 10kHz range the RIAA equalisation was very accurate, with some rolloff outside these limits; a mild subsonic and ultrasonic filtering.

Mains ripple was not particularly well rejected as the 40Hz power spectrum showed. Here the 100Hz line component was only 60dB down — one wonders how the 'BX would sound if this were improved?

Conclusion

This latest Rotel stormed through the listening tests, much as the FA820A had done in the previous issue. The 'BX version has now definitely come of age and can be warmly recommended. Load tolerant, it also offered a respectable output plus a very clear sound with excellent stereo. A Best Buy rating is therefore the only logical conclusion!



Disc eq accuracy and (right) power supply rejection

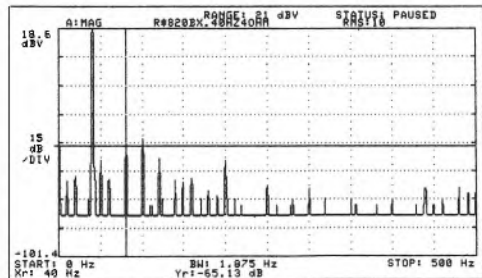
Test measurements

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.....	15.9dBW	16dBW	15.7dBW
Both channels, 4ohm load.....	13.0dBW	13.7dBW	13.5dBW
One channel, 2ohms, pulsed.....	-dBW	14.5dBW	-dBW
Instantaneous peak current.....	+ 15A	- 15A	
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.....	-66dB	-74dB	-55dB
Intermodulation, 19/20kHz, rated power, aux input.....	-65dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-73dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....	-74dB		
Disc (mc) input (IHF, CCIR weighted).....	-dB		
Aux/CD input (IHF, CCIR weighted).....	-82dB		
Residual, unweighted (volume control at min).....	-dB		
DC output offset.....	left 36mV, right 19mV		
DC offset, pre-amp.....	left -mV, right -mV		
Input overload			
	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	36dB	34dB	34dB
Disc (mc) input (IHF).....	-dB	-dB	-dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	63dB	64dB	41dB
Aux input.....	62dB	48dB	24dB
Output impedance (damping)...			
	0.24ohm	0.24ohm	0.25ohm
Channel balance, disc, at 1kHz			
			0.05dB
Volume/balance tracking			
	0dB	-20dB	-60dB
Aux input.....	0.1dB	0.8dB	0.1dB
Input data			
	socket type	sensitivity	loading
Disc (mm) input.....	Phono	-mV	50kohms
Disc (mc) input.....	Phono	-mV	4ohms
Aux input.....	Phono	-mV	50kohms
Output, pre-amp.....		>1V max,	3.8kohms
Disc equalisation error, 30Hz-15kHz			
		+ 0dB,	-0.6dB
Size (width, height, depth).....			
		.43 x 6 x 25cm	
Typical price inc VAT.....			
		£130	



Rotel RC870/RB870

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



Last year it was obvious that the commendable *RB870* power amplifier needed a matching pre-amplifier, and this has now arrived in the form of the specially designed *RC870*. The same price is now common to both units, making a suggested combined total of £420. The *RC870* is another unfussy design finished in satin black and offering a range of inputs from disc (moving magnet and moving coil) two tape machines, CD and tuner. A headphone socket is also provided. Inputs are via phono sockets, those for disc being gold plated.

On the rear of the power amplifier is a switch that will engage monaural bridge operation, which almost quadruples the output into the higher impedance loudspeakers (6-8 ohms) when a second amplifier is added for stereo. In normal stereo mode the *RB870* is rated at 60W per channel.

Internally the units are cleanly built with safe mains wiring. Via disc each mc and mm input has its own optimised buffer amplifiers followed by a common equalisation stage. This and the later stages make use of the popular 5534 op amp. Fine quality components are employed, evidenced by the precision Alps volume control attenuator. A separate stage independently powers the headphone circuit. Surprisingly for the price, the power amplifier is double mono with two power transformers.

Circuitry is discrete with the usual differential input, while provision has been made for high output currents. The output itself comprises a paralleled array of direct coupled complementary transistors and although output fuses are fitted, these are linearised by placing them within the feedback loop.

Sound quality

While the performance of Rotel's own 'BX' models has tended to undermine the standing of their other products, the *870* series held up well on audition. The power amplifier proved to be a likeable design, with a worthwhile maximum level, (103dB_A, 8 ohms) as well as pleasing dynamics. Aberrations were confined to some bass softness and a touch of 'steel' in the treble. Stereo focus was good, while image space and depth were well represented with a worthwhile clarity.

The pre-amp matched the power amplifier well, though the latter could also partner more costly designs with success. Via disc good stereo depth was preserved, as well as a really competent resolution of rear detail in the presence of stronger front image sounds. Tonally it seemed a touch 'lean' if verging on the 'clinical', but overall the frequency extremes were liked — a fine sound for the money.

Lab results

Power bandwidth was excellent at 18.7dBW, the output peaking at near 100W 8 ohms and 24dBW (250W) in the bridge mode. At 4 ohms, the bridged output was higher than normal by 4.5dB at 18dBW. The loss into 2 ohms was just 2.4dB showing how very load tolerant this unit was, as confirmed by the generous peak current, with an amazing $\pm 35A$ available.

Total harmonic and intermodulation figures were very good while the noise levels were satisfactory (not for very low output moving coils, though). Input overload margins were ample, while the channel separation proved to measure much better than average. Channel balance and tracking were both excellent. The RIAA equalisation was also exemplary — very uniform once past the mild subsonic rolloff.

Input sensitivity as well as impedance were well ordered, while the power amplifier input impedance gave an average loading. Up to 10V of undistorted output was provided by the pre-amp, from a higher than average 1.2K ohm impedance. The power spectrum showed an average rated rejection of power supply ripple at about -80 dB.

Conclusion

Our firm recommendation of the *RB870* power amplifier is continued, its performance proving competitive with many respectable equivalents costing up to twice as much. The pre-amplifier is a welcome introduction, completing the pair, and establishing a good performance in its own right. As it stands, it is one of the most competitive pre-amps in its price category, and also merits recommendation.

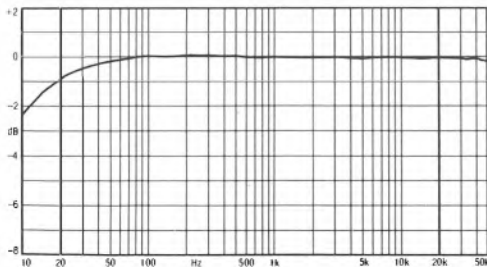
Test measurements

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.

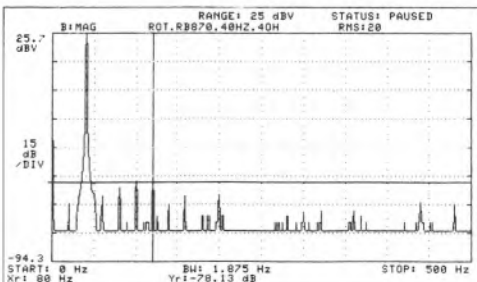
GENERAL DATA

Pre- and power amplifier

Power output			
Rated power into 8ohms, maker's spec.....	60W (= 18dBW)		
Power output.....	20Hz	1kHz	20kHz
One channel, 8ohm load.....	18.7dBW	19.0dBW*	18.8dBW
Both channels, 4ohm load.....	17.6dBW	18dBW*	17.8dBW
One channel, 2ohms, pulsed....	-dBW	16.6dBW	-dBW
Instantaneous peak current.....	+35A	-35A	
Distortion			
Total harmonic distortion,.....	20Hz	1kHz	20kHz
at rated power, aux input.....	-87dB	-85dB	-80dB
Intermodulation, 19/20kHz, rated power, aux input.....	-80dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-85dB		
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	-77dB		
Noise			
Disc (mm) input (IHF, CCIR weighted).....	-80dB		
Disc (mc) input (IHF, CCIR weighted).....	-61dB		
Aux/CD input (IHF, CCIR weighted).....	-87dB		
Residual, unweighted (volume control at min).....	-85dB		
DC output offset.....	left 2mV, right 9mV		
DC offset, pre-amp.....	left 0mV, right 9mV		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	33dB	32dB	33dB
Disc (mc) input (IHF).....	35dB	36dB	30dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc input.....	83dB	85dB	66dB
Aux input.....	-dB	90dB	-dB
Output impedance (damping).....	0.042ohm 0.058ohm 0.076ohm		
Channel balance , disc, at 1kHz.....	0.1dB		
Volume/balance tracking	0dB	-20dB	-60dB
Aux input.....	0.1dB	0.08dB	0.1dB
Input data	socket type sensitivity loading		
Disc (mm) input.....	Phono	1.2mV	47kohms 120pF
Disc (mc) input.....	Phono	0.150mV	100ohms -pF
Aux input.....	Phono	80mV	50kohms -pF
Power amp.....	Phono	1200mV	20kohms 220pF
Output, pre-amp (tape).....	10V max, 1.2kohms		
Disc equalisation error , 30Hz-15kHz.....	+0dB, -0.5dB		
Size (width, height, depth).....	43 x 6 x 31cm, 43 x 6 x 31cm		
Typical price inc VAT	£210, £210		
* Bridged output at 1kHz: 28.8dBW (8ohm), 22.8dBW (4ohm)			



Disc eq accuracy and (right) power supply rejection



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 $2 \times 4700\mu\text{F}$ 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 relatively 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 $\pm 6A$, 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

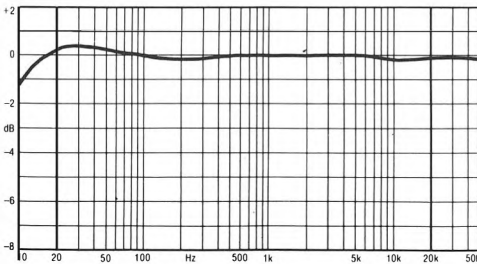
Disc input.	-68dB -76dB -48dB
Aux input.	-76dB -76dB -51dB

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

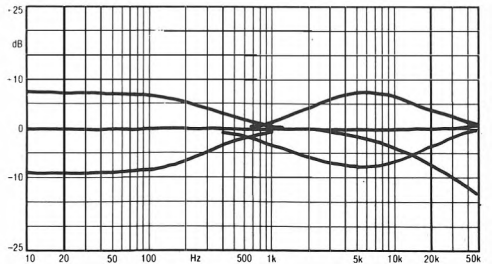
Input data

	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 AU-G33X

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



This is a new model from the Sansui 'X' series, and is reasonably priced, considering the specification on offer. The basic rating is 50W (17dBW) per channel but it has been designed with a good tolerance of adverse loads and the ratings also include a pulsed power of up to 145W per channel into 2 ohms. Exemplary performance figures are quoted for measurements such as distortion but so far we have not established a firm link between low distortion and better sound quality.

This is a well equipped model, six touch buttons on the cleanly styled satin black fascia allowing selection from Tape 1 and 2, CD, disc (mm and mc input), auxiliary and tuner. Tone facilities include bass and treble rotaries, with defeat, plus loudness, subsonic and treble filters. Two sets of speakers can be connected using binding posts.

Internally the power amplifier largely conformed to the new 'X' balanced system, but one side of the speaker is still grounded (in the larger AUG-90X amp, the output is bridged and fully balanced). However, the '33's power amp input is a true balanced differential, fed via a balanced line from the pre-amp section. This allows the pre- and power amplifier earth lines

to be separated, minimising the interaction which can occur between these sections.

The mains transformer is of generous size and the output stage uses fast bipolar transistors in a direct coupled complementary configuration. Overall the construction is to a good standard.

Sound quality

Unfortunately, listening test results tended to refute the attractive technical background as promoted by the manufacturers; sound quality of this model was judged well below average via both of its main inputs.

