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This book follows the format we have developed over the years in the *Choice* series, so regular readers should have no difficulty in finding their way around; for the newcomer, the book is divided up for convenience into a number of sections. First is a short *Editorial Introduction*, which is an opportunity to explain the reasons behind some of the decisions made concerning the project as a whole, and also make a few excuses for the products that have been left out!

The *Consumer's Introduction* is an attempt to discuss many of the different aspects of amplifiers and their performance in non-technical language that is as jargon-free as possible. The first section examines the evolution of the amplifier over the years, which gives an interesting perspective on today's designs. The second section examines the role of the amplifier itself in rather more detail, discussing the necessities and the 'frills', the matching and the design requirements. The third section discusses the review procedure itself, explaining what we have done and why we have done it; the various technical parameters found in the reviews themselves are explained (albeit less than rigorously), and some of their implications examined. The fourth section suggests the criteria a would-be purchaser should bear in mind when considering buying an amp, together with a few words of advice on what not to do when he has bought it! The *Technical Introduction*, freed from constraints of avoiding technicalities, explains in some detail the test procedures adopted and their rationale.

The *Reviews* themselves provide a straightforward written description of the various amplifiers, conveniently grouped under subheadings which discuss the design itself, its lab performance, the results of our listening tests, and a general summing-up. Each report is accompanied by selected data from our tests to enable the product's compatibility with other components to be established, and the basis of our judgements to be examined.

The *Conclusions* looks in retrospect at the overall findings of the project, discussing such trends as may have been established, while the *Best Buys and Recommendations* highlights those products that have performed particularly well, both in absolute terms, but specifically in relation to their price.

The *Overall Comparison Chart* is another summary section, which presents a selection of the data obtained for each amplifier in tabular form, to enable the would-be purchaser to easily short-list models that best meet his or her specific requirements.

We should point out that there are dangers in ignoring the detailed parts of the book and merely relying upon the summaries. If we felt that some sections of the book were unnecessary, we wouldn't have gone to the trouble and expense of writing and publishing them! A summary always leaves a lot unsaid, and if relied upon can be misleading. They are published because they are a useful way of presenting our findings accessibly, but amplifier reviewing does not readily lend itself to the 'pithy one-word characterisation', and the summaries should not be regarded as substitutes for the reviews themselves.

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Editorial introduction

This book represents something of a departure from our established procedure, being the product of collaboration between myself, as a 'word-spinner', and David Watson, whose name will be unfamiliar to readers of hi-fi journals, but whose experience, enthusiasm and technical expertise, gained on the retail side of the business, makes him particularly well qualified to carry out the laboratory work. The motive behind this approach was not the personal aggrandisement of a frustrated editor, I would hasten to add, but rather the awareness that in some respects this is an impossible book to write! Amplifier design is currently in a state of great controversy, with considerable disagreement amongst designers and 'experts', even over such basics as whether amps sound different from one another, let alone whether the differences are important! There is little point in carrying out an expensive detailed survey of this type if amps don't sound different, so for this reason alone it would have been futile to employ a consultant with such views!

On the premise that two heads are better than one, and with both of us convinced of the importance of amplifier sound quality, we decided that such a joint project had advantages that outweighed its unorthodoxy, and that David Watson's involvement with retailing conferred additional benefits in appreciating things from the customer's point of view. Even though we believe that there are important differences between amplifiers, it is quite another matter to prove it, so throughout we have been deliberately cautious in ascribing cause and effect or in claiming undue authority or reliability for our sound quality assessments. We have done our best to produce a book which contains useful advice, but the controversies within the industry demand that the findings are not ascribed an authority they do not warrant. By admitting we do not have all the answers, we hope this will encourage readers to demand high quality demonstrations to make up their own minds which equipment suits them best; we feel that our reviews are valuable in helping one to compile a shortlist, but should not take the place of the listener's ears for the final decision.

One drawback to using someone involved in retail is that they could be accused of bias when reviewing the products which they actually sell! For this reason we decided as a matter of policy to exclude amplifiers from Naim Audio and the Edinburgh Wireless Company, as Russ Andrews High Fidelity heavily promote the former and actually 'invented' the latter brand name. While we were loath to exclude any models, and indeed several manufacturers also expressed their regret over this decision, we feel sure that this was the right move and effectively forestalls any criticism of bias.

Sadly these were not the only names unrepresented. Such is the rate of obsolescence and replacement these days that at any particular time of the year something like one third of the manufacturers will be about to make major model changes. In some cases we have managed to make special arrangements to include early samples, but inevitably some products were not available in time, and there was little point in testing models on the point of obsolescence. Furthermore the communications chaos that afflicted the country at the turn of the year also played its part in making life difficult. Notable absentees for these reasons include Rogers, Alba, Toshiba, Trio, Sanyo, Yamaha, and the Hitachi 'popular' models.

Despite these unfortunate omissions we have managed to assemble a wide-ranging selection of models, chosen primarily on the basis of their availability in the marketplace, but also in an attempt to represent all major manufacturers. One criterion that we were forced to adopt to avoid introducing terrible complications was to deal only with integrated amps or pre- and power combinations; while there has been a resurgence of interest in valve amps in recent years, at the time we were gathering our models together few existed as combinations, and no such systems are therefore included. We do not regard the *Choice* format as a battleground for exotic products, and have deliberately tried to restrict our selection to models in the popular price ranges, making one or two exceptions because of unusual technical interest and to help provide a yardstick by which to assess the cheaper products. (While five Sony models may appear to give that *marque* sufficient representation, the additional inclusion of the *88* digital combo was irresistible, and its comparison with the conventional but similar *86* proved fascinating.)

Paul Messenger

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THE DEVELOPMENT OF THE AMPLIFIER

Taking a historical perspective can help to give a few insights on the way things are today, particularly when change has been as rapid and as sweeping as it has been in hi-fi over the past thirty or so years. In fact, if one were to step back thirty years, the current hi-fi user would be baffled and bewildered by the resources at his disposal, as neither the microgroove (LP) record, FM radio, nor tape recorder were domestically established. What sources were available were strictly mono, but naturally required the services of an amp and loudspeaker to make themselves heard. Hi-fi in those days was very much a technical hobby, frequently appealing to the same sort of person as did amateur radio. And with no real shops as such, the chances were that apparatus was almost entirely home-built from components that were readily available from the government surplus stores that gathered in areas like Tottenham Court Road, for example.

As often as not, the most famous designs of this period were just that: printed details of circuit configurations that originated from the valve manufacturers or legendary designers such as D.N.T. Williamson. One first collected together the components and then settled down to assemble the design oneself; indeed, since much of the 'art' in valve amplifier design was vested in the construction of the output transformers, the transformer manufacturers were probably better known than those who assembled complete amplifiers. The finished units tended to be extremely heavy and bulky, and were therefore usually left in their constituent parts rather than 'integrated', so one would frequently find separate chassis for pre-amp, power amp and power supply sections; as the pre-amp is the only part to which one normally requires access, this enabled the bulkier parts to be mounted out of sight and mind in a convenient cupboard. Neither should it be forgotten that they used hot and glowing valves and in their normal form would have generated apoplexy amongst the institutions that now impose a rule of iron over safety standards!

So, in those early days we had very much a hobbyist market, with much of the apparatus home-constructed by people with a fair amount of technical knowledge, who were also prepared to accept or impose standards of domestic acceptability that would be unthinkable in the majority of homes. Even though the amps were comparatively low-powered and mono only, they were big, cumbersome and very heavy, requiring careful housing because of the plentiful heat produced, while the high temperatures and attendant heating and cooling reduced component life and reliability. Over the years size was gradually reduced as advances were made in transformer and circuit design, but the advent of stereo in the 'fifties was a major setback to the 'domestication' of the amplifier, because most of the circuitry and components needed to be doubled up. By this time most designs consisted of two units: the power amplifier/power supply, and the pre-amp, the latter drawing its power via an 'umbilical cord' from the main power amp.There was little point in doubling up on everything for stereo, unless one was already adding to an existing system, so the normal practice became either to control two mono power amps from a single stereo pre-amp, or alternatively use a stereo power amp so that both channels could share a common power supply for economy. Keeping pre- and power amps separate remained *de rigeur* for the 'serious' enthusiast, as indeed it does today, but at the popular end of the market there was a move towards total integration, which was made possible, by smaller transformers, modest power outputs, and improved circuit efficiency, though not without some compromises or design difficulties.

So about twenty years ago the amplifier still used valves, but had succeeded in becoming sufficiently compact that a stereo version would typically occupy less space than the mono one of a decade earler. The market as a whole had grown considerably particularly with the improvements in discs and the then recent introduction of FM radio, so that the manufactured product exceeded the home-constructed type in importance. One aspect in the development of hi-fi that receives little attention is the fact that until very recently the industry carried little commercial 'clout', and was not important enough to warrant the high cost of developing, for example, purpose designed electronic components. Most of the devices used were the crumbs from the table of larger electronics concerns, such as radio, military, or telecommunications. These would be adapted by the ingenuity of the designers to hi-fi use, but longterm developments naturally remained dependent on the opportunities offered by the available devices. When the transistor was invented in 1948, it was in no way suitable for analogue or digital audio use, being fundamentally

no more than a convenient electronic switch. However, switches are of great importance to the electronic industry as a whole, and its potential reliability and longevity, simplicity of mass production and low voltage operation, were sufficient to divert the major research resources of the industry away from thermionics (valves). Indeed at the end of the 'forties prototypes existed of a low voltage 'cold' valve that may have heralded a whole new generation of thermionics, with probably far reaching effects for audio, had not the transistor appeared at about the same time and usurped the development money.

It was the mid sixties before the transistor really became a force to be reckoned with in the hi-fi market; fifteen years on it is still scorned by many die-hard enthusiasts! It is probably true that the early transistor amps were introduced rather prematurely and did not offer the sound quality of a similar valve amp; by the end of the 'sixties they were beginning to come of age and by the mid 'seventies had achieved a maturity that at least places them on an even footing with valves, while offering a lot of other advantages besides. The early transistor amps achieved a degree of commercial success far beyond that which their audio potential deserved, primarily because of inbuilt advantages that soon made them cheaper as well as domestically more acceptable.

First and foremost the transistor amp runs comparatively cool, so the extremes of temperature which the valve shares with the light bulb, and which reduces its working life compared to the transistor or fluorescent tube were absent. While assisting reliability, this also allows greater flexibility in siting the amp which is very useful in a family situation. Secondly the transistor amp is more compact and cheaper to make than the equivalent valve amp, particularly when comparing power for power, mainly because the output transformers are no longer necessary. Consequently the Leak *Stereo 30* transistorised integrated amp was very little larger than Leak's valve stereo pre-amp that was manufactured at the same time and which needed to be used with bulky power amps, while the Quad *303*, a 45 watt per channel stereo transistorised power amp was similar in size and lighter than each of the two 15 watt mono power amps it replaced. Thirdly, the transistor amp arrived about the same time that the low-output magnetic cartridge had established a firm foothold, and by the mid 'sixties the transistor amplifier caused less hum and noise problems with these devices than did the valve equivalent. Finally, the transistor was not subject to the gradual ageing process that always plagued the valve designs, and by and large would not change its performance over a period of time.

While both manufacturers and customers rushed headlong into the transistor age, the unkind might suggest this was largely a case of the deaf leading the deaf. Although it was possible to 'prove' the superiority of the transistor amp on paper, many designers had obviously overlooked a number of the implications of the sweeping changes they were making whilst embracing this whole new way of doing things; after all the valve amplifier was the result of decades of careful painstaking development, so it was perhaps inevitable that the new technology would have its teething problems. It must nevertheless remain something of a tribute to the persuasiveness of marketing techniques that transistors became established so quickly and with such little fuss — we were after all basking in the 'white heat of technological revolution' around that time, and had already finished 'never having had it so good'.

This is not intended as a panagraeic against transistors, as I am a happy user of transistor power myself, while quite freely admitting that certain valve designs remain high on my list of personal favourites. It is intended to illustrate the unfortunate way that fashion and attendant commercial pressures tend to dominate the hi-fi markets, and can work against rather than in favour of the consumer. It is an interesting fact that on the whole the 'breakthrough' in technology usually acts *against* the best interests of the user first time around, because many of the attendant problems are only partly overcome; the second and third generation usually turns out to be a far safer bet, particularly as the reduction in fashion status usually also results in a lower price! Undoubtedly one of the reasons that the transistor gained its foothold so quickly was that it appeared to offer superior power at reduced price. This it did under test bench conditions, but it was many years before it became accepted that the 'real' conditions of music signal and loudspeaker drive gave the valve amp certain compensatory advantages, particularly when driving near the overload limit, and that the transistor amp probably needed to be twice the power of its valve

equivalent in lab terms to avoid running into its potentially rather nastier overload problems.

Even though some diehard enthusiasts might disagree, from the point of view of mass market audio the transistor amp was a godsend, and even though the initial steps may have been a little faltering, the end result has been to spread hi-fi to a far wider audience at reduced cost. There is no doubt that even if a big manufacturer was to mass produce valve designs in large quantities today there would be a significant cost penalty of at least 50% compared to an 'equivalent' transistor model.

The amplifier receives a rival

At around the time that the integrated transistor amp was gaining a foothold, another form of integrated unit known as a receiver was also starting to appear in the UK, effectively combining an integrated amp with a tuner. This combination has gone from strength to strength commercially, because of its benefits in extra compactness and a saving of about 20% over equivalent separate tuner and amplifier combinations (costs saved on power supply, transport and case etc), despite some penalty in flexibility. The decision to go for a receiver instead of an amplifier will depend largely on how important radio is as a signal source, and this in turn may well depend on the area in which the purchaser lives: the shot in the arm of the receiver market generated by the introduction of stereo radio in the late sixties must have to some extent been dissipated by the current poor financial situation at the BBC where radio has obviously been forced to play second fiddle to TV, and in my opinion some parts of the country hardly receive programming quality sufficient to justify more than a transistor radio.

In terms of flexibility the receiver has certain limitations. First if one decides to try and improve either amp or tuner, it is necessary to change both at once. Secondly one has no control over the proportions in which the money has been spent; this equation has already been handled by the manufacturer. So if you decide you want a really powerful or high quality amplifier section, it is invariably necessary to purchase a 'state-of-the-art' tuner section to go with it, and if this is not desired the receiver may prove a false economy. Finally, while it is true that one or two specialist receiver manufacturers produce machines with amplifiers that stand up to the better separate combinations, the manufacturer who operates in both markets normally pays rather greater attention to the amplifier in his separates range than in his receiver range — not a hard and fast rule, but a general indication of attitudes and priorities. Although there is very little apparent justification, receivers do tend to get tainted by the 'jack of all trades, master of none' syndrome that, taken to its logical conclusion, makes such a mess out of music centres.

So we arrive at the beginning of the current decade with hi-fi sales booming like never before (or since!) almost total transistorisation, a handful of separate pre- and power amp combinations and rather more integrated designs available, plus of course a burgeoning of receivers. The quality of the actual electronic devices continued to improve and/or get cheaper, but most of the changes that were taking place were more at the dictates of fashion and marketing than any particular desire to improve the breed. In the early part of the decade, with a strong home market, domestic manufacturers introduced a number of imaginative and refined designs which continued to stress compactness, but the market as a whole seemed to equate size with potency, and increasing compactness beyond a certain point gave rise to diminishing returns. The first major trend, inspired by the steadily increasing numbers of imported products, was to make the preamplifier section (controls etc) more and more complicated. Around the same time loudspeakers were tending to become less efficient, and required increased amplifier power, so something of a power race also began.

The major market expansion occurred in the first part of the decade, and this created a favourable climate for increased imports from Japan, which then still experienced very favourable trading conditions, due in part to their exchange and labour rates. Most of the UK companies in the hi-fi market were still comparatively small, specialising in hi-fi, while the larger UK electronics companies which were active in the radio and TV markets seemed curiously reluctant to take the hi-fi market seriously. So with one or two exceptions (Goodmans/Thorn, Leak/Rank) there was little spare production capacity amongst the existing manufacturers to cope with a big increase in demand. The Japanese electronics industry, already large from its international transistor radio successes, had found that their domestic consumer was an avid purchaser of hi-fi equipment; the reasons for the Japanese home market strength have never

been fully explained, although the difficulties in aspiring to home ownership must assist in fuelling the consumer economy. Whatever the reasons, the Japanese home market is estimated to be a similar size to the US market or the whole of Western Europe, so naturally the scale of operations and ability to respond quickly to specific local changes in demand anywhere in the world is enormous.

So it is easy to see how the Japanese made strong inroads into the UK market in the early seventies; less perhaps on the basis of technical or sound superiority than due to a reputation for excellent reliability and marketing professionalism that was guaranteed to appeal to the less technical hi-fi dealer who was appearing. It is not as immediately apparent why they have now achieved such a dominant position at the expense of many UK manufacturers, until one recalls a characteristically crass piece of tax legislation perpetrated by Chancellor Healey in the mid seventies, as a deflationary measure in the middle of a consumer boom. The decision to raise the VAT rate on luxury goods, including electronics, to 25% was probably necessary; the decision to announce the measures and then allow a one month period of grace before they came into effect was a piece of fiscal lunacy from which the market has never really recovered. During the month's 'period of grace' it is estimated that approximately twelve months of normal business was done by the harassed retailer. There was no way that the domestic manufacturers could hope to meet this twelvefold increase in demand, and some merely acquired a reputation for poor reliability that came home to roost later in attempting to do so. Instead retailers accepted money for goods that hadn't even left the Japanese factories, and most importers emptied their European warehouses (one bringing in goods at the rate of three containers a day.) So this extraordinary means of tax increase pre-empted the best part of a year's business, and it is hardly surprising that the slump which followed almost wiped out the home market, sending many retailers to the wall and killing off several manufacturers who were insufficiently established in export markets to cushion the blow. While the importers themselves also suffered to some degree in the aftermath, the slump carried barely a ripple back to the giant Japanese manufacturing plants because for them it was both distant and isolated.

In the wake of this boom/slump the Japanese have asserted an even more dominant influence on the market. However, a number of healthy new small-scale home manufacturers have replaced those that disappeared, building upon a degree of fragmentation that has probably been the latest and current market trend. By this I mean that the market has split into different camps, with some consumers following the trend towards greater complexity that was established at the start of the seventies and which was to achieve its zenith in the quadrophonic *debâcle* of the mid-seventies (about which the least said the better), while others, perhaps in reaction against this overt consumerism, but also because it is increasingly accepted that the simpler the signal path the better the attainable quality, have opted to go the other way entirely, even to the exclusion of tone controls.

This trend towards simplicity is by no means just a British phenomenon, and similar trends exist in America and Japan. Neither does it appear to be short-lived, because the approach is now being reflected in the more 'exclusive' products from the major volume manufacturers.

So, coming right up to date, we have a market that at the same time offers enormous variety between its extremes, while also appearing almost regimentally conformist in the mass market sector (where sometimes the most obvious difference between products is the maker's name.) There has been a revival of interest in the valve amp, as a number of recently introduced amplifiers show, most are as yet only power amps and in any case have a rather specialist appeal, so we have not included them in this book. The resources of the Japanese majors and the sheer size of the market has finally ensured that companies are devoting money to fundamental research for hi-fi ends, and the fruits of this has been a number of new devices like Sony's and Yamaha's V-FETs, Hitachi's MOSFETS, and Trio and Matsushita's EBTs which will presumably be made available to other manufacturers in due course. It is also true to say that the market has never been more controversial, with some companies taking up the stance that there is no real difference between the majority of competently designed amplifiers apart from price, power and facilities, while others claim that the amp makes a vital contribution to the overall sound of a system. A more detailed discussion of these contrary positions will be found elsewhere in the book.

THE ROLE OF THE AMPLIFIER

There can be little doubt that the amplifier lies at the heart of the hi-fi system. Lose one of the other components and you probably still have a spare program source, or a single loudspeaker or headphones through which to listen. But lose the amp and the system is silent. The amplifier's job is quite simply to accept signals from a variety of different program sources, process them as required, and then amplify them sufficiently to drive loudspeakers. So far so good; this is fine as a basic definition, but as soon as one starts to try and define this in engineering terms, controversy begins. Before becoming enmeshed in this, let us look at the sort of things an amplifier is usually capable of doing, why it incorporates these facilities, and what sort of reasoning lies behind their inclusion or exclusion.

Every amplifier consists of three basic building blocks, namely the pre-amp, power amp and powersupply, which are normally combined together in the same box to make up an integrated amplifier. Some designs, either for technical or fashion reasons, separate these into separate boxes in various configurations, normally with power amps and supplies in one section and the pre-amp in the other, although sometimes power amps and power supplies are further separated.

The pre-amp contains the various signal inputs and their switching circuitry, and required processing (eg pickup equalisation) or optional processing (eg tone controls), plus feed signals for tape recorders. Having converted the different input signals to a common and controllable one (eg volume, balance), this signal can then be passed to the power amp. The power amp's job is to multiply this signal to a sufficient level to drive the loudspeakers, and as a by-product headphones, to the required levels. The power supply or supplies are an integral part of the other components and perhaps should not be considered separately at all; their job is to supply the right amounts of electricity in the right places and at the right time.

The pre-amp:
The bare necessities

There are a number of basic functions that every pre-amp section should be capable of carrying out compentently. These include being able to accept and correctly process the signals from a variety of program sources, notably record player (ie cartridge), tuner, and tape recorder. It should also control the volume level and channel balance and provide a suitable signal to send to a tape recorder for recording a signal received on one of the other inputs. None of these functions are entirely without their problems.

The pickup cartridge input

The pickup input should be designed around the signals it receives from a cartridge, which until recently was almost invariably a moving magnet design with a typical output level of 1 mV/cm/sec, responding to the disc modulations in a velocity sensing manner. Understanding those last two technicalities is not really necessary; their implication is that most cartridges produced a similar output from the same record, and that it is necessary to process this output by changing its relative level at different frequencies, because of the way the disc cutting is pre-emphasised to get the information on in the first place (If this equalisation process was not carried out, the sound would be all top, treble, and tizz, with no bass.) Happily a 'standard' weighting curve exists for this transformation, known as the RIAA equalisation curve, although matters are somewhat in the air at the moment owing to debate over whether to rolloff the extreme bass frequencies or leave them 'flat' as hitherto.

Will the coil catch on?

One fly in the ointment of the disc input has been the recent increase in popularity of the moving-coil cartridge, which is likely to produce a lot lower voltage output than the moving magnet type, and consequently needs special treatment. (There are a number of 'high output' m-c cartridges about, and these should work normally, but the majority need about 20dB extra boost.) Most manufacturers/importers of m-c cartridges supply step-up devices (transformers and head amps) to match them to the normal amplifier input, but these tend to cost at least £50, which is something of a deterrent. This high final price is caused by the fact that head-amps need to be self-contained 'mini amplifiers', with their own case and power supply (often batteries); to build the head amp into the amplifier in the first place, either as an optional extra or as an extra feature, costs very little indeed in manufacturing terms, and is increasingly being found amongst the more expensive and 'sound

quality oriented' models, including a number evaluated in this book. Whether the obligation for providing moving-coil amplification is the responsibility of the amplifier or cartridge manufacturer must remain a moot point. But the very fact that it is much cheaper for one than the other, and that it was the amplifier manufacturer who took responsibility for the 'special circuitry' that was then necessary for the 'new' magnetic cartridges 20 years ago, suggests that the establishment of the m-c's popularity over the last few years places the obligation firmly on their shoulders, at least for products towards the expensive end of the market. It is a valid observation that the widespread inclusion of head-amplification will have the reciprocal effect of increading the popularity of the m-c cartridge, which will no longer be labouring under the marketing millstone of the step-up accessory.

This is not the end of the problems for the pickup input. The very 'nature of the beast' 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. But this introduces 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, *ie* infra- and ultrasonic. Until fairly recently, most moving magnet cartridges incorporated an automatic HF rolloff, due to an electrical filter caused by the resonant interaction of their internal inductance and resistance with the resistance and capacitance of the arm lead and pickup input. For a number of reasons including the flirtation with CD4 quadrophony and the desire to avoid 'messy' compatibility problems, the emergence of low inductance cartridge types came about, including by their very nature the moving-coil types, leaving the ultrasonic band with its tip-mass resonance 'wide open'. The significance of this remains the subject of disagreement among manufacturers and designers, although I have heard of claims that spurious signals at 160kHz of a much higher level than expected have been measured, which if substantiated may cause some concern.

This clearly illustrates that the pickup 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 could therefore 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, as we felt it was most likely to show up reliable differences in sound quality of relevance to the user.

The tape input/output

The tape recorder must be connected to the amplifier so that it can replay tapes via the system, but also so that it can record any of the signals being processed by the amplifier from other inputs, such as tuner or disc. The situation is made rather tricky by the fact that there are two international standards which are not really compatible with one another operating, one based on the German DIN standard and used by most European manufacturers, while the other uses the so-called 'phono' plug and socket and has been adopted by the American and Japanese manufacturers. Both systems have advantages and disadvantages, and there is little likelihood of problems when sticking to one system or the other. However the fact of the matter is that there are very few cassette recorders using the DIN standard compared to the 'phono-oriented' Japanese models in the marketplace, and in many Japanese machines the DIN socket tends to be something of an afterthought.

However the DIN socket does have some advantages over the phono in terms of its engineering, convenience and compactness, so some manufacturers use the DIN connector for its benefits, but accepting the reality of the marketplace use it wired compatibly to phono level standards. While some might condemn this practice on the grounds that standards are set to be kept, I feel this criticism is unfair because such decisions have been made in order to respond to general market compatibility without making unwanted engineering compromises. Nevertheless this does make it extremely difficult to quote glib rules concerning absolute compatibility between types of connector, and the reader is advised to consult the individual reviews in this and the companion volumes, or rely on the

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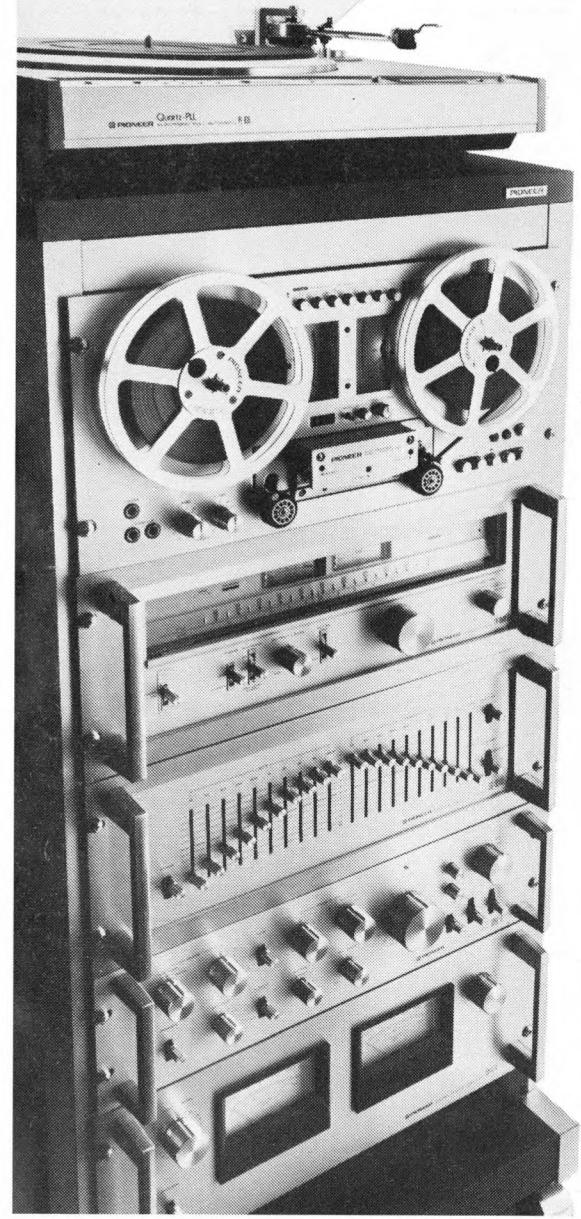

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integrity and guarantee of a good dealer, to ensure prospective purchases match each other properly. As most available tape machines are best used via phono sockets, and most amplifiers are equipped with phono sockets or DINs masquerading as phonos, the following basic matching rules may prove useful: for 'phono' standards, signals prefer to travel from one impedance to a similar or larger impedance (up to say 100X), while the sensitivity of an input should be similar or somewhat less than the output level that it is being fed, though this output level must never exceed the input's clipping point (which proved to be greater than 10 volts for all but one amp tested, which is more than adequate). The overall rule must be to use phono-to-phono or DIN-to-DIN except where the DIN is a 'disguised phono' (see reviews, comparison chart). Fortunately there is usually sufficient leeway built into both tape machines and amplifiers by virtue of their various gain controls that practical problems are rarely encountered.

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-the-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 independantly between this 'source' and the tape inputs. 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 while the recording is actually taking place, in time to take remedial action in case of trouble.

More complex facilities for tape deck connection will be described later in the consumer introduction.

Other essential inputs

In addition to providing for disc and tape connection, a tuner input is an essential. In fact this is normally the same as the tape replay sockets, because the signal from a tuner is typically the same as that from a tape recorder (although of course no signal need be sent from the amplifier.) Most amplifiers include more than one socket of this type, to facilitate connection of such devices as television audio tuners and transistor radios (to cover wavebands not provided on the system tuner.)

The Volume control

The most important control on the pre amplifier adjusts the volume level, so it is ergonomically desirable that it is easily accessible and readily identifiable. It is also important that the volume can be adjusted over a very wide range, without significant shifts in channel balance. A curious myth seems to have spread amongst those who normally have little to do with hi-fi, to the effect that the power of an amplifier is in some way related to how far round the scale the volume control needs to be for normal listening levels; I have even encountered people who have criticised an amplifier for needing to have the volume control above halfway! If an amplifier has already reached the point of delivering full power from a typical signal when the volume control is only halfway, increasing it will only drive the system into distortion, and therefore the second half of its travel is entirely wasted; the usable part of the range becomes unnecessarily cramped, and a small movement results in an undesirably large jump.

The ideal volume control should cover a range of at least 60dB evenly, so that similar sized rotational steps result in similar sized changes in volume. Many of the potentiometers used for audio volume controls can manage fine at the higher volumes, but are frequently too sensitive at the lower levels, so that a slight movement gives too large a change for accurate setting; moreover this can give problems in maintaining accurate channel balance at these low levels. It has become fashionable recently to use volume controls which mimic the action of professionally used 'attenuators', so that their action consists of a series of steps; this often makes problems of low level volume setting rather worse.

The professional attenuators which inspired this fashion do not in fact use potentiometers (ie sliding variable resistances, or rheostats) at all; instead the control comprises a multiple-position rotary switch with many individual resistors wired to provide the relevant degree of accurately specified attenuation at the different switch positions (the calibration aspect being of some importance under certain professional applications.) Some years ago a few of the more esoteric and expensive pre-amps started to

use switched attenuators of this type, and this gave a cachet of 'exclusivity' that undoubtedly assisted sales; actual performance benefits were probably marginal, although channel balance tracking was improved.

Whatever the advantages or disadvantages, the switch-action volume control became the latest fad, held back only by its very high cost compared to a simple potentiometer type. So with admirable cynicism some of the Japanese component manufacturers introduced ranges of 'detent-action' potentiometers, which added a pseudo-switching action to the conventional 'pot', thereby satisfying the fad and creating the worst of both worlds, but without the cost penalty. When fitted to a cheap pot, the detent-action usually merely ensures that the possible adjustment steps at low levels are even further apart than they would be otherwise.

Incidentally the only real 'hard-wired' attenuator that I am aware of on the UK market is that fitted to the exclusive and expensive Mission *771* pre-amp, which was not available in time for this project. However a number of the more expensive Japanese models and the Spendor *D40* use full attenuators based on wafers with discrete printed resistors which amounts to much the same thing. One clever compromise is adopted by Sony on the *TAF6B,* which has a calibrated detent action at the top of the range supplemented by a continuously variable section at the low end. In general I cannot see that any real benefit is gained by fitting a continuously variable pot with detent-action, unless perhaps accurate calibration is also provided (which it usually is not), and therefore this so-called 'desirable feature' will be accorded the cynicism it deserves.

One useful technique that is often used to extend the operating range of a potentiometer is to combine it with a switchable attenuator that offers one or two positions of muting or quieting, typically subtracting 20dB from the operating level. As well as helping to 'stretch' the low level area of control, this feature is quite handy when, for example, answering a telephone or addressing a spouse. The mute switch is therefore a useful part of a volume control, although its greatest benefit will be conferred when the volume potentiometer itself is a fairly cheap device; a really good full range type (necessarily expensive) renders it much less necessary.

The balance control

The final essential control is the balance control, which is I suppose the fundamental distinction between mono and stereo pre-amps. This is required to adjust the channel balance, that is the relative loudness of the two channels, which can be necessary for a number of reasons. In fact the balance control is not likely to be needed very often, but is important when it is needed. Its uses include compensating (more or less) for an off-centre stereo listening seat, or making some allowance for speakers which are not the same distance from the listener; compensating for a poor output match between the two channels of a stereo cartridge or two loudspeakers with slightly different sensitivities; compensating for volume control 'mistracking', ie channel balance shifts at different volume levels. Most balance controls are able to quieten completely one or other of the channels at their extremes of travel, which can be useful when checking for system faults or for correcting mistracking faults at extremely low levels. A great many balance controls are also fitted with a centre-indent knob, ie one that 'clicks' at the centre position; this is largely unnecessary unless the equipment is so sited or designed as to make visual identification difficult. (It could be argued that the balance control should be set by ear and should not be calibrated at all, as this can psychologically pressure the individual into using the centre position when it is inappropriate, but unless the pre-amp is sited near the listening seat, it can be difficult to set an uncalibrated control by ear alone.)

Other features and facilities:

'Mode' switching

The simple stereo/mono switch must count as the most useful of the 'inessentials'; and indeed some would regard it as essential, especially for playing old mono recordings, as it reduces the background noise level (especially low frequency 'rumble' effects) without sacrificing any of the music. Other frequently provided 'mode' switch positions include left and right channels alone, plus a 'reverse' position which swops left and right stereo channels — a convenience only really useful if the system has been wired up with the channels reversed somewhere in the chain. Most of these 'mode' switching positions can be useful in fault checking, but the more complex they become, the harder it can be to check for a specific fault, as the very complex combination can become confusing.

Other inputs/Outputs

In addition to those basic facilities mentioned in *The bare necessities,* and the power amp outputs that will be discussed in the power amp section, amplifier manufacturers frequently offer a number of other inputs and outputs to increase the versatility of their machinery. The value of these will depend very much on the complexity of the installation in which the amp is to be used. The switching for connecting tape recorders or extra inputs are available as accessories that can be added later if desired, so those who may be concerned about the future expansion of their system and hence the provision of amplifier inputs really have very little to worry about.

A few models include a front-mounted jack socket for connecting a microphone. The only real purpose appears to be to enable the user to play DJ at a party or on tape, and as this has little to do with hi-fi as we perceive it we have paid little attention to this facility. Those who wish to use mikes in conjunction with tape recording will find such a facility available on the tape deck; this can usually be switched to give output through amp and loudspeakers direct if required. The mike socket on an amplifier usually does offer a mono 'mixing' facility that the tape decks frequently do not (would-be DJs please note), but this by no means offers the versatility of mixing facilities required by the serious home recordist, which is better satisfied by the accessory mixer units that can be obtained.

The most confusing switching circuitry at first sight must be that employed to connect and cross-connect two tape recorders. And when one considers how few people are actually likely to own two tape recorders, let alone record ('dub') from one to the other or vice-versa, their widespread inclusion seems rather unnecessary. I suppose the real reason is that the addition of such a feature is quite cheap, but the extra five-position function when fully labelled sacrifices as much in ease-of-use as it gains in versatility. Some manufacturers provide one of the tape sockets on the front panel, so that one can easily connect a friend's tape recorder into the system without creating mayhem amongst your own wiring arrangements while groping about at the back of an amp. This would seem an admirably sensible arrangement, because there is no doubt that cassette tapes usually replay best on the machine on which they are recorded. So if a friend wishes to pillage your collection of rare non-copyright material (ahem), he'll probably get the best results by bringing his own recorder along for the evening. Under such circumstances the front-mounted socket and dubbing functions could be useful.

When one considers the significant loss in quality that occurs when making a tape dub, it is difficult to appreciate its place in a domestic hi-fi system, though I can well appreciate its value in a variety of professional applications. The most likely applications of dubbed tapes, for in-car or party use, seem little justification for the cost of a second tape deck, while the rudimentary switching offered does not permit the insertion of 'sound-shapers' in order to doctor up an originally poorly recorded tape.

Potentially rather more useful is a method of switching which allows the signal being sent to the recorder to be different from the one which is being replayed via the loudspeakers. This has parallels with the way a video recorder allows one to record a second channel while watching the first, and could be useful as a 'time-stretch' mechanism, enabling one to remain independent of the radio schedules while using the hi-fi as one pleases. One could therefore play records while entertaining and simultaneously capture a desired radio broadcast on tape, or monitor a long radio programme while using the hi-fi for record playing, and then find a desired extract at a later time without having to go through the whole programme (*ie* by using the fast winding and search capabilities of the recorder.) I imagine this facility would be quite attractive to those who build up a large library of recordings from the radio, although it is hardly an impossible feat to by-pass the amp and connect recorder and tuner directly to one another when the occasion demands! If one wished to listen to the radio while (probably illegally) recording discs, however, this switching arrangement would be essential.

The final input/output that is sometimes fitted to the more expensive integrated amplifiers is a 'break-point' between pre- and power amp sections. These usually comprise two sets of phono sockets, either physically and electrically connected by metal rods, or controlled via an adjacent switch. This allows the integrated amp to be regarded as a separate pre-/power combination in all but siting flexibility, with the advantage that certain accessories can be inserted between pre- and power amp stages if desired, although this is currently rarely done in UK. (If the sensitivities matched and the tuner incorporated a volume control, it might also permit the dual operation of a system recording

from disc while playing the tuner as mentioned in the last section.)

The items that might be inserted between the amp stages include graphic equalisers, which are very popular in the US but never seem to have captured the consumer's imagination (or ears?) in Britain; these highly sophisticated tone control circuits offer considerably greater flexibility than the rudimentary 'sound-shapers' fitted to the typical amplifier. Another device that has proved popular in the US but is very much in its infancy in the UK is the 'add-on' subwoofer system, which can be driven directly from the loudspeaker terminals, but in practice usually works better if it incorporates its own power amp, and this in turn requires pre-amp feed and usually some form of electronic crossover. The subwoofer incidentally is a loudspeaker designed to handle the extreme low frequencies; it can, it is usually claimed, be sited virtually anywhere – and therefore discretely – in the listening room, and enables small and therefore similarly unobtrusive loudspeakers to be used for the mid and high frequencies; at the time of writing the success of these systems has been fairly limited in the UK. One system approach that requires a pre-/power split, and which shows plenty of signs of gathering momentum in Britain, is the so-called 'active' speaker system, where each drive unit in the speaker system is driven directly from a power amplifier, the signal being split electronically into the required bands before being fed to the power amps; systems along these lines are currently being marketed successfully, albeit in small numbers, by a number of manufacturers, but are normally 'fixed' total systems. However the integrated amp with split facility could be used as part of such an arrangement by adding extra power amps and an electronic crossover.

The sound-shapers (tone and loudness controls, filters etc.)

One of the classic definitions for an amplifier is a 'straight wire with gain'; in my view it leaves a number of stones unturned, but nevertheless has a certain elegance as a concept. This means that the amplifier should merely produce a magnified version of the input signal, and otherwise leave it unchanged. In fact very few hi-fi users seem content to leave things as simple as that, and most seem to demand a number of special controls to interfere with the original sound balance created by the recording engineer. (Readers will have to excuse a certain air of disdain when discussing tone controls and the like; having lived happily without them for two years or more now, I remain fairly unconvinced of their benefits.)

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'. the various sound-shapers 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 distinctly different types of sound shaper, and these will be discussed separately; most have some potential for adversely affecting the signal, and for this reason a number of the more expensive amplifiers around are omitting them entirely or going to some lengths to ensure that they can be switched out of the signal path. The heart of the matter is that any circuit used to 'bend' the frequency response of an amplifier introduces an electrical resonance, and resonances are fundamentally undesirable things that should be avoided as far as possible, because they can cause 'ringing' and phase shifts. The counter-argument is that such circuits, and indeed resonances in general, are inevitably introduced by a variety of mechanisms at different parts of the recording/playback chain, so that one or two more are neither here nor there; but at the same time two wrongs rarely make a right, and I think it is not unfair to regard the avoidance of resonances in the audio band as something worthwhile *per se*.

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 offer slightly different modes of operation: the Quad *33* for example keeps the slope constant in the bass range while the control setting determines how much of the bass region is affected; a number of 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 number of manufacturers also offer a 'middle' or 'presence'

tone control that boosts or depresses the upper midband, usually to a fairly small degree.

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 graphic equaliser that enables complex tailoring to be accomplished. Even so many people regard the adverse effects of the multiple resonances introduced by this 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 worthwhile tone control compensation. Cartridges are best compensated by their pre-amp loading, as the tone control is again rather crude, and it is better to retune one resonance than introduce another. Cassette decks can also give a fairly flat response at modest cost provided they are aligned and adjusted correctly and are used with a properly matching tape. Basically the tone control is usually too crude an instrument to be of much value in correcting frequency response anomalies, and the steadily improving standards of commercial equipment renders it steadily less useful. Having said that, some compensation for the characteristic cartridge presence dip is possible with gentle and judicial use of treble lift plus some filtering, while some bass lift, particularly of the type offered on the aforementioned Quad *33*, can help augment the bass response of a small loudspeaker; but as before the value of the tone control must always be offset against its distortions.

The final application of the tone control is doctoring the balance offered by the recording engineer. This is perhaps its most defensible role, but again one only has to contrast the crudity of its operation compared to the variety of complex equalisations available on the individual constituent parts of a recording to the engineer 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; my own experience on modern recordings is that it is invariably better to use a carefully set up and optimised 'flat' system.

A *loudness* (contour) switch or control is often fitted to amplifiers, and its value is even more questionable than tone control circuitry. The theory behind its adoption is that the ear is progressively less sensitive to low and high frequencies compared to middle frequencies as volume levels are reduced, which is an accepted fact. The loudness control offers an attempt to compensate for this effect by boosting low and high frequencies by an appropriate amount, and is intended for use at low listening levels, indeed some manufacturers go as far as offering variable compensation circuitry. However in my 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 inbuilt, we are used to living with it, and in fact use it to help determine absolute levels of loudness; so that 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 has been my personal observation that the better the hi-fi system is, the less necessary and the more obtrusive a loudness contour becomes.

The final 'sound-shaper' is the *filter*, whose operation is normally rather more discreet 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 operate beyond audibility.

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 conception of the amp, 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. Naturally the steeper the slope the less 'muck' will be able to fly through the 'window', but unfortunately at the same time the filter itself produces increasingly unpleasant effects as its rolloff rate is made steeper, with ringing effects and abrupt phase changes. Indeed it has always seemed rather unfair that the British press has regularly castigated Japanese amplifiers for the relative ineffectiveness of their filtering in terms of the amplifier's frequency response (especially compared to the steeper rates of filtering available on many British designs), without I feel fully appreciating that the Japanese themselves prefer the 'gentle' filter rate that does not introduce as many of its own unpleasantnesses as the steeper variety.

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 un 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. Certainly the causes are still fairly obscure, and seem to involve a variety of mechanisms that are not entirely susceptible to analysis; but attacking the cause of any problem is always much more satisfactory than treating the symptoms in a way which is both inadequate, and rather gross.

So despite their limitations, switchable filters can be useful in some circumstances, although predominately 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 the problems can be avoided while the benefits accrue. It is interesting to note that discussion is currently taking place between manufacturers on an international level over whether to modify the standard (RIAA) pickup cartridge equalisation curve to include a fixed LF rolloff filter; some manufacturers are already adopting this approach.

The power amp:

The power amp has the supposedly simple task of driving the loudspeakers with the signal it receives from the pre-amp. That this is in fact a far from simple task is evident from the existence of an international committee which is currently deriving specifications to cover the complexities and controversies that surround the 'interface' between amp and speaker. To examine and discuss some of the ideas involved, it is first necessary to understand a little about what electricity consists of and how it behaves. This does not mean that I am about to launch into a jargon-ridden treatise on electronics, which would accomplish nothing; but an examination of the nature of electricity and its relationship with hi-fi will help establish a

perspective on some of the controversies surrounding amplifier design.

Electricity is concerned with the movement of minute particles called electrons within a conductive medium, which is usually a metal. The engineering discipline of electronics is basically concerned with controlling the behaviour of electrons by manipulating the medium in order to carry out all manner of complex tasks, some of which are concerned with hi-fi reproduction and transmission. Hi-fi is trying to store and reproduce sound, and sound is a vibration in the molecules of the air, with the size (amplitude) of the vibrations corresponding to volume, and their frequency (number of vibrations per second) to the pitch of the sound. This is often accomplished by making a 'model' of these air vibrations in the form of electrical vibrations – hence the microphone converts the movement of the air into a movement of electrons *via* a diaphragm. The reason electricity and electronics are used for this purpose is merely that their technology is the most suitable; one could probably derive hi-fi systems based on mechanico-acoustics, like the early 'pre-electric' gramophones, or even fluidics, but electronics appears to be the easiest medium in which to work.

In fact the fluid flow of normal household plumbing can yield analogies that are useful in understanding some basic concepts of electricity, although the parallel should not be taken too far, as it really only refers to the direct current system as used in cars, rather than the 'alternating' or vibrational variety used in the home and for audio. When examining the flow of water through a tap, two considerations (or parameters to use a little scientific jargon) determine the rate at which the water flows. One of these is the force or pressure with which the water is being pushed, which corresponds rather neatly to the voltage in an electrical system; the other is the size of the outlet through which the water flows, and this corresponds to an electrical circuit's resistance. The actual rate at which the water is flowing (current) depends on both the pressure (voltage) and the size of the opening (resistance), and one can cut down the flow from a tap by either turning the tap off a little, or frequently by turning on another tap which is part of the same system, as this often shares the total pressure available; it also explains why an upstairs bath may not run water any faster than a downstairs sink despite having a larger tap (ie lower resistance), because its extra 'current' capability is offset by a reduced 'voltage', pressure or head of water.

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 (which adds a few complexities that are not really relevant here yet.) These descriptions and analogies work fairly well for electricity that is running in a single direction (known as direct current), but audio signals are modelled by to-and-fro vibrations, more akin to the AC mains found in domestic household electrical circuitry. Under these circumstances the simple concept of resistance becomes the more complex 'impedance', with the addition of two rather more abstruse types of load known as 'capacitance' and 'inductance'; these have much in common with resistance, but their behaviour depends on the alternating frequency *ie* the rate of vibration, and they have peculiar effects that are rather like storing the electricity for brief moments in the way that a spring can store mechanical energy. This has the effect of throwing the voltage and current cycles out of phase (out of step with each other). While it is perhaps inconvenient from the point of view of simple conceptualisation that these more complex loads exist, it is perhaps just as well because much of electronics is based on using their properties!

So far we have examined electricity rather than electronics, yet the distinction is an important one, and frequently not appreciated; indeed confusion often seems to result from the fact that certain elements of hi-fi engineering derive from electrical engineering, while others are rooted in electronics. In a nutshell, electrical engineering is concerned with electricity as a form of energy – its generation and the ways in which its energy is used. Electronics, in contrast, is to do with using the properties rather than energy of electricity in, for example, signal processing and control functions. Perhaps the most fundamental distinction between the two is that when we are dealing with electrical energy we are concerned with quantities, and hence

the electrical current plays as important a role as the voltage. When dealing with electronic signal processing, current plays a minor and usually quite insignificant role, the signals being modeled by the voltage, and the circuit components kept at a high impedance to avoid the inconvenience of surges of unnecessary current. In fact large currents would prove a considerable embarassment for delicate signal processing tasks, for the very reasons that they are needed in an energy or power context, namely their ability to generate heat and magnetic fields.

If there is any single cause of the disagreement and controversy evident today in amplifier design, I am quite sure that it is due to the confusion of these two disciplines. Most discussions of amplifier behaviour seem to concern themselves primarily with the voltage signal, which is designed to correspond with the audio signal input, while in point of fact the loudspeaker is a motor which requires current to drive it (and on a rather smaller scale the pickup cartridge is a generator of comparatively low impedance which tends to produce significant current as well as voltage.)

However to get back to the subject of power amps, their essential characteristic is to deliver energy to the loudspeaker in order to get back an audio signal corresponding to the 'voltage model' of the audio signal that has been passed through the pre-amp. Ensuring that the output voltage corresponds to a magnified version of the input voltage without significant distortions is one part of the problem, and indeed the area that attracts most attention because it is in the 'familiar' field of electronics and voltage is much more susceptible to measurement than current. Having presented this voltage to the loudspeaker, the loudspeaker draws the appropriate current corresponding to its impedance at that instant of time, and it is here that we find some fundamentally unreconcilable disagreements between designers. The nub of the problem is deciding exactly what the impedance of the speaker is in order to decide what the amp has to do to drive it accurately.

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 resistive 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 that are '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 value of the impedance over the whole cycle, and that this only further 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 this debate may appear somewhat esoteric for discussion in this context, and will no doubt be resolved in the fullness of time, its implications for power amp design are far-reaching for the following reasons. To supply a certain number of volts and make available a certain number of amps costs, by and large, a fairly fixed amount of money in components, labour costs etc. Consequently most amps are designed to deliver their maximum power when driving a load of say 4-8ohms, within which the typical modulus of speaker impedance lies. If it should be technically desirable to provide an excess of current to meet this rather less predictable load, it will cost considerably more money to provide the same voltage and hence loudness (though not necessarily energy) from the system, with merely the possible benefits of offering better loudspeaker control. So if this load unpredictability *is* established, amplifier designers will either have to make considerably more expensive amps to produce the same approximate volume, or accept compromises in sound quality due to this phenomenon. It may seem a little irresponsible to suggest that the whole concept of amplifier design may need a fairly radical rethink; but a number of specialist manufacturers have been producing 'heavy current' designs, in some cases for several years now, and with significant commercial success. And at a recent seminar with one of the world's leading amplifier design theoreticians, who is retained by a major international manufacturer, some very similar ideas were expressed, together with suggestions that experimental evidence was imminent. So it would be irresponsible to take a

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stance at this juncture, but at the same time it would be equally irresponsible to ignore a potentially vital element in amplifier design.

Slew rate limiting

Amplifier design never seems to actually stabilise, even though many commentators and designers would tend to suggest that all the problems are long solved and nicely under control, and certainly orders of magnitude less severe than the distortions that occur in other components in the audio chain. Over the last few years the related distortion mechanisms known as Transient Intermodulation (T.I.M. or T.I.D.) and Slew rate limiting have both been put forward, hotly debated, and finally won a grudging acceptance that is finally finding its way into commercial design. Interestingly the concept of slew rate limiting is fundamentally so simple and obvious that it is surprising that it was not publicised 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 used in these stages 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 (*i.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 x 10, 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 amp, 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 the development of 'superfast' output devices like the V-FET (Sony, Yamaha), EBT (Trio), and power MOSFET (Hitachi). In the final analysis this approach probably has the edge, although one should not overlook the adage about the dangers of opening the window too wide and allowing too much muck through; sometimes careful bandwidth control can give the best compromise.

I don't propose to try and explain TID in similarly simple terms, because it would take rather longer and not really serve any useful purpose. In essence though TID can be regarded as somewhat similar to SID, applied to complete circuits rather than just devices. All amplifiers rely on a mechanism called feedback, which compensates for distortion producing 'nonlinearities' in the devices. However it takes a finite time for this feedback to operate, depending on the circuit design, and in this case the circuit can 'fail to catch up with itself' when trying to handle the highest frequencies, so that the output becomes uncorrected distortions

Output switching

This is another area where there is some measure of controversy amongst designers, with some claiming that speaker switches in the signal path between power amplifier stages and loudspeakers are undesirable either on performance or reliability grounds. Certainly there is some reason to regard switches that carry comparatively heavy currents representing delicate transient musical information with a measure of suspicion, although the majority of amps use them anyway. However the fact that the more expensive and exotic models, and those from specialist 'enthusiast' manufacturers, tend to eschew them suggests perhaps that there is no smoke without fire, and that there is at least the possibility of sound quality benefits where switches are not used.

The reciprocal argument would claim that the provision of a headphone socket and the need for this to mute the speakers already introduces speaker switching, but then the esoteric tend not to

provide headphone switching either! While the debate remains unresolved, I do believe there is some room for re-thinking how speaker and headphone switching is carried out, and with a little more care in the engineering it should be possible to have one's cake and eat it too. One neat solution is fitted to the A&R *A60* amp, which provides three terminals per channel on the back; one of these is connected 'directly' while a parellel one connects via the headphone socket, and the third 'return' also connects direct. The user then has the option of 'straight-through' connection, or via the headphone socket with its built-in muting.

I personally would like to see all amps with at least one 'straight-through' speaker connection socket, and then perhaps two switchable positions for those wishing to use auxiliary speakers in other rooms; these switched sockets could also offer the heaphone option, and could perhaps be arranged to give either/or rather than either/or/both, to avoid the possibility of damage if the 'main' speakers are left connected.

The whole area of interfacing between amps 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 amp is primarily designed for one set in terms of its 'conventional' power rating and impedance matching, and even its ability to do this adequately is challenged by the existence of multi-amplification systems (where a separate power amplifier is used for each loudspeaker drive unit).

Headphone driving poses few of the problems found with loudspeakers, if only because a far smaller amount of energy is required, the headphone only needing to energise the ear canal rather than an entire room. The majority of headphones should work without any difficulty from a normal headphone socket, which should be designed to give a fairly good match for the various types encountered as well as a measure of protection against their being overdriven and destroyed by the comparatively high-powered amplifier. Some of the more exotic 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 as mentioned above will of course apply.

Power indicators

A number of amplifiers are fitted with large meters which are supposed to indicate the power being delivered by the power amps. Different mechanisms are used to display this, but the standard so-called 'VU'-type swinging needle meter type is usually marginally worse than useless, because its reaction time is invariably too slow to respond accurately to the transient peaks which are the important part of the music signal. Some methods of metering, either using very fast and expensive needle types or some sort of electronic light emitting device, are of limited usefulness, although there are none that I know that actually register power. They are in fact all devices which measure the voltage that is being delivered to the loudspeakers, with varying degrees of success; they are then calibrated in watts (the measure of power) as a result of the designer's flight of fancy that the loudspeaker load that they will be driving is precisely eight ohms at all frequencies, which in point of fact it never is.

As we have already discussed, the power amp will produce a signal at its loudspeaker outputs whose voltage should correspond to the required audio signal, but whose current needs to be supplied to the demands of the loudspeaker itself, which at any given instance and frequency may not correspond to eight ohms at all. Power meters measure voltage for the simple reason that it is fairly easy to design apparatus which measures voltage; measuring current is much more difficult, having the nasty 'Catch 22' that any measurement tends to interfere to some extent with the transmission of the current.

So-called 'power meters' will not therefore give information about the power being delivered by the amp; they will give information about the voltage being presented at the output terminals, provided they are fast enough. This can nevertheless be useful because if an amplifier is called upon to deliver more voltage than is within its design capabilities it goes into a state known as 'clipping', which can cause a variety of ill effects ranging from simple distortion to more serious 'latch-up' losses of signal while it, so as to speak, recovers its breath,

and also possibilities of loss of control and instability. So clipping can be indicated by decent power meters (although one or two simple light emitting diodes – LEDs – are in fact quite sufficient), and this is a state to be avoided; hence such meters do have their uses. Incidentally if you find that you wish to run your amp into its clipping region quite often, there are only two solutions open to you: buy a more powerful amp, or use more efficient or sensitive loudspeakers.

THE POWER SUPPLIES

Amplifier power supplies have recently come under close scrutiny from designers, some of whom have suggested that they comprise the most important part of any design. Indeed one could go so far as to describe an amplifier as a power supply connected to a loudspeaker, while the signal is applied by controlling this supply in the manner of a tap controlling the flow of water. A variety of different design approaches exist, and some of these have been touted as 'inherently desirable' by advertising copywriters. But like most things audio, the 'feature' is less important than the appropriateness of its applications; there is no single 'right way', merely a variety of available techniques, whose effectiveness is probably pretty closely related to their price.

One recent trend which seems to have caught on amongst the more expensive amps has been the adoption of separate power supplies for the two stereo channels; this is claimed to reduce any interference that may result when a heavy demand from one channel is 'reflected' in the other channel by the power supply's inability to cope. The problem with power supplies is that when you remove power from them, you reduce their ability to deliver more power. A slight drop in capability may not matter in a household domestic electricity supply, where one is only interested in drawing 'crude' power from the system, but audio power corresponds to an extremely complex and subtle musical signal, so any such lack of capability will show up as a form of distortion in the signal. A power supply that is fairly impervious to such undesirable effects is often referred to as 'stiff'.

It is therefore quite likely that two separate supplies will be better than one, all things being equal. However in practice all things are by no means equal, and a number of considerations need to be taken into account. The most important is that two supplies will inevitably cost twice as much as one, if each is to match the capability of the single one. In practice 'twin-powered' amps tend to use somewhat smaller supplies, which is perhaps fair enough as they only have to power one loudspeaker and hence provide on average half as much energy. However music consists of peaks rather than averages, and the smaller supply will necessarily be less capable of providing voltage or current peaks than a bigger shared supply. So the twin power supply approach that is commonly encountered, where each supply is correspondingly smaller, may offer certain advantages in reducing interference between channels, but is also likely to reduce the peak power capability of the amp, which is a corresponding disadvantage. A similar result to 'twinning' may be obtained by 'regulating', which involves controlling the output of the power supply by electronic means. This again effectively gives separate power supplies, although only one transformer is used, but again the peak capabilities are lower than with a similar unregulated supply, and so a larger supply will be needed to obtain equivalent peak performances. To this cost penalty must also be added the cost of the regulating circuitry.

These examples show quite clearly that there is 'no such thing as a free lunch'. If one were to try and define the power supply's functions, it would probably be to provide the required current and voltage at every stage of the amplification, in such a manner that all supplies were independent inasmuch as they did not influence each other. The big question mark remains over that word 'required', and here we come back to the points made earlier concerning possible unknowns in pre-amp current handling and louspeaker transient current requirements. While the limited knowledge and current prevailing controversy makes it impossible to take a stance, those designers who emphasise both the subjective performance of their amplifiers and the importance of their power supplies tend to try to increase the independence of the different stages, their current handling capability, their internal control, and the speed at which they can supply both voltage and current.

This is best illustrated by reference to examples found in some commercial amps. the Meridian *103* modular system splits the amp into three basic modules, one is a pre-amp with built-in supply, the second is a stereo power amp without power supplies, and third a power supply section. The user

can choose between using a single power supply module for a power of 35 watts per channel, or two separate (and incidentally identical) power supplies to give 45 watts per channel and claimed subjective improvements; this configuration also permits the purchaser to begin with one supply and upgrade without obsolescence at a later date. The Naim *160* and *250* power amps are claimed to offer virtually identical power amplifier circuitry, yet one costs twice the price of the other because of their power supply differences, the *160* having a single unregulated supply while the *250* uses a larger transformer and no fewer than four regulated supplies. The latest 'top-of-the-range' Sansui 919 integrated amp also uses no fewer than 5 supplies for the pre- and power amp.

This illustrates the extent to which some designers feel it is necessary to go with power supplies, and suggests also that this would be a fruitful area for further research into measurements that might reflect the listening experience. As yet we have not succeeded in developing such tests, partly because it is of course impossible to test a power supply in isolation from the amplifier (except perhaps the Meridian!) without cutting into the circuitry.

REVIEWING AMPS: THE PITFALLS

There is probably no audio component more difficult to evaluate meaningfully than the amplifier, for a number of very good reasons. Many of these have been touched on in the preceding sections examining the constitutent parts of the amp in some detail, but this is an opportunity to tie them together. Two quite opposite schools of thought currently exist amongst the experts in the field. The problems boil down to the simple question of choosing the criteria that are relevant for design or evaluation, and here the reader will have to make some effort to establish *his* criteria, rather than merely taking the reviewer – or his critic's – word for it.

These opposing stances are so dissimilar and strongly held that there can be no consensus approach to deciding what makes an amp, broadly speaking, good bad or indifferent. One point of view would not be inaccurately described as 'objectivist', and claims that any reasonably designed amp that is operated within its limits (of power capability into the accompanying loudspeaker impedance) will sound indistinguishable from any other, provided sufficient care is taken to match levels and ensure that there are no frequency response anomalies. Close to this extreme position are many who consider that as the measured distortions introduced by amplifiers are so much lower than those produced by other elements in the chain, notably cartridges and loudspeakers, any marginal differences between models will be irrelevant. The implication of this attitude is that the only valid criteria for a sensible approach to purchasing an amp are its power capability in relation to price and one's requirements and loudspeakers, and the features and facilities that are needed, provided that the design does not show any obvious weaknesses on technical measurement.

The other so-called 'subjectivist' stance proposes that amps are really by no means perfect, and their performance exerts a powerful influence on the overall sound quality of a system. It is also implied that our present measuring techniques are unsuccessful at revealing these audible differences, the limitations lying in the techniques used, which oversimplify the complexities of music signal to a large degree. If one accepts this stance, the criteria of power capability and facilities should be extended to include listening tests, while it is also suggested that comparable power ratings may not yield similar maximum tolerable loudness levels, due to a variety of possible mechanisms, and that this 'loudness capability' is a more valid or useful criterion than measured power.

The essential difference between these points of view is that one places importance on listening tests, while the other regards their results as figments of either the imagination or inadequate test procedures. While the co-authors of this book are both firmly convinced that the amplifier does indeed make a vital contribution to sound quality, our researches before the project got under way indicated that current methods of subjective assessment, at least when dealing with large numbers of products, are far from reliable. Moreover neither can objective measurement techniques be relied upon to give results which correlate with claims for sound quality. Consequently any findings related to sound quality must be regarded as tentative rather than definitive.

Despite this measure of uncertainty we are quite convinced that listening tests must be carried out, and the results reported. Even though the 'subjectivists' have not succeeded in proving the reliability of their results, the fact remains that a

sizeable percentage of those involved in hi-fi – probably the majority – would regard themselves as more or less in this camp. So while the easy way out would be to omit more than cursory subjective testing, and produce a book based merely on simple (and perhaps meaningless) objective tests, this would have rendered the project worthless in the eyes of a significant segment of audio opinion. To take the opposite course and rely heavily on the probably unreliable listening tests to make value judgements would be equally indefensible.

From this vantage point, perched uncomfortably on the horns of a dilemma, it is possible to see a way to wriggle out of this situation by means of careful qualification and a degree of necessary reserve. Therefore an amp which offers a competitive package of power and facilities will not be debarred from recommendation on the basis of poor results in the listening tests, though the review will naturally exhort the reader to confirm or deny our findings for himself. Similarly, good and consistent listening test results will be sufficient justification for recommending an amplifier that might not otherwise qualify for example on the basis of price/power or poor measured distortion

Our advice to the buyer must be to try to confirm or deny our subjective results for himself, or at any rate try to establish for himself the importance of sound quality in amplifiers. Those who line up with the 'objectivists' will nevertheless find the reviews useful in providing facility/power/price data to assist them in making a choice, and can cheerfully ignore our 'subjective impressions'! Hopefully those who consider that amplifier differences are significant like ourselves will find our subjective findings correspond to some degree with their own, and consequently our attempts in this direction will be of some value.

While setting up the review project we have constantly borne in mind the difficulties that are caused by these fundamental disagreements amongst experts regarding the role of the audio amplifier. Investigations were pursued into various aspects of both subjective and objective testing, in the hopes of improving the reliability of the former and of finding new objective test procedures that would give reliable correlation with the listening results.

The listening tests

Before the project got under way *Hi-Fi Choice* co-sponsored an investigation by Martin Colloms into the subjective testing of power amplifiers. This was published by *Hi-Fi News & Record Review* (the other sponsor) in their issue dated November 1978. We do not propose to repeat all the data here; the purpose of the investigation from our point of view was merely to establish the reliability of 'blind' subjective testing. The results were perhaps rather discouraging, particularly in the case of a full day's formal panel testing with three power amps, where essentially random discrimination was obtained. Later individual sessions offered a few crumbs of comfort, with one or two listeners managing some degree of reliability; nevertheless the overall pattern merely served to reinforce the pattern of random results. Obviously these results cast something of a question mark over the results of listening tests, and certainly imply that their accuracy should not be accepted in blind faith.

However the whole field of subjective testing and the factors that affect result reliability is full of unknowns and question marks. The results of the above power amp comparisons can be contrasted with a similar if less closely controlled test of integrated amps, carried out under similar though far more relaxed conditions some weeks previously. In this instance the panel agreement and consistency with a much more limited range of repeats was astonishingly good. Certainly the power amp comparisons were carried out under a fair amount of stress, as they were designed more to examine the reviewers than the amps; conversations with experimental and clinical psychologists since then has suggested that under any conditions of stress one's powers of discrimination are considerably impaired.

On the basis of this admittedly fairly limited evidence it was felt that the most reliable results would be obtained by carrying out several quite separate listening tests under different circumstances on all of the amps, while trying to ensure that the conditions were as relaxed as possible. The 'blind' listening was designed to include a number of repeats to help give an indication of the reliability that was being obtained during the course of a single test. One could continue to make listening tests more and more elaborate in the hopes of making them more reliable and meaningful. Even so there appears to be no guarantee that the results could be replicated independently elsewhere under different circumstances, which is the real criterion for a 'scientific' test. Nevertheless we feel that we have

at least done our damnedest to avoid generating unreliable results, whle remaining aware that this is an area where nothing is strictly provable.

In my own experience, the only really reliable method of subjective amp assessment remains to live with the model for at least a few days under relaxed home conditions, and even this can give results that may not be truly universally applicable (in other words they may only work in the context of the particular system). Under such 'home' circumstances I have myself spent over £1500 on my personal amplification system; while this may not prove anything (apart from certifiable tendencies in some people's estimation), it does indicate a personal commitment to the subjective importance of the amp in a hi-fi system. Unfortunately it is impossible to carry out this extensive 'home-use' evaluation on the large range of products that are accommodated in a *Choice* project, and if this was attempted the results would not only still be somewhat system-dependent, but many of the models would probably have become obsolete in the meantime!

The measurements

The measurements taken on an amplifier fall roughly into two types: those that are taken in order to determine the basic physical and electrical parameters of the amp, such as its size and input sensitivities; and those that are taken in order to get information on how well the amp performs, such as distortion and noise measurements. The former are vital in order to establish whether the amp is likely to electrically match other items of equipment, the room decor, the available shelf space, the impedance of the speakers being used, etc, etc. The second group is intended to give information on how well the amp performs rather than merely what it performs, and implies that we have some knowledge of what constitutes a worthwhile lab performance. In point of fact most so-called performance measurements have developed not so much because they represent desirable amplifier functions, but more because the machinery existed to carry out the test!

The problem exists because the music signal is infinitely complex, containing signals that are both harmonically related and unrelated and spanning a wide range of relative levels, whereas the test signal, which must be susceptible to analysis, is necessarily considerably simplified. Add to this the problem areas such as the indeterminate input bandwidth supplied from some cartridges and the possibly peculiar dynamic impedance characteristics and reverse drive effects of loudspeakers, which were referred to earlier, and it becomes plain that many of the commonest measurements which are the easiest to carry out simply do not test the amp anywhere near its 'use' situation. Furthermore when these simple tests are applied to other components in the chain such as cartridges and loudspeakers, the results are inevitably orders of magnitude worse, so it is easy to see how the body of opinion that considers current amplifier designs virtually beyond criticism has arisen.

When embarking on this project we examined closely the tests that were carried out by manufacturers and reviewers in order to build up a programme. Although we would have liked to include some fairly new techniques in the hopes of achieving close reliable subjective/objective correlations, this was not always practical for a variety of reasons: some can be challenged on the grounds that they are not representative of 'use' conditions; some risk damaging the amplifier through stressing it too hard, and the last thing we wanted were a lot of 'dead' amps; some require rather more development of technique and/or apparatus that we were unable to accomplish in the time available. However this nevertheless left us with an enormous number of possible measurements to take on each amp, all of which qualified for possible inclusion either on grounds of tradition, hoped for correlation, or to reveal potential trouble spots.

There are of course an infinite number of measurements that one could take on a single amplifier. The big question, for which in all honesty noone has provided a totally satisfactory answer, is what measurements are the important ones? If one accepts the point of view that the differences between amps are insignificant, then measurements are merely required to show that the sample is performing adequately and define the parameters necessary for basing one's selection on price/power/facilities/matching; in fact even a 'poor' amplifier will produce harmonic distortion, frequency response and crosstalk measurements that are far 'better' than those given by the best speakers and cartridges, so one could perhaps argue that most measurements are irrelevant.

If one takes the stance that amplifiers do play an important role in sound quality, as we do, then which measurements indicate the sound quality

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Separation	Over 20 dB at 1 kHz	Over 20 dB at 1 kHz	Over 20 dB at 1 kHz
Frequency Response	20–20,000 Hz	20–20,000 Hz	20–40,000 Hz
Stylus	Shibata type III	Shibata type III	Special parabolic
Armature Material	Super permalloy	Super permalloy	Polyacetal
Cantilever	Tapered aluminium	Straight berylium	Straight boron
Compliance	$12x10^{-6}$ cm/dyne	$12x10^{-6}$ cm/dyne	$12x10^{-6}$ cm/dyne
Wiring Resistance	200 ohms	200 ohms	30 ohms
Recommended Tracking Force	1.5 gms	1.5 gms	1.5 gms
Total Weight	19 gms	19 gms	18.5 gms
Effective Length	50 mm ±3 mm adjustable	50 mm ±3 mm adjustable	50 mm ±3 mm adjustable
Azimuth Angle	±5 degrees adjustable	±5 degrees adjustable	±5 degrees adjustable

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performance? The simple answer is that we don't know! All we can hope to do is to take a lot of measurements of different kinds and look for *differences* between amplifiers, rather than absolute values that can be labelled 'good' or 'bad'; then we can see whether or not these differences correspond in any way to the results of listening tests. There is even some evidence which suggests that improving certain measurements without due consideration for the total performance may worsen the listening results. In the early days of transistor amp design for example, the tendency was to increase the amount of feedback to a level far higher than was used – or indeed possible for technical reasons – in valve designs. It is now generally accepted that this technique, which certainly enhanced the measured performance using simple steady state techniques, tended in some cases to introduce undesirable dynamic distortions which were less easily measured but were certainly audible. In fact the unavoidable low feedback in valve designs may have been one reason why they have maintained their popularity amongst a minority, despite certain other inherent technical limitations and extra costs, because it is that much more difficult to mis-engineer the feedback loop! The net result was that some amps which produced better harmonic distortion results than others actually sounded worse. Although we do not wish to imply that this is a reliable 'inverse' indicator either, it does rub home the fact that measurements are really only worthwhile as indicators if they follow some pattern which relates to the listening experience.

On the basis that absolute measurement values on amps rarely bear any direct relationship to sound quality, we started by measuring a deliberately excessive number of different parameters, and then used these initial results to look for those measurements that seemed to offer the best chance of giving differences and perhaps correlations, in addition to including those which have almost by habit become 'standard'! We should also point out that a further process of editing has been applied to the results we have in fact published, because printing interminable lists of figures is baffling for any but the most technical reader and ultimately self-defeating; we see little point in publishing data merely to prove that we have taken it! A number of unpublished measurements were in fact also taken to help build up a picture of the amp or to check that it didn't possess certain specfic weaknesses. Let us now examine the different measurements that were taken, discussing the meaning and interpretation of the results.

Power output

The power of an amp is traditionally expressed in watts, which is the unit of 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 which itself determines the current required: with ordinary power systems like the mains or car battery (and ignoring AC voltage complexities), the voltage supplied is set at 240 and 12 respectively, so ¼ amp at 240 volts will give 60 watts, whereas 5 amps will be necessary at 12 volts to give 60 watts (¼ x 240 = 5 x 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 that well known relationship Ohm's Law, which states that the current (I, amps) multiplied by the load (R, ohms) equals the voltage. So the load that gives 60 watts via ¼ amp from the mains will have a resistance of 960 ohms, but with the 12 volt battery it will be 2.4 ohms. 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.

We require the amplifier to work right across the audio spectrum from the deepest bass at 20Hz to the highest treble at 20kHz. While it is true that most of the energy will be required at the middle frequencies, there are some indications that a restricted power delivery capability at the frequency extremes can be a slight weakness; as our measurements of power are made as far as possible at the level at which 0.1% distortion is reached, this reduced power may merely correspond to an increase in distortion. The 'standard' load used to represent loudspeakers is 8 ohms, so we have measured the maximum power with both channels driven simultaneously into 8 ohms at a suitable midband frequency (1kHz), and repeated the measurement at 20Hz and 20kHz to check for any possible limitations.

We then measured the power with only one channel driven. If the amp can produce more power when driving only one channel, this implies that the power delivery when both channels are driven is being limited to some extent by the capabilities of the power supply which is 'running out of steam'

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and not fully meeting the demands placed upon it by the amp's circuitry under certain conditions. In other words the power supply could with advantage be 'stiffened', because switching on the second channel when driving the first at full power would reduce the volts (and/or amps) supplied to the first channel, giving a 'reflected' distortion through the power supply.

In addition to measuring the channels separately with an 8 ohm load, we have also investigated their ability to drive into lower impedances. The theoretically 'ideal' amplifier would maintain its voltage and double its current when the load is halved, thus producing double the 8 ohm power output into 4 ohms and a further doubling into 2 ohms. However, to do this is expensive and usually also means restricting the power that can be delivered into 8 ohms, as the amp has to be designed with reduced voltage and increased current capability. A minority of designers consider that it is necessary to sacrifice loudness for this enhanced ability to drive complex loads, their claim being that it is vital to prevent the loudspeaker from being starved of current. The majority would say that this is largely unnecessary overdesigning, and is potentially commercial suicide! Loudspeaker impedances tend to measure at more or less 8 ohms, so why use a power amp which will give more current than is required? The debate continues, and the proof of the pudding must remain in the listening experience. But we have as far as possible measured the amps' abilities to drive these low impedances in order to give an indication of the designer's priorities and also the ability of the amp to drive some of the 'nastier' speaker types around.

The final power test is a measure of the transient power of the amp, to see what power it can develop in a short 'burst', which is more representative of music peaks than the steady state sinewaves used for the other power tests. A high 'burst' capability should indicate an amp that goes quite gently into distortion when it is driven hard, and can therefore be driven harder without unpleasant distortions than one which does not produce the same 'burst' power, but may give the same steady state power.

Inputs

We have measured a large number of parameters concerned with the inputs of the amp so that the reader can check to see that an amp matches the inputs and outputs of other components that may already be owned or be contemplated for future purchase. Details concerning checking the matching of sensitivities and impedances is given in the earlier section describing the different pre-amp inputs in detail; note that the input capacitance of the disc input can significantly affect the sound from moving magnet cartridges.

Outputs

Our figures relating to the outputs from the amp that feed tape decks and headphones are designed to try and indicate typical use conditions. The precise conditions are specified in the technical introduction, but for the tape outputs the intention has been to measure the signal when loaded by a typical tape deck impedance of the appropriate standard, and when driven at typical signal levels from disc and auxiliary inputs.

Any power amp is more than capable of driving headphones, as these require relatively little energy compared to loudspeakers – so little in fact that most models can be driven from a tape deck pre-amp with little difficulty. The main problem when driving headphones from power amps is avoiding destroying their delicate moving parts with too much power. For this reason the headphone socket is fitted with an attenuator, and this serves the extra purpose of allowing the amplifier to drive the headphone in its normal working range; if driven directly from the speaker terminals, the volume control will need to be kept retarded, and this can allow the residual noise in the potentially powerful amplifier output stage to become obtrusive, but the attenuator minimises this problem. To ensure that the headphone socket is suitable for driving the wide variety of impedance types found amongst commercial designs, we have measured the socket voltage that is supplied across three typical representative impedances (8Ω, 470Ω, 2.2kΩ) using a similar 'standard representative' input signal.