Tonally, it showed a thin, lean quality in the mid register with a superficial clarity accentuated by some added hardness. The treble sounded vaguely sibilant, and while the low frequencies seemed firm enough, they lacked information. Low level detail was masked, while the stereo image was unconvincing. Via disc (mc) the sound was described subjectively as rather 'mechanical', going through the motions but devoid of real life. Images were noticeably flat as well as two dimensional. On the SL600 speakers some stability problems were also encountered,

although adverse load tolerance was otherwise fine. Peak sound levels reached 102dBA.

Lab results

A superb 8 ohm power bandwidth was exhibited at 18.1dBW which exceeded spec, and the output also held up very well into 4 and 2 ohms. The 17.2dBW peak in the latter impedance corresponded to a pulsed power of 200W which again was better than spec. Peak currents of over 14A were possible (limited by measurement). Distortion levels were very low, and input noise levels satisfactory, except for the lower output mc cartridges. The dc offsets were low while the output impedance was also low, in the region of 0.04ohms. Channel balance was fine while the outputs tracked well right down to -60dB. Channel separation was above average and the input characteristics cause no special concern. RIAA equalisation was also acceptably accurate.

The power spectrum result may be suspect due to earth problems using the special test fixture loaned for the purpose. Reasonable figures of -80dB were nonetheless obtained.

Conclusion

Here is a good example of a current audio contradiction; an amplifier which measures well but sounds disappointing. The '33X is a high current, fast, load tolerant low-distortion integrated amplifier where the test measurements and the technical story all augured well. Confirmation of the success of this performance was to be expected from the auditioning, but this provided unexceptional results. On sound quality grounds the *AUG33X* was uncompetitive.

(Note: Just before going to press, we learned from Sansui that the sound quality of this amplifier was a matter of some concern to them and it is claimed that by the time this issue is published, improvements will be incorporated in production models.)

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.....	18.2dBW 18.3dBW 18.1dBW
Both channels, 4ohm load.....	16.1dBW 16.4dBW 16.2dBW
One channel, 2ohms, pulsed.....	-dBW 17.2dBW -dBW
Instantaneous peak current.....	>14A > 14A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	> -70dB > -80dB > -80dB
Intermodulation, 19/20kHz, rated power, aux input.....	> -75dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	> -80dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....	> -75dB

Noise

Disc (mm) input (IHF, CCIR weighted).....	-74dB
Disc (mc) input (IHF, CCIR weighted).....	-60dB
Aux/CD input (IHF, CCIR weighted).....	-75dB
Residual, unweighted (volume control at min).....	-80dB
DC output offset.....	left 4mV, right 5mV

Input overload

Disc (mm) input (IHF).....	20Hz 1kHz 20kHz
Disc (mc) input (IHF)*.....	31dB 32dB 31dB
Aux/CD input (IHF).....	33dB 34dB 32dB
Aux/CD input (IHF).....	>20dB >20dB >20dB

Stereo separation

Disc input.....	65dB >57dB 40dB
Aux input.....	75dB 73dB 47dB
Output impedance (damping).....	0.4ohm 0.38ohm 0.4ohm
Channel balance, disc, at 1kHz.....	0.4dB

Volume/balance tracking

Aux input.....	0dB -20dB -60dB
Aux input.....	0.06dB 0.08dB 0.08dB

Input data

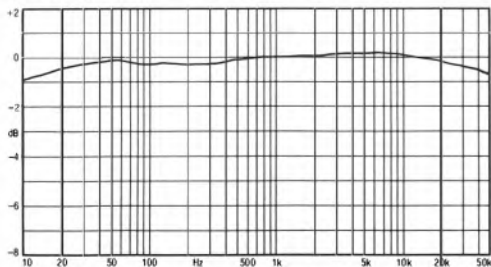
	socket type	sensitivity	loading
Disc (mm) input.....	Phono	-mV 47kohms	190pF
Disc (mc) input.....	Phono	-mV 100ohms	1.5nF
Aux input.....	Phono	-mV 54kohms	5pF

Output, pre-amp (tape)..... >3V max, 280ohms

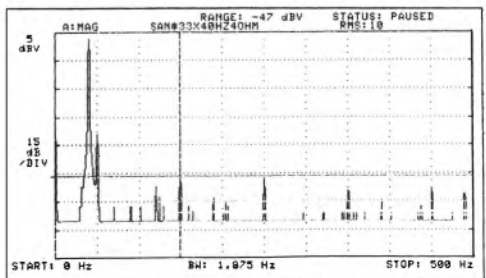
Disc equalisation error, 30Hz-15kHz..... +0.2dB, -0.3dB

Size (width, height, depth)..... 43 x 11 x 33cm

Typical price inc VAT..... £170



Disc eq accuracy and (right) power supply rejection



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 6800 μ F 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,

acity was very reasonable for the power level concerned; peak output level into the adverse loads was quite well held, measuring about a 4.0dB 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 recommended 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.	30W (= 15dBW)		
Power output*	20Hz	1kHz	20kHz
One channel, 8ohm load	15.1dBW	16.0dBW	16.0dBW
Both channels, 4ohm load	12.3dBW	14.2dBW	14.0dBW
One channel, 2ohms, pulsed	—	12dBW	—
Instantaneous peak current	+ 12A		- 9A

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)	- 72 dB
DC output offset	2mV

Input overload

Disc (mm) input (IHF)	20Hz	1kHz	20kHz
Aux/CD 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
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Channel balance, disc, at 1kHz

2.0dB

Volume/balance tracking

Aux input	0dB	- 20dB	- 60dB
	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, 22nF
Aux input	Phono	82mV	48kohms, 316pF

Disc equalisation error, 30Hz-15kHz

+ 0.2dB, - 2.6dB

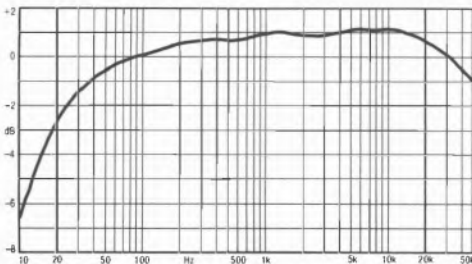
Size (width, height, depth)

32 x 265 x 7.5cm

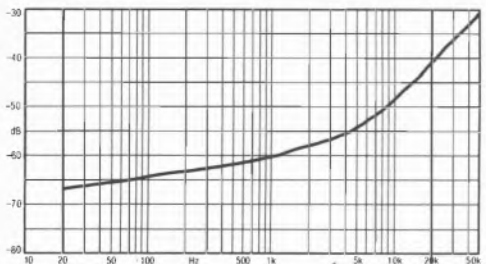
Typical price inc VAT

£179

* Note: dislikes capacitive loads



Disc input: RIAA equalisation accuracy



Disc input: stereo separation

Sony TA-AX500

Sony UK Ltd, Sony House, South Street, Staines, Middlesex TW18 4PF
Tel Staines 61688



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 construction 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 $2 \times 15,000\mu\text{F}$ 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 ± 9 amps 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 inter-modulation, were exemplary, typically at -90 dB 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		

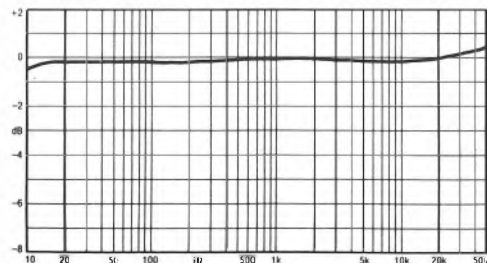
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF)	30dB	30dB	29dB
Disc (mc) input (IHF)	26dB	26dB	26dB
Aux/CD input (IHF)	>20dB	>20dB	>20dB

Stereo separation			
Disc input	-92dB	-91dB	-72dB
Aux input	-92dB	-91dB	-70dB

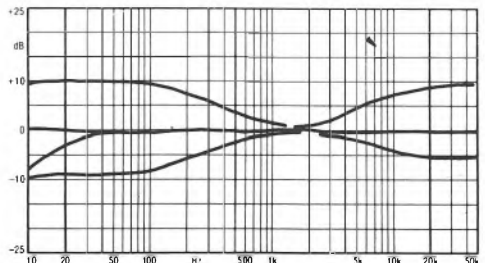
Output impedance (damping)	0.12ohm	0.12ohm	0.19ohm
Channel balance , disc, at 1kHz	0.5dB		
Volume/balance tracking	0dB	-20dB	-60dB
Aux input	0.5dB	0.7dB	0.7dB

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



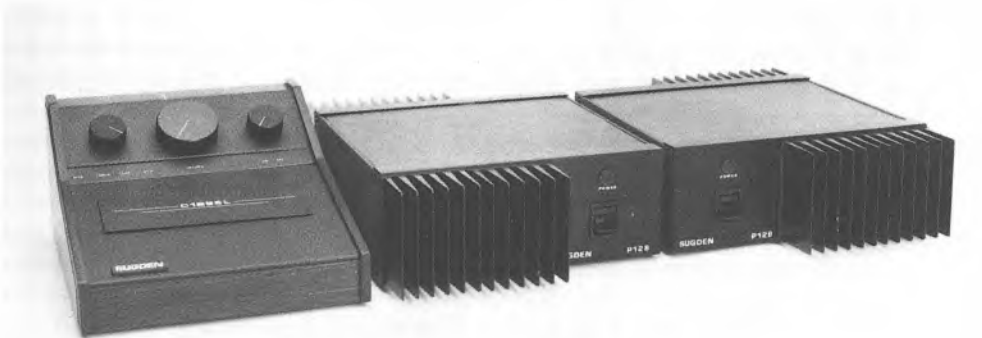
Disc input: RIAA equalisation accuracy



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 which are now physically completely separated. With heatsinks dominating the front and rear aspects it has no real front panel as such. Rated as 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 supplied for this edition, the moving-coil input performed well and gave a fine sound when auditioned, earlier problems having been fully overcome. 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

into 2ohms. At full power to 20kHz, harmonic distortion was worsening but elsewhere both IM and harmonic distortion levels were very good. Signal-to-noise ratios were also satisfactory. The power amp dc offset was satisfactory.

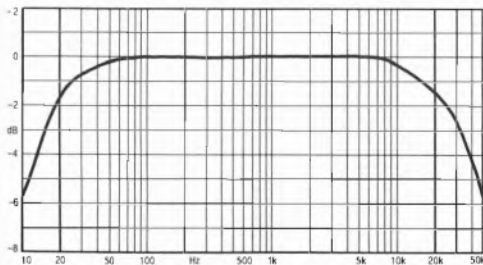
Input overload margins were exemplary and while stereo separation was satisfactory it was measured as strangely constant over the spectrum. Channel balance and volume tracking were fine. All the input and pre-amp output characteristics were entirely satisfactory, while the power-amp sensitivity was compatible 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 very worthwhile combination. Now judged in production form, the *C128* proved better than before, and offered a front rank performance in its chosen price category. Despite its unorthodox presentation, this pre-amp is a versatile and most competent design, which can give much musical pleasure, and is therefore comfortably recommended.



Disc input: RIAA equalisation accuracy

Test measurements

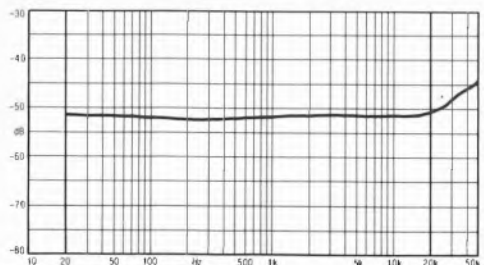
To show how well the amplifier sustains its 80hm output into real loudspeaker loads, the level into 4ohms and 2ohms is given in dBW (where 0dB = 1W), without adding 3dB or 6dB respectively, as in usual 'power' ratings.

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.....	+21A	-23A	
Distortion			
Total harmonic distortion,	20Hz	1kHz	20kHz
at rated power, aux input.....	-75dB	-95dB	-85dB
Intermodulation, 19/20kHz, rated power, aux input.....			-95dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....			-70dB
Intermodulation, 19/20kHz, at 0dBW, disc(mc).....			-66dB
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).....			> -90dB
DC output offset.....	left -mV, right -mV		
DC offset, pre-amp.....	left -mV, right -mV		
Input overload	20Hz	1kHz	20kHz
Disc (mm) input (IHF).....	36dB	36dB	36dB
Disc (mc) input (IHF)*.....	35dB	36dB	31dB
Aux/CD input (IHF).....	>20dB	>20dB	>20dB
Stereo separation			
Disc (mc) input.....	>80dB	74dB	49dB
Aux input.....	110dB	75dB	49dB
Output impedance (damping)	0.2ohm	0.22ohm	0.3ohm
Channel balance , disc, at 1kHz.....			0.4dB
Volume/balance tracking	0dB	-20dB	-60dB
Aux input.....	0.5dB	0.6dB	1.3dB
Input data	socket type sensitivity loading		
Disc (mm) input.....	Phono	4.5mV	49kohms
Disc (mc) input.....	Phono	0.25mV	500ohms
Aux input.....	Phono	85mV	50kohms
Power amp.....	-	-mV	-kohms
Output, pre-amp			>7V max, 50ohms
Disc equalisation error , 30Hz-15kHz.....		+0dB,	-0.5dB
Size (width, height, depth).....			47 x 9 x 23cm
Typical price inc VAT.....			£275

Note: distortion and noise measurements are pre-amp only



Disc input: stereo separation

Technics SU-V2X

Panasonic UK Ltd, 300-318 Bath Road, Slough, Berks
Tel (0753) 34522



The *SU-V2X* is a moderately priced integrated amplifier with an excellent finish and appearance. It provides a nominal output of around 40W (16dBW) per channel and in common with many other recent Japanese designs, was conceived with a high peak current capacity.

Well equipped, the *SU-V2X* comes with a headphone socket, plus outputs for two sets of speakers, bass and treble controls and 'defeat', a subsonic or rumble filter and loudness with -20dB muting. A touch button selection of inputs provides tapes decks 1 and 2, video/aux, CD, tuner and disc, the latter moving magnet.

Loudspeaker connection is via twist grip sockets which won't accept very thick wire. All signal sockets are phono, the array including in/out connections for an external processor.

Inside, some of the mains wiring is unshrouded, while the line switching is single pole. The large MEC transformer energises twin 8,200 μ F reservoir capacitors, shared between channels. The output stage is a complete stereo thick film module (STK 2038 IV) coupled to a copper heat pipe with exten-

sive radiator fins. A total of 13 printed circuit boards are used, though many perform single local connecting tasks. Source switching is solid state, accomplished by Toshiba TC91464N CMOS switches, with disc input and equalisation effected by a single IC for both channels, namely a dual 4014. More ICs are used in the line amplifier as well as tone control sections. Space is available for additional circuitry, which would allow the manufacturer to produce more complex versions of the design in future.

Sound quality

Overall this amplifier scored below average. Auditioned via the auxiliary input, the sound proved uninspiring. The treble sounded 'busy' with a wispy almost 'buzzy' tonality. Dynamics appeared compressed and the sound did not exhibit life and drive. The bass lacked truthfulness and stereo stages were flattened. It deteriorated a little more via disc; here the treble showed added 'zing' and the bass lacked definition. Stereo images were rather weak as regards both depth and ambience. Peak sound

levels reached 101dB on the 8 ohm load.

Lab results

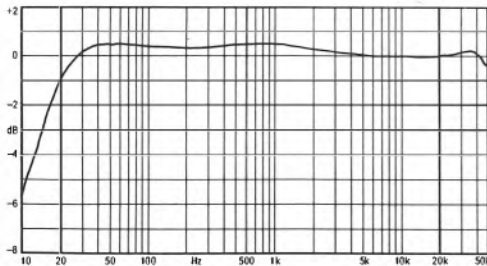
Our first sample suffered from an odd fault which caused high distortion (rare with Technics equipment), and a second sample was used for test.

For what it's worth the '2X demonstrated a superb 8 ohm power bandwidth. Peak current capacity was really high at $\pm 25A$, and its adverse load tolerance was very good, as was also shown by the fine 16.5dBW pulsed output into 2 ohms. Distortion was also very low, this coupled with good input noise levels. Both the output impedance (damping factor) and dc offsets were negligible. Input overload margins were ample while channel separation was held at rather better levels than usual. Channel balance and volume tracking were both fine. On the RIAA equalisation a shade of treble cut can be observed, but this was considered to be of little importance on test.

Input characteristics and loadings were all fully satisfactory. Line harmonics were well rejected as the 40Hz power spectrogram showed; here 100Hz was rejected by 94dB.

Conclusion

It would appear that responding perhaps to the results obtained from earlier issues, the Technics designers have hoped to fit the bill with this new amplifier by adding fine load tolerance as well as high peak current to the overall specification. Both have certainly been achieved but unfortunately have not coincided with a significant improvement in sound quality; this was well below average, and thus the SU-V2X cannot be recommended here.



Disc eq accuracy and (right) power supply rejection

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 (= 16dBW)
Power output	20Hz 1kHz 20kHz
One channel, 8ohm load.....	17.6dBW 17.6dBW 17.5dBW
Both channels, 4ohm load.....	14.5dBW 15dBW 14.8dBW
One channel, 2ohms, pulsed.....	-dBW 16.5dBW -dBW
Instantaneous peak current.....	+25A -25A

Distortion

Total harmonic distortion,	20Hz 1kHz 20kHz
at rated power, aux input.....	-91dB -90dB -80dB
Intermodulation, 19/20kHz, rated power, aux input.....	-91dB
Intermodulation, 19/20kHz, at 0dBW, disc(mm).....	-100dB

Noise

Disc (mm) input (IHF, CCIR weighted).....	-69dB
Aux/CD input (IHF, CCIR weighted).....	-71dB
Residual, unweighted (volume control at min).....	-76dB
DC output offset.....	left 1mV, right 2mV
DC offset, pre-amp.....	left -mV, right -mV

Input overload

Disc (mm) input (IHF).....	20Hz 1kHz 20kHz
Aux/CD input (IHF).....	30dB 31dB 30dB
Aux/CD input (IHF).....	>20dB >20dB >20dB

Stereo separation

Disc input.....	72dB 85dB 60dB
Aux input.....	76dB 75dB 50dB

Output impedance (damping)...

Disc (mm) input.....	0.96ohm 0.96ohm .14ohm
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Channel balance, disc, at 1kHz.....

Volume/balance tracking	0dB -20dB -60dB
Aux input.....	0.5dB .05dB 1.1dB

Input data

Disc (mm) input.....	socket type sensitivity loading
Disc (mm) input.....	Phono 4mV 47kohms 100pF
Disc (mc) input.....	Phono -mV -ohms -pF
Aux input.....	Phono 20mV -kohms 50pF
Power amp.....	Phono 20mV -kohms -pF

Output, pre-amp (tape).....

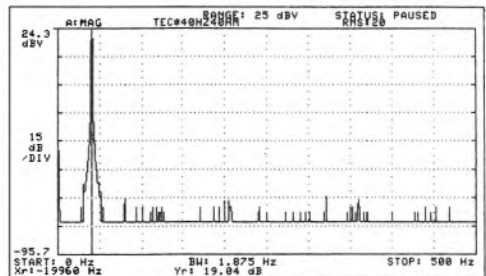
Disc equalisation error, 30Hz-15kHz.....	>9V max, -ohms
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Disc equalisation error, 30Hz-15kHz.....

Size (width, height, depth).....	43 x 11 x 29cm
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Typical price inc VAT.....

Typical price inc VAT.....	£140
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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

80hm 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 $\pm 9A$. 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 recommended rating this time around.

Test measurements

To show how well the amplifier sustains its 80hm 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	- 73dB	- 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	32dB	31dB	31dB

Volume/balance tracking

Aux input	0dB	- 20dB	- 60dB
	0.3dB	0.6dB	0.1dB

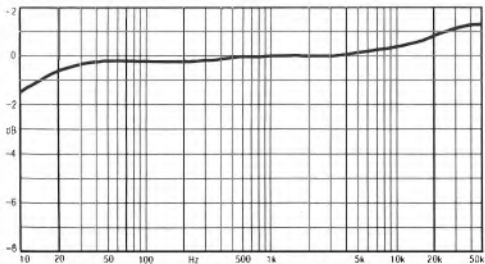
Input data

	socket type	sensitivity	loading
Disc (mm) input	Phono	0.44mV	46kohms, 260pF
Aux input	Phono	29.5mV	38kohms, 40pF

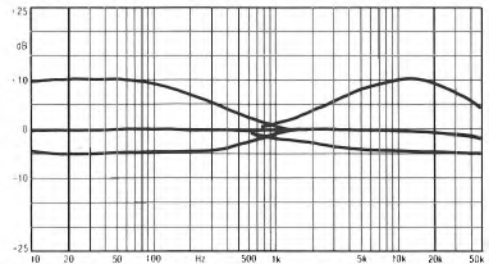
Disc equalisation error, 30Hz-15kHz + 0.5dB, - 0.2dB

Size (width, height, depth) 44 x 30 x 10cm

Typical price inc VAT £90



Disc input: RIAA equalisation accuracy



Tone control/filter responses

SUMMARY REVIEWS

These brief reviews summarise our findings on models which have been fully tested at one time or another but which have been displaced from the main review section by shortage of space. Some of the older models here may be seen at advantageous 'end of line' prices, and a number of models here are fully recommended.

Akai AM-U3 (£130)

Powerful (45W, 16.5dBW) with good load tolerance, the *AM-U3* was well built and produced a generally pleasant sound which nonetheless lacked immediacy and image depth. Rated as worth considering.

Akai AM-U5 (£250)

This model did little in our view to justify a price nearly double that of the *AM-U3*, with little more power (60W, 17.5dW) and rather weak moving-coil input.

Burmester 785 (£900)

Warmly received in the last edition, this self-contained high-quality pre-amp was exceptionally well built and finished and rated highly on audition in terms of neutrality, consistency and precision. Measured results and compatibility were excellent.

Denon PMA-750 (£235)

Well made and well specified this amplifier was rated at a healthy 80W (19dBW) but protection circuit operation frustrated any measurement of representative peak current capability. The sound was characterised as forward and somewhat compressed in stereo depth, with some boominess in the bass. Though in the last edition it was found superior to run-of-the-mill Japanese competition, it just missed recommendation.

Electrocompaniet Preampliwire/Ampliwire (£785/£785, mc head amp extra)

The original 25W Electro power amp enjoyed a cult following some years ago, but a lack of continuity in manufacturing and marketing has hampered UK acceptance of the later series models referred to here. The 50W stereo power amp we tested also forms the basis of a bridged mono-block design giving around 150W (21.5dW). Listening tests revealed a fine transparent sound and very good stereo images, and despite the high price, and the slightly 'pre-production' nature of our samples, this interesting design won a recommendation last time round on sheer sonic merit. If available, it could be worth considering.

Fisher CA-275 (£180)

Exceeding its 75W spec by a huge margin, the *CA-275* actually peaked at 23.5dBW (over 200W) into 8ohm loads, though a merely adequate peak current delivery tends to preclude awkward speaker loads. Sound quality rated as

average. It seemed well built and could form the basis of a disco-oriented system to produce high levels.