Noise

While we have measured this parameter with one of the most recent standard methods, there is little doubt in my mind that noise has a fairly limited effect upon the listening experience, because no domestic program source yet available can produce noise figures that are anywhere near as good as most amps, and most sources also have a far more restricted 'real' dynamic range capability than even their noise figures indicate. Admittedly some very low inherent noise figures are promised for the

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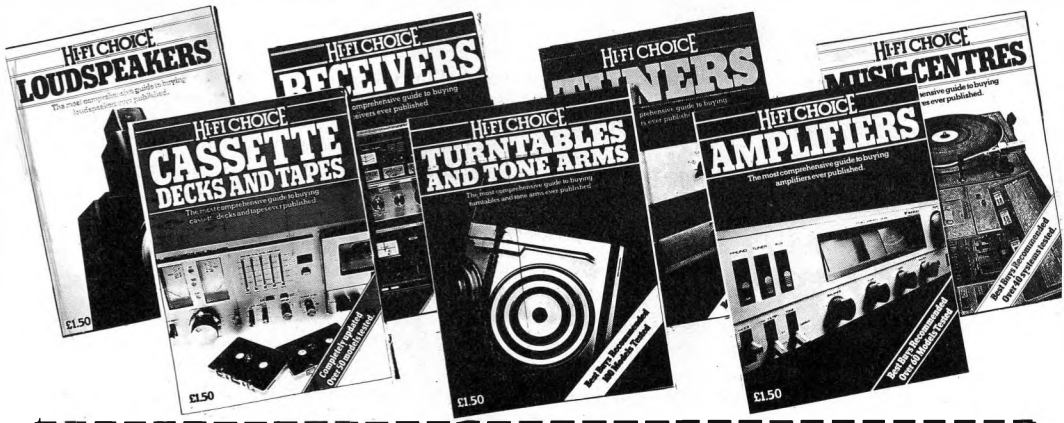

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'digital disc' formats that are appearing in prototype form from a number of manufacturers, but this does little to change my feelings (prejudices?) that by and large random noise is the least offensive form of distortion, and insignificant compared to other problems generated in systems when the music is actually playing – after all there is little point in listening to the background noise on its own!

Damping factor

The damping factor is the ratio of the internal impedance of the amplifier output to the impedance of the loudspeaker (which is traditionally taken as 8 ohms). The theory is that the amplifier acts as a brake on the movement of the loudspeaker cone by acting as a near short circuit when seen from the speaker. (Try for yourself the difference in pushing a loudspeaker bass cone with and without a wire connecting the two speaker terminals together (and don't forget to disconnect the amp first!); this is particularly noticeable with reflex type designs). In practice there seems little point in increasing this ratio beyond 40 (some consider 15 is ample), and it is likely that the dominant factor will be the resistance of the speaker leads in any case. The output impedance of the amplifier is in fact an artificial effect cause by the feedback loop within the amplifier, and we have measured it at three frequencies to see where and whether there is any significant variation at these different frequencies. A significant drop in damping factor at HF can be an indication that the internal bandwidth of the amplifier is limited, and this may result in unpleasant distortion effects (TID etc) if fed from a wide-bandwidth source such as a moving-coil cartridge.

DC offset

The DC offset is a measure of the DC voltage measured at the amplifier's outputs. This is an undesirable side-effect that has come about since most amps abandoned capacitor coupling in favour of direct coupling a few years ago, and it will produce a slight forward or backward permanent offset in the speaker cone, which could be a possible source of distortion and will also heat the voice coils. It is also a convenient indicator to show how well the amp has been set up when it left the factory. The DC offset should be as small as possible and similar in both channels.

Power bandwidth

This is an indication of the highest and lowest frequencies at which the amp can deliver reasonable amounts of power at low levels of distortion. It is difficult to interpret, as although there are indications that a narrow bandwidth has certain undesirable attributes, there is also evidence that too wide a bandwidth may give rise to equally harmful effects of a different kind (the wider you open the window etc.) It is probably desirable for this bandwidth to cover the audio band from 20Hz to 20kHz, but extension beyond this is likely to be unnecessary, and bandwidths extending above 50kHz may give rise to problems.

Total Harmonic Distortion

Rather than quote a figure for this parameter, we have examined the content of the distortion in order to provide a value judgement. The much more useful technique of making a sweep plot, which examines the way distortion changes with frequency, had been employed to give the curves for the 2nd and 3rd harmonics, while the data chart entry is designed to expose any weaknesses that may remain, particularly in relation to higher odd-order harmonics which are considered to be subjectively undesirable.

Harmonic distortion is one of the key traditional parameters of amplifier design, which is one reason why most designers make sure that their products show little of it! However its effects are known to be fairly innocuous, because music signals contain large proportions of harmonics naturally. In addition, cartridges and loudspeakers both produce quite large amounts of harmonic distortion, more than sufficient to mask that produced by virtually any amplifier. The addition of harmonics to a single note will change its 'timbre' slightly, but unless the amplifier is producing large amounts of high-order harmonics (11ths, 13ths etc), the distortion is unlikely to be detectable. The examination of harmonic distortion is frankly more use in understanding the internal behaviour of the the amp than in producing a meaningful result which will correlate with subjective listening tests.

Intermodulation Distortion

Intermodulation distortions are generally considered to be far more offensive than their harmonic brethren. Whereas the harmonic distortion merely gives extra amounts of frequencies which are

present in the music anyway, marginally changing their relationship but nothing else, intermodulation distortions are the products of two (or more) frequencies, and give the frequencies that were not present in the original at all, known as sum and difference components. For instance the combination of frequencies at 19kHz and 20kHz (quite likely to be produced as a result of the tip mass resonance of a typical cartridge and poor disc surfaces) will produce an unrelated difference signal at 1kHz, where the ear is quite sensitive.

We examined a number of ways of measuring intermodulation distortion, and settled for the one which gave the most revealing results. Two sweeps are shown, one with the amplifier driving a 'dummy' resistor load, and the other with an actual loudspeaker connected, to see whether this gives more revealing results. Several 'spot' measurements *via* the disc input were also made, as a further check on the operation of this stage (see Technical Introduction for further details.)

Hum performance

Once again we decided the best way to describe the hum performance of an amp was via a value judgement, after a careful examination of the hum spectrum. Hum is, I suppose, related to noise, but acts at particular frequencies, which therefore stand out when it is present, and the results are far more objectionable than the gentle 'swishing' of random noise. The cause of hum is breakthrough from the mains alternating frequency of 50Hz (60Hz in the US), but its effects become more objectionable when the higher harmonics, which are more clearly audible are generated (eg 150, 200, 300Hz).

Crosstalk and Separation

Crosstalk or separation is a measure of the breakthrough from one channel of a stereo amplifier to the other. Traditionally it has been held that there is likely to be no problem provided it exceeds a modest 40dB, which is more than most pickup cartridges can manage. However crosstalk is a form of distortion, and if it lies only 40dB below the other channel signal it is rather higher than other forms of amplifier distortion. Crosstalk may also be an indication of the independence of the power supplies.

Squarewaves

A squarewave is a convenient signal for testing and analysis, because changes in shape are readily identified, and because it contains a wide range in frequencies in the one signal. In fact a squarewave consists of a 'base' frequency, which is the lowest frequency present, plus proportions of all the odd harmonics of this frequency in a precise phase and amplitude relationship (which means that any change in shape can be interpreted as either a frequency response or time coherency anomaly). Therefore a 1kHz squarewave will contain sine waves (ie pure tones) of 1kHz, 3kHz, 5kHz, 7kHz, 9kHz, 11kHz, etc etc, with a theoretically infinite upper limit all mixed in the one signal.

The squarewave is therefore a convenient way of examining the behaviour of an amp under a variety of conditions, and we have presented up to six examples: two at HF, using a simple 8 ohm load and with added capacitance; two at 1kHz under similar conditions; and one at 100Hz, plus one extra if a switchable LF filter is fitted. Naturally the ideal amp would show perfect squarewaves throughout, though a degree of 'ringing' under the capacitive loads is not unusual. However the squarewaves do help show how well controlled the amplifier is under simulated 'difficult drive' characteristics, and also how even and linear the phase response is over the major part of the audio band. While it would be dangerous to assume that good squarewave performance is a vital parameter for any amplifier, the fact remains that it is another important piece of the jigsaw puzzle that helps build up the overall picture, and a poor performance may indicate trouble.

Pulse response

All the test signals used so far have been of a wave type, which repeat a cycle containing both positive and negative parts (as indeed do most music signals). The pulse test (or more correctly double pulse test) presents the amp with what is known as an 'asymmetric' signal, that is one which goes in one direction only from the base line. It is not easy to justify this type of signal in terms of music signal, although it is well known that the human voice contains such 'asymmetric' components and there is also some evidence that they play an important part in defining the start of a sound (which is at least as important for the brain as the sound itself).

Absolute interpretation of the results is again difficult, because we really do not know the precise effect on the sound quality of an amp's relative failure to reproduce this pulse cleanly. But it is

notable that no amps precisely replicate the pulse, and all show a droop after the initial voltage rise, followed by an overshoot as the pulse finishes, with varying times and types of recovery. Having a test which all the amps fail – albeit to an apparently greater or lesser extent – is perhaps no more useful than the harmonic distortion type of test which all amps pass; however we believe the pulse test does offer pointers to an amp's inherent stabilities and reaction times, which may well relate to sound quality differences.

Crossover distortion

With the exception of the 'slimline' Sony separates, all the models reviewed in this book operate in what is known as class B or class AB mode; this refers top the way in which the output signal is passed through two sets of transistors, one of which handles the 'top' half of the wave cycle, and the other the 'bottom' half. As the signal is passed from one to the other, one set is switched off and the other on, and this will cause a slight 'ripple' distortion effect known as crossover distortion. We have examined the crossover components in each amp on an oscilloscope, and comments are made where they look like a potential source of trouble.

CHOOSING AND USING AN AMP

How does one set about choosing an amp from the hundred or more models that are available these days? At first sight the prospect is daunting, but providing one doesn't simply panic and pick up the first pretty one to catch the eye, it's not difficult to cut the list down to size. The first thing is to decide on a list of priorities, start getting down to a shortlist, and finally do a little listening for yourself to make sure you like the sound.

For most people the first criterion will be price. But having decided on a price, bear in mind that a little less money spent on the amp could leave a little more for the record deck, and you may prefer the overall result; alternatively a more expensive amp with cheaper speakers may be more to your liking. So go for a price bracket, but keep flexible, and try to listen to the cheaper and more expensive options at least to find out what you are gaining or losing.

Price is however not the only criterion; for many people the big question will be 'how powerful?' This is virtually impossible to answer in general terms, and provided one is reasonably careful, it is also probably true to say that there is no such thing as too much power! 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 things, not all of which can be predicted, that there are really no worthwhile rules; it depends on the type of program (electronic synthesiser type music being the most dangerous), the ability of the amp to keep control of itself particularly when driven hard, and the cleanliness of the program source as much as the so-called power ratings. 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. One shop with a large dem room has often remarked to me how the cheap low-powered amps tend to blow up their speakers far more readily than the high powered monsters, due to the effects that can occur when a smaller amp is persistently overdriven.

So if too much power is unlikely to be a problem, what is the minimum one can get away with? Again one factor in the equation will be how well the amp behaves when it is near its limit, but the most important considerations will be how loud one likes to play music, how large the listening room is, and how sensitive one's 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. Amongst the loudspeakers in our last survey there was a difference of rather more than 10:1 in the 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 amp power, while the less sensitive designs may need as many as 40 watts 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

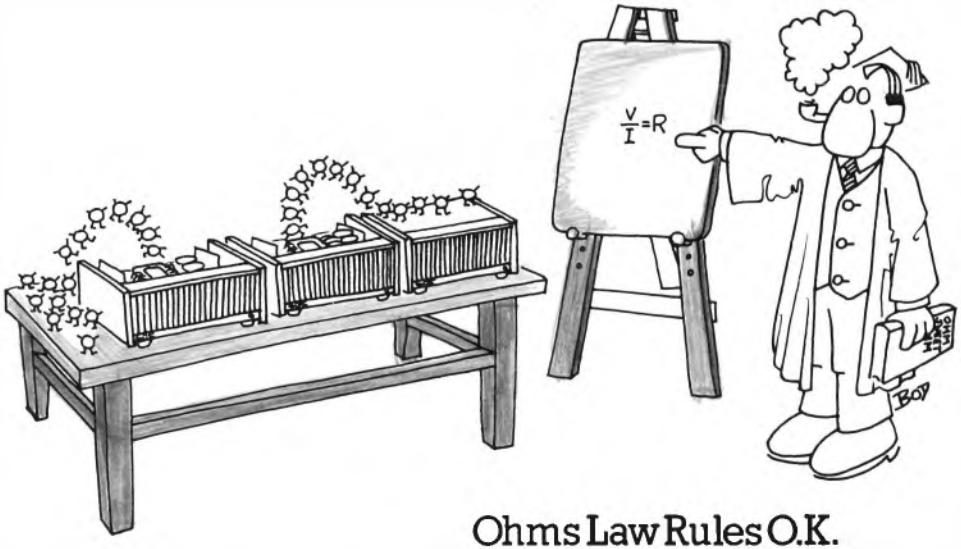
power levels in music). 50 watts or so is likely to leave sufficient in hand for the 'average' situation, but if the speakers used are fairly sensitive, 20 watts may be ample. If you find even more powerful amplifiers of 100 watts of more beginning to strain and giving insufficient 'headroom', it is time to consider using more sensitive speakers; this will be a much 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 louder levels; sheer numbers of 8 ohm watts do not give a reliable indication of whether a combination will sound good at high levels.

Another criterion for choosing an amp will be the provision of the right facilities. However it is not really necessary to place a plethora of 'just in case' inputs as a high priority, because these can always be added later if such a case arises. It is however quite important to make sure that the inputs that are provided are going to match your other equipment adequately, and the outputs for tape, headphones, and most importantly loudspeakers likewise. For loudspeakers, the amp should be able to deliver plenty of power at the speaker's *minimum* impedance value (if not below this), particularly if this minimum is in he midrange.

Physical appearance is often one of the most important criteria for the purchaser. This may be prejudice, but I sometimes wonder whether the 'satin-chrome monster' that gleams amongst its brethren on the shop shelf is very well suited to blend in with the lounge decor, or is merely gleaming in order to make sure that it is noticed in the shop? I may be old-fashioned, but have always felt that discretion was the better part of styling, particularly with something that one has to live with day in and day out. It is perhaps rather sad that the average customer gets little alternative to chrome in the majority of ranges, although at least some manufacturers now offer a matt black alternative, while the smaller British manufacturers do offer a wide variety of different styles and finishes; indeed the chances are that any two British amps will be more different from each other than the styling differences encountered amongst the entire range of Japanese hi-fi!

The final, and in our view the overriding criterion must be sound quality. We have done our best to give advice on this aspect of an amp's performance, but as detailed elsewhere this is a tricky field. We do feel that no hi-fi product should be purchased without prior demonstration, and that the customer should ideally be afforded the opportunity of a home demonstration with the chance to compare one or two alternatives in the context of his own system (don't expect big discounts with this sort of service, however, or you'll end up with a bankrupt dealer!) A good dealer should also be able to demonstrate the improvement if he tries to sell you an expensive amp instead of a cheap one. If a dealer is a good one, his standard of demonstration should be high, and the overall sound quality should be good; another old adage 'if it sounds wrong it is wrong' is also worth keeping in mind. Above all have a little faith in your own powers of discrimination; if a dealer can sway you by the standard of his demonstration rather than the smoothness of his patter, then the chances are he does have something to offer.

In conclusion a few 'don'ts' when using an amp. Don't economise on speaker cable by grafting together miscellaneous lengths of leftover bell wire with sticky tape; use mains cable of at least 5amp, and preferably 13amp capability, without any joins; make sure this is securely fastened at each end and that the two wires cannot accidentally touch. Don't unplug inputs or outputs while the amp is switched on – this is just asking for trouble; if you have been playing around with the inputs or outputs for any reason, then switch on afterwards at a low volume setting and increase this slowly while making sure nothing is wrong. Don't overdrive the amp for long periods; overdriving is usually easily detectable by an increase in distortion, and if you keep it up for a long time you may well damage the amp or the speakers.



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The technical introduction is intended to explain in some detail the techniques used for the various measurements and some of the reasoning behind them. Much of the philosophy upon which the reviews have been based is already discussed in the *Consumer Introduction*, and will not be reiterated unnecessarily.

Power outputs

One of the most difficult things to define precisely is the power output of an amplifier, and sometimes as many techniques as there are amplifiers appear to exist! As far as possible all our measurements were taken at distortion levels of 0.1%, which more closely approximates the threshold of clipping than the 1% point that has frequently been used in the past. This does tend to result in a more severe test at the frequency extremes, where distortion tends to be greater, so some amps that show an apparent power drop at these frequencies (20Hz and 20kHz) ref the available power at 1kHz may merely be indicating an increase in the relative distortion. In a few stated instances it was necessary to relax the distortion criteria in order to get a sensible measurement, and this has been stated where appropriate.

The 'prime' measurement of the amplifier's output power is considered to be the power developed across a heavy duty 8ohm resistor with both channels driven to 0.1% distortion at 1kHz, supplemented by similar measurements taken at 20Hz and 20kHz. Distortion residuals were examined on a 'scope to check for crossover products, hum and instability. A further series of measurements were taken with one channel only being driven and with different loads, to examine first the extent to which the power supply is affecting the power delivery of the amplifier, and second to give an indication of the voltage and current relationship of the power output. The assessment of the power supply capability is not an exact one, as it can depend on other elements of the design, but the 'normal' single power supply amp which shows a large variation between single and dual channel drive clearly shows that each channel is being 'starved' to some extent when both channels are driven to the limit; this will certainly affect the quality when the amp is driven hard, and possibly at all levels.

The decision to examine the amps into a 2ohm as well as 4ohm loading was made in order to show the way in which the amp's power was delivered. Theoretically the amplifier should behave as a constant voltage supply, though for practical reasons it is designed to do this over specific load ratings. The 'theoretical' amp would therefore double its current and hence power each time the load impedance is halved, thereby requiring infinite current into a short circuit! While some designers claim this is an important end in itself for reasons of transient control, this is not yet proven and remains a minority opinion (partly no doubt because of the practical problems involved!) The normal approach is to assume that the speaker presents a fairly stable load to the amplifier corresponding to its impedance modulus, and then design the amp to produce its maximum power into this impedance area, while limiting the current available into lower impedances so as to avoid getting out of the safe operating area of the transistors and risking device failure.

Unfortunately even the 'static impedance measure of loudspeakers gives quite a wide variation between models, and the amplifier designer has to decide what sort of load the amp is to be optimised to handle. Contrast for example the power delivery of the Quad *33/405* or Sony *TA-F6B* with the Meridian *101/105* or Sansui *919*. The former are much cheaper than the latter designs, yet all produce similar sort of power delivery into 8ohms; whereas the Quad and Sony tail off into low impedances in the manner of a current rather than a voltage source, the Meridian and Sansui produce big increases, which helps explain their extra cost. It also implies that the Quad and Sony should be rather better value providing the speaker impedance does not drop below 8ohms, but some care needs to be taken in selecting the loudspeakers to accompany these amps, whereas the Sansui and Meridian should remain fairly unaffected by any loudspeaker impedance characteristic. These examples approximately represent the opposite extremes of power delivery characteristics, and most designs adopt a more middle road; by examining delivery into 8, 4 and 2 ohms some indication of the amp's sensitivity to different impedances and the sort of impedance into which the amp is happiest working can be determined, so that a good combination can be chosen.

A rather more complex measure of power output was also made into these three different resistive loads in an attempt to establish the transient capability of the amps, by feeding a single cycle 1kHz sinewave signal and advancing the volume control until clipping occured; the voltage just before the onset of clipping was

recorded for each channel and the power calculated.

This complete matrix of measurements when viewed as a whole gives a reasonably good idea of the power capability and delivery of the amps. There remain alternative methods of presentation, and we were in fact sorely tempted to abandon the concept of 'watts' entirely, in favour of separately specifying current and voltage maxima, though we eventually decided that this would be too confusing for the casual reader, who has been steeped in years of (frequently misleading) power specifications. Within current limits of certain knowledge regarding the amp/loudspeaker drive interface, we believe this presents a fairly accurate picture.

Equipment used for power output included the Sound Technology *1700* distortion measurement system, Telequipment 'scope, B&K *2010* analyser, *4440* gating system and *2425* peak hold voltmeter, plus an Advance *OS4000* storage 'scope. Care was taken to 'pre-condition' equipment before testing to avoid carrying out measurements while equipment was cold, and the mains voltage was carefully controlled to 240v.

Noise

Following some of the recent IHF recommendations for standard test procedures a system of *reference levels* was adopted for noise measurements, and also in determining relative output levels. The noise levels are related to 1 watt output, and are measured with the volume control in such a position as to produce this when driven from 5mV disc and 500mV line input levels (and, where appropriate, 500μV *via* m-c disc input)

Noise measurements were taken with 'A' weighting on the B&K *2010*, the inputs being loaded by 1kΩ source and a shielded 'typical' commercial cartridge; for the m-c input the source loading was 10Ω.

Noise measurements were also taken with the volume control at zero, the level recorded being referenced to the 1watt figures which is perhaps not strictly correct, as this measure is traditionally related to the maximum power of the amp. However it is very simple to convert the figure by calculating the maximum output of the amp in dBs ref 1watt, and then add this figure to our zero volume figure to obtain the signal-to-noise ratio referred to maximum power. For example, the Akai *AM2250* has a noise figure of 85dB at zero volume, and a power output capability 15dB above 1 watt, therefore the s/n ratio ref maximum output is 99dB.

Hum

Similar methods were used to measure hum, but this time the 'A' weighting was replaced by a narrow band filter of 10Hz width centred on 50Hz, 100Hz and 150Hz. Similar input loading was adopted, and as a final check a sweep was made from 2Hz to 2kHz to check on the existence and relationships of any higher harmonics, and to correlate with the spot measurements. Rather than present further lists of figures the hum was summarised by means of a value judgement characterisation which relates to the average performance of the group as a whole, and any further qualifications deemed necessary are mentioned in the review text.

Inputs

Input (and output) impedances were measured using the Wayne Kerr *862* precision bridge at a standard frequency of 1591Hz. Sensitivities were related to the continuous power outputs (both channels driven) already established and, with the volume control set to a maximum, a 1kHz signal from an appropriate source impedance was increased in level until the rated power was achieved. The disc inputs were further checked at 20Hz and 20kHz, and a sweep check made on the RIAA equalisation curve.

Checking of overload points was also carried out at the three disc sensitivity frequencies by reducing the volume control setting and increasing the input signal until a sudden onset of distortion indicating pre-amp overload was noted; the figure was converted to dBs ref sensitivity for publication. Some random checking of high level inputs revealed that all were impervious to overload from signals up to 10V, so no further time was spent checking these clearly more than adequate overload margins.

Outputs

Output levels were related to the reference levels adopted for the noise testing, as it was felt that this would provide a sensible indication of typical domestic use conditions. The tape outputs were loaded by a 'worst case' 10kΩ/1000pf for 'phono' sockets and those DIN sockets that were clearly designed to match 'phono' standards. DIN standard sockets were checked into 100kΩ.

The headphone output was similarly related to

this reference level, and the socket was loaded by three resistance values to represent the extremes found amongst commercial designs; this should give a fairly good idea of how the amplifier will drive different impedance 'phones when referred to a speaker terminal output of 1 watt (2.83V/8Ω).

Damping factor, DC offset

The damping factor was calculated by measuring the output voltage on an Advance digital voltmeter both on and off load when driven to approximately 1 watt at three frequencies, 30Hz, 1kHz and 30kHz. The same equipment was used to check the DC offset values (where appropriate.)

Harmonic distortion

T.H.D. and noise is the rather more precise term which we are using in place of T.H.D.; the change has come about largely because harmonic distortion levels tend to be very low in many designs, and are frequently obscured by residual noise in the amplifier or measuring system. Spot mesurements were taken with the ST *1700*, with the residual monitored on a 'scope, at half power and 1watt and the following frequencies: 20Hz, 100Hz, 1kHz, 3kHz, 10kHz, 20kHz and 30kHz. The figures have not been quoted, but a value judgement characterisation relating to the average of the test group has been derived, and any specific features considered relevant are pointed out in the text.

To complete the harmonic distortion picture further, sweeps were plotted from 20Hz to 20kHz at half rated power into an 8ohm load for the second and third harmonics. As the latter is considered likely to be audibly the more significant, it was selected for publication.

Intermodulation distortions

Again two approaches were made to examine intermodulation distortions. The first used the B&K *2010* and *1902* distortion measuring system to check the CCIF standard 'spot' measurement via the disc input. A 1:1 mixture of 19kHz and 20kHz was checked at four different power levels: 0.1watt, 1watt, 10watt and -3dB ref max power, measured as 'equivalent sinewave power' to take account of the additive peaks generated by the combination. A summary comparative value judgement of the results has been made and recorded in the reviews.

The second method of examining intermodulation distortions involved plotting a frequency sweep between 200Hz and 200kHz, using a fixed frequency of 70Hz in 1:1 ratio with the swept frequency. These were carried out at a standard level of 15watts (equivalent sinewave power), so all the amps may be compared directly, and into two loads: an 8ohm resistor and a Tangent *TM3* loudspeaker, for comparison purposes.

Bandwidth

With the B&K *2010* as signal source, ST*1700*, 'scope and load box across the output, a sweep was made at -3dB ref the max power at 1kHz to determine the total pass bandwidth of the amplifier, concentrating on the disc input, but also checking the other inputs. This can prove something of a stern test for the amplifier, by generating a lot of localised heat at the transistors, particularly when the bandwidth is rather wide, though happily only one example suffered (at the not unlikely frequency of 200kHz.)

Any evidence of waveform triangulation within this bandwidth was noted, as this is evidence of slew limiting, a form of distortion that is generally considered to be undesirable. Slewing problems can be observed by this means but they are not easy to pin down to a precise cause without examining the amplifier internally stage by stage, and may be introduced in power amps, pre-amps or internal interfaces within the amps. We have commented on slew limiting in the review text where relevant.

Squarewaves

Squarewaves from a Levell oscillator were connected to the disc input *via* an inverse RIAA network, and the output from the amp connected to the load system and storage oscilloscope; no attempt was made to bandwidth limit the input signal, as it was felt preferable to use this as a 'worst case' test. Although we would readily concede that it may not be fully representative of typical input signals, the trend towards wide-bandwidth cartridges continues, and we are inclined to feel that Murphy's law may well apply.

The load was varied between 8Ω and 8Ω + 2μf and signals applied at 10kHz, 1kHz and 100Hz at the modest power of about 1watt. The lower reproduced trace used only the 8ohm load; 'normally' in the left hand trace, while the right hand trace represents the effect of a switchable LF filter if one is fitted. Some amplifiers have a fixed LF

rolloff on disc input, and this is reflected in the phase changes observed.

Asymmetric pulses

This pulse was generated by a Hewlett Packard *HP214A* pulse generator and put through the line input of the amplifier; the volume was turned up to the point where the amp is delivering maximum voltage, *ie* on the point of clipping but not actually into overload. In fact a double pulse was used, each having a duration of 5ms, separated by 5ms, which represents approximately 100Hz. The height of the pulse, which is scaled, represents the maximum peak output voltage of the amplifier, and may be compared with the measurements of power output.

Precisely the implications of conducting this test, or its resultant interpretation remains somewhat obscure. Certainly there is some reason to believe that asymmetrics play a role in sound reproduction, and recent discussions concerning the audibility of absolute phase appear to bear this out, so there may be good reason for examining an amp's abilities in this direction. Parallels also exist with current methods of impulse testing. However if one tries to find a single amp that actually repeats the input signal one is doomed to failure; all amps show some degree of voltage swing followed by a pattern of recovery, and occasionally some strange shape distortions as well. Undoubtedly some of the swing is due to phase shift that merely reflects the LF rolloff characteristic shown in the squarewaves, but there does not seem to be any fixed relationship between the known parameters of the amp and its behaviour. And it is clear that those amps which show the smallest shifts tend to take longer to fully recover. The implication perhaps is that neither the swing nor the recovery lag is desirable, and that parameters within the amp and power supply determine some degree of compromise between these two apparently interrelated effects.

One reason for including the pulse test as part of the procedures arose from an interesting and frustrating experience during the research we undertook before getting started on the tests themselves. During these 'shakedown' tests on a group of about five amps, the pulse test was tried with a loudspeaker connected as load as well as an 8ohm resistor, with quite dramatic results! The pulse appeared to be 'reflected' and cause all manner of upset to the amps with large voltage swings and LF ringing; interestingly the amp that was most favoured subjectively amongst this group showed the most stable behaviour. Unfortunately we were unable to repeat the results reliably enough for consideration in the main project, which remains a source of mystery and frustration. Nevertheless this perhaps suggests an avenue of exploration that other researchers might care to take up, particularly as the results seemed to bear some relation to the 'interface intermodulation' effects recently postulated by Otala. We would be pleased to hear from anyone who can shed further light on this interesting but perplexing area.

Separation

Both channels were driven to an output of 1watt, and then the input to one channel was removed and replaced by a 1kΩ source; the output from this channel was then recorded while the other was swept from 20Hz to 20kHz *via* both the disc (*via* inverse RIAA) and the tuner inputs.

LISTENING TESTS

Considerable thought ws given to the listening tests to be conducted for this project, particularly in the light of the research conducted on our behalf by Martin Colloms on power amp listening tests (see Consumer Introduction). While we remain quite confident that our efforts were worthwhile, and that detectable differences between amps were identified with quite good reliability in the tests, there must remain some doubt that these differences will remain consistent when system components are different, and selecting the components in the first place introduces an element of randomness and prejudice that can never be removed. However, by conducting several separate tests and deliberately varying the conditions somewhat we hope that some of these undesirable possibilities will have been weeded out.

Perhaps the hardest thing to decide was the choice of ancillary equipment to be used in assessing the amps. The decision to concentrate on disc sources because of personal preference and domestic availability meant that a low inductance cartridge was a necessity to avoid unpredictable frequency response variations due to electrical HF resonance between the cartridge and the differing pre-amp input parameters. To add variety several models were used, but it is only reasonable to point out that their characteristics as a family are bound

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to differ slightly from the numerically more common cartridge type which does resonate electrically and then rolls off at an earlier frequency than the models we used, which included the Grado *F1+*, Ultimo *10X*, Supex *901* and *900* (m-c inputs). Turntable by personal preference was universally the Linn Sondek *LP12*, though several arms were used including the Grace *707*, Mission *774* and Breuer *Dynamic*.

Choosing the speakers was rather more difficult. Most of the models that panelists considered tolerable over a hard few days listening tend to have certain idiosyncracies that make their selection slightly unfair on the amps, and whatever choice is made, it is bound to have its critics. From our 'shortlist' of 'tolerable' designs, the Quad *Electrostatic* was felt to offer high frequency impedance that was untypically capacitive, and would probably have suffered damage from some of the more powerful amps in any case. High quality smallish loudspeakers such as the Spendor *BC1* and Mission *770* were generally felt to offer insufficient bass extension to fully represent the capabilities of the more expensive amps adequately. The bigger quality speakers such as Spendor *BCIIIs*, Mordaunt-Short *Signifiers*, AR *9s*, Linn Isobariks etc all tend to offer a slightly or even very awkward impedance load. The KEF *R105* was perhaps the obvious choice, but previous experience had shown it was not a very good match acoustically with the room used in the first tests. This model was used in some of the second tests, on loan from the shop, and was then unfortunately sold (such is life!) In the end the Isobarik *DMS* was used predominately, due to personal preference and availability.

The low static impedance of this model was a possible source of worry with some of the amps, but this is offset somewhat by the quite high sensitivity of the design; moreover the fairly simple crossover and high dynamic stability are also in its favour. The fact that one of the least suitable amps in terms of power/impedance characteristics (the A&R *A60E*) was clearly in no trouble whatsoever must help vindicate the decision, and considerable care was of course taken to ensure that levels were well within the power limits of the amps during the controlled 'blind' testing.

In the first 'hands on' sessions a pair of Mordaunt-Short *Pageant IIs* were also used throughout, and these have a much higher modulus of impedance; in general they merely helped confirm the findings, though they were clearly less analytical and rather more fatiguing than the Isobariks. Other speakers that were used on occasion included Dahlquist *DQ10s* and Allison *Ones*, but the overall feeling was that the choice of speakers did not significantly alter the characterisation of the amps to any significant degree. A further series of checks were carried out by inserting a necessarily limited selection of the amps into a possibly more 'typical' system for a longer period than is normally possible with multiple testing; in this case the signal source was a Rega *Planar 2* turntable with ADC *VLM III* cartridge, and once again the results tended merely to confirm the general findings of the panel listening.

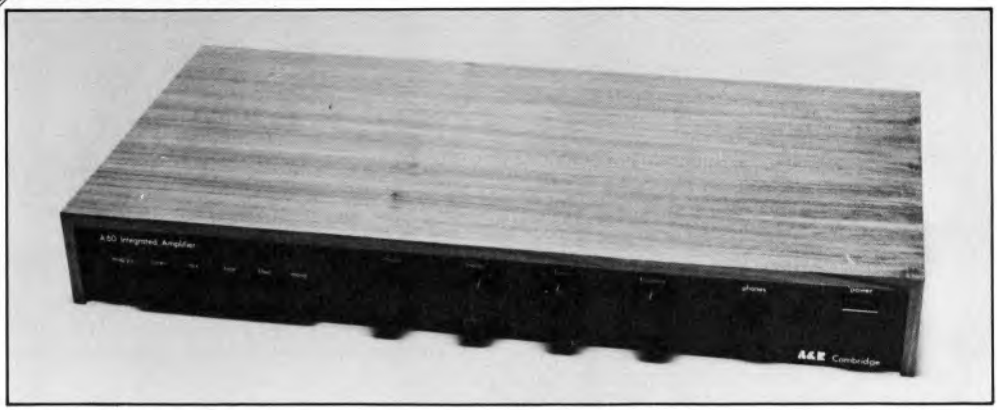
The panel listening involved four separate tests for each amplifier (with occasional noted exceptions due to sample failure etc.) These were conducted in two separate groups of sessions, each comprising one set conducted 'hands on' and one carried out 'blind'. Because of the unwieldy number of products involved, and a conscious attempt to avoid building up undue psychological pressure amongst listeners, we were less concerned with examining or attempting to analyse the minutiae of the reproduction of a particular bar or note some sixty times, than with the general behaviour of the product under a variety of conditions. Neither are we naive enough to assume that it is possible to replicate conditions precisely throughout a multiple test; even if the physical conditions were controlled the psychological ones never can be. General ground rules were applied concerning consistency of ancillaries, 'scope monitoring of levels to avoid clipping/protection operation and maintain loudness levels, insistence on a wide variety of types of music, and a reasonable sprinkling of 'control' repeats to monitor consistency in the panel.

We make no claims whatever for the authority of the results of our listening tests; we are merely reporting what we have done, why we have done it, and a summary of the results that we obtained plus comment on their general consistency, which we emphasise is based on subjective opinion. Reporting 'facts' that are based on opinions is a logically shaky but rhetorically effective device which must be approached with caution. We advise and indeed encourage readers to confirm or deny the relevance of our opinions for themselves, and not merely accept them without question.

RECOMMENDED

A&R (Cambridge) A60E

A&R (Cambridge) Ltd., French's Mills, French's Road, Cambridge CB4 3NP
0223 54507



Presentation, facilities etc.

Although A&R (Cambridge) have only been involved in hi-fi amplifier manufacture for a few years, their *A60* has acquired a strong reputation for offering good sound quality at a reasonable price. This model has one of the slimmest profiles amongst the test group, although it needs a wider shelf than many designs, and the black-on-black controls are not the easiest to distinguish and use. Rear mounted heat sinks allow the use of an attractive wooden sleeve, which is available in teak, walnut and black finishes.

All inputs use DIN connectors, with the facility for the one tape machine incorporating pre-sets to assist compatibility and level matching. The pickup disc input can also be modified to achieve good cartridge match by means of alternative modules, and an extra pair of 4mm binding-post speaker terminals allows the headphone socket speaker-muting function to be bypassed completely if desired. Other facilities are fairly limited, with a simple HF filter, (thankfully) no 'loudness', and no centre position or cancel switch for the tone controls.

Lab performance

The provision for variable capacitance on the pickup input should enable any cartridge type to be matched with little fuss. Likewise the tape replay socket allows some adjustment, and the value shown in the data is taken with this set at its most sensitive position. Although a DIN-type socket is used for tape recorder connection, the signal output is really much closer to the phono standards, and a DIN-to-phono connecting lead will probably be required to match most tape machines.

Most of the performance parameters measured were adequate, if hardly spectacular, though separation between channels was rather poor. The disc overload margin was well maintained at HF, though the damping factor drops somewhat; the input bandwidth was also tightly limited on the disc input at low frequencies, being -3dB at 30Hz. This appears to be a deliberate move to avoid the amp receiving signals that it might have difficulty handling.

The power outputs from this amp were not particularly impressive when one takes price into account. However they should be adequate for most purposes. The large increase with one channel only indicates that a bigger power supply would be of some advantage, and the low impedance performance is adequate rather than inspiring; however the toneburst measurement shows that the short-term capability is rather better.

Subjective impressions

In the first series of listening tests, the *A60* was consistently highly praised under both 'hand-on' and 'blind' conditions, particularly for superior bass definition. Some criticisms were made of a rather 'fizzy' treble, though this might perhaps be ameliorated by using a cartridge with less extended HF (eg ADC *VLM*, Ultimo *10X*).

In the second series of tests similarly positive results were again consistently obtained under 'blind' and 'hands-on' conditions, the amp being described as one of the best overall at any price, if lacking a little weight and having an occasional tendency to hardness or harshness at HF. Bass

detail was again mentioned as a comparative strength.

Conclusions

The *A60* is a difficult design to assess. The presentation is refreshingly 'domestic' amongst a plethora of 'pseudo-scientific' designs, and the facilities and bandwidth control would appear to be well chosen. On a price/power basis it would seem a little on the expensive side, but if one places any credence in the consistently very good listening test results, then there is no doubt that the model can be firmly recommended, and subjectively speaking rates as a 'best buy'.