Harman Kardon PM640 (£170)

Like the larger *PM-650* (see full review) and *660*, this 30W (15dBW) model embodies the 'high peak current' philosophy adopted by H-K at the instigation of the designer Matti Ojala. Providing a strong results on audition, with a pleasing dynamic sound, wide response and good stereo, it handled difficult speaker loads well. While not felt to be Best Buy material, it gained a recommendation in the last issue and is still a worthy contender.

Hitachi HA-2 (£120)

With a complex array of control and lights, this 50W (17dBW) model appeared to offer nothing special in sonic terms, rating below average on both lab and listening tests. Hitachi's *HA-6* (see full review) seems more promising.

JVC AK-22 (£90)

Now deleted, this amplifier may still be available from some outlets. In our view, its performance was insufficient for any recommendation, though reasonable enough for the price asked. Rated at 38W (15.5dBW) it did go quite loud on 'easy' 8ohm speaker loads.

JVC AX-40 (£154)

Again deleted but possibly still available, this is an impressive-looking mid priced model with elaborate power meters and five-band 'equaliser' tone controls. The *AX-40* unfortunately rated below average in our tests, and its 50W (17dBW) output was not sustained well into difficult loads.

Luxman L430 (£325)

Big brother to the *L230* (see full review), this model is substantially more powerful, and despite a slightly thin-sounding balance, produced a pleasing enough sound last time to rate a recommendation, which in the light of recent competition becomes 'worth considering'. It offers 105W (20dBW), though difficult speaker loads were not well handled. It is built and finished to the usual high Lux standard.

Marantz PM-230 (£90) and **PM-330** (£110)

Officially replaced now by '40 series modeld (see *PM-240* full review), these Marantz models unfortunately fell below average sonic standards on audition despite their reasonable

output (both 30W, or 15dBW, per channel) and load tolerance.

Mission 777BU (£750)

With the front of its massive cast enclosure deeply sculpted in the company logo, this distinctive power amplifier delivered a correspondingly impressive power output of 100W (20dBW), well maintained into lower impedances. Its sound quality was rated as 'very good' and goes a long way towards justifying the price. Aside from strict value considerations, the performance earned a firm recommendation.

Myst G-Ohm pre- and power (£440)

Preceding the *TMA-3* integrated design, this pair of separates offer more power at 80W (19dBW) per channel, and remain worthy products constructed to a very high standard, although not such good value as the *TMA-3*.

Nytech 202 (£148)

With a rewardingly above-average sound quality, Nytech's least expensive model is built to a good standard of workmanship though with quite complex circuit design and layout. Ergonomically styled and neat in appearance with its sloped front panel, the 202 previously won a recommendation for its light, easy-on-the-ear sound quality with above-average depth, but its increased price and the strength of current competition have eroded its position.

Onkyo A22 (£90)

When Onkyo products reappeared in the UK distributed by Goodmans Loudspeakers, the A22 proved one of the more successful items. With a fairly generous power output (35W, 15dBW), and well equipped with facilities, it won a 'Best Buy' rating in issue No 33, and remains a recommended model.

Revox B251 (£897)

With a wealth of features mainly directed to the needs of tape recordists — accurate peak reading meters, variable gain inputs and optional remote control — this impressive 100W (20dBW) unit also employs a fully-stabilised high frequency power supply instead of the usual mains transformer. In view of its advanced technical features, the 'average' sound quality rating was a disappointment and precluded any recommendation last time round. Revox have since modified the power amplifier section of the *B251*, but did not supply a sample for us to retest.

Rotel RA-870 (£220)

Largest of the Rotel integrated amplifier series, the *RA-870* is a 'straight line' no-frills model

which offers decent output power (60W, 18dBW), good load tolerance and good stereo sound. A little bright or brash in the treble, it still merits recommendation.

Sansui AU-D55X (£239)

Now effectively replaced by the 'X balance' *AU-G* series models, this amplifier incorporated Sansui's earlier 'Super Feed Forward' power amplifier circuitry. Unfortunately, sound quality was found to be below average and some measured parameters were weak in any case.

Tandberg 3012 (£520)

This finely-crafted Scandinavian amplifier design could sound a little cold and clinical in our view, but it did offer a powerful and extended bass, good stereo focus, depth and detail. If available, this 100W (20dBA) model could be worth auditioning.

Tandberg 3002/3006A (£415/£510)

More powerful at 150W (21.5dBA) per channel, the Tandberg separates nonetheless failed to stand up to more recent competition, including the company's own revised *3012* integrated model, and offered poor value for money.

Technics SU-V303 (£130)

An ordinary, straightforward and inexpensive amplifier, this model was previously rated as worth considering. Sound quality was a touch thin and nasal on vocal, but with reasonably sharp stereo focus.

Trio KA-31 (£95) and **Trio KA-71** (£149)

With new distribution arrangements for the UK, Trio intend to launch a new range which will make these products obsolete. Though sounding fairly pleasant and unlikely to induce listener fatigue, these amplifiers were considered insufficiently competitive to merit any commendation at their intended prices.



Mission's distinctive 777BU power amplifier

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 second *Hi-Fi Choice* on the subject of amplifiers, and again I must admit that in some respects the project proved to be an arduous as well as a rewarding undertaking! A very large number of new products have been reviewed for the first time, while many important models covered previously have been retested for the new edition, particularly where improvements have been made by the manufacturer in the last few months.

It is clear 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 sensitivity can spoil the signal-to-noise ratio; and listening test results are affected to a surprising 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's disc input 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 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

CONCLUSIONS: AMPLIFIERS

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 of 10, while the Rotel (the cheapest), scored a clean 6. Extending the comparison 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.

Clearly, the Rotel, in company with the Mission *Cyrus*, demonstrates that good sound is possible without resorting to elaborate technology or great 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 judgements have been made with thorough cross-checking between products included for the first time in this issue and those that have been reassessed or completely retested this time. However, as with every edition of *Hi-Fi Choice*, judgement standards are to a great extent 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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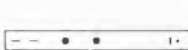
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CONCLUSIONS: AMPLIFIERS

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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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. Products are listed under each heading in ascending order of price.

BEST BUYS: UNDER £100

Rotel RA-820A (£95)

Continued from the last edition, this was a remarkable little amplifier with a fine sound and load tolerance, offering very good value.

QED A230 (£99)

A very competent British amplifier, this one was also load tolerant with a clear, competitive sound plus good build quality.

RECOMMENDED: UNDER £100

Pioneer SA301 (£70)

Remarkably inexpensive, this amplifier did not disappoint, and proved worthy of recommendation. Very good value.

Onkyo A22 (£90)

Continued from the last edition, this tidy amplifier continued to offer good value, and a respectable output power.

Yamaha A300 (£100), A320 (£90)

The A300 was well finished and provided a basically good performance and so is still worth recommending this year. The new A320 was tried briefly, and found to sound a mite

clearer than the A300 due to deletion of tone controls. It is also good value.

BEST BUYS: £100-£175

NAD 3120 (£110)

Surprisingly powerful with a clean solid sound and a modest mc disc input, this was a fine product of the 'straight line' variety.

Mission Cyrus One (£130)

A delightful musical performer this tidy box packed good dynamics plus load tolerance, with good subjective stereo depth and a moving-coil input.

Rotel RA820BX (£130)

A real stormer, the 820BX put up a great performance with a real punch and transparency, and was particularly good on CD. (Disc input is mm only.) Strongly recommended.

AR Amplifier (£174)

Right at the top of this price category we have the AR (originally the Cambridge Audio P35), now in full cry. With a high output, a fine load tolerance was also offered, plus a clean musical sound and satisfying stereo images via all the inputs.

RECOMMENDED: £100-£175

Creek CAS4040 (£125)

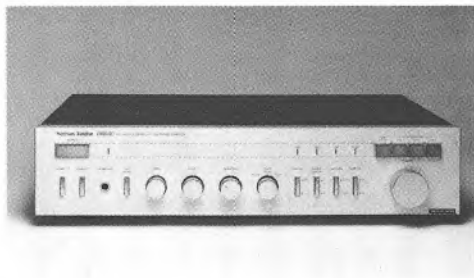
Carried forward from the last issue, this amplifier offered a lively sound worthy of recommendation.

NAD 3020B (£125)

This latest version of NAD's tone-control-equipped 3020, with improvements noted over the 3020A model, has maintained the good



Onkyo's budget A22 model



Harman-Kardon 'high current' PM-640

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BEST BUYS AND RECOMMENDATIONS: AMPLIFIERS

standing of the name and is comfortably recommended.

Nytech 202 (£130)

A lively, above-average performer with good ergonomics, the *202*'s power delivery looks small by today's standards.

Proton 520 (£130)

A sort of 'luxury' NAD *3020B*, this Proton was well equipped and gave a competitive performance on both sound and input.

Rotel RA840B/840BX (£170)

The *840B* was recommended in the last issue though not then subjected to full test. If the latest 'BX' modifications on the *820* are anything to go by the *840BX* should be fine. Moving coil input will also be included — and this should be a 'louder' version of the *820BX*.

Harman Kardon PM-640 (£175)

This load tolerant amplifier did well in earlier tests and still deserves recommendation.

BEST BUYS: £175-£250

Mission Cyrus Two (£230)

In context of price and power this amplifier gave an excellent performance. Precision, dynamics, stereo imaging and transparency were all outstanding. Strongly recommended.

RECOMMENDED: £175-£250

Sondex S230 (£199)

Minor improvements over the year have helped to maintain this model's competitive position. A tidy unit of good finish, it offered versatile input matching with a pleasant sound.

Naim NAIT (£199)

Standing its ground, the NAIT remains a small but musical amplifier helping to build a number of inexpensive disc playing systems. Well constructed and finished, it carries a firm recommendation.

Luxman L230 (£190)

This beautifully finished amplifier was well equipped and gave a fairly good all round performance, although a trifle intolerant of adverse loads.

Harman Kardon PM-650 (£240)

The *PM-650* was and remains a recommended product. It is powerful, load tolerant and input versatile.

Myst TMA-3 (£250)

Fully reviewed in *HFC* for the first time, the *TMA-3* performed well. Offering a range of custom input options, this craftsman-built product should be very reliable. Load tolerant, its essentially clean sound confirms the recommendation.

Rotel RA-870 (£245)

Just scraping into this price category, the *RA-870* was a substantial amplifier with many facilities and a tremendous load tolerance. Its value rating remains good.

RECOMMENDED: OVER £250 (INTEGRATED)

Note that we have excluded models above £250 from our 'Best Buy' classification.

Audiolab 8000A (£275)

Now in revised form this amplifier continued to set a high standard on the listening tests. It also offers good engineering, styling, facilities and finish and is firmly recommended.

Musical Fidelity Synthesis (£345)

This no-frills amplifier achieved good scores on the listening tests. Into straightforward speaker loads it offered a wide dynamic range with good peak sound levels, but difficult loads were handled less well.

Mission Cyrus Two plus PSX (£400)

With the addition of the extra power pack, the *Cyrus Two* acquired additional power and authority, establishing a strong position at this price break.

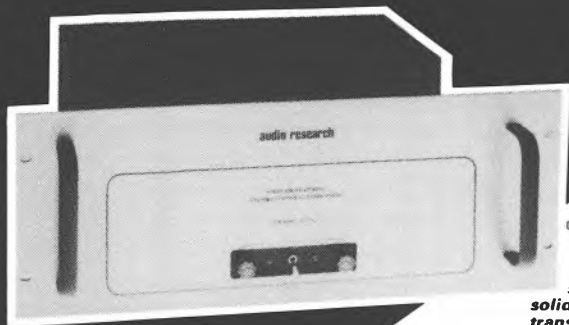


Rotel's larger integrated model, RA-870



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Class 1b International Audio Review Hotline

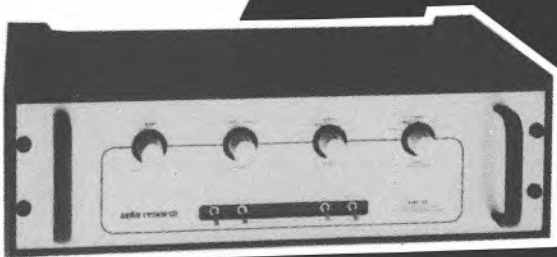
12 August 1981 Peter Moncrieff

"I can't recommend the Audio Research SP8 highly enough. I wonder how I could have tolerated less."

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BEST BUYS AND RECOMMENDATIONS: AMPLIFIERS

WORTH CONSIDERING: OVER £250

Meridian Component Series (£300-500)

Due to its high pricing the *Component* amplifier falls into this second category though its sound was eminently musical and the overall quality has been slightly improved over last year's sample.

RECOMMENDED SEPARATES

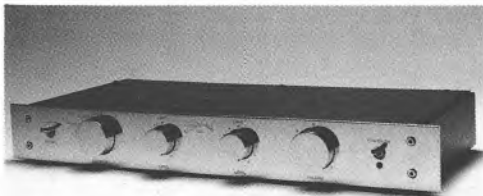
Recommended pre-amplifiers and power amplifiers are given here in ascending price order. See text for details of performance and matching considerations. In the listing 'M' denotes a product felt to be of additional special merit. The list also includes some models which for one reason or another could not be fully reviewed, but were auditioned — these are marked 'audition'.

PRE-AMPLIFIERS

Rotel RC 870 (£210)
Audiolab 8000C(£275)
Sugden C128 SL (£275)
Pink Triangle Pip (£360)
DNM Primus (£450)
Counterpoint SA7 (£550)
DNM 2A (£850)
PS Audio IV (£570)
Counterpoint SA3-I (£995)
DNM 2A double twin (£1,000)
Naim NAC32 (Hi-Cap)
Conrad Johnson PV5 (£1735) M
Audio Research SP8 II (£1790) M
Audio Research SP10 II (£3696) M
Conrad Johnson Premier 3 (£3150, audition) M

POWER AMPLIFIERS

Rotel RB 870(£210)
Audiolab 8000P (£350)



Burmester 785 pre-amplifier

Naim NAP 250 (£780)
PS Audio IIC (£411)
Robertson Forty Ten (£995) M
Naim NAP 135 (£1760, pair)
Krell KSA50 (£1795) M
Conrad Johnson MV45 (£1195)
Magnum A100 (£1995, pair)
Audio Research D70 II (£1965)
Krell KSA 100 (£2590, audition) M
Audio Research D115 II (£2980, audition) M
Conrad Johnson Premier 4 (£3400, audition) M
Audio Research D250 II (£5662, audition) M
Burmester 828 (£4600, audition) M

SEPARATES: WORTH CONSIDERING

These separate components have just missed recommendation, but are products of excellent quality, especially in the right system context.

PRE-AMPLIFIERS

Hafler DH110 (£360, kit £295)
Quad 34 (£240)
Quad 44 (£340, now revised)
A&R C200 (£280)
Musical Fidelity The Preamp II (£285)
Meridian Component series (from £375)
Beard P505 (£595)
Magnum P100 (£750)
Burmester 785 (£960)
Mark Levinson ML10A (£2750, audition)
Burmester 838/846 (£890/£890)

POWER AMPLIFIERS

A&R SA200(£375)
Hafler DH220 (£420, kit form £355)
Sugden P128 (£385, pair)
Musical Fidelity DT (£590)
Mission 777 BU (£750)
Musical Fidelity Studio T (£890)
Beard P100 (£995)



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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.

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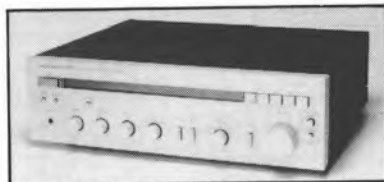
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TECHNICAL INTRODUCTION: TUNERS

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 encoder and low distortion transmitter/generator, fed with master-quality digital PCM programme material. The degradation imparted by the tuners was assessed on a before-and-after transmission basis. In addition, the low-signal radio frequency and quieting performances were subjectively assessed, particularly with respect to the odd 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 over-modulation 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 suppression 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.

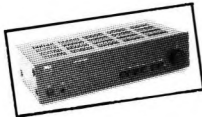
Aerial considerations

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.

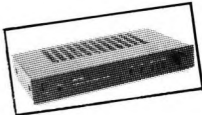
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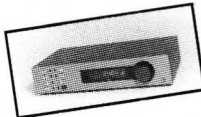
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Akai AT-A2L

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



This lightly-constructed slimline tuner is finished in satin silver with a contrasting grey panel area. A synthesiser design, it has pushbutton auto-seek tuning plus a set of preset buttons that allow up to 16 stations to be memorised. It covers long, medium and VHF/FM wavebands.

All the controls are pushbutton and the stereo auto muting mode can be cancelled to allow reception of weak mono stations. As is now common with recent low cost designs, the specifications were pretty good, and were more or less guaranteed by the stack of standard tuner ICs used inside. Unless used in the matching Akai rack the 'A2L's fixed output cable, rather short at only 0.3m, may prove a minor nuisance.

Sound quality

Rated below average, this tuner sounded weak on low frequencies with a thinned almost scratchy upper mid-treble register. Vocals were both pinched and hard sounding. It did prove sensitive with rapid quieting, but stereo hiss levels were just average.

On AM the sound was positively disliked and in our opinion was worse than many a portable radio.

Lab results

Sensitivity was satisfactory with signals above 500 μ V providing good stereo signal to noise ratios. The 60dB (CCIR ARM) noise figure was unexceptional improving to 68dB in mono.

Selectivity was reasonable at 55dB while the pilot tone spurious were well suppressed. Channel balance was very good, while the frequency response was most uniform; for example within 0.15dB at 10kHz. Stereo separation was very good, and the measured harmonic distortion levels were most reasonable. The RF performance was good for the price, while both AM suppression and capture ratio were fine. The front end also demonstrated a good overload performance.

Conclusion

Basically a good tuner in measurement terms, this Akai did however have poorer noise levels than usual. In addition, sound quality was judged to be disappointing, on FM and particularly on AM. No recommendation is appropriate here.

GENERAL DATA	Tuner
Sensitivity for 50dB signal-to-noise Mono/stereo.....	3.5 μ V/40 μ V
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref) Mono/stereo.....	68dB/60dB
Muting threshold	25 μ V
Alternate channel selectivity	55dB
Pilot tone rejection , 19kHz/38kHz.....	65dB/72dB
AM rejection	60dB
Capture ratio	1.4dB
Total harmonic distortion at 100% mod, 1kHz mono/stereo.....	-56dB/-57dB
Stereo separation , 1kHz/5kHz/10kHz.....	60dB/49dB/45dB
Output level , 100% mod.....	741mV
Channel balance	0.02dB
Dimensions (width, depth, height).....	44 x 25 x 7cm
Typical price inc VAT.....	£85

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Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG
Tel (0753) 888447



Modestly priced, the 710 is a slimline, satin black unit of clean and tidy styling. It is a conventionally-tuned model fitted with a pleasant fly-wheel loaded rotary control covering long, medium, and VHF/FM wavebands. Signal strength indication is given by an LED indicator with six bars. A male coaxial socket is fitted at the rear, requiring a back-to-back adapter to take a normal UK plug. The AM antenna is the usual plastic-cased loop fitted on a swivel.

Sound quality

This tuner scored well above average. A hint of sibilance and blurring was evident in the upper treble, but the sound was considered to be clear and lively. Detail was preserved while reasonable depth and precision were noted in the stereo image. With healthy signals, the background hiss was quite low.

AM performance was quite pleasant for this band, and again definitely well above average.

Lab results

Practical stereo quieting was achieved at a respectable $40\mu\text{V}$ with the ultimate signal to noise ratio reaching 65dB stereo, 73dB mono (CCIR ARM 1kHz). Alternate channel selectivity was fine at 60dB while the AM rejection was also good. Some mild weakness was shown on

the capture ratio with this sample, but pilot tones were rejected well. Distortion was low in mono but just satisfactory in stereo, where it approached 1% at 1kHz. Channel separation was fine mid band, but deteriorated at higher frequencies to a satisfactory 26dB, 10kHz. On frequency response the output dropped by 1 – 1.5dB at the higher frequencies.

Conclusion

This tuner was easy to use and offered a pleasant sound on both AM and FM. It did not offer the ultimate in measured performance, but has done well enough to rate as good value, and hence merit a recommendation.

GENERAL DATA

	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo.....	2.8 μV /40 μV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo.....	73dB/65dB
Muting threshold	23 μV
Alternate channel selectivity	60dB
Pilot tone rejection , 19kHz/38kHz.....	65dB/>80dB
AM rejection.....	58dB
Capture ratio	3dB
Total harmonic distortion	
at 100% mod, 1kHz mono/stereo.....	– 51dB/– 43dB
Stereo separation , 1kHz/5kHz/10kHz.....	50dB/32dB/26dB
Output level , 100% mod.....	585mV
Channel balance	– 0.5dB
Dimensions (width, depth, height).....	43 x 30 x 7cm
Typical price inc VAT.....	£90

Denon TU-750

Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG
Tel (0753) 888447



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 150 μ V input sufficed for a 50dB stereo signal to noise ratio with the mono result at 7 μ V (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.

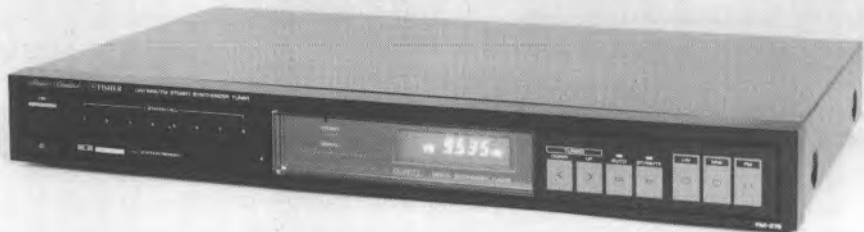
GENERAL DATA

Tuner

Sensitivity for 50dB signal-to-noise	
Mono/stereo	7 μ V/150 μ V
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	67dB/63dB
Muting threshold	5.5 μ V
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

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 possessed 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 100 μ V 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

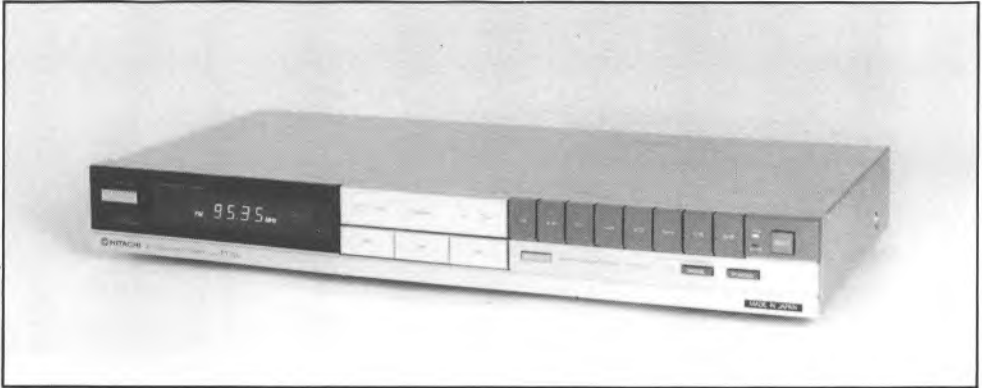
This neat tuner provided a good all round performance at a competitive price. The sound quality was sufficient to bring it into the 'Best Buy' category, and it can be warmly commended.