GENERAL DATA

Typical price (inc VAT) £160
Approx size (w × h × d) ..... 18(45) × 2½(6) × 10(26) ins (cm)
Approximate weight ..... 10 lbs (kg)
Presentation (fascia, case etc) ..... matt black, wooden sleeve*
Quality of external finish ..... good
Listening impression summary ..... f. good

Features and Facilities

Tape facilities ..... one machine (DIN socket*)
Tone controls/switchable? ..... simple/no
Filters/loudness ..... HF, fixed dise LF/no
Others ..... disc capacitance, tape input adjustable.

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 36/35 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 30/30 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 30/30 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω..... 45/47/12 Watts*
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 42/38/12 Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 57/92/29 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 DIN, 49kΩ/240*pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.48/2.1/19mV
Disc: overload 20Hz/1kHz/20kHz..... 36/37/37dB
Tuner: impedance/sensitivity 103kΩ/100mV
Aux: impedance/sensitivity..... 103kΩ/100mV
Tape DIN: impedance/sensitivity..... 48kΩ/100mV*

Outputs

Tape DIN: for 5mV disc/for .5V aux/imp..... 235mV/465mV/50kΩ*
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ ..... 70mV/.9V/1 .1V

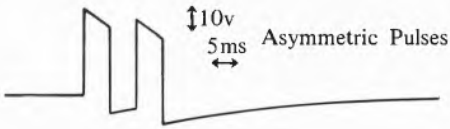
Noise (ref 1 watt, A wtg)

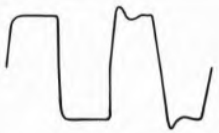
At zero volume ..... –81dB
Aux, ref vol, 1kΩ source..... –77dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –75/–71dB

Other technical parameters

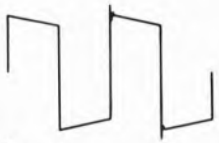
Damping factor 30Hz/1kHz/30kHz 40/40/17
DC offsets L/R..... +30/–18mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 30Hz—70kHz
Total Harmonic distortion (inc noise) ..... below average
Intermodulation dist (CCIF 19/20kHz RIAA)..... average
Hum performance ..... below average

* See text

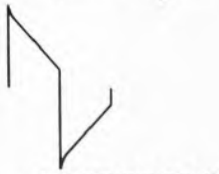




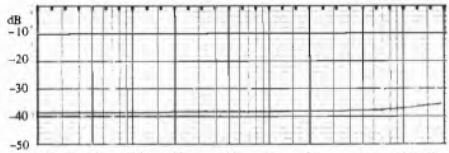
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



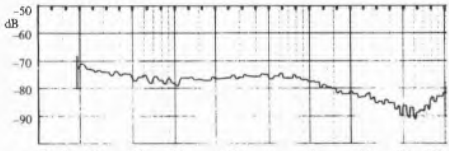
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



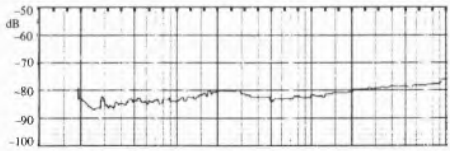
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



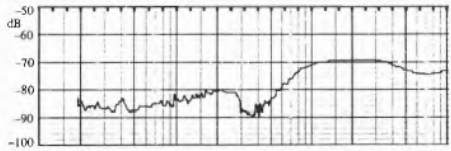
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Akai AM-2250

Akai (UK) Ltd., 82/106 Cricklewood Lane, London NW2 2DP. (01) 450 2011

Presentation, facilities etc.

This brand new Akai model was received just in time to be included, though some listening tests had already taken place without it unfortunately. As an example of the latest Japanese budget amps, it reveals ingenious cost-cutting techniques which are no doubt a response to increased competition and the Yen appreciation in recent years; however the amp by no means looks cheap, and in fact was admired for its attractive presentation, with dark matt grey finish highlighted by shiny black plastic knobs; it is also quite compact, but without really appearing so!

The inputs are phono type, with one tape DIN duplication, and crossdubbing is provided between the two tape machine connectors. Simple unswitchable tone controls and a loudness switch are fitted, but no filters. The interior contains some 'fresh air' due to the extensive use of ICs.

Lab performance

Although by far the simplest amplifier tested in terms of internal components, the *2250* nevertheless performed quite respectably. The disc input has very low capacitance, and this will probably need to be increased for most cartridges by means of plug in equalisers, while the overload margin was less generous than most at HF. Other inputs should pose no problems, though the headphone socket output levels are rather high into all impendances.

While noise is quite acceptable, hum is a little below average at 50Hz. Separation through the line input was rather disturbing: from a minimum of about –80dB at 30Hz it deteriorated to less than –20dB at 20kHz, though the disc input was more even and 10dB better at HF. Swept distortions were also reasonable but showed a rise on intermod with speaker load at HF. Squarewaves and pulse show some overshoot at LF and the usual degree of ringing into capacitive loads, while the bandwidth is perhaps a little high at 80kHz.

Power output was naturally restricted, with evidence in the single/dual drive difference that the power supply could be improved. Although the 'ideal' doubling into low impedances was not shown, delivery at reasonable levels was creditably maintained.

Subjective impressions

This was one of the last models to arrive and unfortunately missed out on some of the listening tests. The results on the others were nonetheless very encouraging for the price, with an above average overall rating. Described as slightly 'soft' and 'bright' with some muddling, the amp continued to sound reasonable even when played at maximum volumes. These results were quite consistent in the limited tests undertaken.

Conclusions

This model would appear to be attractive proposition at its very modest price, and does not appear to have suffered in any way from the cost-cutting and advanced IC technology used. Presentation was very good, facilities and power adequate, and though our listening results must remain tentative they are nevertheless promising.

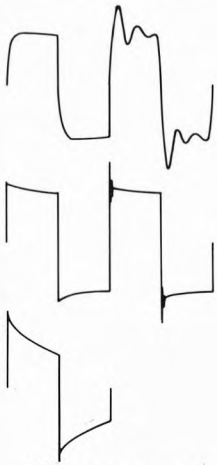
Akai AM~2250

RECOMMENDED

GENERAL DATA

Typical price (inc VAT)	£86
Approx size (w × h × d)	15(38) × 5(13) × 10(24) ins (cm)
Approximate weight	14lbs
Presentation (fascia, case etc)	dark matt grey
Quality of external finish	v. good
Listening impression summary	above average*
Features and Facilities	
Tape facilities	2 sets, one-way dub, DIN dup.
Tone controls/switchable?	simple/no
Filters/loudness	no/yes
Others	
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	31/31 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	26/27 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	29/27 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	37/42/50 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	37/42/50 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	39/75/77 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 53Ω/20 pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.44/3.2/30mV
Disc: overload 20Hz/1kHz/20kHz	31/31/26dB
Tuner: impedance/sensitivity	61kΩ/160mV
Aux: impedance/sensitivity	61kΩ/160mV
Tape phono: impedance/sensitivity	88kΩ/160mV
Tape DIN: impedance/sensitivity	88kΩ/160mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	240mV/480mV/650Ω
Tape DIN: for 5mV disc/for .5V aux/imp	45mV/90mV/31kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	120mV/2.1V/2.6V
Noise (ref 1 watt, A wtg)	
At zero volume	–84dB
Aux, ref vol, 1kΩ source	–75dB
Disc, ref vol, 1kΩ/M75EJ sources	–75/–73dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	61/57/34
DC offsets L/R	–4/–7mV
Power bandwidth, –3dB ref max power 8Ω disc	12Hz—80kHz
Total Harmonic distortion (inc noise)	average
Intermodulation dist (CCIF 19/20kHz RIAA)	average
Hum performance	below average

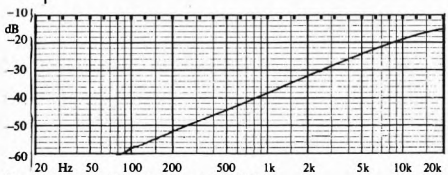
* See text



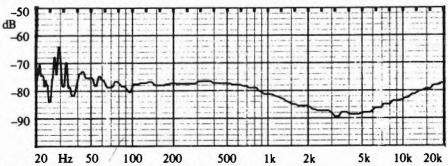
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

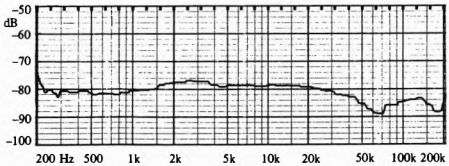
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



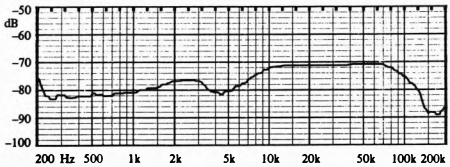
Channel Separation, line input, 1w/8Ω.



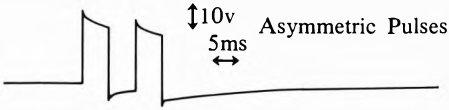
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz



Amstrad EX330

Amstrad Consumer Electronics Ltd., 1-7 Garman Road, London N17 0UF. (01) 801 4431

Presentation, facilities etc.

This British made amplifier is characterised by offering styling very similar to the popular Japanese norm at a very modest price. The standard of finish is not quite as high as typical models of Japanese (rather than merely Far-Eastern) origin, but this is not really visually apparent from a yard or so away. The matt silver fascia includes two power meters of limited usefulness and a large detent-action volume control; HF and LF filters and 'loudness' are offered, together with tone controls operating on bass, treble and middle, but without defeat switching.

All inputs are 'phono' type, and the single tape input offers pre-sets for compatibility and level matching. There are DIN outputs for two sets of loudspeakers, and these are not switchable (possibly inconvenient, but not necessarily a bad thing.) This model was simple and straightforward to use, though the 'feel' to some extent betrayed its low price.

Lab performance

The disc input is fine, but shows a fairly low overload margin at HF, and the high level inputs offer different impedances and sensitivities which should assist in matching ancillary components. The headphone output level was rather too high, while the type output gives rather different levels for from disc and tape sources that could prove a little troublesome.

None of the measurements were particularly inspiring, but the hum level appeared to be the most serious problem, having a high harmonic content, and tended to dominate the noise figures. The distortion levels are also high, with the majority of measurements around the -60dB point, and significant HF rises. Most of the swept intermod rise is supersonic, though within the disc bandwidth which extended higher than the Solavox' to 40kHz. Separation was also rather poor, though the squarewaves and pulse were reasonably controlled, apart from a persistent undamped ringing with capacitive loading, generated at about 60kHz.

Power output was good for the price, albeit with limited low distortion bandwidth. A reasonable freedom from single/dual difference and a quite well maintained output into low impedances, particularly on tonebursts, was shown.

Subjective impressions

In the first series of listening tests, reasonably good agreement was obtained between 'blind' and 'hands on' results, and the amp was described as quite 'alive' although somewhat muddled in the bass and upper treble. Some hum was noted, which may be found offensive to some users under certain circumstances.

The second tests were rather less favourable, and were carried out on a different sample. The hum was found to dominate, being audible in quiet passages and adding coloration. A degree of 'muddle' was also noted, but an absence of HF aggression. The bass was felt to be lacking, but despite these criticisms, the sound was felt to be quite promising.

Conclusions

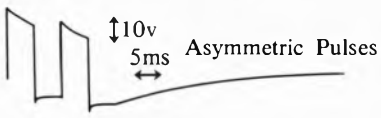
While the *330* appears to offer a lot for the price, with plenty of facilities, quite good power, and reasonable presentation, the measured performance is rather rudimentary, and the degree of hum worrying. Despite its obvious limitations, there are

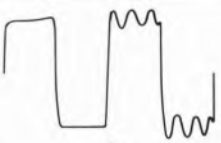
indications of promise, and in the listening tests it was sometimes quite well rated, because although the problems were noted the sound was still felt to have potential. It appears that this model could become a strong 'budget area' recommendation, but without some hum improvement we intend to reserve judgement, while recommending audition for those seeking a very cheap amp.

GENERAL DATA

Typical price (inc VAT)	£67
Approximate size (w × h × d)	17(43) × 6(15) × 13(33) ins (cm)
Approximate weight	17 lbs
Presentation (fascia, case etc)	silver
Quality of external finish	f. good
Listening impression summary	below average*
Features and Facilities	
Tape facilities	1 set
Tone controls/switchable?	bass, mid, treble/no
Filters/loudness	HF, LF/yes
Others	meters
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	29/28 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	20/20 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	18/18 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	30/40/28 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	30/36/25 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	41/58/69 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 48kΩ/127pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.63/3.5/37mV
Disc: overload 20Hz/1kHz/20kHz	34/29/14dB
Tuner: impedance/sensitivity	165kΩ/68mV
Aux: impedance/sensitivity	86kΩ/300mV
Tape phono: impedance/sensitivity	36kΩ/94mV
Tape DIN: impedance/sensitivity	kΩ/mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	100mV/600mV/2.3kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	210mV/2.35V/2.9V
Noise (ref 1 watt, A wtg)	
At zero volume	-69dB
Aux, ref vol, 1kΩ source	-69dB
Disc, ref vol, 1kΩ/M75EJ sources	-69/-69dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	50/50/50
DC offsets L/R	0/0mV
Power bandwidth, -3dB ref max power 8Ω disc	23Hz—40kHz*
Total Harmonic distortion (inc noise)	Poor
Intermodulation dist (CCIF 19/20kHz RIAA)	Poor
Hum performance	Poor

* See text

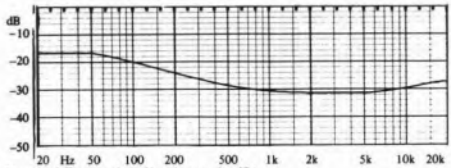




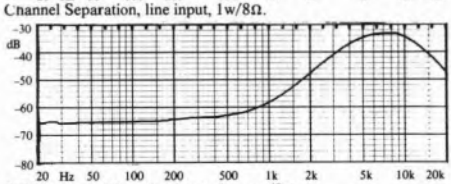
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

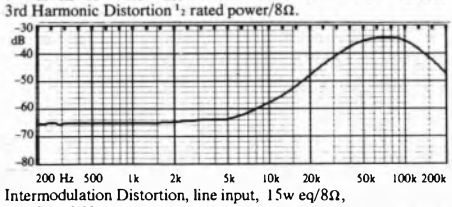
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



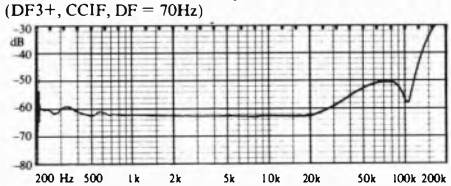
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz

Cambridge P80

Cambridge Audio Ltd., 105-109 Oyster Lane, Byfleet, Surrey KT14 7LA. 09323 51051

Presentation, facilities etc.

This very slim design was finished in black, with silver knobs and rosewood end pieces, the ensemble being considered particularly elegant and unobtrusive. This model has been in production in a basically similar format for a number of years now, and it is a tribute to the original design that it still appears fresh, modern and distinctive, and might fairly be considered the 'father' of the low-profile models that are becoming steadily more popular. The DIN-type inputs are cunningly fitted within a recess underneath the amp, which makes for concealment, and easy access if the front is lifted.

The tape recorder connection circuitry is rather unusual: up to three machines can be connected, two for record/replay and one for replay only, dubbing being possible when using the latter connection only; in addition one of the tape outputs is affected by the tone controls, so a poor recording or tape/machine match can be 'doctored' on record. Tone controls are simple and defeatable, while an LF and two variable slope HF filters are provided. An unusual arrangement is adopted for the volume control, with separate controls for pre- and power amp sections; green and red LEDs are provided to indicate the clipping and -20dB points for the pre-amp overload, the intention being to ensure that the pre-amp is never overloaded.

Subjective impressions

Rather inconsistent results were obtained in the first listening sessions: with 'hands on' the unit was described as lively, detailed and uncoloured if a trifle 'hard'; under 'blind' conditions, 'hardness' and 'brightness' were both regarded as more dominant. To confuse matters still further the second sessions produced very similar results reversed between 'blind' and 'hands on'. The overall result was above average, and we are compelled to wonder whether the low disc HF overload was giving trouble on some occasions and not others.

Lab performance

Despite considerable care in setting the unusual dual volume control arrangement which is intended to assist input overload margins, we were unable to improve on the highly unsatisfactory 0dB HF overload margin recorded, although a slight improvement was noted with toneburst rather than steady state signals, and this must prejudice any further findings on the amp. In other respects inputs and outputs should be fine, though one should note that the DIN tape socket is aligned to the more commonly encountered 'phono' standards.

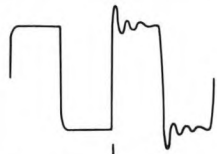
All distortion measurements were rather below average, and the sweeps show that these may well be audible in the audio band at -60dB. Squarewaves showed reasonably good control, and the pulse likewise, while the bandwidth was quite restricted, sensibly so in our opinion, but not tightly enough to avoid slew limiting above 20kHz on disc.

Power output was reasonable though not high at this price level, and showed a significant difference between single and double channel drive. Drive was reasonably maintained into low impedances, particularly so under 'burst' conditions.

Conclusions

Although this model has a number of points in its favour, notably neat smart presentation and useful tape facilities, and was surprisingly, though incon-

sistently, well received in the listening tests, the disc overload problems and high distortion levels must preclude general recommendation, though careful selection of band-limited cartridges may give good results.



10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £185
Approx size (w × h × d) ..... 16½(42)×2½(6)×10(25) ins (cm)
Approximate weight ..... 12 lbs
Presentation (fascia, case etc) ..... black, rosewood etc*
Quality of external finish ..... v. good
Listening impression summary ..... above average*

Features and Facilities

Tape facilities ..... complex*
Tone controls/switchable? ..... simple/
Filters/loudness ..... 2 HF, LF/no
Others ..... pre and power volume controls

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 53/52 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 49/46 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 50/50 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 64/90/50 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 64/90/55 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 95/154/211 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 DIN, 50kΩ/140pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.2/1.0/9mV*
Disc: overload 20Hz/1kHz/20kHz 17/15/0dB*
Tuner: impedance/sensitivity 98kΩ/165mV
Cassette: impedance/sensitivity 98kΩ/165mV
Aux: impedance/sensitivity 46kΩ/80mV
Tape phono: impedance/sensitivity ..... kΩ/mV
Tape DIN: impedance/sensitivity 98kΩ/175mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 350mV/350mV/4.8kΩ*
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 150mV/1.0V/1.0V

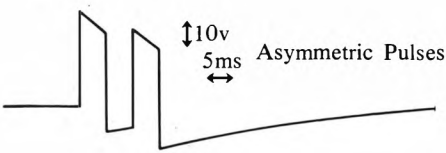
Noise (ref 1 watt, A wtg)

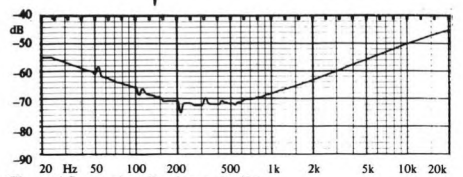
At zero volume ..... –82dB
Aux, ref vol, 1kΩ source ..... –82dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –79/–74dB

Other technical parameters

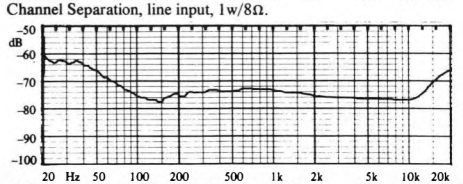
Damping factor 30Hz/1kHz/30kHz 150/140/72
DC offsets L/R ..... +2/+11mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 26Hz—38kHz*
Total Harmonic distortion (inc noise) ..... below average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... below average
Hum performance ..... average

* See text

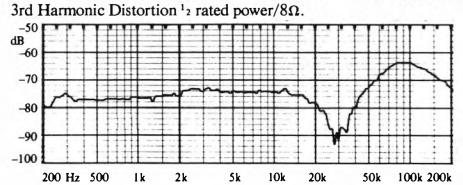




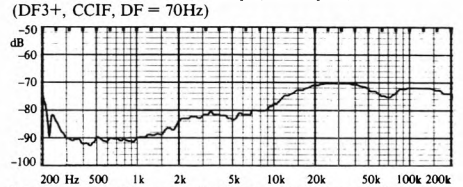
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

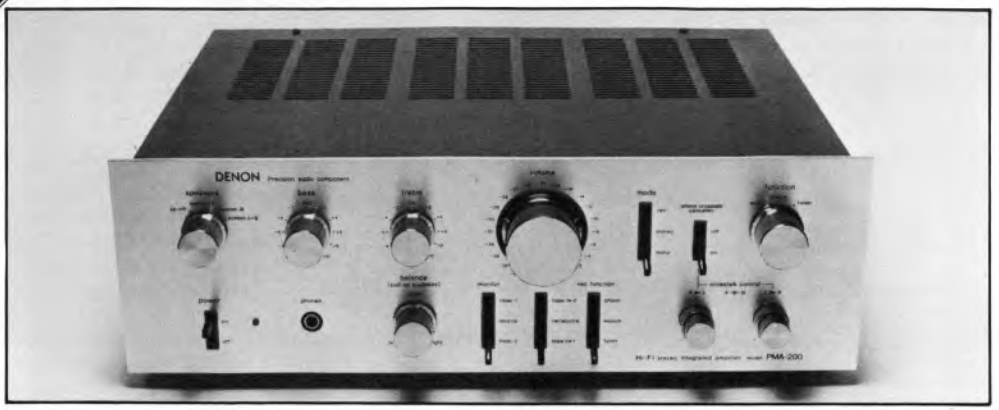


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Denon PMA-200

Denon, Eumig (UK) Ltd., 14 Priestley Way, London NW2 7TN. (01) 450 8070



Presentation, facilities etc.

The *PMA-200* is the cheapest model in the recently re-introduced Denon range of electronics, although it is by no means a 'budget' amp. Fairly conventional in styling, it was very well-finished with a brightish 'silver' fascia. All inputs are of the 'phono' type, and allow the connection and cross-dubbing switching of two tape recorders. Tone controls are simple and unswitchable, and a 'loudness' switch is fitted but no filters.

An unusual feature is known as a 'crosstalk canceller' and operates optionally on the disc input. Using a special (45 rpm) disc provided, two controls on the front panel are adjusted in an iterative manner to provide a minimum signal, which is claimed to improve the disc performance; operation was fairly easy, but we remain dubious of the benefits (see later.)

Lab performance

The disc input of this model has a very low capacitance, so a large number of cartridge types will benefit from the use of plug-in equalisers to add a little extra. The headphone socket provides a rather high output which could be an embarrassment with sensitive models.

The hum performance is let down by a significant component in the RH channel at 100Hz on our sample, and if this is typical it would be undesirable to use a speaker with similar LF resonance. Most of the other measurements were quite good, though the swept intermod – low throughout the audio band, and with little change with speaker loading – clearly shows some HF problems. Fortunately the disc input is rolled off at 66kHz, so problems are largely avoided, but the line input is open to 100kHz and slewing distortion can occur from 62kHz, which is probably undesirable. Square-waves showed control which was well above average.

Power delivery is reasonable but not spectacular for the price, and shows significant single/dual drive difference. It is reasonably well maintained into low impedances.

Subjective impressions

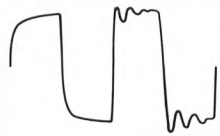
In the first listening tests the *PMA-200* scored fairly good marks with good consistency. The 'crosstalk canceller' was checked during the 'hands on' sessions, and under our conditions its effects were considered marginal and possibly detrimental: some suggestion of extra separation seemed to be accompanied by a slightly 'jangly' effect. Used normally, definition, detail and control were well-liked throughout, although consistent criticism was also made of a rather 'thin' top, with some loss of control, not liked on strings. Gratifyingly similar results were obtained on the second sessions, with the *200* again well received, and again the only serious criticism was of rather 'harsh' high frequencies.

Conclusions

This Denon model may not be as cheap as some other models of similar power, but its finish was to a high standard, and it scored consistently well in the subjective tests, although we do feel that it would have been still better value had the 'crosstalk canceller' been omitted. Performance results were generally good, the possible problems shown on the

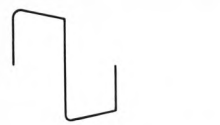
RECOMMENDED

swept intermod not being reflected in the fairly well controlled squarewaves. Providing the low disc capacitance is taken into account it should prove a very capable performer.



10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £215
Approx size (w × h × d) ..... 17(43)×6(14)×14(36) ins (cm)
Approximate weight ..... 20 lbs
Presentation (fascia, case etc) ..... silver
Quality of external finish ..... v. good
Listening impression summary ..... f. good*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing
Tone controls/switchable? ..... simple/no
Filters/loudness ..... no/yes
Others ..... 'crosstalk canceller'*

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 59/59 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 53/54 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 56/56 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 70/88/66 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 69/86/67 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 91/41/145 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 52kΩ/15pf*
Disc: sensitivity 20Hz/1kHz/20kHz 0.3/2.8/28.5mV
Disc: overload 20Hz/1kHz/20kHz 38/38/29dB
Tuner: impedance/sensitivity 100kΩ/175mV
Aux: impedance/sensitivity 100kΩ/175mV
Tape phono: impedance/sensitivity 100kΩ/175mV
Tape DIN: impedance/sensitivity ..... kΩ/mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 275mV/460mV/550Ω
Tape DIN: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ ... 110mV/2.65V/3.0V*

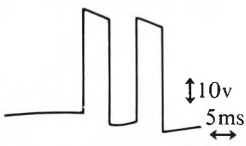
Noise (ref 1 watt, A wtg)

At zero volume ..... –86dB
Aux, ref vol, 1kΩ source ..... –82dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –79/–79dB

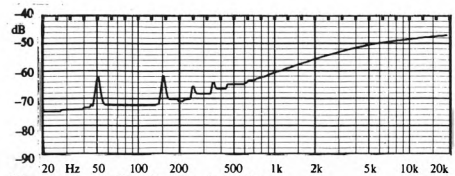
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 100/100/83
DC offsets L/R 2/20mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 6.5Hz—66kHz*
Total Harmonic distortion (inc noise) ..... above average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... above average
Hum performance ..... below average

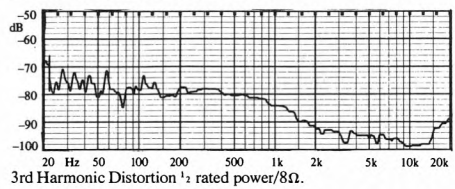
* See text



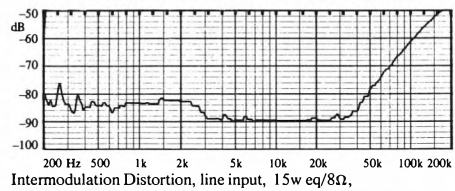
Asymmetric Pulses



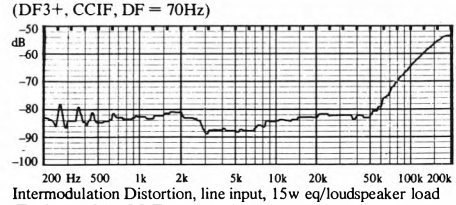
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Denon PMA-400

Denon, Eumig (UK) Ltd., 14 Priestley Way, London NW2 7TN. (01) 450 8070

Presentation, facilities etc.

This model is very similar to the smaller Denon *200*, but offers higher power capability and a couple of extra pre-amp controls. The fascia is a similar 'bright' silver, and the range of the detent action volume control is extended by an extra muting facility. The all-'phono' inputs again allow two tape recorders to be connected with the cross-dubbing facility. To the loudness control is added an LF filter, but again no bypass switching is provided for the centre-indent tone controls.

This model is also fitted with Denon's unusual 'crosstalk canceller' circuit on disc, and is provided with the special disc which is used when adjusting the two front controls to give a minimum signal. Although simply done, we remain to be convinced of the value of this facility.

Lab performance

The disc input capacitance is very low, so a number of cartridge models will probably benefit from some increase here. Other inputs and outputs should give no problems, though the headphone output is (as usual) on the strong side.

Performance measurements were generally pretty good, though the bandwidth is rather wide at 107kHz, and slew limiting could be induced above 60kHz at high powers, so some earlier HF curtailment would be very worthwhile. The swept intermod showed evidence of this at very high ultrasonic frequencies, but also showed a fairly significant in-band HF rise when the speaker load was connected. The squarewaves showed a slight overshoot at HF on resistive load, and some ringing with reactive loading. Separation was rather better than average.

Power output was hardly any greater than that offered by the slightly cheaper *200*, though tight power supply control is shown by the unchanged delivery with single or dual channel drive. Output is quite well maintained into low impedances, with a healthy transient capability.

Subjective impressions

The results of the first listening tests were generally favourable, but marginally inconsistent; nevertheless on all tests the *PMA-400* scored above average or fairly good overall. Once again we remain unimpressed by the 'crosstalk canceller', which made a difference, but not necessarily an improvement to our ears. The sound quality was praised for its transmission of detail and information, but some criticisms were made of treble emphasis and lack of bass control, although the overall impression remained that the amp was pleasant to listen to as well as detailed. The second sessions confirmed many of these findings with good correlation: generally positive, but again the *200* was preferred, and the 'brightness' criticised.

Conclusions

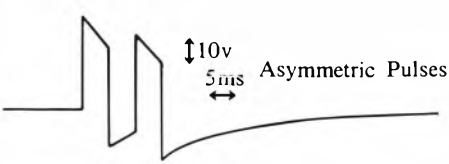
Although the *400* is a good enough amplifier in its own right, it remains rather in the shadow of the slightly cheaper *200* in the results of our tests, as power delivery, presentation and facilities remain very similar, while the measured performance on certain parameters was rather less encouraging. The results of the listening tests, while quite respectable, nevertheless fell slightly short of the *200*. Once again, in our opinion omission of

the 'crosstalk canceller' would have improved value for money, and the disc input capacitance may need to be increased by the user.

GENERAL DATA

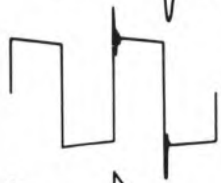
Typical price (inc VAT)	£260
Approx size (w × h × d)	17(43) × 6(15) × 14(36) ins (cm)
Approximate weight	28 lbs
Presentation (fascia, case etc)	silver
Quality of external finish	v. good
Listening impression summary	above average*
Features and Facilities	
Tape facilities	2 sets, crossdubbing
Tone controls/switchable?	simple/no
Filters/loudness	LF/yes
Others	'crosstalk canceller'*
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	62/62 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	58/58 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	57/57 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	62/86/85 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	62/86/88 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	91/146/145 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 52kΩ/23pf*
Disc: sensitivity 20Hz/1kHz/20kHz	0.3/2.8/26.5mV
Disc: overload 20Hz/1kHz/20kHz	39/39/38dB
Tuner: impedance/sensitivity	100kΩ/165mV
Aux: impedance/sensitivity	100kΩ/165mV
Tape phono: impedance/sensitivity	100kΩ/165mV
Tape DIN: impedance/sensitivity	kΩ/mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	300mV/470mV/125Ω
Tape DIN: for 5mV disc/for .5V aux/imp	mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2. 2kΩ	100mV/2V/2.5V
Noise (ref 1 watt, A wtg)	
At zero volume	-85dB
Aux, ref vol, 1kΩ source	-80dB
Disc, ref vol, 1kΩ/M75EJ sources	-78/-76dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	102/92/79
DC offsets L/R	5/9mV
Power bandwidth, -3dB ref max power 8Ω disc	6Hz—107kHz*
Total Harmonic distortion (inc noise)	above average
Intermodulation dist (CCIF 19/20kHz RIAA)	good
Hum performance	average

* See text

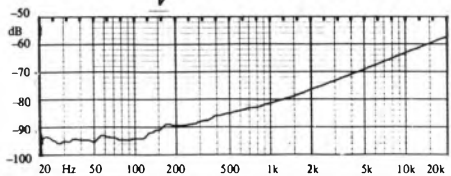


Asymmetric Pulses

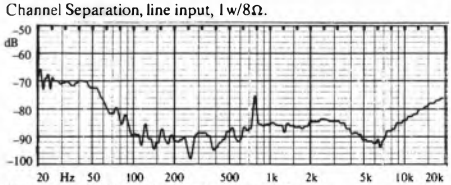

10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

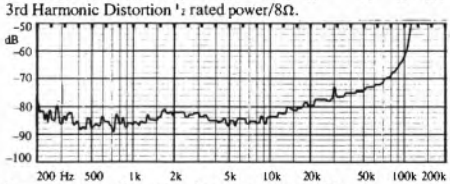

100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



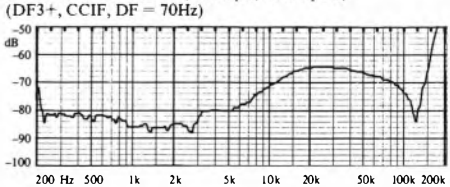
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

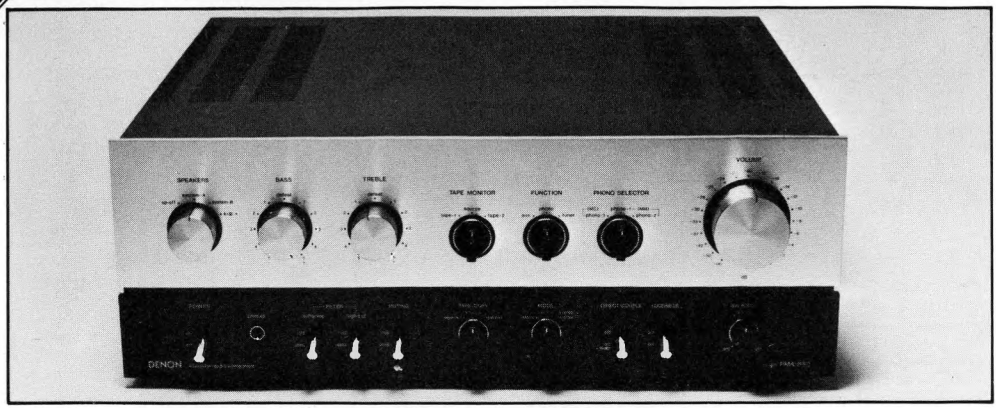


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Denon PMA-850

Denon, Eumig (UK) Ltd., 14 Priestley Way, London NW2 7TN. (01) 450 8070



Presentation, facilities etc.

This elaborate, bulky and heavy amp represents the top model from the Denon range imported into the UK. The styling is refreshingly unusual in its blend of grey and silver, and is more reminiscent of European amps like the Revox than the typical oriental design. The quality and standard of finish was exceptionally good. Facilities are comprehensive, with inputs/outputs for two tape machines and cross-dubbing switching, the option of a direct-coupled mode on the power amp, and pre-/power split socketry.

HF and LF filters and loudness are available, plus a full bypass facility on the simple tone controls. The all-'phono' inputs include no less than three (!) disc inputs, one of which incorporates a head-amp for the direct connection of moving-coil cartridges, which is logical in view of Denon's success in this field.

Lab performance

Some care should be taken when matching moving magnet cartridges, as the input capacitance is on the high side, and it is likely that the cartridge will see a total load of 350–450pf, which is too high for some models. The low 5ohm moving-coil impedance is a bit of a surprise, as it is less than optimum for Denon's own 35–40ohm cartridges. It should however work reasonably well with all types, from the Ortofons at one extreme to the Denons at the other, in view of the high sensitivity and good noise and overload figures.

Most of the performance parameters were well above average, though the swept intermod showed a significant in-band HF rise with speaker loading. Hum was excellent, and noise very good, but with a significant reduction with the cartridge load attached. Separation through line input was quite exceptional, but gave a rather different and somewhat unusual trace on disc, improving from -40dB at 50Hz to -80 at 20kHz! Squarewaves show quite good control, but the very high bandwidth could permit slew limiting above 100kHz on line.

Power output was reasonable for the price, showing some single/dual drive difference, but was well maintained into low impedances particularly under 'burst' conditions.

Subjective impressions

Rather mixed and inconsistent results were obtained from the first listening tests, and in some respects the *850* was not as well received as its cheaper brethren. Although described as fairly detailed and generally rather 'pleasant' sounding, with good control, some criticism was levelled at the treble, which was described as 'thick' and 'furry'. Whilst some rated the *850* quite highly, others were less impressed, and the overall findings are best summarised as 'good in parts'. The moving-coil input was assessed separately, and the sound quality *via* this input was considered fairly decent but with some similar misgivings.

The second sessions largely reinforced this somewhat ambivalent attitude, with further comments concerning a very 'smooth' treble, but descriptions of slight 'muddle' and 'harshness' when loud, and an overall slight lack of delicacy.

Conclusions

The excellent finish, comprehensive facilities, generous power delivery and good measured performance backed up by reasonable listening test

RECOMMENDED

results suggests this design is worthy of recommendation, though prior personal listening is also advised.