GENERAL DATA

	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo	8 μ V/100 μ V
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	74dB/69dB
Muting threshold	5.1 μ V
Alternate channel selectivity	- 67dB
Pilot tone 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 buttons, 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

500 μ V 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	5 μ V/500 μ V
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	71dB/66dB
Muting threshold	6.5 μ V
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

Hitachi FT-5500

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

RECOMMENDED



This well established tuner is a black finished, slimline model of the quartz locked synthesiser variety. Its wide range of features includes a record level calibrator. Both digital and analogue indication of tuner frequency is given and a set of ten preset station positions are available for AM and FM. A 'computer' controlled field strength related system is used which automatically alters bandwidth, mono/stereo switching and so on to give optimum reception with poor or variable signals. Both manual and auto-seek tuning is provided.

On the rear panel, the 75 ohm socket is a male one and requires a back-to-back adapter. The only other aerial connections are for the AM loop to be clipped to the back.

Sound quality

Basically good quality, the 5500 sound was marred by some mild background whistles, which set in below a 1mV RF input in stereo mode. The audio quality did not seem very 'involving', with some loss of life and space, but no specific failings were noted and the output was considered to be a fair copy of the original.

The AM band coverage was fairly good providing an acceptable performance for news/cast purposes — many were worse!

Lab results

A high sensitivity was denoted, which together with the very good RF performance — exemplary selectivity, capture ratio and AM suppression — indicates a potential for fringe

reception. Conversely it was also subject to front end blocking above a 2mV input and if used close to a transmitter an RF attenuator of 10 or 18dB would help. On the audio side the signal to noise ratios were very good, with excellent pilot tone rejection. Harmonic distortion was also very good, with 0.03% in stereo. On our sample stereo separation was OK if not to the expected level. Frequency response was uniform, showing good de-emphasis; a slight 0.3dB loss was noted by 10kHz.

Conclusion

While this tuner was unhappy at really high signal strengths, it worked very well on low to moderate levels. It offered low distortion, high sensitivity and a selective RF performance while audio sound quality was also pretty good if not quite to the standard of the best newcomers. Recommended.

GENERAL DATA

	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo.....	2.3µV/20µV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo.....	77dB/70dB
Muting threshold.....	10µV
Alternate channel selectivity.....	>65dB
Pilot tone rejection, 19kHz/38kHz.....	>90/82dB
AM rejection.....	70dB
Capture ratio.....	0.9dB
Total harmonic distortion	
at 100% mod, 1kHz mono/stereo.....	-80dB/ -73dB
Stereo separation, 1kHz/5kHz/10kHz.....	27dB/28dB/28dB
Output level, 100% mod.....	552mV
Channel balance.....	0.01dB
Dimensions (width, depth, height).....	44 x 30 x 8cm
Typical price inc VAT.....	£160

JVC TX-200L

JVC (UK) Ltd, JVC House, 12 Priestley Way, Eldonwall Trading Estate, Staples Corner, London NW2 7AF
Tel 01-450 2621



A budget-priced model, the '200L conforms to the latest school of tuner design — namely, a set of standard synthesiser chips locked to a quartz crystal oscillator. Styled in JVC's usual silver livery, this tuner offers long, medium and FM bands, with the ability to memorise up to 16 stations via a set of 8 keypads plus changeover button. Manual power tuning is possible in addition to the selfseeking auto tune mode. Mono and stereo operation are possible, aerial connection being made via binding posts with a choice of 75 or 300 ohm matching. AM is served by a ferrite bar, which does not rotate.

Sound quality

Sounding fairly pleasant with a near average quality, the output contained some audible synthesiser whistles in the 16-17kHz region. Even with a 1mV aerial input, a whistle could be heard in the stereo background. The treble sounded soft and fluffy, while transients appeared blurred, and the stereo image did not appear to be either very clear or deep.

AM sound was severely coloured by a ringing audio response, but it did show some detail.

Lab results

The 50dB quieting sensitivities were about average for both stereo and mono modes. The meter-recorded signal to noise ratios, excepting the faint whistle, were very good, measuring 68dB stereo and 73dB mono. The RF parameters were also good, with a 1.5dB capture

ratio, a 65dB AM rejection and a surprising 70dB of alternate channel selectivity. Pilot tone rejection was very good, although an essentially harmless 57kHz spurious component was present at -65dB. Harmonic distortion was low while stereo separation was more than satisfactory with output quite high at just over 1 volt. The de-emphasis was fine.

Conclusion

On paper and on the evidence of the lab tests, this was an above average tuner, but the sound quality results indicated that as regards this important feature, it was below average. The good RF performance ensured that it could acquire clean signals but the audio side would not appear to meet the same standard; inevitably, no recommendation is possible.

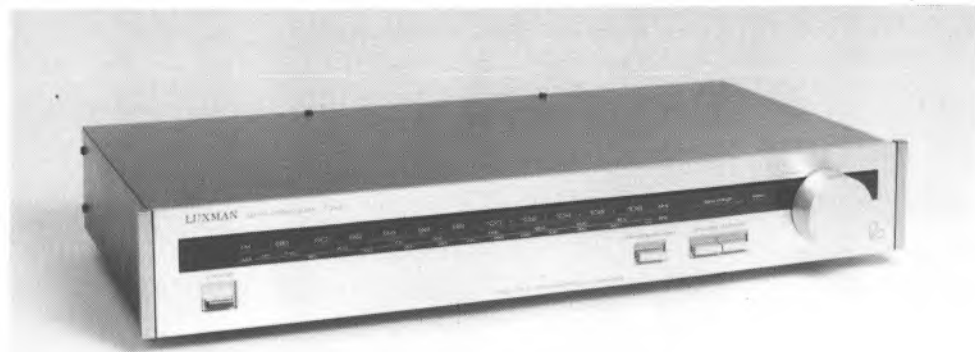
GENERAL DATA

	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo.....	5 μ V/45 μ V
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo.....	73dB/68dB
Muting threshold	16 μ V
Alternate channel selectivity	70dB
Pilot tone rejection , 19kHz/38kHz.....	-74dB/-65dB
AM rejection.....	65dB
Capture ratio	1.5dB
Total harmonic distortion	
at 100% mod, 1kHz mono/stereo.....	60dB/57dB
Stereo separation , 1kHz/5kHz/10kHz.....	44dB/38dB/35dB
Output level , 100% mod.....	1150mV
Channel balance	0.06dB
Dimensions (width, depth, height).....	45 x 30 x 8cm
Typical price inc VAT.....	£125

*57kHz

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 $6\mu\text{V}$ for our specially weighted result, and the $60\mu\text{V}$ 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 $2\mu\text{V}$; $10\mu\text{V}$ is a more realistic muting threshold value. Output was normal at 700mV, while stereo separation was to the usual standard. Distortion was surprisingly 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 $+1\text{dB}$ 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	$6\mu\text{V}/60\mu\text{V}$
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	74.5dB/70.5dB
Muting threshold	$2\mu\text{V}$
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

BEST BUY

NAD 4020B

Hi-Fi Markets Ltd, Cousteau House, Greycaine Road, Watford WD2 4SB
Tel (0923) 27734



Traditionally styled, this tuner looks much as tuners did a decade ago, but is none the worse for that. A large 'slide rule' tuning scale dominates the front panel showing clearly that here we have a traditional analogue design which still evades the almost ubiquitous synthesiser chip. I still like analogue tuners and appreciated the rapid dial response of the flywheel-loaded tuning of this model. On the debit side, preset station facilities are absent.

A simple but effective tuning indicator is used, namely two red lamps flanking a green 'OK' light. FM and the medium wave AM band are covered. Muting and mono modes can be separately engaged.

On the rear panel, in addition to the movable rod AM aerial there is also a proper UK coaxial socket for FM. Clip connectors are also provided for an additional AM aerial as well as 300 ohm and 75 ohm FM options.

Sound quality

Scoring very well on the listening tests, clean stereo reception was obtained with signal levels over 800 μ V. Background hiss was just satisfactory, countered by a lively and open sound, plus good stereo image, these showing fair depth and space.

The AM sound was quite presentable and in fact above average; but as usual this is not saying much!

Lab results

While not up in the super class the sensitivity was sufficient for most applications (but not extreme fringe). Stereo signal to noise leveled

off at 58dB and in mono did not improve greatly while the muting threshold of 5 μ V was too low to give sensible service. The pilot tone rejection was fine and total harmonic distortion was satisfactory both as regards mono and stereo. Stereo separation was pretty good right up to 10kHz while the radio frequency parameters were also good, including selectivity, AM suppression (rejection of interference) and capture ratio. The audio frequency response was sensibly flat and the RF input showed a fine overload performance.

Conclusion

While this was neither the quietest or the most sensitive tuner of the group, it nonetheless provided a great sound for the money. Easy to use, it was musical as well as ambient, proving a worthy match for the NAD 3120 as well as any other comparably good amplifier. The value rating suggests a Best Buy.

GENERAL DATA

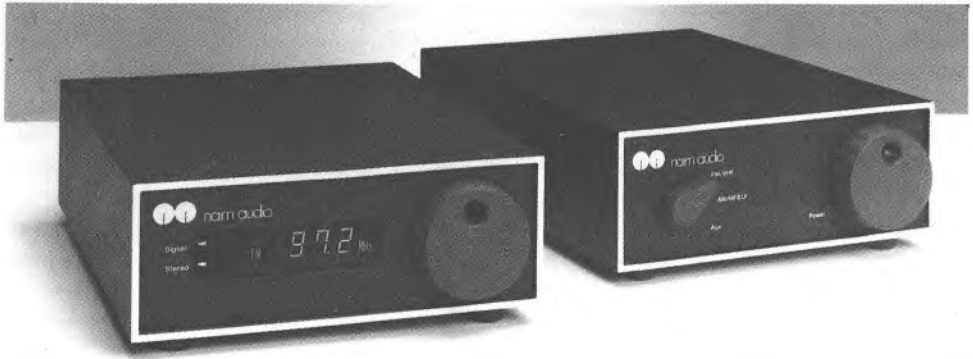
Tuner

Sensitivity for 50dB signal-to-noise Mono/stereo.....	4 μ V/80 μ V
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref) Mono/stereo.....	63dB/58dB
Muting threshold	5 μ V
Alternate channel selectivity	68dB
Pilot tone rejection , 19kHz/38kHz.....	58dB/>70dB
AM rejection	60dB
Capture ratio	1.4dB
Total harmonic distortion at 100% mod, 1kHz mono/stereo.....	-51dB/ -50dB
Stereo separation , 1kHz/5kHz/10kHz.....	55dB/52dB/48dB
Output level , 100% mod.....	910mV
Channel balance	0.03dB
Dimensions (width, depth, height).....	42 x 24 x 10cm
Typical price inc VAT.....	£125

Naim NAT 01

Naim Audio Ltd, Southampton Road, Salisbury SP1 2LN
Tel (0722) 223366

RECOMMENDED



Borrowed with the manufacturer's blessing from a local dealer, Naim's FM-only tuner is priced on a par with the Revox B261. No facilities are provided, bar the manual rotary tuning knob, with the selected frequency indicated by a large digital display. It comes with a substantial separate power supply like those for the Naim pre-amplifier, and has some switching facilities and outputs for an anticipated AM tuner model. A synthesiser chip, quartz locked, provides the local oscillator reference, this made by OKI in Japan. Multiplex demodulation is by a TCA 4500A integrated circuit and thereafter discrete Naim-style circuits take care of filtering, de-emphasis and line output.

Sound quality

From the outset it was clear that this tuner sounded 'nice'. It imparted almost an 'analogue turntable sound' to broadcasts, which can often sound harder and fiercer than the finest vinyl disc sources. It scored well for listenability but was not entirely accurate; indeed it sounded dulled as if top cut were present. Detail in the depth plane was subdued, but frontal focus was both coherent and precise.

Lab results

Sensitivity was high with fairly good selectivity and decent AM suppression. Capture ratio was really disappointing and could be associated with of the high distortion levels possibly due to a misalignment. Up to 4% harmonic distortion was possible depending on signal strength. The best was -43dB, 0.7%, this at 150µV, which was too low for a quiet background. Stereo noise peaked at 59dB, which

was poorer than average. Channel separation was satisfactory if not outstanding, while output was lower than usual at 350mV. Channel balance was also offset by nearly 1dB.

The audio frequency response indicated inaccurate de-emphasis. Down 1.2dB at 5kHz, 1.6dB at 10kHz and 2.2dB at 15kHz it showed audible treble cut, this agreeing with the audition results.

Conclusion

This tuner sounded nice but this was not enough at the price level to merit recommendation — moreover the sound varied too much with signal strength. However the sample on which our tests were carried out was subsequently recalled from the dealer concerned by Naim Audio. On retest, distortion fell to around -50dB, and proved consistent with level. Capture ratio was 5dB, stereo signal to noise 68dB and frequency response virtually flat. Sound quality improved further and the design is now recommended.

GENERAL DATA

Tuner

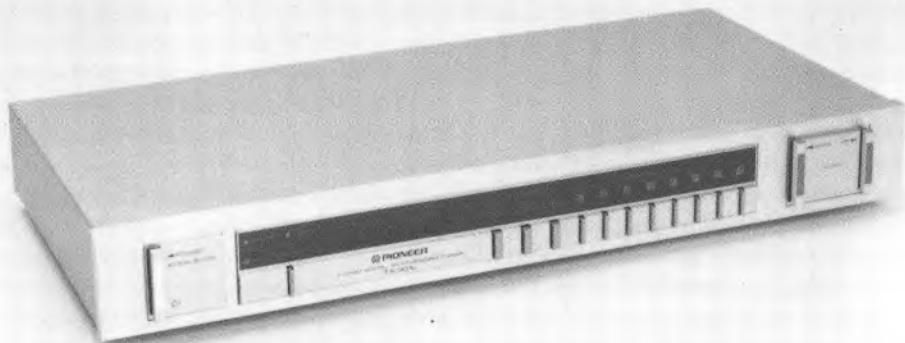
Sensitivity for 50dB signal-to-noise	
Mono/stereo	<15µV/30µV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	75dB/59dB
Muting threshold	15µV
Alternate channel selectivity	55dB
Pilot tone rejection, 19kHz/38kHz	50dB/70dB
AM rejection	66dB
Capture ratio	10dB
Total harmonic distortion	
at 100% mod, 1kHz mono/stereo	-29dB/ -28.5dB
Stereo separation, 1kHz/5kHz/10kHz	35dB/35dB/34dB
Output level, 100% mod	350mV
Channel balance	0.9dB
Dimensions (width, depth, height)	30 x 22 x 7.6cm
Typical price inc VAT	£900 (inc NAPST power supply)

Note: test results not typical, see text

BEST BUY

Pioneer TX-301L

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



This inexpensive tuner partners the 301 amplifier. Despite its low cost it uses a quartz crystal referenced synthesiser, and offers power tuning over three wavebands, namely VHF/FM, medium and long waves. There are 8 preset positions for FM, with a further 8 for AM as well — a comprehensive coverage, and one which could prove useful as part of secondary systems around the house! Programming was fairly straightforward. The rear panel is blessed with a standard UK FM socket plus binding posts if preferred for 75 or 300 ohm FM, plus the supplied loop antenna or an outside aerial for distant reception.

Sound quality

This tuner did well on audition. It sounded surprisingly clear, and the stereo was most presentable with low background noise, fair depth, plus good space and focus. The bass was more than satisfactory though the treble showed a hint of brittleness.

On AM it sounded quite colored and chesty with some muffling; not terrible, but below average here, although this isn't saying much!

Lab report

What can one say about a RF performance as presentable as this one! Sensitivity, capture ratio AM rejection and selectivity were all to the standard of tuners costing upwards of £200. Signal-to-noise ratios were very good though its one weakness was pilot tone and related

harmonic rejection ratios. These were just adequate especially at 19kHz, a level potentially audible to young listeners. Distortion reached a just satisfactory 1.5% on stereo but was rather better at 0.23% (-53dB) in mono. Channel balance held to a close tolerance. The frequency response was wide, with minimal high frequency rolloff, while the front end showed a good overall performance useful in view of its limited image rejection.

Conclusion

Despite the marginal pilot tone rejection and the mild stereo distortion at peak modulation, the '301 tuner did well both on lab tests and audition. As such it offers very good value and a Best Buy rating is assured.

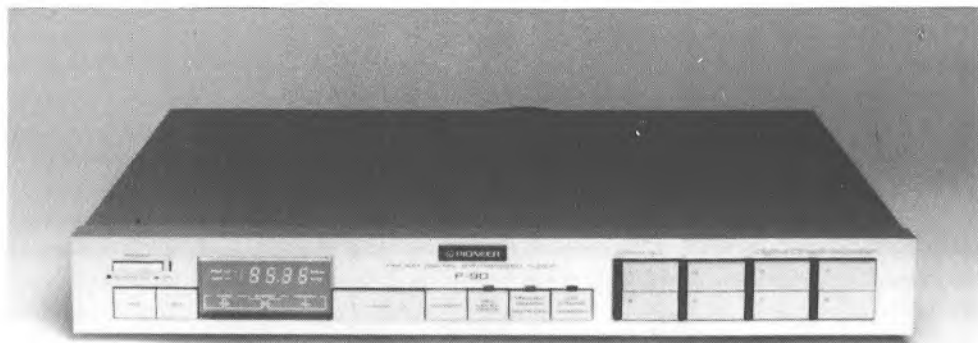
GENERAL DATA

Tuner

Sensitivity for 50dB signal-to-noise	
Mono/stereo.....	5µV/45µV
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo.....	74dB/69dB
Muting threshold	10µV
Alternate channel selectivity	65dB
Pilot tone rejection , 19kHz/38kHz.....	-30dB/-34dB
AM rejection.....	67dB
Capture ratio	<1dB
Total harmonic distortion	
at 100% mod, 1kHz mono/stereo.....	-53dB/-36dB
Stereo separation , 1kHz/5kHz/10kHz.....	46dB/34dB/28dB
Output level , 100% mod.....	675mV
Channel balance	0.1dB
Dimensions (width, depth, height).....	42 x 21.7 x 6cm
Typical price inc VAT.....	£85

Pioneer F90

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



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 bandwidth – 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 600 μ V 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 60 μ V 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 6 μ V. 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.

GENERAL DATA

Tuner

Sensitivity for 50dB signal-to-noise	
Mono/stereo	5 μ V/60 μ V
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	81dB/75dB
Muting threshold	6.0 μ V
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	730mV
Dimensions (width, depth, height)	42 x 32 x 6cm
Typical price inc VAT	£220

*'Narrow' IF bandwidth setting

Proton 440

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



This inexpensive tuner is distinguished by the inclusion of a special IF circuit by Schotz; this also used in some NAD tuners. By modifying the IF response according to level, the Schotz circuit improves the signal to noise ratio of weak stations at the edge of the tuner's usable performance.

Covering FM and AM medium wave bands, this is a synthesiser design with six auto tuned presets for FM and for AM. Cleanly styled, the case is in satin black with all pushbutton-controls. These include a Schotz noise circuit 'cancel' as well as a mono over-ride. At the rear it is usefully equipped with an output level control plus AM, loop antenna and three options for FM aerial; input-clip terminals for 300 and 75 ohm plus a proper UK socket for a 75 ohms coaxial plug. Using the usual stack of integrated circuits inside, this model is made in Taiwan.

Sound quality

We were not impressed by this model. On good signal strengths some synthesiser noise was audible in the unmodulated background, though hiss levels were low. Tonally it was 'open', but transients appeared lifeless, and the bass dry and lacking in definition. The stereo presentation was satisfactory but showed depth compression.

AM performance was tidy — very bandlimited but of satisfactory clarity.

Lab results

The 440 proved very sensitive with satisfactory signal to noise ratios. However, the 3 μ V muting 180

threshold was too low for good stereo reception. Selectivity was high and the multiplex harmonics were excellently suppressed. Distortion was low, in fact much better than the specification while the channel separation results were also good. The clean IF performance was shown by the very good results for the AM suppression as well as for capture ratio.

Conclusion

This tuner had an excellent RF performance, complemented by fine measured data on the audio side, and so as a radio receiver it has done its job well. However, its audio fidelity was considered to be below average and unfortunately this alone precludes any recommendation.

GENERAL DATA

	Tuner
Sensitivity for 50dB signal-to-noise	
Mono/stereo.....	2 1 μ V/25 μ V
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo.....	69dB/66dB
Muting threshold	3 μ V
Alternate channel selectivity	70dB
Pilot tone rejection , 19kHz/38kHz.....	83dB/>95dB
AM rejection.....	70dB
Capture ratio	10dB
Total harmonic distortion	
at 100% mod, 1kHz mono/stereo.....	-67dB/-63dB
Stereo separation , 1kHz/5kHz/10kHz.....	55dB/47dB/42dB
Output level , 100% mod.....	170mV to 1,350mV variable
Channel balance	0.12dB
Dimensions (width, depth, height).....	42 x 25 x 11cm
Typical price inc VAT.....	£190

Quad FM4

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 70 μ V 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.

GENERAL DATA

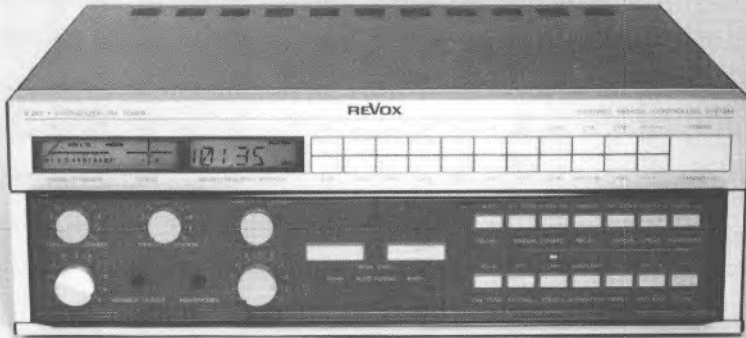
Tuner

Sensitivity for 50dB signal-to-noise	
Mono/stereo	7 μ V/70 μ V
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	70dB/66dB
Muting threshold	
Alternate channel selectivity	-49dB
Pilot tone 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

RECOMMENDED

Revox B261

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



This is a remarkable FM tuner, closer to a professional rather than a domestic receiver in terms of build quality. For FM only, it has a host of facilities ranging from auto aerial rotation to twin volume-adjustable headphone sockets. Digitally synthesised, the tuner has space for 20 preset stations whose names may be entered on a keyboard and displayed on selection. The signal-strength meter is highly accurate and all its many facilities worked well including the variable muting threshold and variable stereo threshold. Infra-red remote control is possible, and this model is also compatible with the new line of Revox electronics. Variable and fixed output level phono sockets are provided, while the aerial input is 75ohm coaxial (male). A DIN audio socket is also included.

Sound quality

This tuner was superbly engineered, and felt 'right' when setting up for the auditioning. It proved to be sensitive, with good quieting by 50 μ V and almost silent at 500 μ V 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 1.6 μ V with our 50dB stereo (1kHz ref CCIR/ARM) figure sustained at a good 45 μ V. 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	4 μ V/45 μ V
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-D99XL

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

BEST BUY



This slimline compact model is an upmarket design with a comprehensive specification. A quartz locked synthesiser model, it offers FM coverage as well as AM medium wave, with 8 auto-tuned preset station positions on each band. Details include a record calibration tone at -6dB on peak level, plus a local/normal switch for front end sensitivity and a normal/narrow IF switch to aid separation of closely spaced stations. There is also a noise suppressor for weak stereo stations. At the rear, a Japanese-style coaxial connector is fitted using a special plug which has to be made up. 300 ohm FM connection is via binding posts and these also serve for the AM loop antenna.