GENERAL DATA

Typical price (inc VAT) £445
Approx size (w × h × d) ..... 17½(44)×6(15)—16(41) ins (cm)
Approximate weight. ..... 38 lbs
Presentation (fascia, case etc) ..... silver, grey*
Quality of external finish ..... excellent
Listening impression summary ..... above average*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing
Tone controls/switchable? ..... simple/full bypass
Filters/loudness ..... HF, LF/yes
Others ..... M-C disc

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 106/106 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 104/104 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 102/102 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 114/150/136 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω .... 114/150/144 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω. ..... 139/222/241 Watts

Inputs

Disc: sockets, impedance/capacitance .... MM or MC, or MM50kΩ/231pf,MC5Ω
Disc: sensitivity 20Hz/1kHz/20kHz MM0.29/2.8/28.5mV, MC18/55/500μV
Disc: overload 20Hz/1kHz/20kHz MM38/37/37dB, MC33/37/37dB
Tuner: impedance/sensitivity 47kΩ/360mV

Aux: impedance/sensitivity..... 47kΩ/360mV
Tape phono: impedance/sensitivity 47kΩ/360mV
Tape DIN: impedance/sensitivity ..... kΩ/mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 620mV/460mV/78Ω
Tape DIN: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ..... 80mV/1.5V/2.1V

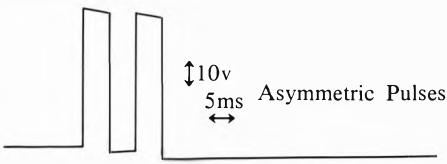
Noise (ref 1 watt, A wtg)

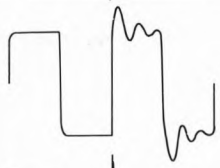
At zero volume ..... –86dB
Aux, ref vol, 1kΩ source..... –85dB
Disc, ref vol, 1kΩ/M75EJ sources ..... MM–82/–76dB, –MC(10Ω) –84dB

Other technical parameters

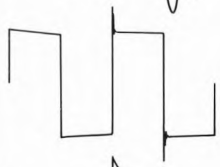
Damping factor 30Hz/1kHz/30kHz 92/90/64
DC offsets L/R..... –7/–9mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 5Hz—114kHz
Total Harmonic distortion (inc noise) ..... good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... good
Hum performance..... excellent

* See text

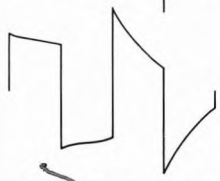




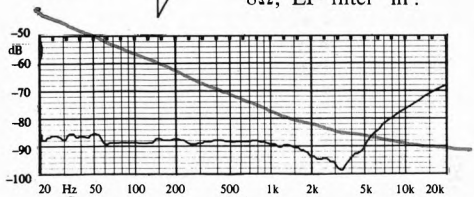
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



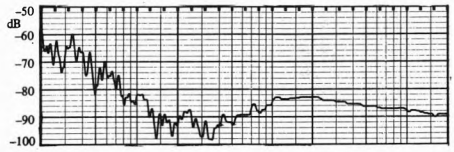
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



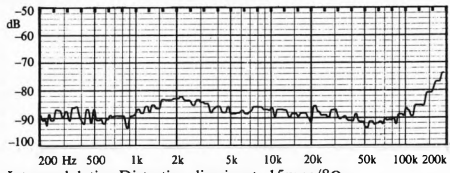
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



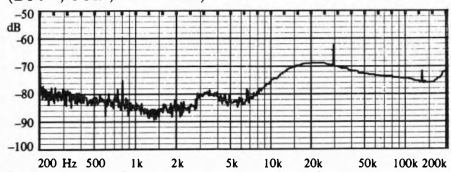
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Eagle A7200

Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU.
(01) 902 8832

Presentation, facilities etc.

Eagle have always tended to specialise in popularly priced components, and offer no less than seven models at less than £140. The *7200* is one of the cheapest at about £80, yet was surprisingly heavy compared to similarly priced contemporaries. Presentation is quite 'normal' with a matt silver fascia and very basic facilities.

Inputs were phono, though with tape DIN duplicated, one machine being catered for. The overall finish was fairly good, but one would be surprised to find exceptional standards at this sort of price, and would probably question whether there were 'hidden' economies inside. Simple tone controls without defeat were fitted, and the inevitable 'loudness' switch, but no filters.

Lab performance

The disc input had rather high capacitance which might make optimum matching for some cartridges a little problematic, so careful cartridge selection is advised. Other inputs and outputs should be fine, with the headphone output showing sensible attenuation, which is very unusual.

Performance parameters are generally quite good, particularly considering the low cost of this model, though some increase of HF intermod with loudspeaker load can be seen. The bandwidth is sensibly curtailed, and no slew limiting was observed. The squarewaves showed quite good waveforms, with some quickly damped HF overshoot on reactive load, and 'odd' overshoot at LF reflected in the pulse test.

Power output was quite respectable considering the price, but showed a significant difference between single and dual channel drive. Some capability was available into low impedances, but this was quite restricted.

Subjective impressions

Despite its low price the *7200* was quite well received, attaining a comfortable overall 'average' level. The best results were obtained in the first tests, where the amp was considered quite lively and 'solid', if a little 'shrill' and coarse. Criticisms were also made concerning a slightly 'vague' image and some bass 'looseness', but the detail was regarded as quite good.

The second sessions were less positive, finding an exaggeration of surface noise and lack of HF definition, plus a lack of 'punch'; the amp was not particularly liked.

Conclusions

With adequate facilities, finish and power at a very reasonable price, the *7200* gave a decent measured technical performance and rather inconsistent listening test results, which nonetheless gave an overall 'average' result. While we recommend potential purchasers to conduct their own tests, particularly as the amp is likely to be used with ancillaries of a very different standard to those used in the tests, it is without a doubt a competently engineered product worthy of some consideration by the 'budget' purchaser.

GENERAL DATA

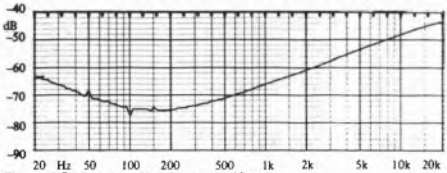
Typical price (inc VAT)	£80
Approx size (w × h × d)	16(41)×6(15)×13(33)ins (cm)
Approximate weight	19 lbs
Presentation (fascia, case etc)	silver
Quality of external finish	f. good
Listening impression summary	average*
Features and Facilities	
Tape facilities	1 machine
Tone controls/switchable?	simple/no
Filters/loudness	no/yes
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	37/36 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	30/30 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	35/34 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	43/49/23 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	42/36/18 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	49/61/33 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 47kΩ/233pF*
Disc: sensitivity 20Hz/1kHz/20kHz	0.4/3.1/29mV
Disc: overload 20Hz/1kHz/20kHz	30/31/28dB
Tuner: impedance/sensitivity	69kΩ/185mV
Aux: impedance/sensitivity	69kΩ/185mV
Tape phono: impedance/sensitivity	78kΩ/185mV
Tape DIN: impedance/sensitivity	78kΩ/185mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	240mV/420mV/2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	31mV/52mV/78kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	43mV/175mV/155mV
Noise (ref 1 watt, A wtg)	
At zero volume	–86dB
Aux, ref vol, 1kΩ source	–83dB
Disc, ref vol, 1kΩ/M75EJ sources	–76/–77dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	63/61/22
DC offsets L/R	25/49mV
Power bandwidth, –3dB ref max power 8Ω disc	15Hz—49kHz
Total Harmonic distortion (inc noise)	average
Intermodulation dist (CCIF 19/20kHz RIAA)	above average
Hum performance	above average

* See text

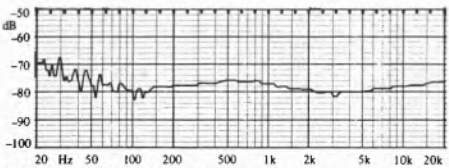
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

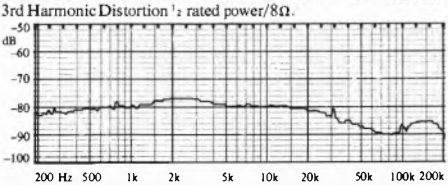
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



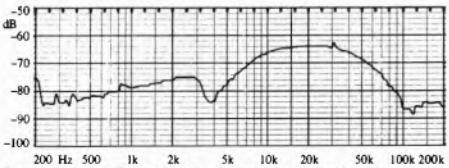
Channel Separation, line input, 1w/8Ω.



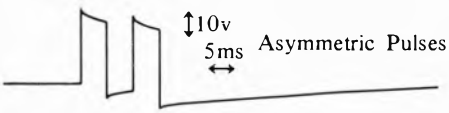
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF, DF = 70Hz



RECOMMENDED

Eagle A7400

Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU
(01) 902 8832

Presentation, facilities etc.

Near the top of Eagle's large low-cost range, the *7400* offers a better standard of finish, more facilities and more power than the *7200*. The styling is very similar, with the same almost obligatory matt silver fascia (though to be fair Eagle have helped pioneer the black-look as an alternative.)

Inputs are mostly *via* phono sockets, although one tape input is DIN duplicated; crossdubbing is offered between the tape inputs. Simple tone controls without defeat switching are fitted, and the loudness function is now joined by a high pass (LF) filter. A microphone input is fitted as a jack socket on the front panel.

Lab performance

The inputs and outputs showed fairly typical values apart from the phono tape out impedance which was much higher than usual at 54kohm, so it would be worth checking this function for compatibility if considering this model or selecting a recorder to use with it. The headphone output was as usual rather high.

Although there was a fair amount of 2nd harmonic distortion, 3rd was well under control and the swept intermod curves likewise, though the usual worsening results were obtained with the speaker load connected. Noise was fair, and hum let down rather by a significant 50Hz component on the left channel. The bandwidth was quite tightly controlled, and no slew limiting problems were in evidence. The squarewaves gave some slightly odd shapes, and likewise the pulse leading edge, but there was virtually no ringing, which is quite unusual.

Power output was quite reasonable for the price, but showed a fairly large difference between single and dual channel drive, while drive into low impedances was rather limited under steady state drive, though somewhat improved under 'burst' conditions.

Subjective impressions

In the first sessions the *7400* was not particularly liked, but an improvement in the second pulled it up to an overall average placing. The first sessions criticised the bass for being rather 'lacking', and a generally rather 'untidy' and 'ragged' overall sound, although the detail was considered fairly promising. The second sessions praised the model's lack of HF aggressiveness, and described it as easy to listen to, if rather lacking in definition and slightly 'jumbled'.

Conclusions

This model offers quite good power, albeit of the '8ohm' variety, a good standard of finish, and a fair number of facilities at a very competitive price. Moreover the listening test results were quite favourable, and perhaps more significantly, when considered with the carefully limited bandwidth, suggest that this amp should be more capable than most of working well and without aggression with the cheaper type of component which is likely to accompany it. It would seem to offer one of the better compromises for use in the 'budget' system, provided the speakers have an impedance which does not drop significantly below 8ohms.

Eagle A7400

RECOMMENDED

GENERAL DATA

Typical price (inc VAT) £120
Approx size (w × h × d) ..... 16(40)×6(16)×14(35) ins (cm)
Approximate weight ..... 19 lbs
Presentation (fascia, case etc) ..... silver
Quality of external finish ..... good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing, DIN dup
Tone controls/switchable? ..... simple/no
Filters/loudness ..... LF/yes
Others ..... mike input

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 43/45 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 37/38 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 42/41 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω 54/36/18Watts*
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 52/18/18 Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 72/69/36 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 54kΩ/100pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.35/2.55/27mV
Disc: overload 20Hz/1kHz/20kHz 34/35/34dB
Tuner: impedance/sensitivity 69kΩ/140mV
Aux: impedance/sensitivity 69kΩ/140mV
Tape phono: impedance/sensitivity 82kΩ/140mV
Tape DIN: impedance/sensitivity 80kΩ/150mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp ... 205mV/420mV/54kΩ*
Tape DIN: for 5mV disc/for .5V aux/imp. 32mV/50mV/80kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ. 82mV/1.9V/2.6V

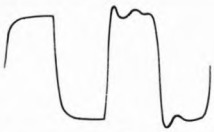
Noise (ref 1 watt, A wtg)

At zero volume ..... –83dB
Aux, ref vol, 1kΩ source. ..... –75dB
Disc, ref vol, 1 kΩ/M75EJ sources ..... –71/–72dB

Other technical parameters

Damping factor 30Hz/1kHz/30kHz 44/43/18
DC offsets L/R. 35/25
Power bandwidth, –3dB ref max power 8Ω ..... 20Hz—40kHz
Total Harmonic distortion (inc noise) ..... below average
Intermodulation dist (CCIF 19/20kHz RIAA). ..... average
Hum performance ..... below average

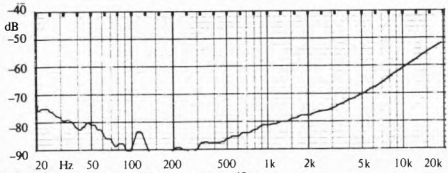
* See text



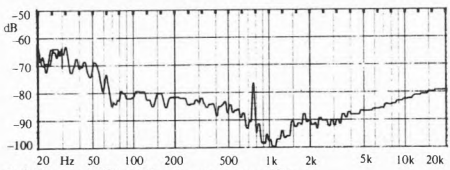
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

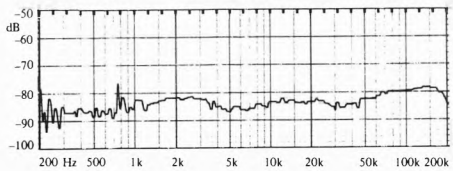
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



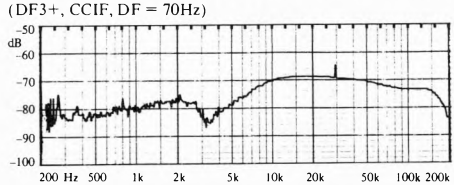
Channel Separation, line input, 1w/8Ω.



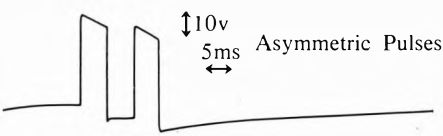
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

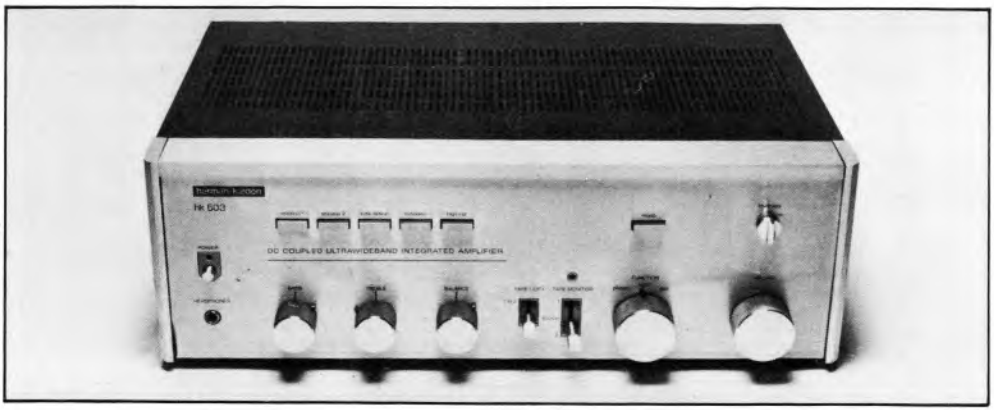


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



Harman Kardon H~K 503

Harman UK., St Johns Road, Tylers Green, High Wycombe, Bucks. HP10 8HR
049 481 5221



Presentation, facilities etc.

This is the cheaper of two new models in the middle of the Harman Kardon range; they are a lot more expensive than the budget *A401*, and a lot cheaper than the Citation series separates, comfortably fitting a mid-priced slot but leaving some gaps either side. Styling is a distinct contrast to earlier Harman models, with the large matt silver fascia and grey metal case nevertheless managing to look quite restrained.

The external finish was good, but our early-production sample had received slight transit damage, due perhaps to the fairly flimsy packaging; however this is presumably an isolated instance, and is an observation rather than a criticism. Facilities were quite comprehensive, with phono sockets throughout including two tape connectors which offered one-way dubbing. Simple tone controls were provided, together with defeat switching, loudness, HF and LF filters. Speaker protection in the form of a re-settable electro-magnetic contact breakers was fitted on the rear.

Lab performance

All inputs and outputs should be fine, and give no compatibility problems, though the headphone output into high impedances was a little on the high side.

Amongst the performance parameters the hum level gave a little cause for concern; as our sample was from early production, it is possible that this is not typical, and our measured figure is still pretty low and unlikely to be troublesome in practice. It is part of Harman Kardon's design philosophy to use very wide bandwidths, and the *503* is no exception, extending to 163kHz; while we feel that this is possibly unnecessary and can give practical problems, we detected no evidence of slewing distortions. No problems were apparent with the swept intermod which showed only a slight rise into loudspeaker load. Squarewaves showed some ringing into capacitive loads, some overshoot into resistive load at HF, and some rounding at LF.

Power delivery was reasonable but by no means exceptional for the price, but showed consistently good increases into low impedance loads, limited only by the circuit breaker speaker protection. A fairly small increase from dual to single channel drive is evidence of good power supply engineering, though the *505* was even better in this respect.

Subjective impressions

This model was generally considered to be quite detailed compared to most, but criticisms showed some inconcistencies. However the bass performance was noted by most listeners as rather ill-defined, a little 'detached' and 'loose'. While overall reactions were not particularly enthusiastic, neither were they very critical.

Conclusions

The good presentation and finish, sensible facilities, and good power delivery into loads are in the *503*'s favour, but its price is on the high side for the power offered, and our listening test results, while by no means poor, were not really enthusiastic enough to balance the price/power ratio.

GENERAL DATA

Typical price (inc VAT) £250
Approxsize (w × h × d) ..... 17(43) × 5½(14) × 12(30) ins (cm)
Approximate weight ..... 21 lbs
Presentation (fascia, case etc) ..... silver, grey
Quality of external finish ..... v. good*
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 2 sets, one-way dubbing
Tone controls/switchable? ..... simple/yes
Filters/loudness ..... HF, LF/yes
Others ..... circuit breaker protection

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 55/52 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 52/50 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 53/51 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 60/90/112 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 57/90/112 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 73/121/170 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 48kΩ/130pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.22/2.8/26mV
Disc: overload 20Hz/1kHz/20kHz 37/36/36dB
Tuner: impedance/sensitivity 29kΩ/170mV
Aux: impedance/sensitivity 29kΩ/170mV
Tape phono: impedance/sensitivity 29kΩ/170mV
Tape DIN: impedance/sensitivity 29kΩ/170mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 260mV/460mV/1.4kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 44mV/73mV/46kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 47mV/1.4V/2.4V

Noise (ref 1 watt, A wtg)

At zero volume ..... –81dB
Aux, ref vol, 1kΩ source ..... –79dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –75/–73dB

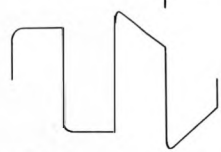
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 58/58/45
DC offsets L/R ..... –17/–20
Power bandwidth, –3dB ref max power 8Ω disc ..... 3Hz—163kHz
Total Harmonic distortion (inc noise) ..... average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... below average

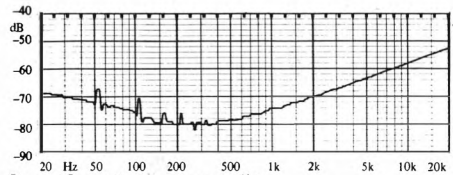
* See text

10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

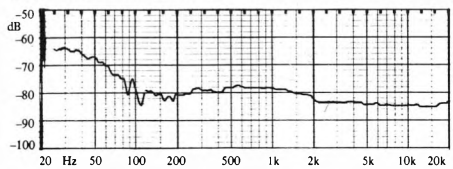
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



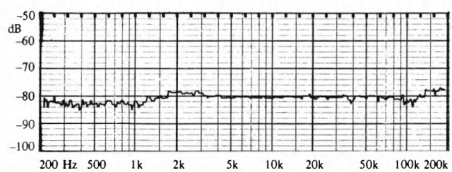
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



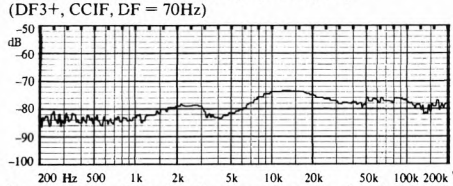
Channel Separation, line input, 1w/8Ω.



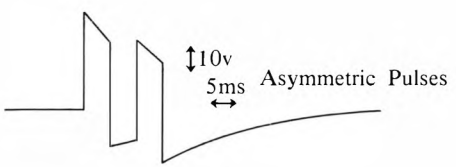
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



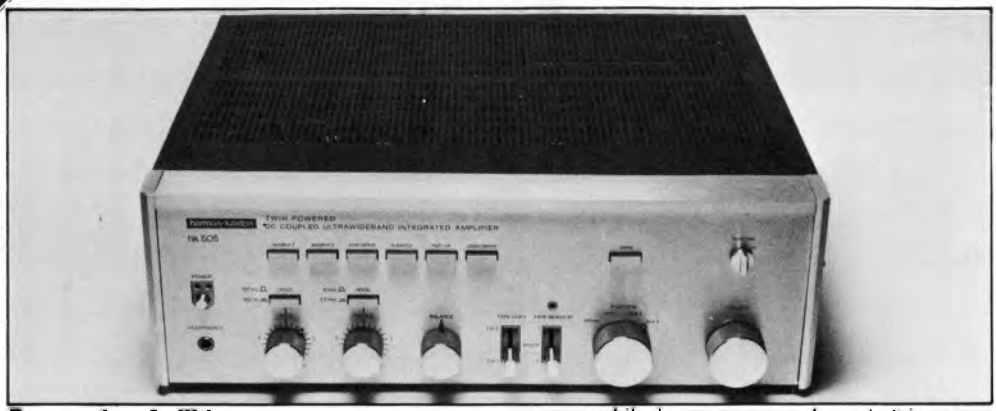
Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz



RECOMMENDED

Harman Kardon H-K 505

Harman UK., St Johns Road, Tylers Green, High Wycombe, Bucks. HP10 8HR
049 481 5221



Presentation, facilities etc.

This is the largest of Harman Kardon's integrated amps, and is a new model which was introduced at the same time as the *503*, the two bearing a close family resemblance. The extra £90 provides higher power levels and still further facilities for this attractively styled model. The matt silver fascia and grey case manages to look quite restrained despite its fair bulk, and the finish is very good.

Inputs are phono type, but a DIN tape alternative is provided and crossdubbing between the two inputs enabled. The tone controls are quite complex with switchable turnover points to vary their operating range, and defeat switching is also provided, along with loudness function, HF and LF filters. A contact-breaker method of speaker protection is provided on the rear; several indicator LEDs and a switch labelled 'capacitance' are also provided.

Lab performance

The disc input offers two values of capacitance which are particularly suitably chosen to match most current moving magnet cartridges. No compatibility problems are likely to be encountered with the other inputs or outputs, though the headphone output is (as usual) a little on the high side for high impedance models.

In general the performance measurements were pretty decent, with most parameters average or better, though the separation, while consistent between inputs, was only fractionally better than 50dB, and not as good as the *503*; swept intermod likewise showed a slight worsening into the loudspeaker load. The asymmetric pulse showed very good control but slow recovery, while the squarewaves showed a fair amount of ringing into capacitative loads and some overshoot at HF into 8ohms. Although we feel that Harman Kardon's adherence to an ultra-wide bandwidth philosophy may give rise to certain problems in practice, it is encouraging to note that no slew-limiting effects were noted. The drop in damping factor and pickup overload at HF is also noteworthy.

Power output was pretty good, showing a commendable lack of difference between single and dual channel drive, which indicates that the supply is adequate. The increases available into low impedances were also a healthy sign, the 'burst' performance in particular being encouraging.

Subjective impressions

The *505* was quite well received overall, and was generally felt to offer a slight improvement over the *503*. The bass was still criticised for some lack of definition, but not as strongly, and again the midband detail was generally liked, though there was mention of a feeling of lack of integration between the bass and the rest. Treble characterisations were less consistent, but the consensus seemed to be that the amp sounded a little bright but not aggressively so.

Conclusions

Although fairly expensive, this model offered comprehensive and well-chosen facilities, a healthy power delivery that was fairly resistant to load changes and showed minimal single/dual channel differences, and a high standard of finish. Performance measurements were reasonable, and overall sound quality fairly favourable, though personal listening is still recommended.

Harman Kardon H-K 505

RECOMMENDED

GENERAL DATA

Typical price (inc VAT) £340
Approx size (w × h × d) ..... 17(43) × 6(15) × 15½(39) ins (cm)
Approximate weight ..... 27 lbs
Presentation (fascia, case etc) ..... silver, grey
Quality of external finish ..... v. good
Listening impression summary ..... above average*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing, DIN dup
Tone controls/switchable? ..... complex/yes
Filters/loudness ..... HF, LF/yes
Others ..... circuit breaker protection etc*

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 77/77 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 74/74 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 75/75 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 78/124/162 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 79/127/146 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 100/172/274 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 47kΩ/103/286pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.33/2.42/23.2mV
Disc: overload 20Hz/1kHz/20kHz 39/40/30dB
Tuner: impedance/sensitivity 30kΩ/145mV
Aux: impedance/sensitivity 30kΩ/145mV
Tape phono: impedance/sensitivity 30kΩ/145mV
Tape DIN: impedance/sensitivity 2.9kΩ/145mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 250mV/440mV/967Ω
Tape DIN: for 5mV disc/for .5V aux/imp 42mV/70mV/470kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 50mV/1.5V/2.4V

Noise (ref 1 watt, A wtg)

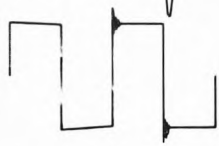
At zero volume ..... –80dB
Aux, ref vol, 1kΩ source ..... –80dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –79/–78dB

Other technical parameters

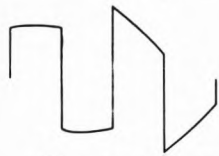
Damping factor 30Hz/1kHz/30kHz 112/107/67
DC offsets L/R ..... –9.0/–10.0mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 3Hz—170kHz
Total Harmonic distortion (inc noise) ..... average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... average

* See text

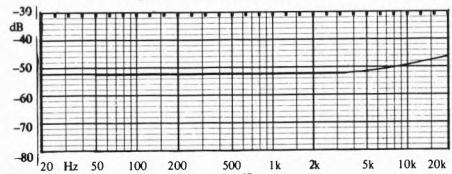
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



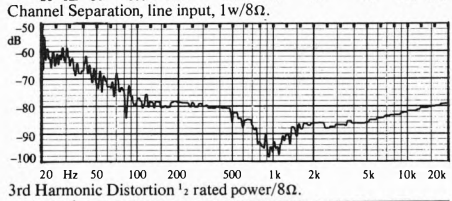
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



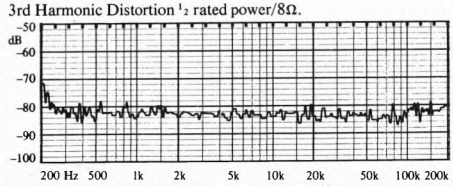
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



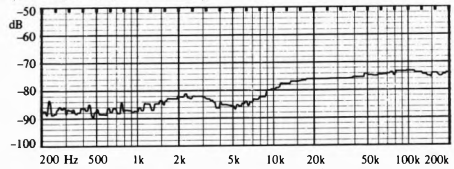
Channel Separation, line input, 1w/8Ω.



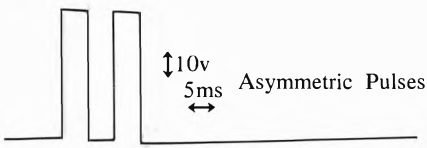
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

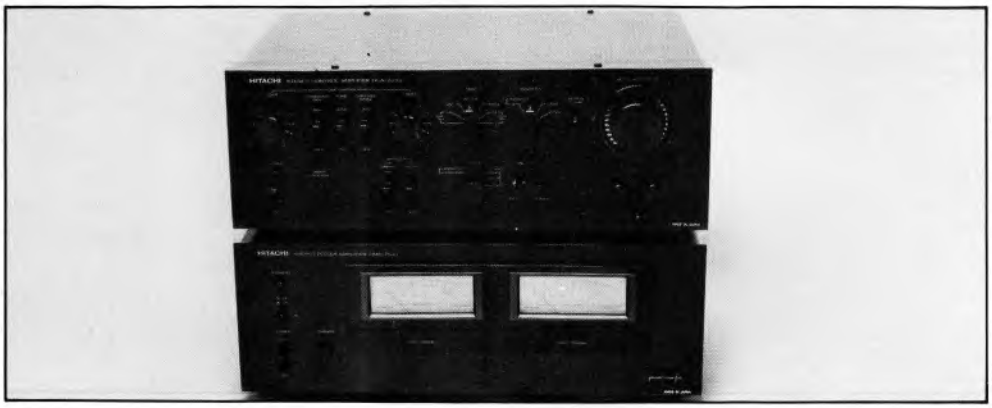


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



Hitachi HCA 7500/HMA7500

Hitachi Sales (UK) Ltd., Hitachi House, Station Road, Hayes, Mddx. UB3 4DR. (01) 848 8787



Presentation, facilities etc.

This expensive pre- and power amp combination certainly offers plenty of metalwork for the money, the pre-amp alone weighing more than some integrated models! The bulky and unbroken matt black presentation with large illuminated power meters could perhaps be described as aggressive/impressive. Finish is to a high standard, and the pre-amp offers comprehensive facilities. The *pièce de resistance*, well touted in advertising, is the special ultra-fast power-MOSFET devices used for the power transistors.

Inputs are all to phono standards, the disc loading usefully offering variable capacitance and impedance, the latter with a 100ohm option that should enable direct connection of some of the more efficient moving-coil cartridges (eg Denon). Tape crossdubbing is also offered. Tone controls have alternative turnover points and defeat switching, and HF and LF filters are fitted but no loudness. The effective range of the high quality volume control is extended with a mute facility.

Lab performance

The disc input was particularly versatile, offering well-calibrated impedance and capacitance switching that should enable all cartridge models to be effectively matched; the 100ohm impedance offered is unusual, and is well suited to higher-output moving-coil models. The headphone socket gave rather too much output for high impedance 'phones.

Performance parameters were generally pretty good, the various swept distortions being virtually indistinguishable or masked by noise across the bandwidth. On the other hand the separation deteriorated to –40dB at HF on line input, and at both HF and LF on disc. The impressive-looking meters consistently under-read. The bandwidth is a little on the wide side at 85kHz, but no slewing problems were noted, no doubt due in part to the high speed of the Mosfet devices. In spite of this bandwidth the squarewave performance was better controlled than most, though there was still some overshoot into reactive loads, and the asymmetric pulse was also controlled, if slow to recover.

Power delivery was fairly modest considering the price, and showed only slight increases into low impedance loads; the lack of difference between single and dual channel drive capabilities shows that the power supply is well up to the task, so there is presumably current limiting within the power amp.

Subjective impressions

This combination was consistently rated highly on all the listening tests, being generally described as 'tidy' sounding with good detail. Criticisms were notably sparse, though there was some mention of a 'thickened' midband, and one comment that it 'nearly made it!'

Conclusions

On sheer price/power ratio, this combination is clearly rather expensive, even though it offers comprehensive and useful facilities. However the consistency of the favourable subjective comments should be considered, and suggest that for some people a listening test may make traditional 'value

for-money' criteria irrelevant. Those who are in the market for an expensive amp should certainly try to hear this model.

GENERAL DATA

Typical price (inc VAT) £620
Approx size (w × h × d) .... total 20(48) × 14(33) × 15(36) ins (cm)
Approximate weight ..... 16/33 lbs
Presentation (fascia, case etc) ..... matt black
Quality of external finish ..... v. good
Listening impression summary ..... f. good*

Features and Facilities

Tape facilities ..... 2 phono, crossdubbing
Tone controls/switchable? ..... complex/yes
Filters/loudness ..... HF. LF/no
Others ..... power meters, var disc loading

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 90/90 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 88/88 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 90/90 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 91/100/50 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 91/100/50 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 111/181/90 Watts

Inputs

Disc: sockets, impedance/capacitance .....

Disc: sockets, impedance/capacitance... 2 disc, 50kΩ, var/var, 127pf*
Disc: sensitivity 20Hz/1kHz/20kHz 0.3/2.45/21mV
Disc: overload 20Hz/1kHz/20kHz 43/44/43dB
Tuner: impedance/sensitivity 151kΩ/115mV
Aux: impedance/sensitivity 151kΩ/115mV
Tape phono: impedance/sensitivity 141kΩ/115mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 230mV/240mV/680Ω

Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 90mV/2V/2.8V

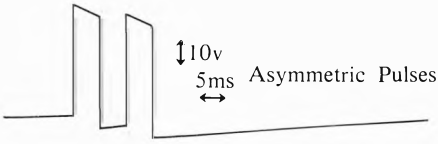
Noise (ref 1 watt, A wtg)

At zero volume ..... –94dB
Aux, ref vol, 1kΩ source ..... –86dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –81/–75dB

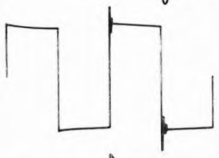
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 74/72/60
DC offsets L/R 12/17mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 7Hz—85kHz
Total Harmonic distortion (inc noise) ..... excellent
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... average

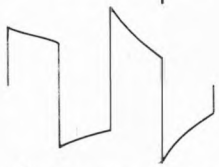
* See text



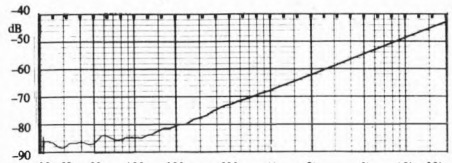
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



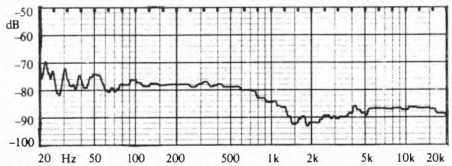
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



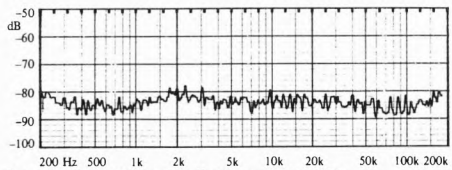
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



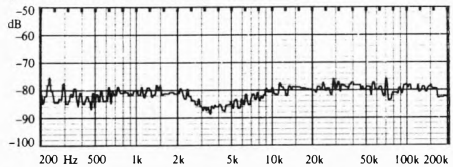
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

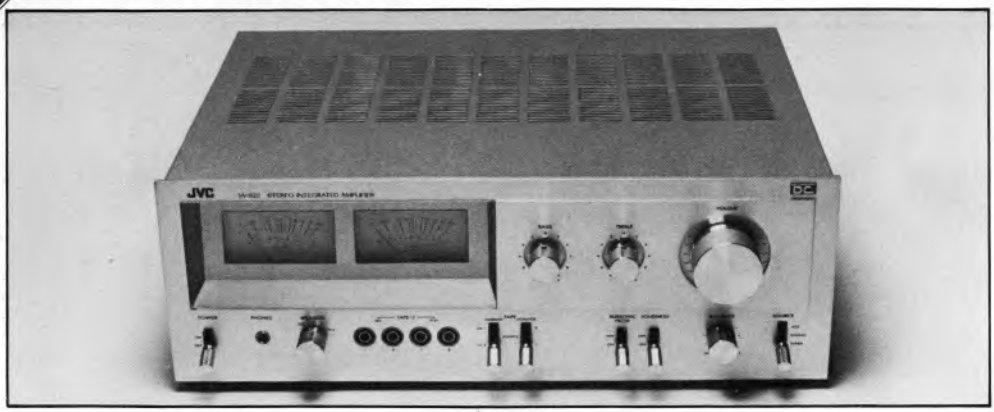


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

JVC JA-S22

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



Presentation, facilities etc.

The three JVC models tested in this book sit firmly in the middle of their very comprehensive range. The *22* is the cheapest of this group of new models and more or less replaces the popular *31*, while the well-received budget models *10* and *11* below £100 continue to be available. Styling was considered smart with very good finish at this price level, although perhaps rather conventional with the silver-fronted fascia and silver-grey case dominated by large power meters.

Inputs are predominantly phono with DIN duplication for tape, while the phonos for the second tape recorder are mounted on the front panel, which is quite useful for the person who is unlikely to own two machines but may well wish to temporarily connect a friend's machine for dubbing or recording purposes; crossdubbing is provided. The simple unswitchable tone controls are supplemented by loudness and LF filter functions.

Lab performance

Inputs and outputs offer reasonable parameters that should not pose compatibility problems, though (as usual) the headphone output is rather excessive.

Most of the measured parameters were to a very high standard for such a reasonably priced amplifier, though the separation was rather poor at high frequencies. The swept intermod was low and showed only a marginal in-band rise with loudspeaker loading, but there was evidence of problems at very high frequencies, and slew limiting was detected above 60kHz. The squarewaves showed some ringing at HF on both resistive and reactive loading.

Power output was pretty generous for the price, though the difference between single and dual channel drive figures was significant. Power delivery was reasonably well maintained into low impedances, but by no means exceptionally so, and the 'burst' ratings did not exceed the steady state measurements by much of a margin.

Subjective impressions

The *JA-S22* was generally well received in the listening tests, rather better than its more expensive brothers in point of fact. The first tests described an improvement over the (possibly faulty) *55*, with descriptions of a firm, clean and tidy sound, albeit with some veiling and muddling, and an overall ranking comfortably above average.

The second tests were rather less positive, and described a generally muddled sound, with the bass described as rather 'leaden', and a rather 'dull' presence area band. There is clearly some inconsistency in the overall rating of this model, so the prospective purchaser should try to listen for himself.

Conclusions

This model clearly offers good power output, a high standard of finish and measured performance, plus comprehensive facilities at a very modest price. Moreover the listening results were quite favourable, though rather inconsistent, so the model certainly merits recommendation, though prior personal listening is advised.

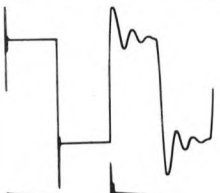
JVC JA-S22

RECOMMENDED

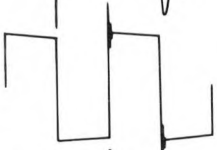
GENERAL DATA

Typical price (inc VAT)	£112
Approx size (w × h × d)	16½(42)×6(15)×13(33) ins (cm)
Approximate weight	19 lbs
Presentation (fascia, case etc)	silver, silver/grey
Quality of external finish	v. good
Listening impression summary	above average*
Features and Facilities	
Tape facilities	complex*
Tone controls/switchable?	simple/no
Filters/loudness	LF/yes
Others	meters
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	48/48 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	44/44 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	46/46 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	57/76/60 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	57/76/60 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	70/91/73 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 50kΩ/155pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.28/2.55/25mV
Disc: overload 20Hz/1kHz/20kHz	39/39/36dB
Tuner: impedance/sensitivity	54kΩ/165mV
Aux: impedance/sensitivity	54kΩ/165mV
Tape phono: impedance/sensitivity	62kΩ/165mV
Tape DIN: impedance/sensitivity	62kΩ/165mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	300mV/460mV/470Ω
Tape DIN: for 5mV disc/for .5V aux/imp	40mV/60mV/77kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2. 2kΩ	90mV/1.8V/2.4V
Noise (ref 1 watt, A wtg)	
At zero volume	–87dB
Aux, ref vol, 1kΩ source	–78dB
Disc, ref vol, 1kΩ/M75EJ sources	–77/–75dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	79/78/59
DC offsets L/R	–23/–9.0mV
Power bandwidth, –3dB ref max power 8Ω disc	7Hz—60kHz*
Total Harmonic distortion (inc noise)	good
Intermodulation dist (CCIF 19/20kHz RIAA)	good
Hum performance	above average

* See text

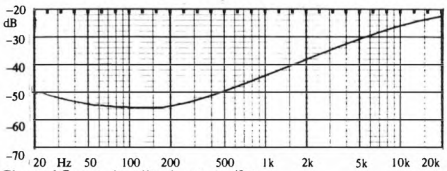


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

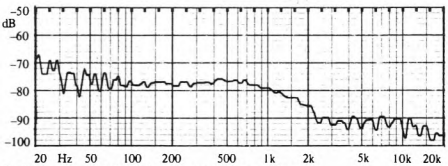


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

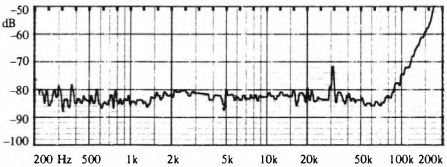
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



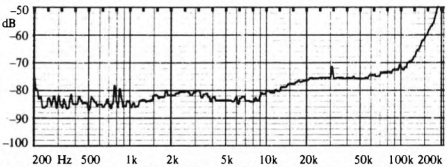
Channel Separation, line input, 1w/8Ω.