Sound quality

Scoring very well on the listening tests, the '99 produced just slight background whistles, which had cleared by the $200\mu\text{V}$ input level, and from $500\mu\text{V}$ upwards the stereo output was very quiet. It presented a close copy of the original source, although the merest dulling of transients was noted. Otherwise the sound — stereo, depth, and tonal neutrality — all met high standards. High level RF blocking was cleared via the 'local' switch.

The AM sound was thought unpleasant with a notable hardness and ringing sound. Here it rated below average.

Lab results

The '99X acquitted itself well in the lab tests. The RF performance was fine with very good sensitivity, a sensible muting threshold and excellent AM suppression as well as capture

ratio. Selectivity was satisfactory in 'normal' and very good in 'narrow' IF mode. Signal to noise ratios were up with the best, while harmonic distortions held to a fine 0.1%, -60dB , in all conditions. Channel suppression was very good in normal mode and was still more than satisfactory in 'narrow'; for this tuner 'narrow' mode operation was no hardship. Output level was healthy, balance very good with the frequency response respectably flat.

Conclusion

With a front rank sound quality and a very strong RF performance, this is clearly a fine tuner design. Suited, with the 'local' switch, to both fringe and high strength locations, a versatile performance is offered, and if the AM section is not considered important, it could fit the bill nicely. The '99X represents very good value in its price sector, and qualifies for a Best Buy rating.

GENERAL DATA

Tuner

Sensitivity for 50dB signal-to-noise	
Mono/stereo	$2.5\mu\text{V}/25\mu\text{V}$
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	
Mono/stereo	76dB/71dB
Muting threshold	40 μV
Alternate channel selectivity	40dB/75dB
Pilot tone rejection, 19kHz/38kHz	71dB/93dB
AM rejection	68dB
Capture ratio	1.0B
Total harmonic distortion	
at 100% mod, 1kHz mono/stereo	$-60\text{dB}/-63$ (-60)dB
Stereo separation, 1kHz/5kHz/10kHz	.55/58/52dB (37/40/42)dB
Output level, 100% mod	825mV
Channel balance	0.15dB
Dimensions (width, depth, height)	43 x 26 x 5cm
Typical price inc VAT	£230
*Narrow IF bandwidth	

Sony ST-JX500

Sony UK Ltd, Sony House, South Street, Staines, Middlesex TW18 4PF
Tel Staines 61688



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

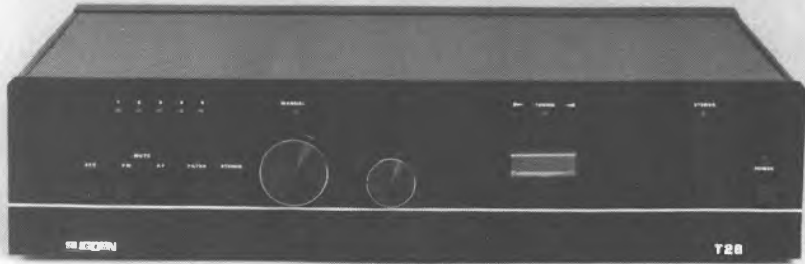
This was a sensitive tuner with good RF performance but let down by an unsatisfactory sound, the causes of which are not obvious from the measurements. No recommendation is possible here for this otherwise promising design.

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

Sugden T28

J E Sugden & Co Ltd, Valley Works, Station Lane, Heckmondwike, West Yorks WF16 0NF
Tel (0924) 404088



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 60 μ V 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 3.5 μ V. 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 ridiculously low at 2 μ V. 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	6 μ V/65 μ V
Ultimate signal-to-noise (CCIR/ARM)	
Mono/stereo	65dB/61dB
Muting threshold	2 μ V
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

RECOMMENDED

Technics ST-G7

Panasonic (UK) Ltd, 300-318 Bath Road, Slough, Berks
Tel (0753) 34522



Technics have long enjoyed a reputation for producing good tuners; the *ST-G7* reviewed here is a recently-introduced upmarket model whose comprehensive facilities include a socket for connection to a computer terminal.

A chunky-looking unit, it is finished in the traditional Technics dark bronze, and sports a backlit liquid crystal display like the *Revox*. It is a synthesiser design, and an array of push-buttons allow pre-selection of up to 16 stations from the FM and medium wave bands. A special 'gold' capacitor provides power for the preset station memories even if the unit is switched off for a week.

Automatic or manual switching for two IF bandwidths is possible affording optimised reception, and the display is also calibrated to read signal strengths in dB. Fine setting of AM and FM synthesised frequencies is possible while a recorder calibration output is also provided.

Sound quality

Highly rated on test, the stereo quality was well in hand by 400µV of signal strength, and the background was clear of whistles once perfectly in tune. Audio quality was considered to be close to the original source, with good dynamics. Good stereo, depth and focus as well as a wide neutral frequency range were also apparent.

However it sounded quite poor via AM with a muffled and laboured effect. Heavy coloration was also present and on the whole it was considered quite fatiguing to listen to.

Lab results

Our test methods differ in some respects from those used to specify the *G7*, and the results

are further complicated by a dual bandwidth IF. On 'wide', which gives best sound quality, sensitivity was normal while signal to noise ratios were also very good. (CCIR ARM 1kHz.) Alternate channel selectivity was satisfactory in 'wide', and good in 'narrow'. Multiplex tone rejection was excellent — no trace of it could be found! AM rejection was also excellent together with a fine capture ratio.

Harmonic distortion, while excellent in mono degraded to 'satisfactory' in stereo, which was a pity. Channel separation was very good in 'wide' but rather worse in the narrow IF mode.

Conclusion

In the optimum 'wide' mode the audio performance was very good, with the RF parameters a little less so. 'Narrow' will allow reception in difficult conditions but is a compromise nonetheless. The overall sound quality was much liked, and if viewed together with its features and major test results, indicates a value level that is sufficient for a recommendation even at this high price.

GENERAL DATA

Tuner

Sensitivity for 50dB signal-to-noise	5µV/50µV
Mono/stereo	77dB/70dB
Ultimate signal-to-noise (CCIR/ARM, 1kHz ref)	8µV
Mono/stereo	47dB/72dB
Muting threshold	>90dB/90dB
Alternate channel selectivity	>70dB
Pilot tone rejection , 19kHz/38kHz	1.5dB
AM rejection	
Capture ratio	
Total harmonic distortion	
at 100% mod, 1kHz mono/stereo	-70dB/ -55 (-34*dB)
Stereo separation , 1kHz/5kHz/10kHz	53 (20*dB)
	45 (16*dB/36dB)
Output level , 100% mod	675mV
Channel balance	0.7dB
Dimensions (width, depth, height)	43 x 28 x 10cm
Typical price inc VAT	£350

*Narrow IF bandwidth

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-

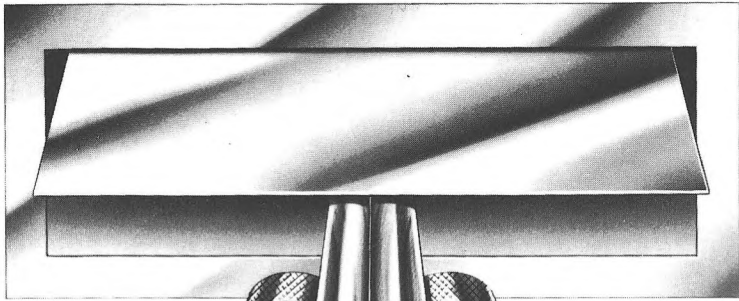
noise ratio (1kHz ref, CCIR/ARM). Ultimate quieting in stereo was 66dB at around 1-2mV input, a reasonably good result. The RF performance was surprising with a selectivity of 79dB making it suitable for crowded station areas. AM rejection and capture ratio were pretty good, and pilot tone suppression 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

BEST BUYS

Out of the 20 or so models covered, the following are regarded as offering exceptional value coupled with a substantially good performance.

Pioneer TX301 (£85)

This surprisingly competent tuner offered a good all round performance with up to 16 programmable stations and a FM, MW and LW coverage.

Luxman T210L (£105)

With its recommendation continued from the last edition, this tuner offered good sensitivity with a fine all round performance.

Harman Kardon TU610 (£130)

A continued listing from the last issue, this manually tuned model gave good sound on FM and MW AM, and also worked well on weaker signals.

NAD 4020B (£125)

Another digital tuner, this model represents a classic design with a fine modern performance and a competitive sound quality. Fine value.

Sansui TUD99X (£230)

This top performing tuner set records for both measured performance and sound quality for the price. It will be hard for many to justify spending more than this.

RECOMMENDATIONS

The following models are recommended on the basis of good value with the accent on improved performance in the case of the more costly models. Sound quality improves with price only up to a certain point but performance as a selective receiver continues to get better as cost increases.

Technics ST-G7 (£350)

A luxury tuner at a comparatively competitive price, the general performance and particularly the sound quality of this well equipped performer ensured recommendation.

Denon TU-710 (£90)

A pleasant sounding three-waveband tuner, this offered a classic non digital approach. The overall performance was well balanced and it represented good value.

Fisher FM-275 (£130)

Once a decently high aerial signal was presented to it, good sound was possible on FM. The AM was weaker than average though with strong coloration. Still represents fair value.

Denon TU-750 (£150)

Brought forward from last year, this digital Denon offered a pleasant sound free from

background 'birdies', while the AM sound was definitely above average.

Sugden T28 (£170)

Somewhat improved for the new edition, the *T28* gets a recommendation on sound quality grounds even though it is FM only and both appearance and operation leave something to be desired.

Hitachi FT-5500 (£160)

This well established tuner scored on its excellent radio performance coupled with its basically good audio quality.

Pioneer F90 (£220)

Brought forward from the last edition, this digital tuner offered an excellent RF performance suited to a wide range of reception conditions.

Quad FM4 (£240)

An ergonomic delight, this FM-only model is the epitome of clean design. With a very competent all round performance and a pleasing sound, this classic has a continuing recommendation.

Revox B261 (£897)

A flagship tuner, this versatile model had a wealth of facilities including auto aerial rotation. For the serious FM radio enthusiast the RF performance was also excellent while the audio was pretty good as well.

Reception conditions

When choosing a tuner, you must consider its ability to deal with prevailing reception conditions as well as its actual audio quality.

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. The *Hitachi 5500* and *Sansui 99X* were also good on weaker signals.

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, if still available, the *JVC TX22L* which did well in the last issue.

With some of the newer recommendations in this issue one can have one's cake and eat it! Several low cost models, such as the *Denon 710* and *Pioneer 301*, proved to be both sensitive and offer a good sound quality.

GLOSSARY

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 of 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 onomatopoeic; caused by interference of mains frequency or harmonics (50Hz etc in UK), perhaps as a result

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.

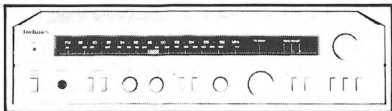
Watt (W): A measure of electrical power, combining the voltage (amplitude) with the current required to drive the 'motor' of a loudspeaker.

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*).

EASTWOOD

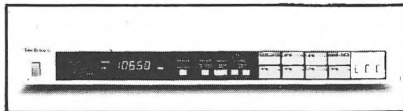
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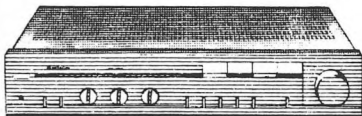


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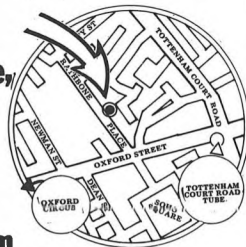
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