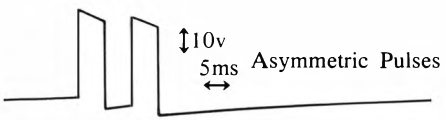
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

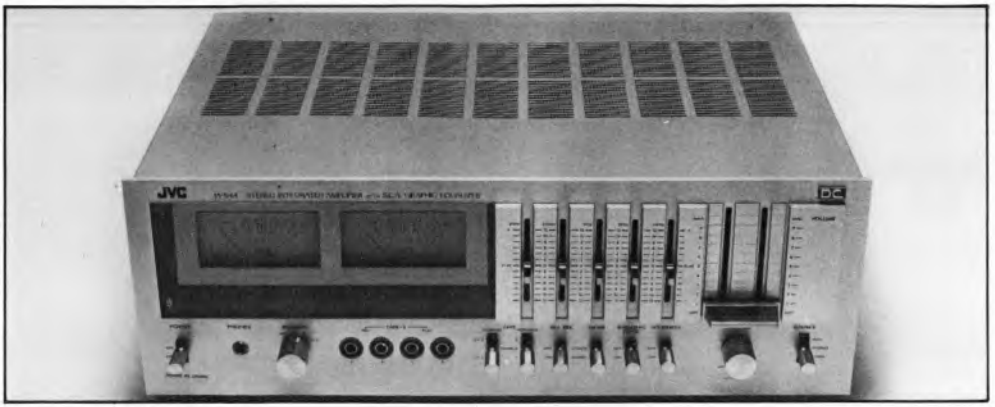


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



JVC JA-S44

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



Presentation, facilities etc.

The *44* occupies the next slot up from the *22* in JVC's UK range, and as might be expected has a number of common touches but also offers rather more facilities and power. In this case the power increase is very slight, and most of the extra money has gone into providing a five-band graphic equaliser instead of the tone controls. This certainly dramatically increases the 'sound-shaping' abilities, but we wonder whether JVC's claimed 371,293 possible tonal combinations (which we didn't check!) may not be a recipe for some confusion; in view of the complexity of this function we felt that the absence of a defeat switch, if only for purposes of comparison, was an irritating omission. In contrast, the ability to use this to pre-equalise a tape recording was considered potentially useful, more so than the oft-suggested compensation for loudspeaker/room interaction about which we remain sceptical, and for which rather more than five bands fixed frequency is really required.

In other respects the *44* was almost identical to the *22*, with large power meters, predominantly phono sockets with tape DIN duplicated, front connection access and crossdubbing for tape 2, LF filter and loudness functions.

Lab performance

Inputs and outputs show reasonably typical values that should pose no compatibility problems, though the headphone output is on the high side into all impedances.

Most of the performance measurements were very good, though hum level was held to 'below average' by the performance on one channel. Distortion levels were very low, but showed the typical characteristic swept intermod rise into the loudspeaker load at high frequencies. Separation was not very good at high frequencies, being less than –30dB at the extreme on our measurement, disc input following a similar trend. The bandwidth extends to a very high 140kHz, which in our view is somewhat excessive and there was some evidence of slew limiting at very high frequencies. Squarewaves showed quite good control, although a modest amount of ringing was still present under resistive loading.

Power delivery was reasonable, but not excessive for the price, though this is presumably because of the complex equaliser fitted. A significant difference was observed between single and dual channel drive, and a reasonable amount of power was available into low impedances.

Subjective impressions

The *JA-S44* was not rated highly in either of the listening tests, and the cheaper *22* was consistently preferred. In the first tests adjectives like 'uninspiring' were consistently recorded, and descriptions of a rather 'thin' sound with a tight but weak bass which lacked 'body'. The second tests did not confirm these findings, but again the *22* was preferred, the *44* described as having rather poor definition and a 'heavy' bass. In view of their inconsistency, these results must be viewed with some circumspection.

Conclusions

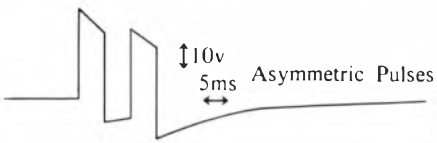
The *44* certainly offers something different to the run-of-the-mill amps with its 5-band equaliser,

though we wonder whether this offers fine enough control to be of significant value, and feel that bypass-switching should have been incorporated. Subjective results were not very encouraging, but neither were they consistent, so while we do not feel able to recommend this model for general applications, where the equaliser function would be properly useful it appears to offer quite good value, but pre-purchase listening is strongly advised.

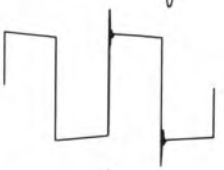
GENERAL DATA

Typical price (inc VAT)	£190
Approx size (w × h × d)	16½(42)×6½(16)×13(33) ins (cm)
Approximate weight	22 lbs
Presentation (fascia, case etc)	silver
Quality of external finish	v. good
Listening impression summary	adequate*
Features and Facilities	
Tape facilities	complex*
Tone controls/switchable?	5-band graphic/no
Filters/loudness	LF/yes
Others	
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	57/57 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	55/55 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	56/56 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	66/95/81 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	66/95/81 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	79/129/100 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 50kΩ/90pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.28/2.6/25.5mV
Disc: overload 20Hz/1kHz/20kHz	39/39/35dB
Tuner: impedance/sensitivity	70kΩ/140mV
Aux: impedance/sensitivity	70kΩ/140mV
Tape phono: impedance/sensitivity	85kΩ/140mV
Tape DIN: impedance/sensitivity	85kΩ/140mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	290mV/460mV/470Ω
Tape DIN: for 5mV disc/for .5V aux/imp	36mV/58mV/76kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	100mV/1.95V/2.65V
Noise (ref 1 watt, A wtg)	
At zero volume	–85dB
Aux, ref vol, 1kΩ source	–78dB
Disc, ref vol, 1kΩ/M75EJ sources	–76/–74dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	97/97/57
DC offsets L/R	–40/–40mV
Power bandwidth, –3dB ref max power 8Ω disc	3Hz—140kHz*
Total Harmonic distortion (inc noise)	excellent
Intermodulation dist (CCIF 19/20kHz RIAA)	excellent
Hum performance	below average*

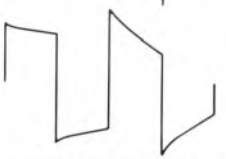
* See text



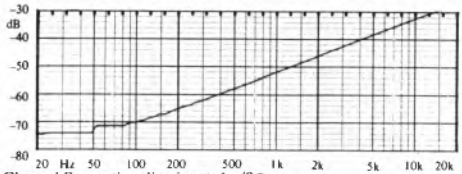
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



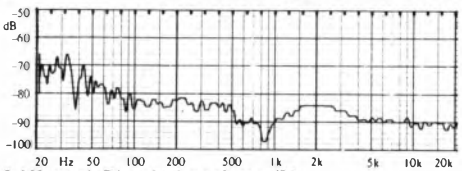
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



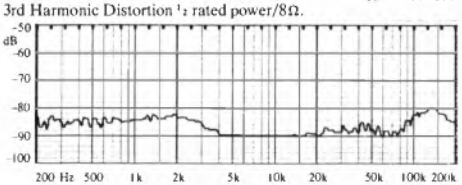
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



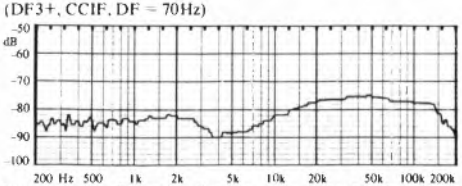
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



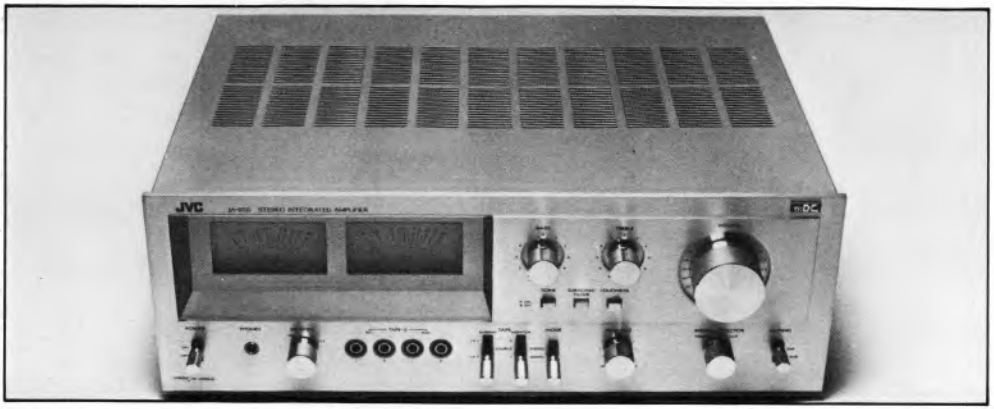
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF, DF = 70Hz

JVC JA-S55

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



Presentation, facilities etc.

JVC's *55* has more in common with the *22* than the *44* in terms of facilities, as no equaliser is fitted, and the series reverts to the traditional tone control arrangement (in this instance providing by-pass switching.) Some increase in facilities and power offered is inevitable, but most of the extra cost seems to have been spent on circuit engineering to improve rather than enlarge the sound output. One feature common to all these JVC models, and indeed emblazoned unsubtly on their fascias, is their DC coupling; this refers to the power amp sections of the cheaper models but is extended to include disc equalizer and tone controls in the 'Tri-DC' *55* and *77* models. Despite the possible theoretical benefits of DC-coupling (and without wishing to become embroiled in the debate over what it really means anyway, several Japanese companies claiming the superiority of their own particular approach) we should point out that the 'wider you open the window' argument does appear equally cogent in practice, and DC coupling should not be interpreted as necessarily a good thing *per se* –it is only relevant as part of the total overall amplifier performance. A further refinement in these designs is the use of separate power supplies, not in the one for each channel format, but so that one handles the stages up to the pre-drivers, and the other the power transistors; this has the advantage that only one large transformer is needed!

For reasons of space the reader is referred to the *JA-S22* for details of the facilities offered; these appear to be virtually identical apart from the inclusion of tone defeat, mono capability and volume control mute.

Lab performance

No serious compatibility problems are likely to be encountered, though the disc input capacitance may need to be increased to optimally match certain cartridges, and the headphone socket output is as usual rather high.

Hum performance was only average, because although it was at a fairly low level a fair number of harmonics were clearly visible. Distortion measurements were very good, though the swept intermod showed a significant in-band increase when connected to the loudspeaker load. The bandwidth was quite wide. and there was a possibility of slew-limiting above the 90kHz -3dB point. A rise in frequency response of 1.5dB was noted at 16Hz. Squarewave and pulse reproduction showed quite good control, although there was still some ringing on the reactive load.

Power delivery was adequate rather than generous at this price level, and showed a significant difference between single and dual channel drive. Reasonable delivery was available into low impedances.

Subjective impressions

During measurement an intermittent fault was discovered on our first sample of the *55*, by which time the first listening tests had taken place. While we have no means of knowing whether the fault condition was operative during these tests, and certainly no obvious evidence was noted, the results in all fairness cannot be recorded.

The second sessions described rather indifferent definition at HF with a tendency to bass 'looseness' and 'muddle'. The amp was liked for its lack of

aggressiveness, but was described as 'dull' rather than 'lively'.

Conclusions

While this amp offered good measured performance, facilities and finish, the power output was on the low side for the price, and the listening test results were insufficient to make up for this. Though our experience of the model was rather limited by the need to replace the first sample, it does not appear to offer sufficient advantage over the *22* to justify recommendation.

GENERAL DATA

Typical price (inc VAT) £230
Approx size (w × h × d) ..... 16½(42) × 6(15) × 13(33) ins (cm)
Approximate weight ..... 21 lbs
Presentation (fascia, case etc) ..... silver, silver grey
Quality of external finish ..... v. good
Listening impression summary ..... adequate*

Features and Facilities

Tape facilities ..... 2 sets, duplicates, crossdubbing
Tone controls/switchable? ..... simple/yes
Filters/loudness ..... LF/yes
Others ..... meters, 'Tri DC'

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 74/74 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 70/70 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 70/71 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 84/105/95 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 84/110/98 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 86/125/100 Watts

Inputs

Disc: sockets, impedance/capacitance 48kΩ/62pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.23/2.3/23mV
Disc: overload 20Hz/1kHz/20kHz 42/40/34dB
Tuner: impedance/sensitivity 45kΩ/180mV
Aux: impedance/sensitivity 45kΩ/180mV
Tape phono: impedance/sensitivity 50kΩ/180mV
Tape DIN: impedance/sensitivity 50kΩ/180mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 380mV/460mV/100Ω
Tape DIN: for 5mV disc/for .5V aux/imp 47mV/60mV/76kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 100mV/2.0V/2.6V

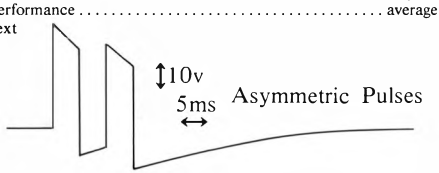
Noise (ref 1 watt, A wtg)

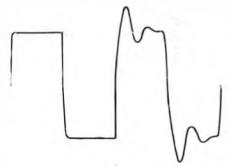
At zero volume ..... –87dB
Aux, ref vol, 1kΩ source ..... –83dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –77/–73dB

Other technical parameters

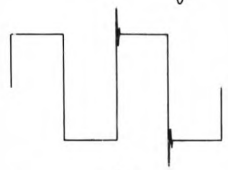
Damping factor 30Hz/1kHz/30kHz 100/100/37
DC offsets L/R ..... –65/+1mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 4Hz—90kHz
Total Harmonic distortion (inc noise) ..... excellent
Intermodulation dist (CCIF 19/20kHz RIAA) ..... good
Hum performance ..... average

* See text

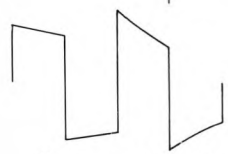




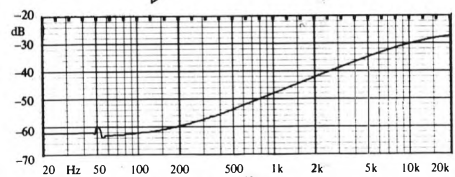
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



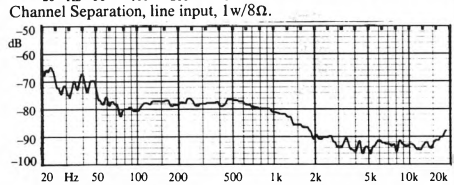
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



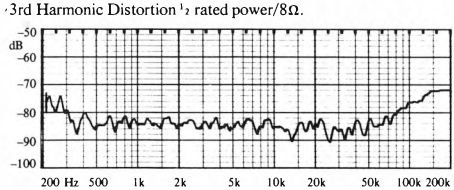
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



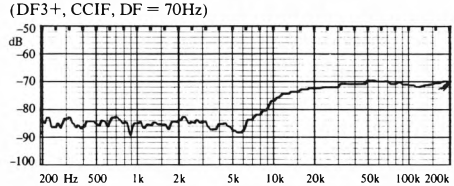
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

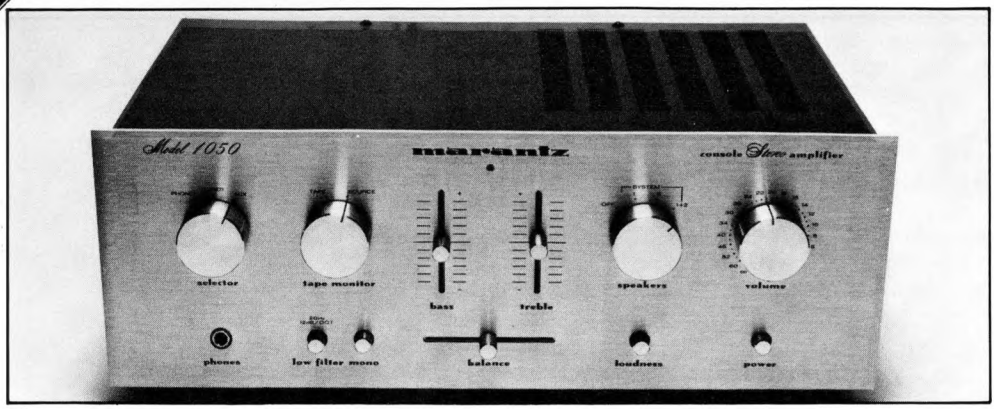


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Marantz 1050

Marantz Audio (UK) Ltd., 193 London Road, Staines, Mddx. (0784) 50132



Presentation, facilities etc.

The *1050* is the 'baby' of the Marantz range, following their established format in providing a symmetrical layout, with sliders in the centre for tone controls and balance. Finish was pretty good for a model costing less than £100, though naturally not quite as 'solid' in appearance as the more expensive models. Choice of facilities would seem pretty sensible, though the tone controls have no defeat and loudness is inevitably included. A low filter and mono switching are useful extras, and the single tape input is DIN duplicated.

Lab performance

No particular input and output compatibility problems are likely to be encountered by 1050 users. The disc input capacitance is a little below average, so slight additional amounts might be needed depending on the cartridge chosen, using the special phono plug/socket adaptors that contain specific amounts and are merely inserted between the disc input and the turntable leads. The headphone output is a little on the high side (but by no means untypical) into higher impedance 'phones.

Results on the performance parameters were nearly all of a very high standard, despite this amp's very low price. Squarewaves showed minimal ringing even into reactive loads, while phase shift was modest. Asymmetric pulse recovery was quick and fairly well controlled. Hum, noise and all distortions noted or swept were average or good, while the bandwidth was restricted to a sensible 50kHz. Areas of slight concern include the unbalanced DC offsets, and the separation, which was good on the published line input, being maintained at better than -50dB even at HF, but in common with the *1072* was rather poorer on disc, not quite attaining -30dB at 20Hz.

Power output was naturally fairly limited and showed some alignment imbalance between the channels, but was well maintained at the audio bandwidth extremes. The all too common large difference between single and double channel drive was also noted, and while reasonable delivery was available into 4ohms, the severe 2ohm load was not really within its capabilities. The tonebursts reflected a reasonable transient capability.

Subjective impressions

The first tests showed some inconsistency, but generally described the sound as rather muddled, lacking detail and any feeling of power, yet also a little bass heavy. No criticisms of treble harshness were made, however, which was quite unusual for such a cheap design.

The second tests showed some correlation, and individual reactions were rather more positive. The lack of power was noted, but is of course only to be expected, but no particular criticisms were made of the bass, though a general lack of detail was again mentioned. The amp was felt to produce a pleasant if unexceptional sound without significant 'nasties', apart from some treble harshness when driven hard.

Conclusions

Power delivery is very reasonable for the price, lab performance was average or good on nearly every parameter, presentation and finish good, and subjective reactions generally favourable (more in terms of the amp's abilities to avoid sounding

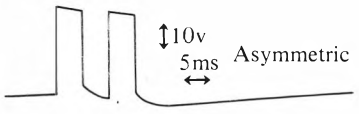
RECOMMENDED

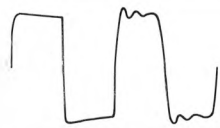
unpleasant rather than its detail or definition – a characteristic that may be important when considering possible ancillary performance in a budget system.) As one of the cheapest amps in the report to boot, it must be warmly recommended.

GENERAL DATA

Typical price (inc VAT)	£95
Approx size (w × h × d)	16½(42) × 6(16) × 11(28) ins(cm)
Approximate weight	15 lbs
Presentation (fascia, case etc)	shiny silver, black case
Quality of external finish	f. good
Listening impression summary	average*
Features and Facilities	
Tape facilities	1 machine, monitoring
Tone controls/switchable?	simple/no
Filters/loudness	LF/yes
Others	mono/stereo
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	31/30 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	30/28 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	30/28 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	39/56/15 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	36/34/5 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	51/91/19 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 47kΩ/80pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.36/3/28mV
Disc: overload 20Hz/1kHz/20kHz	42/32/29dB
Tuner: impedance/sensitivity	33kΩ/205mV
Aux: impedance/sensitivity	33kΩ/205mV
Tape phono: impedance/sensitivity	36kΩ/205mV
Tape DIN: impedance/sensitivity	36kΩ/205mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	305mV/460mV/3.5kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	34mV/50mV/80kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	65mV/1.7V/2.4V
Noise (ref 1 watt, A wtg)	
At zero volume	–90dB
Aux, ref vol, 1kΩ source	–83dB
Disc, ref vol, 1kΩ/M75EJ sources	–78/–75dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	110/110/90
DC offsets L/R	–21/–6.cmV
Power bandwidth, –3dB ref max power 8Ω disc	10Hz—50kHz
Total Harmonic distortion (inc noise)	good
Intermodulation dist (CCIF 19/20kHz RIAA)	good
Hum performance	good

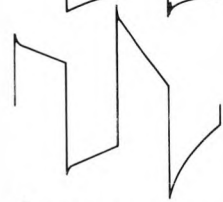
* See text



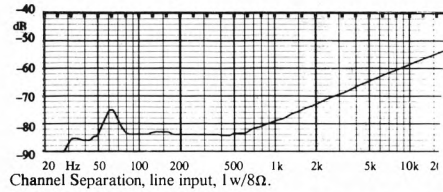


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

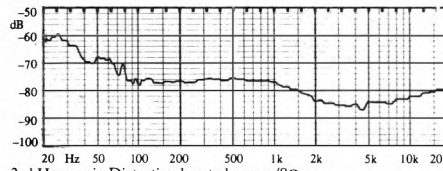
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



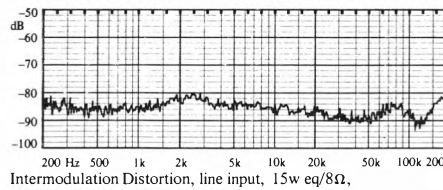
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



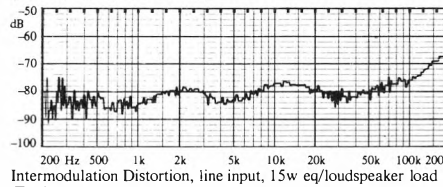
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Marantz 1072

Marantz Audio (UK) Ltd., 193 London Road, Staines, Mddx. (0784) 50132

Presentation, facilities etc.

The *1072* is the middle model in the low cost series of Marantz integrated amplifiers. Styling is very much 'Marantz' with the slightly gilt finish silver front and four different typefaces; sliders are used for balance and tone, knobs and pushbuttons for selectors and volume. Two disc inputs are provided, and the single tape input/output is DIN duplicated.

The simple tone controls cannot be defeated, and the inevitable loudness function is present; more useful is the sensible 20Hz, 12dB/oct LF filter which can be useful for disc replay, and a mono switch for mono disc playback.

Lab performance

All the inputs offered fairly normal sensitivities, although there was no variation between the high level ones to facilitate sensitivity matching. The disc input capacitance is slightly lower than usual, although this is easily adjusted to suit different cartridge types (some extra capacitance will probably benefit users of Shure and Ortofon models for example.) The various output levels are also close to the norm, and should not present matching problems.

A certain channel imbalance in the DC offsets was noted which is less than desirable, but the disc bandwidth was controlled to a sensible 49kHz, avoiding any slew limiting. Noise and harmonic distortions were low, likewise the 'spot' intermodulation through the disc input, but the swept intermod showed a rising characteristic above 60kHz; whether the input bandwidth is sufficiently limited to prevent any problems arising is perhaps a moot point, but it is likely that this will not have any harmful effects. The channel separation was very good on the line input, only measuring worse than 60dB above 15kHz, but a similar measurement via the pickup input was less promising, varying quite smoothly between 23dB and 56dB at 20Hz and 20kHz respectively.

The power delivery was pretty good for the price, but showed the all too familiar variation between single and double channel drive, though not to the same extent as some models. The power was well maintained into 4ohm loads, but two ohms proved too severe even on the toneburst signal.

Subjective impressions

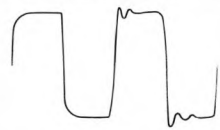
The first listening tests rated the *1072* somewhat below average overall, finding the treble not very pleasant and rather on the 'bright' side, plus a degree of muddling. The sound was described as a bit 'jangly', although the bass was rated rather higher than some of the immediate competition.

The second sessions also described a harshness and a rather piercing HF, plus some muddling, but again the low frequencies were considered quite reasonable, and criticisms were less severe than for some other models in this price range.

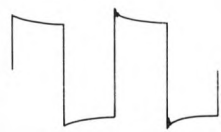
Conclusions

The *1072* would appear to be a competent but not particularly inspiring product at a pretty fair price. A reasonably sensible choice of facilities, plus more than adequate technical performance and power

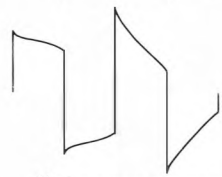
output suggests that recommendation is in order, but our subjective findings were not sufficiently encouraging to further endorse this, and we would advise prospective purchasers to carry out their own listening before committing themselves.



10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £125
Approx size (w × h × d) ..... 16½(42) × 6(16) × 11(28) ins (cm)
Approximate weight ..... 17 lbs (kg)
Presentation (fascia, case etc) ..... shiny silver, black
Quality of external finish ..... good
Listening impression summary ..... average

Features and Facilities

Tape facilities ..... 1 machine, DIN or phono
Tone controls/switchable? ..... simple(sliders)/no
Filters/loudness ..... low/yes
Others .....

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 48/46 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 45/43 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 47/45 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 55/83/19 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 63/74/10 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 65/118/27 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 2 phonos, 48kΩ/80pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.32/3/26mV
Disc: overload 20Hz/1kHz/20kHz 35/35/29dB
Tuner: impedance/sensitivity 34kΩ/190mV
Aux: impedance/sensitivity 34kΩ/190mV
Tape phono: impedance/sensitivity 37kΩ/190mV
Tape DIN: impedance/sensitivity 37kΩ/190mV

Outputs

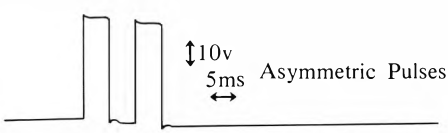
Tape phono: for 5mV disc/for .5V aux/imp 300mV/450mV/260Ω
Tape DIN: for 5mV disc/for .5V aux/imp 32mV/50mV/80kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 50mV/1.25V/1.8V

Noise (ref 1 watt, A wtg)

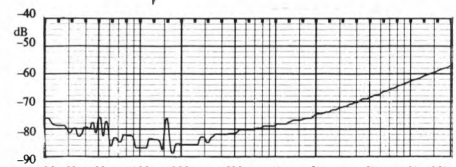
At zero volume ..... –87dB
Aux, ref vol, 1kΩ source ..... –82dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –79/–78dB

Other technical parameters

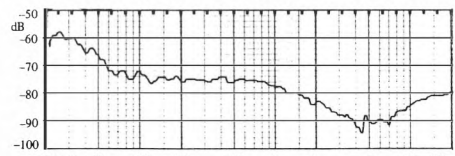
Damping factor 30Hz/1kHz/30kHz 115/115/86
DC offsets L/R ..... –4.4/–23.8mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 8Hz—49kHZ
Total Harmonic distortion (inc noise) ..... very good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... good
Hum performance ..... below average
* See text



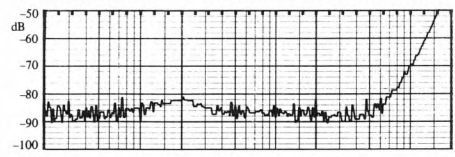
Asymmetric Pulses



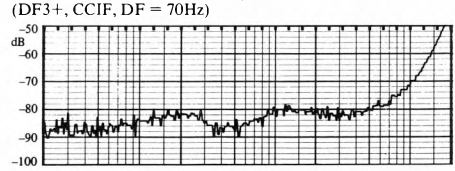
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

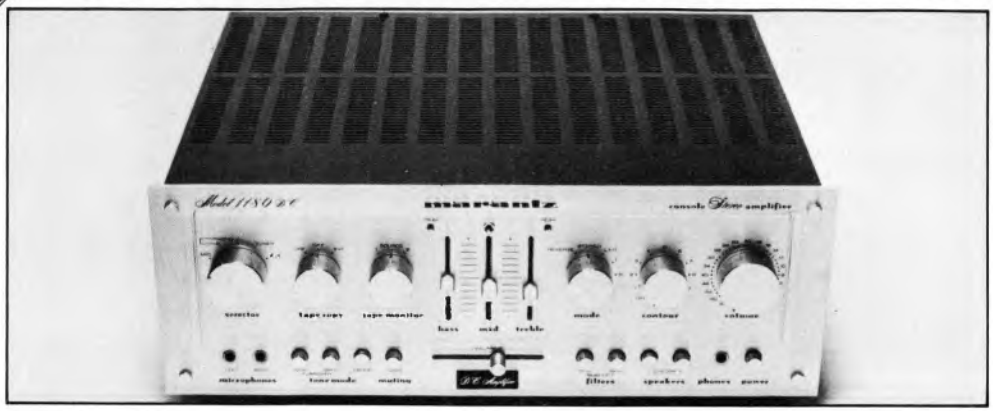


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Marantz 1180DC

Marantz Audio (UK) Ltd., 193 London Road, Staines, Mddx. (0784) 50132



Presentation, facilities etc.

Second only to the *1300DC* in terms of price, power and facilities, the *1180* is one of Marantz' largest integrated amps, and incorporates a lavish standard of finish and line-up of facilities. Its DC coupling is emphasised with a certain lack of subtlety on the fascia, and we should point out that this is by no means a proven practical advantage. Tone controls are complex, offering two-position turnover point and also a 'middle' control, which offers options about half-way towards a 5-stage graphic; defeat is also provided.

Phono sockets are used predominantly, with DIN tape duplication and separate channel mike jacks on the front; crossdubbing is offered on tape. HF and LF filters are provided, and these have fairly steep slope rates so their operation will be less 'vestigial' than in many other cases. The loudness function is now expanded to included a 'contour' control which allows the degree of compensation to be varied independently of the volume control.

Lab performance

Input and output levels should pose no practical problems, but the disc input capacitance is a little lower than average, so with some cartridges a little extra may be found desirable. The headphone socket level into high impedance 'phones is at a rather more sensible level than in many models.

The power bandwidth extends to a rather high frequency, and some slew limiting was noted within this capability, albeit at high powers and above 73kHz; nevertheless an earlier rolloff at say 40kHz would perhaps be desirable. The other performance measurements were all average or better than average, with the disc intermod rated as good; swept intermod was also low and showed only a marginal change with loudspeaker loading. Square-waves showed rather more ringing than usual into capactive loads, and some overshoot was present on 100Hz/8ohm; this was also reflected in the asymmetric pulse, which appeared otherwise well controlled but showed slow recovery.

Power delivery was generous, and the amp produced a decent increase into 4ohms and a reasonable amount into 2ohms, which suggests that it will cope reasonably well with most loads. There was little difference between single and dual channel drive, which indicates that the power supply is adequate.

Subjective impressions

Fairly consistent comments described this model as having plenty of energy, one 'blind' comment being 'nice heavyweight'. Good detail, particularly in the midband, was marred to some extend by comments concerning a rather 'loose' and prominent bass, and some treble 'fizz' and hardness.

Conclusions

This amp has very comprehensive facilities, plenty of power with reasonably good delivery, a high standard of finish and quite good results on the performance parameters. In addition, the results of the listening tests were quite favourable. All things considered the admittedly highish price would seem to be fairly well justified, but we would advise listening before purchase.

Marantz 1180DC

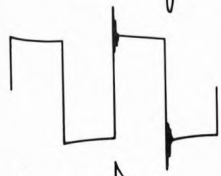
RECOMMENDED

GENERAL DATA

Typical price (inc VAT)	£420
Approx size (w × h × d)	16½(42) × 6¼(16) × 14(36) ins (cm)
Approximate weight	32 lbs
Presentation (fascia, case etc)	silver, black
Quality of external finish	v. good
Listening impression summary	f. good
Features and Facilities	
Tape facilities	2 DIN or phono, crossdubbing
Tone controls/switchable?	complex/yes
Filters/loudness	HF, LF/variable
Others	various*
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	113/110 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	107/97 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	112/108 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	120/199/68 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	120/196/43 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	145/266/121 Watts
Inputs	
Disc: sockets, impedance/capacitance	2 phono, 49kΩ/74pf*
Disc: sensitivity 20Hz/1kHz/20kHz	0.25/2.2/20.6mV
Disc: overload 20Hz/1kHz/20kHz	42/43/40dB
Tuner: impedance/sensitivity	15kΩ/215mV
Aux: impedance/sensitivity	15kΩ/215mV
Tape phono: impedance/sensitivity	17kΩ/2.4mV
Tape DIN: phono: impedance/sensitivity	17kΩ/215mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	480mV/470mV/345Ω
Tape DIN: for 5mV disc/for .5V aux/imp	52mV/165mV/78kΩ
Headphones: for5mV disc, 8Ω/470Ω/2.2kΩ	60mV/700mV/800mV
Noise (ref 1 watt, A wtg)	
At zero volume	–79dB
Aux, ref vol, 1kΩ source	–78dB
Disc, ref vol, 1kΩ/M75EJ sources	–75/–73dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	83/83/64
DC offsets L/R	0/0mV
Power bandwidth, –3dB ref max power 8Ω disc	6Hz—80kHz
Total Harmonic distortion (inc noise)	average
Intermodulation dist (CCIF 19/20kHz RIAA)	good
Hum performance	average

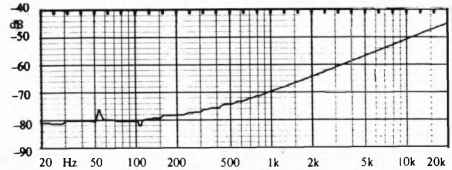
* See text

10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

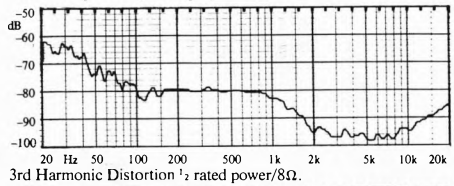


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

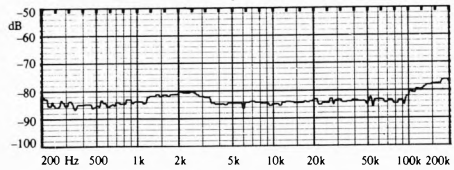
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



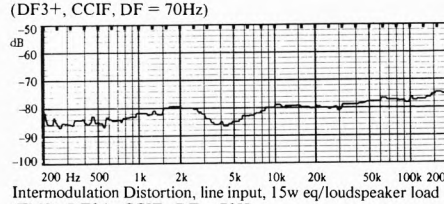
Channel Separation, line input, 1w/8Ω.



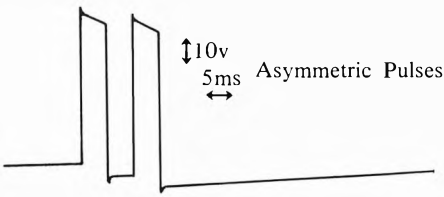
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

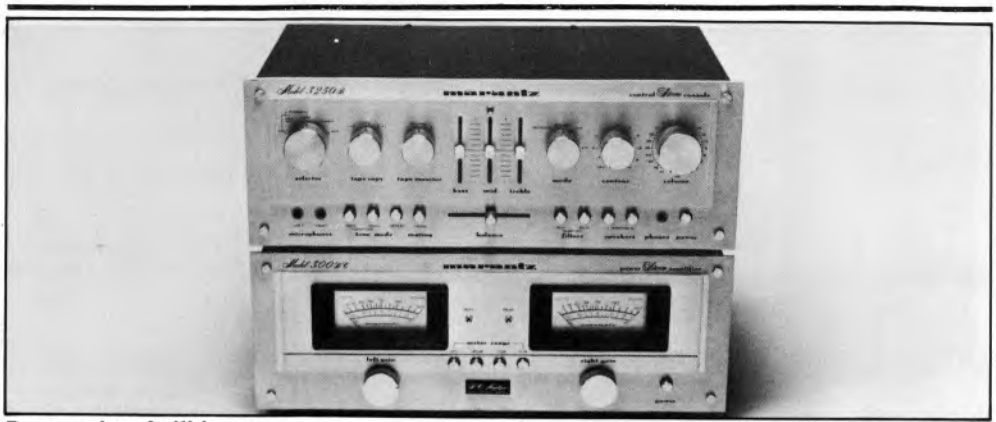


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



Marantz 3250B/300DC

Marantz Audio (UK) Ltd., 193 London Road, Staines, Mddx. (0784) 50132



Presentation, facilities etc.

Representing the extensive (and expensive) Marantz separate pre- and power amp combinations, the *3250B* is similar to the pre-amp fitted to the *1180DC* integrated model, while a more complex pre-amp with even more facilities akin to the *1300DC* integrated model designated the *3650* is also available (a *3800* completes the range). The power amp chosen was the hefty *300DC*, which offers slightly higher output than the integrated *1300DC*. Shelf space is not much more than average, though the total weight of about half a hundredweight may need to be borne in mind!

The *B* designation indicates the inclusion of a head amp for low-output moving-coil cartridges. Mike input jacks are provided on the front panel, and the remaining inputs are phonos, with provision and crossdubbing for two tape machines. Switchable turnover frequencies are provided for bass, treble and middle tone controls, defeat switching, HF and LF filters, while an independently variable loudness, complex 'mode' selection and volume muting are all included. Speaker switching and headphone drive may be had from the pre-amp via the power amp, but it is also possible to connect the speakers directly. The power amp offers gain controls on each channel and large power meters with variable sensitivity supplemented by (more useful) peak indicator LEDs. Not perhaps the simplest of amplifiers to operate, but one of the most versatile, and a knob-twiddler's delight!

Lab performance

No matching problems are likely with this very versatile model, though the moving-coil impedance and sensitivity may not be an ideal match for some of the lowest output low impedance models. Headphone output is sensible for a change!

Noise performance, though reasonable, was not perhaps as good as one would have hoped from such an expensive model; likewise hum was below average, though this was largely due to the level of the 50Hz fundamental, but nevertheless could have been improved. Other measured parameters all attained above average or good results, and the swept intermod showed little change between speaker and resistive loading (and none within the audio band.) Squarewave and pulse response was quite competent, but capacitive loading as usual produced some ringing. The bandwidth was on the high side in our opinion, extending to 90kHz on the disc input.

This was one of the most powerful amplifiers in the report, as one would expect from the price, and showed a slight restriction at the frequency extremes under our measurement spec. The difference between single and dual channel drive was commendably quite small, and a reasonable increase was available into 4ohms, but comparatively little into 2ohms.

Subjective impressions

While this heavyweight combination found favour on a number of counts, the overall consensus placed it slightly below the *1180DC*, as it was felt to exaggerate some of the points on which the smaller model had been criticised. In the first tests remarkably consistent comments were made concerning a 'rich', 'heavy' and rather 'thick' sound; in many ways this was considered not so much unpleasant as 'wrong'. The presumably useless meters indicated a mere 10watts when the peak indicator light actu-

ated on program! The second sessions confirmed the tendency to bass emphasis, and also noted that the treble tended to 'brightness' at lower levels.

Conclusions

While in many ways a competent amp, this model was not felt to offer any real improvement over the *1180DC* except in power output, and was liked less on the listening tests, so at the high price recommendation is not really appropriate.

GENERAL DATA

Typical price (inc VAT) £720
Approx size (w × h × d) ..... total 16½(42)×(32)×14(36) ins (cm)
Approximate weight ..... 15/46 lbs
Presentation (fascia, case etc) ..... matt silver/gold
Quality of external finish ..... v. good
Listening impression summary ..... above average*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing
Tone controls/switchable? ..... complex/yes
Filters/loudness ..... HF, LF/complex
Others ..... meters

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 200/200 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 180/180 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 195/195 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 210/315/91 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 210/315/85 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 250/423/176 Watts

Inputs

Disc: sockets, impedance/capacitance ... MM or MC, MM47kΩ/80pf MC38Ω
Disc: sensitivity 20Hz/1kHz/20kHz MM0. 2/2.0/20mVMC26/110/90μV
Disc: overload 20Hz/1kHz/20kHz MM43/42/40dBMC35/40/35dB
Tuner: impedance/sensitivity 33kΩ/200mV
Aux: impedance/sensitivity 33kΩ/200mV
Tape phono: impedance/sensitivity 38kΩ/200mV
Tape DIN: impedance/sensitivity 38kΩ/200mV

Outputs

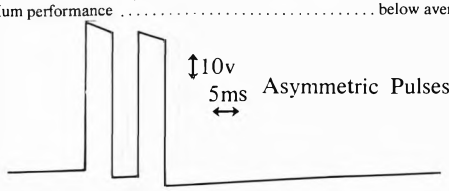
Tape phono: for 5mV disc/for .5V aux/imp 480mV/470mV/285Ω
Tape DIN: for 5mV disc/for .5V aux/imp 55mV/55mV/80kΩ
Headphones: for5mV disc, 8Ω/470Ω/2.2kΩ ... 63mV/700mV/850mV

Noise (ref 1 watt, A wtg)

At zero volume ..... –76dB
Aux, ref vol, 1kΩ source ..... –74dB
Disc, ref vol, 1kΩ/M75EJ sources ..... MM–73/–72.dBMC(10Ω) —70dB

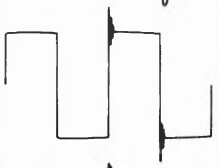
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 137/130/86
DC offsets L/R ..... +13/–21mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 6Hz—90kHz
Total Harmonic distortion (inc noise) ..... good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... above average
Hum performance ..... below average

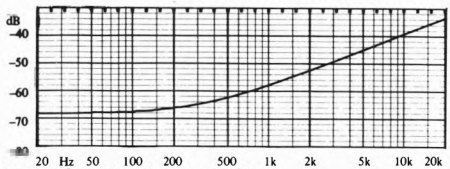


Asymmetric Pulses

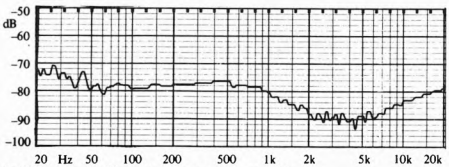

10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

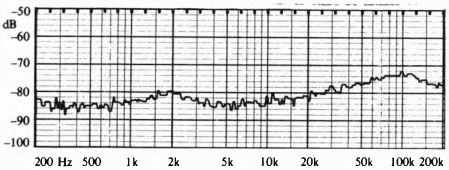

100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



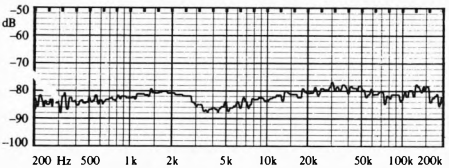
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



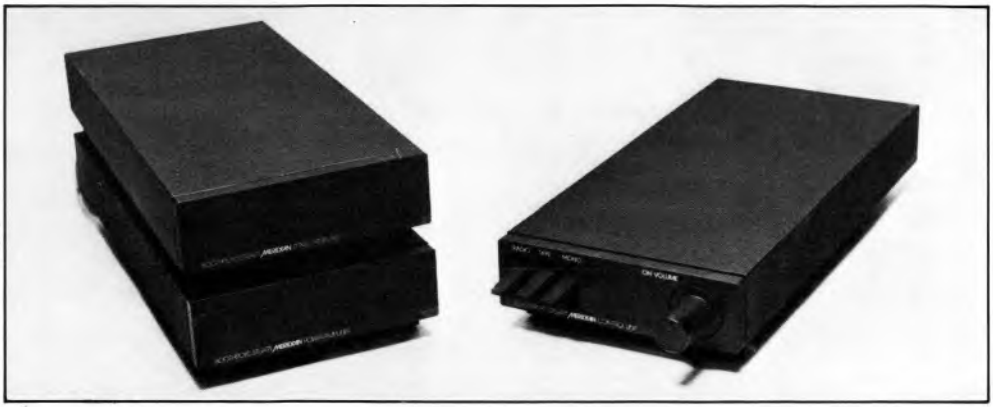
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Meridian 101/103

Meridian, Boothroyd Stuart Ltd., 13 Clifton Rd. Huntingdon, Cambs. PE18 7EJ
0480 57339



Presentation, facilities etc.

The Meridian series is certainly the most original and discrete design reviewed in this book, and is a classic example of success for a smallish company who 'dares to be different'. Three alternative amplification systems are offered, based on permutations about four 'modules' which are assembled in different configurations, the basic *103* using three of these: one *101* pre-amp, one power amp, and one power supply. These modules are basically the same size, approximating the dimensions of a modest box of chocolates, and are ingeniously based, we believe, on an aluminium architectural extrusion.

There can be few greater contrasts in amplifier design philosophies than that seen between the Meridian and the alphabetically juxtaposed Marantz on the previous page. The *103* makes no attempt to being 'all things to all men', sticking uncompromisingly to a 'straight-through', 'black box with gain' approach. A single knob provides on/off switching, volume and concentric balance, and three switches control mono/stereo and selection from disc, tuner and tape DIN sockets. No tone controls are provided, and the filtering is internal, including bass rolloff to the new RIAA recommendations. Drive is provided only for one set of speakers. Interconnections are initially a little perplexing (at least for the harassed multiple reviewer), but nevertheless quite logical, and once accomplished the design permits the wiring to be tucked away out of sight. A variety of internal modules can be obtained for the pre-amp to give optimum matching to almost any cartridge type, including low-output moving-coil models.

Lab performance

The disc input, by means of the matching modules available, is almost infinitely flexible, and indeed the manufacturer's current advertisement illustrates eight different types! Early equalisation standards (78rpm etc) are also available. The DIN-type type sockets should be regarded as 'phono' types for the purposes of compatibility; it should be noted that the input sensitivity is a little lower than usual.

Distortion levels tended to be on the high side, due primarily to crossover components. When questioned about this, the manufacturer agreed with our observation, but stated that in his opinion the distortion itself is much less important than its source of generation. The below average hum consisted predominately of 50Hz component. The bandwidth is in our opinion sensibly curtailed at both ends of the spectrum, and no slew limiting effects were detected. The swept intermod was at a higher level than with some designs and showed some change, but no significant worsening, when the loudspeaker load was applied. The square-waves and asymmetric pulse showed quite good control, albeit with some ringing into capacitive loading. Separation was well maintained at -60dB across the band on disc and line inputs. The DC offset was rather high on one channel.

The power output of this model is very limited considering its high price, and shows a significant difference between single and dual channel drive. A reasonable increase is available into lower impedances.

Subjective impressions

In the first sessions the *103* was consistently

considered a model with good detail, but lacking bass power and weight, and with a slightly 'bright', 'coarse' treble that was exacerbated somewhat when driven hard; less 'open' than the more expensive Meridians. The second sessions confirmed the good clarity and 'cleaness' as well as the 'bright' tendency, with few other complaints.

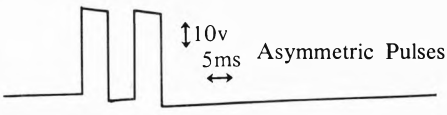
Conclusions

The *101/103* is an unusual package that will appeal to some people despite its minimal facilities and poor price/power/measured performance ratios for certain considerations like simplicity and disc playing versatility. Audition is recommended, but a general recommendation is not considered appropriate.

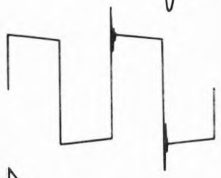
GENERAL DATA

Typical price (inc VAT)	£340
Approx size (w × h × d)	3×5½(14)×2(5)×12(30) ins (cm)
Approximate weight	15 lbs
Presentation (fascia, case etc)	olive green/brown
Quality of external finish	v. good
Listening impression summary	above average*
Features and Facilities	
Tape facilities	1 machine*
Tone controls/switchable?	no
Filters/loudness	no
Others	MC modules available
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	45/45 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	40/40 Watts
Both channels driven 8Ω 20kHz. 1% dist L/R	45/43 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	55/86/85 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	55/86/98 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	68/120/100 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 DIN, MM47kΩ/125pf* MC var*
Disc: sensitivity 20Hz/1kHz/20kHz	MM0. 32/2.1/22mV MC var*
Disc: overload 20Hz/1kHz/20kHz	MM36/36/35dB
Tuner: impedance/sensitivity	100kΩ/150mV
Tape DIN: impedance/sensitivity	32kΩ/790mV*
Outputs	
Tape DIN: for 5mV disc/for .5V aux/imp	205mV/285mV/6kΩ*
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	V/V/V
Noise (ref 1 watt, A wtg)	
At zero volume	–83dB
Aux, ref vol, 1kΩ source	–82dB
Disc, ref vol, 1kΩ/M75EJ sources	–79/–75dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	109/109/47
DC offsets L/R	+114/+47mV
Power bandwidth, –3dB ref max power 8Ω disc	22Hz—50kHz
Total Harmonic distortion (inc noise)	below average*
Intermodulation dist (CCIF 19/20kHz RIAA)	below average
Hum performance	below average

* See text

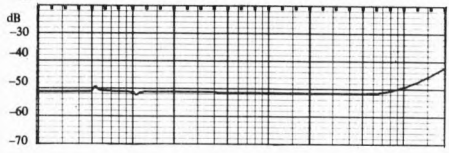


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

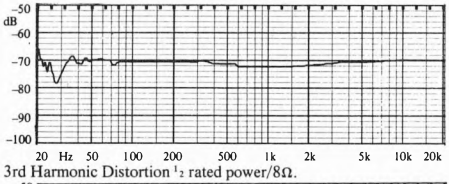


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

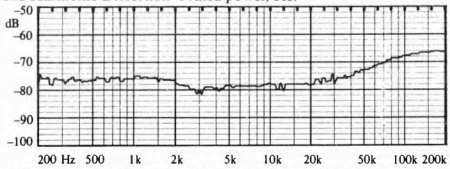
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



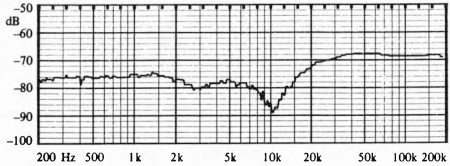
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



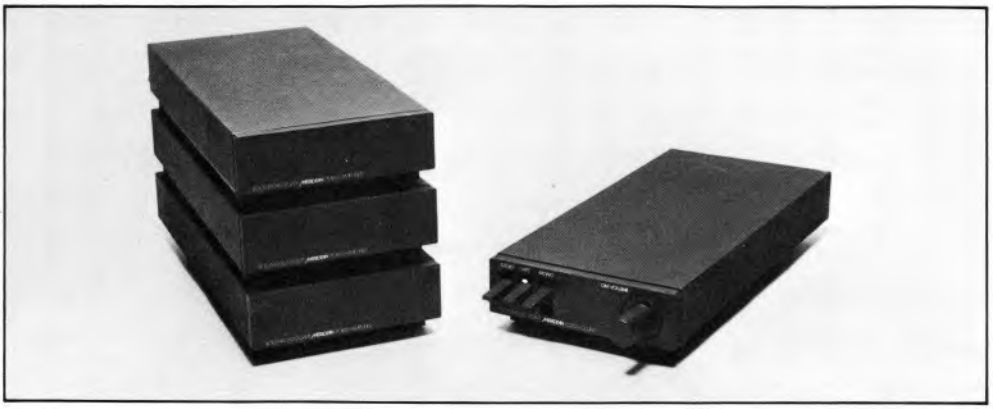
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Meridian 101/103D

Meridian, Boothroyd Stuart Ltd., 13 Clifton Rd., Huntingdon, Cambs. PE18 7EJ
0480 57339



Presentation, facilities etc.

This second permutation on the Meridian system employs four modules; the same pre-amp and power amp as before, but this time with the latter connected to two power supplies, which offers increased power and also claimed subjective benefits. This also means that a *103* owner can upgrade to the *103D* merely by adding a second supply and changing the umbilical connector. (Incidentally, the *101* pre-amp has its own internal power supply enabling it to be used with virtually any power amp; it has proved popular in this role as a good quality low-cost disc-oriented device, not a lot more expensive than some step-up devices.)

Facilities are very limited, with DIN inputs for disc, tuner and tape. Special modules are available to match the disc input to virtually any cartridge type, including low-output moving-coil types. The compact modules offer considerable flexibility, and are also unusually coloured and well-finished in a 'crackle-finish' olive green/brown – a change from black or silver. Could this presage the end of the model-T era in hi-fi equipment?

Lab performance

The same pre-amp is used throughout the Meridian range, so input/output levels will be substantially the same. The moving magnet disc parameters are shown in the data, and a variety of moving-coil and other special modules are available. Once again tape sensitivity is on the low side, though compatibility problems are only likely with non-standard tape machines.

The lab performance shows a number of similarities to the *103*, which is only to be expected, as the only difference is in the use of an extra power supply. Squarewaves interestingly show reduced ringing with this twin supply version. Noise was slightly better, and hum slightly worse. Crossover distortion is of course again present (see *103* review).

Power output shows an increase of about 20% with both channels driven, and there is a much smaller difference between single and dual channel ratings. Curiously the 2ohm 'burst' rating is somewhat reduced.

Subjective impressions

Detail was considered quite good, and showed a general if subtle 'cleaning up' compared with the *103*, with tighter focusing and firmer bass. However the upper middle/treble was criticised as being rather 'thin' sounding.

The second sessions again scored the *103D* highly, with good consistency between 'hands-on' and 'blind' results. A general improvement in detail and control was again described, with the 'brightness' less obvious, but still the sound was not considered particularly 'smooth'.

Conclusions

Once again this model does not appear to offer particularly good value in terms of traditional criteria of price/power/facilities/measured performance. Nevertheless, for those who value elegance, simplicity, and are prepared to place a premium on sound quality, the *103D* would appear to offer a very interesting alternative, and certainly merits audition, if not perhaps quite suitable for a general recommendation.

GENERAL DATA

Typical price (inc VAT) £440
Approx size (w × h × d) ..... 4 × 5½(14) × 2(5) × 12(30) ins (cm)
Approximate weight ..... 22 lbs
Presentation (fascia, case etc) ..... olive green/brown
Quality of external finish ..... v. good
Listening impression summary ..... f. good*

Features and Facilities

Tape facilities ..... 1 machine*
Tone controls/switchable? ..... no
Filters/loudness ..... no
Others ..... MC etc modules available

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 54/54 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 50/50 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 53/52 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 58/100/85 Wattts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 57/100/85 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 73/129/73 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 DIN, MM47kΩ/125pf, MC var*
Disc: sensitivity 20Hz/1kHz/20kHz ... MM0.33/2.0/20mV, MC var*
Disc: overload 20Hz/1kHz/20kHz 36/36/35dB
Tuner: impedance/sensitivity 100kΩ/150mV
Aux: impedance/sensitivity ..... kΩ/mV
Tape phono: impedance/sensitivity ..... kΩ/mV
Tape DIN: impedance/sensitivity 32kΩ/790mV*

Outputs

Tape phono: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 205mV/285mV/6kΩ*
Headphones: for 5mV disc, 8Ω/470Ω/2 .2kΩ ..... V/V/V

Noise (ref 1 watt, A wtg)

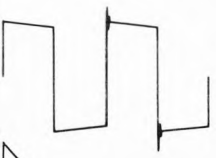
At zero volume ..... –83dB
Aux, ref vol, 1kΩ source ..... –72dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –79/–78dB

Other technical parameters

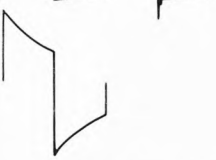
Damping factor 30Hz/1kHz/30kHz 94/93/43
DC offsets L/R ..... +110/+57mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 22Hz—50kHz
Total Harmonic distortion (inc noise) ..... average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... below average
Hum performance ..... below average

* See text

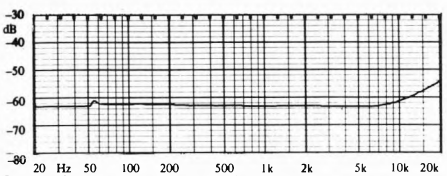
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



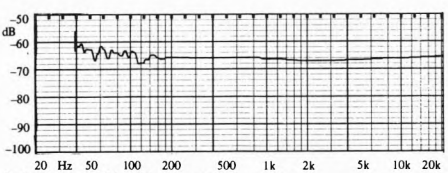
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



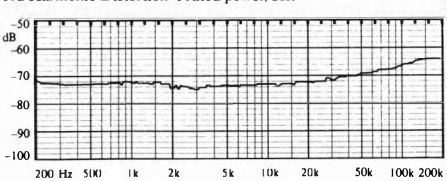
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



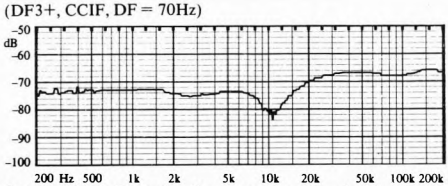
Channel Separation, line input, 1w/8Ω.



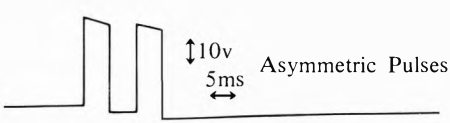
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



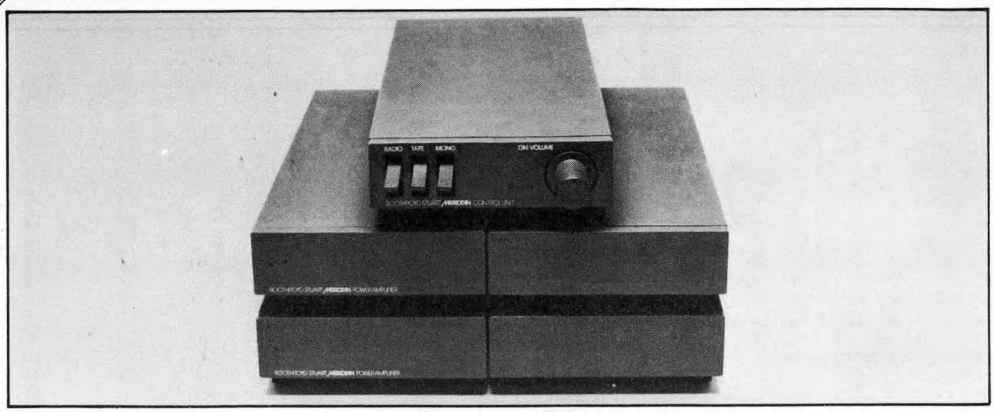
Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz



RECOMMENDED

Meridian 101/105

Meridian, Boothroyd Stuart Ltd., 13 Clifton Rd., Huntingdon, Cambs. PE18 7EJ
0480 57339



Presentation, facilities etc.

The *105* is the largest and most expensive of the Meridian systems; it offers the same facilities as the other variants, as it employs the same *101* pre-amp, but two mono power amp modules, each double the size of the standard one, contain their own (separate) power supplies. Boothroyd Stuart are a fairly new name to hi-fi manufacturing, but the partnership has quite a track record in hi-fi design, being responsible for the Lecson and Orpheus systems to name but two. The compact and elegant presentation uses solid aluminium cases finished in textured olive brown/green, which act as heat sinks for the power amps; thermal protection cuts in if the amps are driven too long, too hard, and power is automatically restored when the units have cooled.

The pre-amp offers only DIN inputs for disc, tape and tuner; no tone controls, or other 'sound-shapers' are provided apart from the inbuilt fixed filtering for bandwidth limiting. A variety of internal modules can be obtained to provide optimum matching for a wide variety of cartridges, including low-output moving-coil types.

Lab performance

The same *101* pre-amp is used as in the other Meridians, and so the same comments apply concerning the high disc input versatility, and the lower than average tape input sensitivity.

Performance measurements show a significant improvement over the *103* models. The slight rise evident in the swept intermod with speaker load unusually occurs at lower frequencies rather than the more normal HF audio region. Crossover distortions were virtually nonexistent in this design, and DC offsets were also small. Noise was slightly better overall, but hum was still below average with a noticeable 50Hz pickup input component. Squarewave and pulse behaviour was quite well controlled, but the capacitive load showed slightly greater overshoot than the *103D*.

Power output was considerably more generous than with the smaller models, but still not excessive for this price level. However the separate mono power amps showed a rock steady independence of single or dual channel drive, and a very generous delivery into low impedances, which under 'burst' conditions approached theoretical 'voltage source' figures.

Subjective impressions

This model was highly rated throughout the listening test. The first sessions unanimously praised the firm detailed bass, commenting generally on the good detail and clean bass and mid, but the treble was also criticised for being rather 'hard', 'bright' and 'ragged', particularly when driven hard. The very high attainable loudness without significant distress was also noted.

The second sessions confirmed these findings, but listeners were clearly not quite as conscious of the treble brightness, which was mentioned rather than criticised. Once again comments concerning the good bass, feeling of power, good delicacy, and attack were made.

Conclusions

This model offers considerably greater power and improved technical performance over the *103*s, and while it is still on the expensive side, it can be

RECOMMENDED

recommended for those for whom complex facilities are neither necessary nor desirable, having given consistently good listening results. Prospective purchasers are advised to listen for themselves nevertheless, and those who do not require the high power levels may find the *103D* equally acceptable.

GENERAL DATA

Typical price (inc VAT) £540
Approx size (w × h × d) ..... 1 single 1 double $5^1/_2$(14)×2(5)×12(30) ins (cm)
Approximate weight ..... 31 lbs
Presentation (fascia, case etc) ..... olive green/brown
Quality of external finish ..... v. good
Listening impression summary ..... f. good*

Features and Facilities

Tape facilities ..... 1 machine*
Tone controls/switchable? ..... no
Filters/loudness ..... no
Others ..... MC etc modules available

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 110/110 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 100/100 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 100/100 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 110/169/212 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω .... 110/169/212 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 160/289/475 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 DIN, MM47kΩ/125pf, MC var*
Disc: sensitivity 20Hz/1kHz/20kHz ... MM 0.43/2.7/27mV, MC var
Disc: overload 20Hz/1kHz/20kHz MM34/34/33dB
Tuner: impedance/sensitivity 100kΩ/190mV
Aux: impedance/sensitivity ..... kΩ/mV
Tape phono: impedance/sensitivity ..... kΩ/mV
Tape DIN: impedance/sensitivity 32kΩ/950mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 205mV/285mV/6kΩ*
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ ..... V/V/V

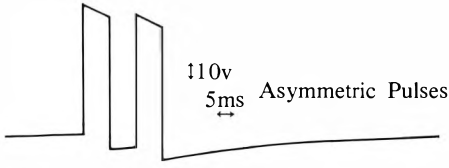
Noise (ref 1 watt, A wtg)

At zero volume ..... –89dB
Aux, ref vol, 1kΩ source ..... –84dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –79/–73dB

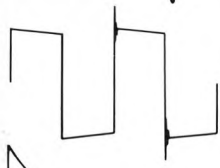
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 84/78/41
DC offsets L/R ..... +1.5/+22mV
Power bandwidth, –3dB ref max power 8Ω disc 20Hz–50kHz
Total Harmonic distortion (inc noise) ..... good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... above average
Hum performance ..... below average

* See text

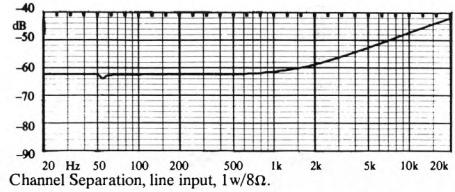


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

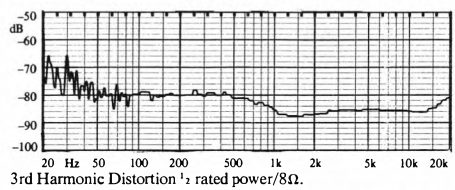


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

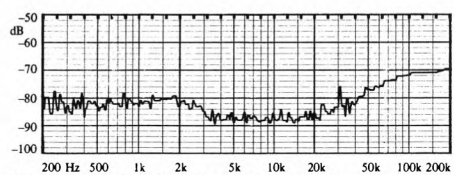
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



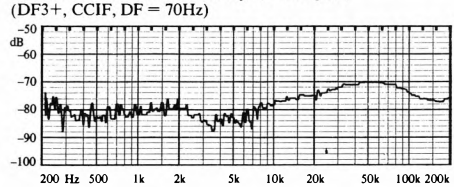
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion $^1/_2$ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Mitsubishi DA-U210

Mitsubishi Electric (UK) Ltd., Otterspool Way, Watford WD2 8LD Herts. 0923 40566

Presentation, facilities etc.

Mitsubishi are a new name on the British hi-fi market, although they have been established in electronics for many years, and the parent company is one of the largest of Japan's multiple-base trading companies. Unusually, the case is a large plastic moulding, but the fascia is the normal brushed aluminium, and metal ventilated panels comprise the top and bottom surfaces; although basically conventional in shape and appearance, this model is slightly slimmer and wider than most.

All normal inputs are provided with 'phono' connectors, the two tape input outputs being DIN duplicated and offering the crossdubbing facility. A front-panel mike jack is fitted and DIN duplication is provided on one speaker output. The simple tone controls are switchable, and loudness rather than filtering is offered. Two power meters are fitted on the front panel, and the overall external finish was considered very good for the fairly modest price. level.

Lab performance

All the inputs are fairly normal in terms of sensitivity and impedance, although there is no variation between the high level inputs to help match different ancillary output levels. The disc overload margin is well maintained at high frequencies. The DIN tape output into 100k was on the high side, and the headphone output gave a rather high output for high impedance 'phones, though neither of these are serious criticisms.

Hum and noise measurements were above average, distortion measurements were generally average: a slight trace of crossover distortion was noted on the LH channel of our sample, and the swept intermodulation test showed a rise at supersonic frequencies above 50kHz, which is perhaps indicative of the excessive bandwidth, which was maintained to 168kHz.

The 8ohm power delivery was not large, though quite respectable nevertheless, while the increase with only one channel driven indicated that the power supply might be 'stiffened' to some advantage. On the positive side, however, the power delivery was little affected by changes in load, particularly if the distortion criteria were relaxed for 2ohms, and this is also reflected in the well maintained 'burst' performance.

Subjective impressions

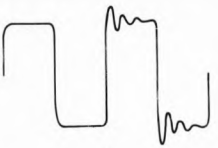
In the first listening sessions quite good agreement was was obtained in the written comments, though the overall reaction did depend somewhat upon the priorities and expectations of the listeners. The amp was described as rather vague, muddled and 'soft', though pleasantly unaggressive, if a little 'bland'.

The second sessions produced gratifyingly similar characterisations, with similar comments concerning indifferent definition and vague imaging, but again the reaction that the overall result was reasonable. A tendency to increased harshness and confusion at higher power levels was also described.

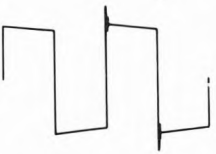
Conclusions

The *DA-U210* seems to be a reasonable if undistinguished amplifier. The overall standard of finish and pre-amp versatility are points in its favour, although some of the features are perhaps a trifle unnecessary in a budget-priced amp. The

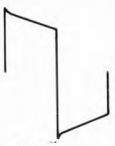
relatively good power delivery into difficult loads is offset by the fairly limited absolute power for the price and the power supply 'softness' limitations. Although by no means poor, the subjective impressions we gained were not sufficiently encouraging to boost this model into the recommended categories.



10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £112
Approx size (w × h × d) ..... 17(43) × 5½(14) × 13(33)ins(cm)
Approximate weight ..... 14 lbs (kg)
Presentation (fascia, case etc) ..... silver/black
Quality of external finish ..... v. good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 2 machines (DIN or phono), crossdubbing
Tone controls/switchable? ..... simple/yes
Filters/loudness ..... no/yes
Others ..... mike input

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 29/28 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 28/28 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 25/27 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 34/40/25 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 33/36/20 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 41/63/60 Watts

Inputs

Disc: sockets, impedance/capacitance ... 1 phone 1 DIN, 51/kΩ/98 pf
Disc: sensitivity 20Hz/1kHz/20kHz ..... 0.3/2.75/26 mV
Disc: overload 20Hz/1kHz/20kHz ..... 37/38/38 dB
Tuner: impedance/sensitivity ..... 153kΩ/165 mV
Aux: impedance/sensitivity ..... 153kΩ/165 mV
Tape phono: impedance/sensitivity ..... 153kΩ/165 mV
Tape DIN: impendance/sensitivity 153kΩ/165mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 275mV/460mV/625Ω
Tape DIN: for 5mV disc/for .5V aux/imp 135mV/230mV/100kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ 72mV/1.7V/2.7V

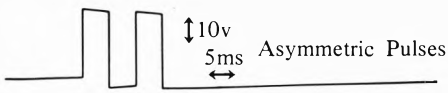
Noise (ref 1 watt, A wtg)

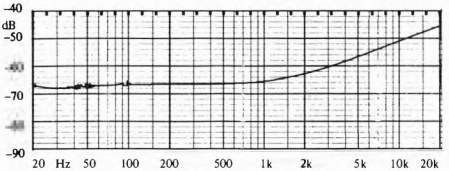
At zero volume ..... –92dB
Aux, ref vol, 1kΩ source ..... –82dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –77/–75dB

Other technical parameters

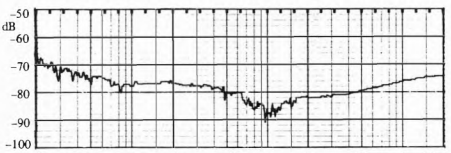
Damping factor 30Hz/1kHz/30kHz 80/80/66
DC offsets L/R 2.0/0mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 11Hz—168kHz
Total Harmonic distortion (inc noise) ..... below average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... above average

* See text

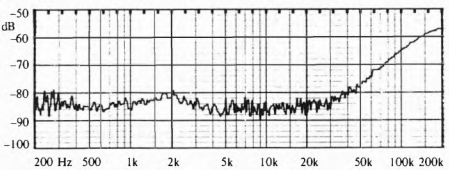




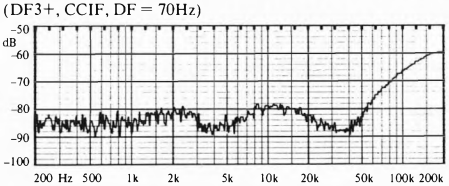
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



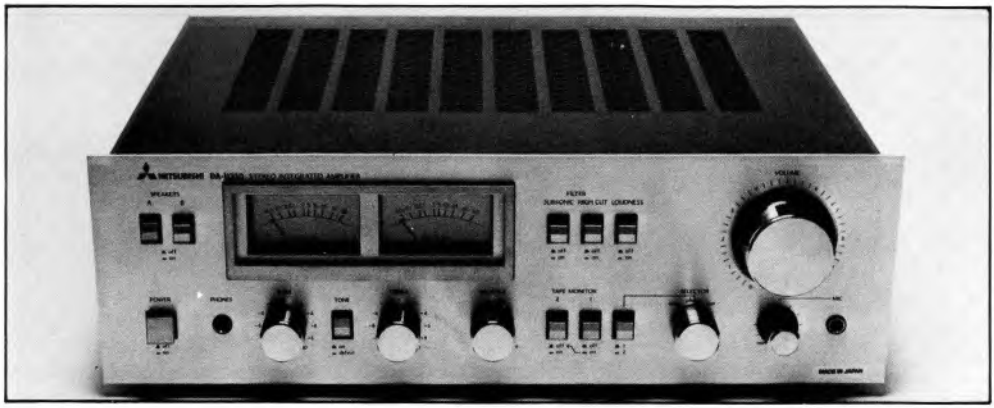
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Mitsubishi DA-U310

Mitsubishi Electric (UK) Ltd., Otterspool Way, Watford WD2 8LD Herts. 0923 40566



Presentation, facilities etc.

The *310* is a logical step up from the *210*, offering double the power output and a couple of extra facilities, though in other respects is pretty much the same. Mitsubishi are a new name to the UK market, though some readers may have come across their Diatone brand, which covers a wide range and is a force to be reckoned with on the Japanese home market.

Although presentation is fairly standard, the amp is slimmer than some and features the same unusual plastic moulded case used on the *210*, with metal ventilated panels top and bottom. The extra features over the *210* are the inclusion of HF and LF filters in addition to the loudness and simple defeatable tone controls. Parallel DIN and phono sockets are provided on all major inputs making ancillary matching that much easier. External finish is very good.

Lab performance

Inputs and outputs all seem quite normal, and no difficulties should be experienced with normal ancillaries, though variation of high level sensitivities is not possible. The DIN tape output is usefully high, and the headphone output perhaps a little too strong into high impedances. Though adequate, the disc overload reduces noticeably at HF, as does the damping factor, but happily the power bandwidth is sensibly restricted to 38kHz at HF.

All measured distortions were good, though a trace of crossover was detected on one channel. Likewise hum and noise figures were good. The meters were not very accurate, over-reading at low and under-reading at high powers, and the volume control had a couple of 'deadspots' (where no gain was apparent) between 5–5.5 and 9–10. The Squarewaves showed very little overshoot even into reactive loads, though there was some LF phase shift.

Power output was pretty healthy, although there was quite a substantial increase in the single channel over the both-channels level, so there is probably room for improvement in the power supply. However the power delivery into low impedances was quite good, particularly so on tonebursts. Channel separation also measured well at LF, but deteriorated at HF.

Subjective impressions

Descriptive comments were quite consistent in the first sessions, though individual reactions varied somewhat. The amp was described as rather 'muddled' with a 'sloppy', 'soggy' bass and quite poor definition, but was nonetheless quite pleasant overall, if rather 'soft' and 'bland'.

Reactions in the second sessions were rather more negative, with similar descriptions of 'muddling' and 'lack of attack', plus additional comments concerning treble harshness particularly at highish levels. The good power delivery received favourable comment nonetheless.

Conclusions

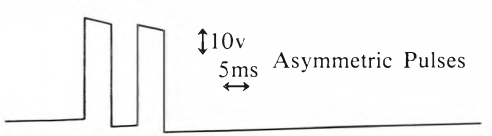
The *310* would seem to have performed quite respectably on our measurement tests, albeit with minor qualifications, and offers very comprehensive facilities and quite good power delivery for the

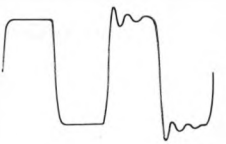
price, with good transient and low impedance capabilities. However the results of the subjective tests were rather less encouraging and reasonably consistent, so we would advise prospective purchasers to listen before making any decision.

GENERAL DATA

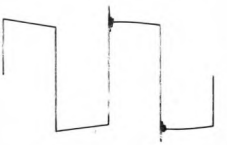
Typical price (inc VAT)	£150
Approx size (w × h × d)	17(43) × 5½(14) × 13(33) ins (cm)
Approximate weight	17 lbs
Presentation (fascia, case etc)	silver/black
Quality of external finish	v. good
Listening impression summary	below average*
Features and Facilities	
Tape facilities	2 machines, DIN or phono, crossdubbing
Tone controls/switchable?	simple/yes
Filters/loudness	HF, LF/Yes
Others	mike input
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	58/58 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	52/52 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	54/56 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	70/105/117 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	70/105/117 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	90/162/257 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono 1 DIN, 51kΩ/190pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.28/2.6/23.5mV
Disc: overload 20Hz/1kHz/20kHz	38/39/32dB
Tuner: impedance/sensitivity	86kΩ/155mV
Aux: impedance/sensitivity	86kΩ/155mV
Tape phono: impedance/sensitivity	86kΩ/155mV
Tape DIN: impedance/sensitivity	86kΩ/155mV
Mic ¼ jack impedance/sensitivity	9kΩ/1.3mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	280mV/460mV/570Ω
Tape DIN: for 5mV disc/for .5V aux/imp	138mV/226mV/100kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	45mV/1.5V/2.4V
Noise (ref 1 watt, A wtg)	
At zero volume	–80dB
Aux, ref vol, 1kΩ source	–77dB
Disc, ref vol, 1kΩ/M75EJ sources	–76/–75dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	80/80/60
DC offsets L/R	4/3mV
Power bandwidth, –3dB ref max power 8Ω disc	16Hz —38kHz
Total Harmonic distortion (inc noise)	good
Intermodulation dist (CCIF 19/20kHz RIAA)	good
Hum performance	good

* See text

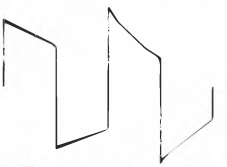




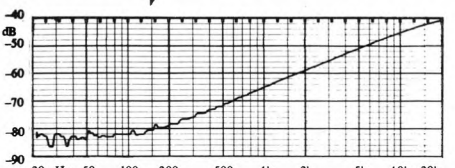
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



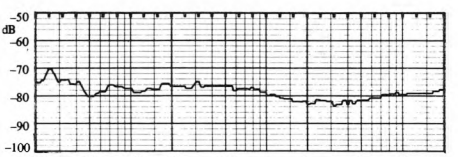
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



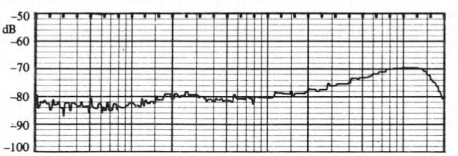
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



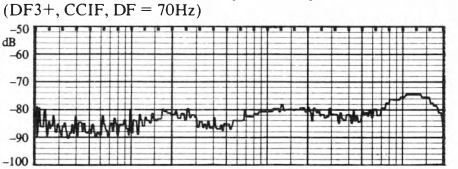
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



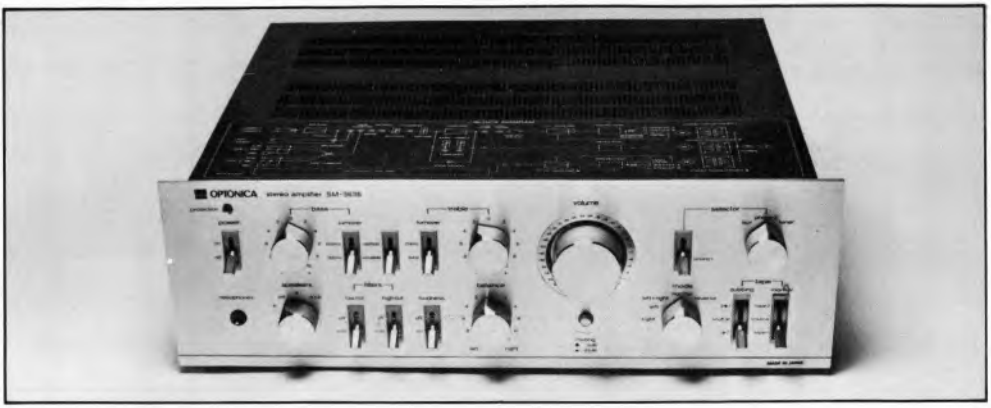
Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz

Optonica SM3636

Optonica, Sharp Electronics (UK) Ltd., Sharp House, 107 Hulme Hall Lane,
Manchester M10 8HL. (061) 205 7321



Presentation, facilities etc.

This large and surprisingly heavy model from Optonica, the hi-fi division of the Japanese Sharp corporation, is finished in the traditional shiny brushed-aluminium, with a black metal case upon which a block diagram is printed. The weight is partly accounted for by the independant power supplies, but the construction is solid and well-finished, and the pre-amp facilities extensive.

The normal phono type inputs are included, with the two tape connectors DIN duplicated and offering crossdubbing connections. Complex tone controls with switchable turnover frequencies and defeat are augmented by HF and LF filters and 'loudness'. A red/green light display indicates protection/power, and pre-/power splitter sockets are provided.

Lab performance

All inputs were very close to 'average' values and should not therefore cause any compatibility problems, though the disc input sensitivity is slightly lower than average. Outputs likewise should be fine, although the headphone level is perhaps a little generous into high impedances.

Most of the measured performance parameters gave above average results, although considering the separate power supplies separation was a little disappointing at high frequencies, and suggests that the third supply for the pre-amp has possibly become the limiting factor. The damping factor is fine, but the drop at high frequencies might be of some significance when the ultra wide power bandwidth (180kHz) is considered, and this latter characteristic is in any case a possible source of trouble. The squarewaves show that the amp has a tendency to overshoot slightly even on resistive loads, and also shows a greater phase shift than the *4646*.

Power delivery is reasonable though less than some cheaper models, but a beneficial characteristic of the twin power supplies is the lack of change when only one channel is driven, while the relatively high capability into low impedances and a burst performance which virtually doubles into 4ohms should make this design fairly tolerant of loudspeaker loading. Interestingly the power amps were large integrated circuits.

Subjective impressions

Quite good consistency was obtained in all the listening tests, with the *3636* ranking below average overall, which was disappointing. Most listeners described it as pleasant and listenable, but a degree of 'fizz' or 'edge' was noted, and some emphasis in the upper bass with a lack of real bass 'weight' was described. While detailing in the bass and midrange was better than average, 'attack' was considered a bit lacking.

Conclusions

The *3636* fared pretty well on all the tests, but the 8ohm power delivery is a little low for the price, although the control and behaviour of power delivery was very good. The subjective impressions were a little disappointing overall when considering the price, and the pre-amp contains an exhaustive list of facilities, which naturally must add to the cost. Overall the *3636* would seem to offer reasonable though not exceptional value for money.

GENERAL DATA

Typical price (inc VAT) £220
Approx size (w × h × d) ..... 17½(45) × 6(15) × 14½(37) ins (cm)
Approximate weight ..... 35 lbs (kg)
Presentation (fascia, case etc) ..... shiny 'silver', black
Quality of external finish ..... v. good
Listening impression summary ..... above average*

Features and Facilities

Tape facilities ..... 2, DIN or phono, crossdubbing
Tone controls/switchable? ..... complex/yes
Filters/loudness ..... HF, LF/yes
Others ..... mute, pre/power split, protection LED.

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 52/52 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 51/51 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 51/50 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 53/77/84 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 53/76/81 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 66/113/150 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 2 phono, 47kΩ/130pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.37/3.4/33mV
Disc: overload 20Hz/1kHz/20kHz 38/38/37dB
Tuner: impedance/sensitivity 39kΩ/177mV
Aux: impedance/sensitivity 39kΩ/177mV
Tape phono: impedance/sensitivity 44kΩ/177mV
Tape DIN: impedance/sensitivity 44kΩ/177mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 210mV/380MV/2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 27mV/50mV/78kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2. 2kΩ 80mV/2.2V/2.5V

Noise (ref 1 watt, A wtg)

At zero volume ..... –83dB
Aux, ref vol, 1kΩ source ..... –81dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –78/–76dB

Other technical parameters

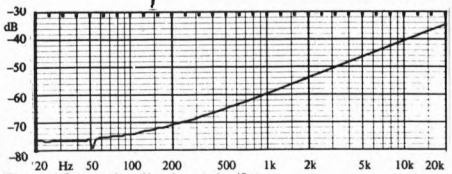
Damping factor 30Hz/1kHz/30kHz 103/103/67
DC offsets L/R 18/8mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 7Hz—180kHz
Total Harmonic distortion (inc noise) ..... above average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... above average
Hum performance ..... above average

* See text

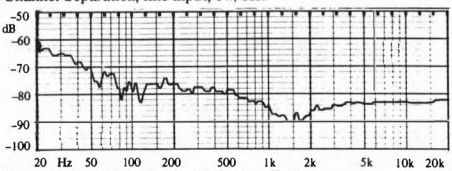
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

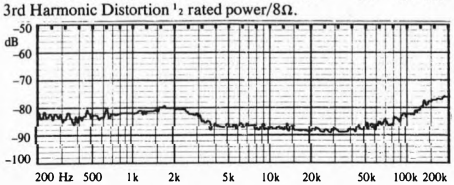
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



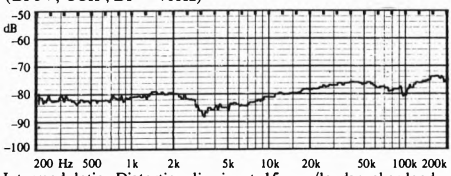
Channel Separation, line input, 1w/8Ω.



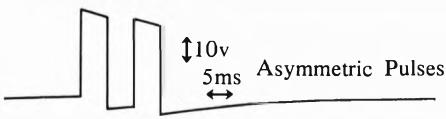
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



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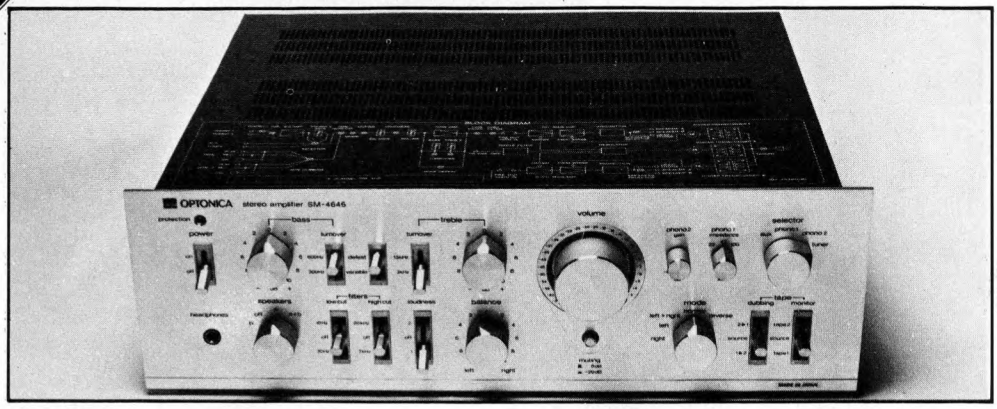
RECOMMENDED

Optonica SM4646

Optonica, Sharp Electronics (UK) Ltd., Sharp House, 107 Hulme Hall Lane, Manchester M10 8HL. (061) 205 7321



Presentation, facilities etc.

The *4646* is big brother to the *3636*. They are very similar to each other, but this model offers nearly double the power and a few extra (!) facilities. The shiny brushed aluminium fascia carries a plethora of knobs which allow complex tone control functions with two turnover points and defeat switching, two 'loudness' contours, two HF and two LF filters. Variable impedance is offered on one pickup input (though we would have preferred the more subtle alternative of variable capacitance), and variable gain on the other (but the gain is quite low anyway, and this can only make it lower!)

The external finish was very good, and the amp had a reassuringly solid and heavy feel, due no doubt to the separate power supplies for each channel. Inputs were provided for all normal inputs, the two tape machines offering cross-dubbing and DIN duplication. Pre-/power splitter socketry is fitted, and red/green LEDs, which indicate protection and power respectively. For such a large amp it was surprising to find a modular IC for the power amps.

Lab performance

Apart from the aforementioned lower than average disc sensitivity, which is unlikely to have any ill-effects, all inputs and outputs were normal, though the headphone socket produced quite a high level into high impedances. No problems are envisaged in practice.

All measured performance parameters appeared to be above average or good, but the bandwidth is rather wide and there was a tendency towards slight HF instability at high powers, while the 20kHz filter is of little help having a -3dB point at 60kHz! Despite the separate power supplies, the channel separation was not much better than average. The degree of squarewave ringing into capacitive loads was a little excessive. Slight variations between the channels were noted on distortion and power measurements, so the alignment at the factory could have been improved a little perhaps.

Power output was not only generous by any standards into 8ohms at 90 watts, but showed significant increase into 4ohm loads; under toneburst conditions this was quite close to the theoretically desirable doubling, and a further significant increase was found into 2ohms. Similar powers were developed with single and double channel drive.

Subjective impressions.

As with the *3636*, encouragingly consistent comments were obtained throughout the listening tests, and these were similar to those obtained with the smaller model, indicating a family resemblance. But the *4646* was rated above average overall, and the extra power capability seemed to be identified irrespective of level, although the overall control seemed marginally less good, so the sound was a little coarser.

Once again criticisms centred around a slight 'fizz' and HF 'brashness', and some overall loss of transient detail. The amp was felt to become slightly fatiguing as levels were increased, but the overall sound at most normal levels was quite acceptable.

Conclusions

Like its smaller brother, the *4646* would appear to

Optonica SM4646

RECOMMENDED

be a competantly designed amp with a very comprehensive pre-amp section; power delivery is high and quite well maintained into difficult loads. Subjective impressions were favourable though not over-enthusiastic. Some possible problems at high frequencies were implied by some of the measurements, and the price is quite high, but the overall package would appear to offer fair value for money.

GENERAL DATA

Typical price (inc VAT) £270
Approx size(w × h × d) ..... 17½(45) × 6(15) × 15(37) ins (cm)
Approximate weight ..... 35 lbs (kg)
Presentation (fascia, case etc) ..... 'shiny' silver, black
Quality of external finish ..... v. good
Listening impression summary ..... above average*

Features and Facilities

Tape facilities ..... 2, DIN or phono, crossdubbing
Tone controls/switchable? ..... complex/yes
Filters/loudness ..... 2HF, 2LF/2 contours
Others ..... Var disc imp., mute, pre-power split, prot. ind.

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 90/89 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 86/84 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 86/85 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 94/135/138 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 91/115/50 Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 100/181/241 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 2 phono, 47kΩ/180pf*
Disc: sensitivity 20Hz/1kHz/20kHz 0.37/3.3/31mV*
Disc: overload 20Hz/1kHz/20kHz 41/41/41dB
Tuner: impedance/sensitivity 40kΩ/200mV
Aux: impedance/sensitivity 40kΩ/200mV
Tape phono: impedance/sensitivity 45kΩ/200mV
Tape DIN: impedance/sensitivity 45kΩ/200mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp. 210mV/380mV/2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 31mV/50mV/80kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ 74mV/1.5V/2.3V

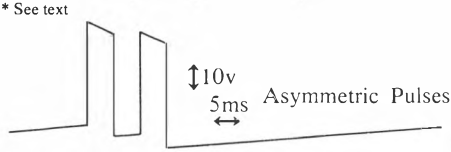
Noise (ref 1 watt, A wtg)

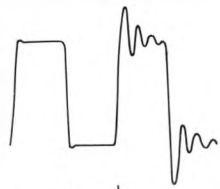
At zero volume ..... –95dB
Aux, ref vol, 1kΩ source ..... –80dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –76/–74dB

Other technical parameters

Damping factor 30Hz/1kHz/30kHz 106/103/64
DC offsets L/R ..... +6.0/–7.0mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 6Hz—100kHz
Total Harmonic distortion (inc noise) ..... above average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... average

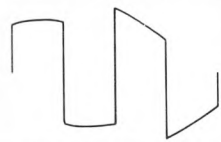
* See text



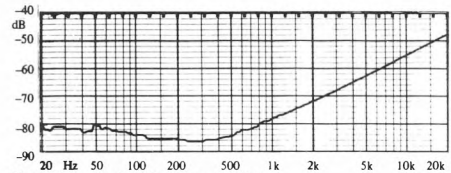


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

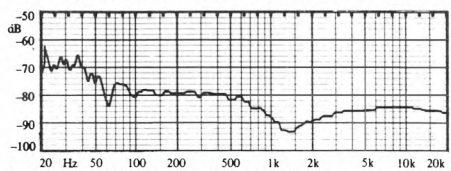
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



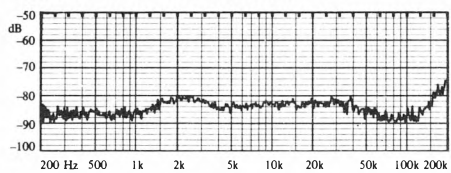
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



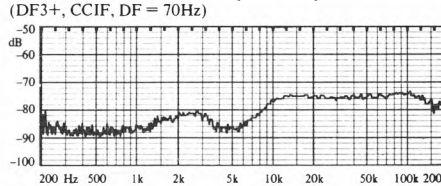
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



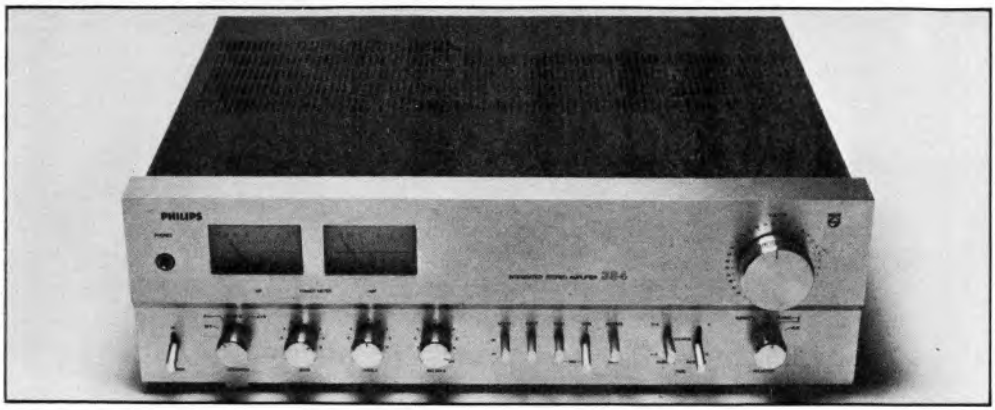
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF, DF = 70Hz

Philips 384

Philips Electrical Ltd., City House, 420/430 London Road, Croydon CR9 3QR. (01) 689 2166



Presentation, facilities etc.

The cheaper of two recent Philips models with a close family resemblance including the same case, the *384* is quite a large and heavy amp for its price, though the enclosure obviously contains a fair amount of fresh air (being used for receiver models as well). Presentation is typically Far-Eastern, where we understand these models are manufactured, with a large matt silver fascia sporting cosmetic power meters and quite numerous facilities. These include predominately phono inputs with some DIN duplication, offering crossdubbing on the two tape inputs. Simple tone controls are fitted, and neither centre indent nor defeat switching is provided; there is also a loudness control and HF and LF filters.

The break with DIN socketry is somewhat surprising for a big European manufacturer like Philips, but we believe it represents a sensible move which reflects an awareness of prevailing international market conditions, rather than an isolationist determination to hide behind the DIN standards as has been done in the past. One concession to Philips' other products is the inclusion of a 'pre-amp out' socket to supply their motional feedback loudspeakers which incorporate their own power amplifiers; this is eminently worthwhile as in our view for technical reasons the only sensible way to use extension loudspeakers is to provide extra power amplifier(s).

Lab performance

No problems should be encountered in interfacing the amplifier with other normal pieces of equipment though phono tape output impedance was a little higher than usual; the headphone output was (not abnormally) on the high side into higher impedance models.

Performance parameter performance was generally quite competant, and the bandwidth seemed to be sensibly controlled, with no particuiar problems apparent. Slight crossover distortion was noted on both channels. Squarewave performance was also reasonable, albeit with some overshoot on capacitive loading, and some phase shifts, but the asymmetric pulse shows a rather halting, slow recovery. The swept intermod showed a slightly disturbing rise when driving a loudspeaker load above about 5kHz.

Power performance was reasonable for the price, though fairly limited when driving low impedances, and showed a significant but not extravagant difference between single and double channel drive.

Subjective impressions

Most of the inconsistencies in the listening test results for the *384* seemed to be related to how hard it was being driven. Provided the volume was kept fairly low, it was generally liked, being considered basically inoffensive, if a little 'soft' and 'bland', with some mild criticism of a 'gentle' bass and some HF sibillant exaggeration. When driven harder, criticisms became much stronger in all areas, and it was felt that the amp was not effectively maintaining control at these higher levels.

Conclusions

The *384* gives an acceptable though far from extravagant power delivery for the price, and was attractively presented though rather bulky, with adequate facilities. Subjectively our impressions

were that it was comparatively good at modest levels, but deteriorated when driven harder, so it is perhaps worthy of consideration in conjunction with efficient speakers (eg Philips models), or where high power levels are not required.

GENERAL DATA

Typical price (inc VAT) £155
Approx size (w × h × d) ..... 19(49) × 6(15) × 15½(39) ins(cm)
Approximate weight ..... 25 lbs
Presentation (fascia, case etc) ..... matt silver, black
Quality of external finish ..... v. good
Listening impression summary ..... below average*

Features and Facilities

Tape facilities ..... 2 machines, crossdubbing, DIN dup
Tone controls/switchable? ..... simple/no
Filters/loudness ..... HF, LF/no
Others ..... MFB output, meters

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 48/48 Watts
Both channels driven 8Ω 20Hz .1% dist L/R 44/43
Both channels driven 8Ω 20kHz .1% dist L/R 45/45
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 55/79/20 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 55/77/22 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 66/106/42 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 2 phono, 49kΩ/115pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.29/2.45/23mV
Disc: overload 20Hz/1kHz/20kHz 33/34/34dB
Tuner: impedance/sensitivity 39kΩ/190mV
Aux: impedance/sensitivity 39kΩ/190mV
Tape phono: impedance/sensitivity 42kΩ/190mV
Tape DIN: impedance/sensitivity 42kΩ/190mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 225mV/300mV/6.5kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 60mV/80mV/160kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 70mV/1.7V/2.5V

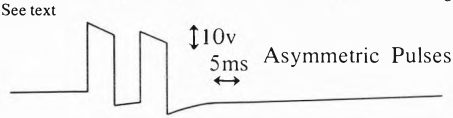
Noise (ref 1 watt, A wtg)

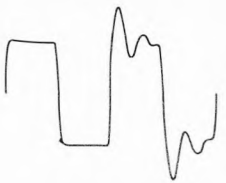
At zero volume ..... –87dB
Aux, ref vol, 1kΩ source ..... –82dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –73/–71dB

Other technical parameters

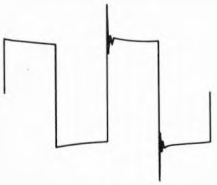
Damping factor 30Hz/1kHz/30kHz 86/84/33
DC offsets L/R ..... –46/–25mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 11Hz—60kHz
Total Harmonic distortion (inc noise) ..... good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... good

* See text

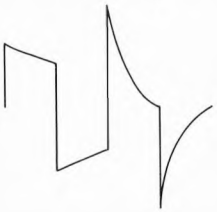




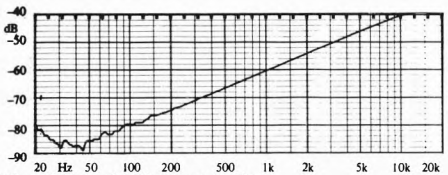
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



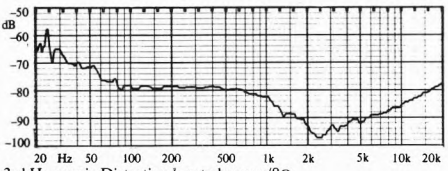
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



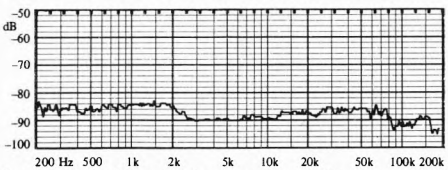
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



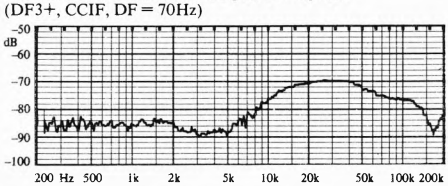
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



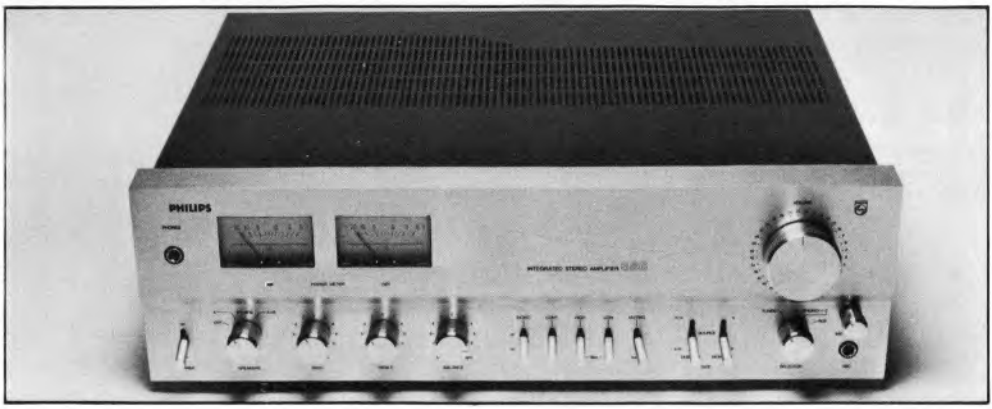
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF, DF = 70Hz

Philips 386

Philips Electrical Ltd., City House, 420/430 London Road, Croydon CR9 3QR. (01) 689 2166



Presentation, facilities etc.

The *386* is, in a nutshell, a *384* with 50% more rated power and an extra mike input, at a not unreasonable price increase of £20. The same bulky black case with matt silver fascia has the same high standard of finish. Inputs are again predominately phono with some DIN duplication, which is an unusual though in our view commendable move on Philips part, bearing in mind the international market situation. (Whereas a small specialist UK manufacturer can get away with using DIN sockets to 'phono' standards, providing he publicises the fact, if a company the size of Philips were to do so it could cause widespread confusion.)

A variety of other facilities are offered, including front-panel mike jack input with gain control, HF and LF filters, loudness, mute, crossdubbing, and a pre-amp output to drive Philips MFB active speakers; in our view the use of active speakers or an extra power amp driven from a pre-amp output is the only technically sound way of using more than one pair of speakers, so this could be useful (though we notice with some regret that two pairs of passive speaker sockets in DIN format are also provided.) The deep 'sculptured' fascia was generally liked, and was rather reminiscent of the H-K models; large (to double as receiver chassis), but restrained (apart from the illuminated power meters.)

Lab performance

Few problems are likely when interconnecting ancillary equipment, as sensitivities, output levels and impedances were all fairly typical; the tape phono output was again slightly higher than normal, though this is unlikely to be noticed.

Performance measurements showed a strong family resemblance to the *384*, with slightly better disc CCIF intermod. Separation was similar, and again not very good, dropping to around -30dB on line input, and varying predominately between –40dB and –50dB across the spectrum on disc. A similar somewhat disturbing rise was noted above about 7kHz on the swept intermod when driving a loudspeaker load. Squarewaves were slightly better controlled, but showed greater phase shift, and the asymmetric pulse swung rather further but recovered a little quicker. Bandwidth was slightly greater, extending, in our view unnecessarily, to 80kHz.

Power delivery was again very similar in character to the smaller model, showing a reasonable output for the money, but similar difference between single and double channel drive, and relative reluctance to drive low impedances.

Subjective impressions

Some inconsistency was again noted on the listening tests, again with indications that reactions depended on how hard the amp was driven, and by and large there was little overall difference in the comments applied to either model, though some felt that the 384 was tidier, and others that the 386 did not deteriorate as quickly. One interesting parallel was made with the Uher, in the general sound quality, and there are certainly quite close parallels in their measured performance, including the swept intermod rise into loudspeaker load.

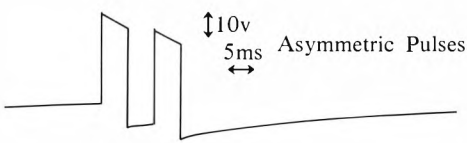
Conclusions

Overall conclusions on this amp must be similar to its smaller brother. Presentation was quite attractive, but bulky, measured performance competant, price/power reasonable but with some reservations regarding delivery, and subjective performance that was liked well enough at low levels, but increasingly criticised as power was increased. A sensible choice for efficient speakers and situations where power requirements will be modest.

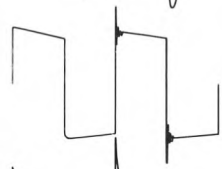
GENERAL DATA

Typical price (inc VAT)	£175
Approx size (w × h × d)	19(49) × 6(15) × 15½(39) ins (cm)
Approximate weight	27 lbs
Presentation (fascia, case etc)	matt silver, black
Quality of external finish	v. good
Listening impression summary	adequate
Features and Facilities	
Tape facilities	2 sets, crossdubbing, DIN dup
Tone controls/switchable?	simple/no
Filters/loudness	HF LF/yes
Others	MFB output, meters, mike input
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	75/74 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	70/70 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	73/71 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	86/93/44 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	83/93/46 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	100/113/61 Watts
Inputs	
Disc: sockets, impedance/capacitance	50kΩ/100pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.32/2.6/24.5mV
Disc: overload 20Hz/1kHz/20kHz	34/35/32dB
Tuner: impedance/sensitivity	49kΩ/195mV
Aux: impedance/sensitivity	49kΩ/195mV
Tape phono: impedance/sensitivity	41kΩ/200mV
Tape DIN: impedance/sensitivity	41kΩ/200mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	230mV/300mV/5.6kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	60mV/80mV/166kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	60mV/1.2V/1.0V
Noise (ref 1 watt, A wtg)	
At zero volume	–86dB
Aux, ref vol, 1kΩ source	–80dB
Disc, ref vol, 1kΩ/M75EJ sources	–80/–80dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	86/86/31
DC offsets L/R	23/29mV
Power bandwidth, –3dB ref max power 8Ω disc	15Hz—80kHz
Total Harmonic distortion (inc noise)	good
Intermodulation dist (CCIF 19/20kHz RIAA)	good
Hum performance	good

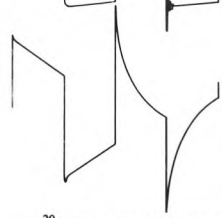
* See text



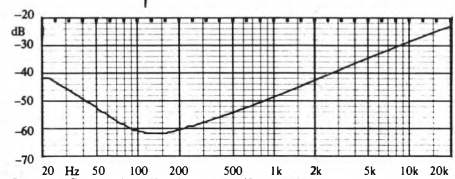
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



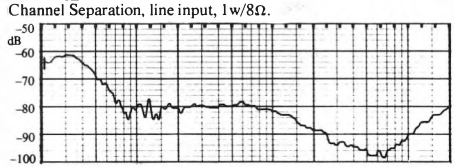
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



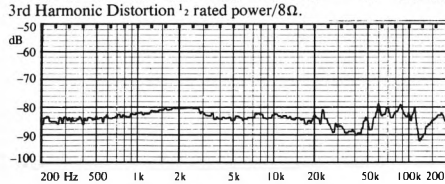
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



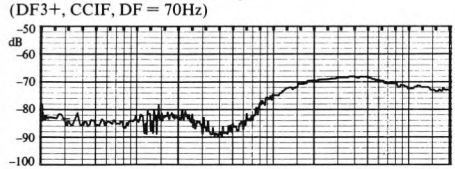
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



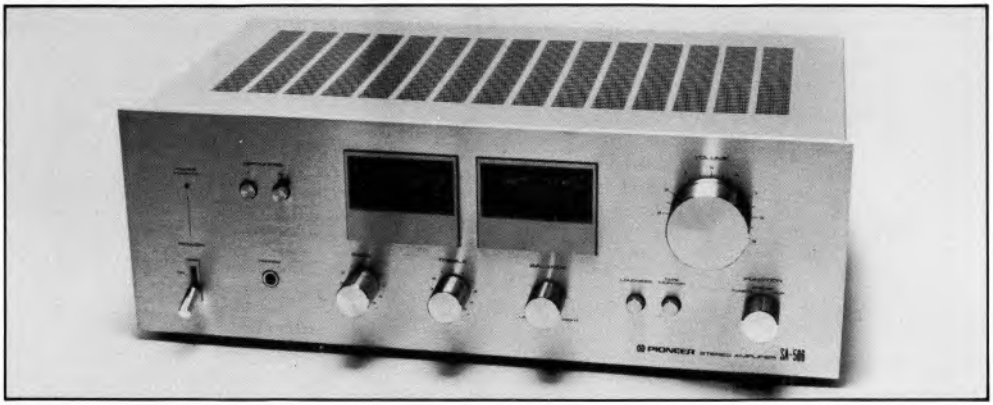
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Pioneer 506

Pioneer UK Ltd., Shriro House, The Ridgeway, Iver, Bucks. SL0 9JL.
0753 652222/7



Presentation, facilities etc.

This is currently the cheapest amp in the Pioneer range, and the smallest of three in the *'06* series. Large power meters dominate the shiny brushed aluminium fascia, which is of 'normal' dimensions, and the case is finished in cream; while more than adequately well finished, economies had obviously been made compared to more expensive models.

Facilities are fairly basic, with the provision for one tape machine DIN duplicated, but otherwise 'phono' throughout. There are no filters and the simple tone controls cannot be defeated, though the ubiquitous loudness control is nevertheless included. The inclusion of such impressive-looking meters would seem an unnecessary luxury in a budget amp, particularly when other facilities are quite limited.

Lab performance

The high level inputs offer fairly normal sensitivities, but the capacitance on the disc input is somewhat higher than usual, and when combined with the leads of a 'typical' turntable system may offer slightly too much to obtain optimum performance from certain cartridge models. While it is always possible to add capacitance, it is not possible to take it away easily, so one should bear in mind that the cartridge will probably see a total load of about 350–400pf.

Hum was below average, but all the measured and observed distortions were well under control. The pickup input bandwidth was (unnecessarily?) wide at 110kHz, and separation tended to become rather marginal at high frequencies. The degree of ringing on squarewaves was also slightly greater than one might have wished.

Power delivery was quite good for the amp's price range, and its ability to deliver increased power into lower impedances, including a good 'burst' rating into 2ohms, is creditable. However the difference noted between single and both channel drive is probably less desirable, and is indicative of economies in the power supply.

Subjective impressions

Some inconsistency was present in the comments from the first listening sessions, but reactions were generally not very favourable and the bass was consistently criticised for sounding 'loose' and 'sloppy'. Some comments concerning lack of control at HF were also recorded.

Similar comments criticising the bass performance were also made independently in the second sessions, and again overall reactions were not very favourable. Further comments were made concerning brightness at HF, which was considered mildly annoying.

Conclusions

While the choice of features for an amp in this price range do seem a little odd, the *506* was nevertheless a capable performer on all normal measurements, though some care may be needed with cartridge matching. Power delivery was quite decent for the price and well maintained into quite low impedances, though the power supply could have been improved. Our subjective impressions were a little disappointing, but nevertheless the power/price ratio suggests that this model is worthy of consideration, though we would advise prospective purchasers to listen before committing themselves.

GENERAL DATA

Typical price (inc VAT) £90
Approx size (w × h × d)..... 17(42) × 6(15) × 12(30) ins(cm)
Approximate weight..... 13 lbs (kg)
Presentation (fascia, case etc)..... shiny silver, cream
Quality of external finish ..... f. good
Listening impression summary ..... adequate

Features and Facilities

Tape facilities ..... one machine, DIN or phono
Tone controls/switchable? ..... simple/no
Filters/loudness..... none/yes
Others ..... large power meters

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 30/30 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 28/27 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 28/28 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω..... 36.6/49/37 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 36/46/32 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω..... 49/85/90 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 56kΩ/240pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.28/2.6/26mV
Disc: overload 20Hz/1kHz/20kHz..... 36/35/29dB
Tuner: impedance/sensitivity 116kΩ/164mV
Aux: impedance/sensitivity..... 116kΩ/164mV
Tape phono: impedance/sensitivity 151kΩ/164mV
Tape DIN: impedance/sensitivity 151kΩ/164mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp.... 241mV/380mV/3.2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp..... 34mV/54mV/84kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ ... 30mV/400mV/500mV

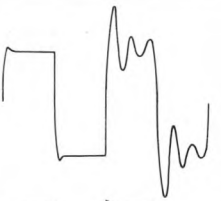
Noise (ref 1 watt, A wtg)

At zero volume ..... –85dB
Aux, ref vol, 1kΩ source..... –80dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –75/–75dB

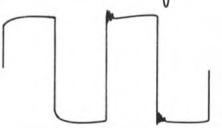
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 56/56/40
DC offsets L/R..... –5/–4mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 12Hz—110kHz
Total Harmonic distortion (inc noise) ..... above average
Intermodulation dist (CCIF 19/20kHz RIAA)..... average
Hum performance ..... below average

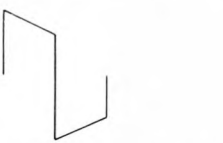
* See text



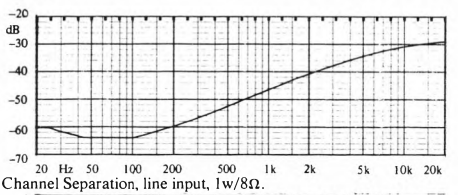
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



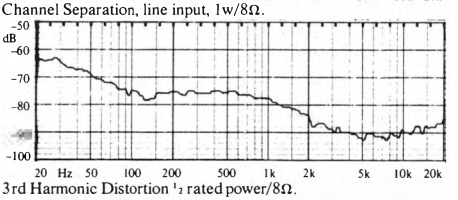
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



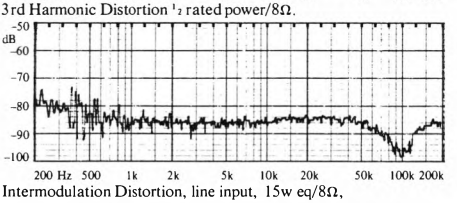
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



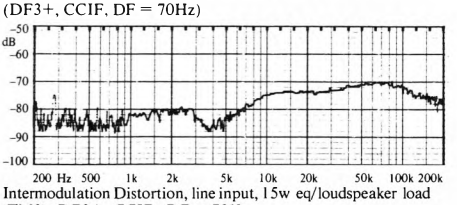
Channel Separation, line input, 1w/8Ω.



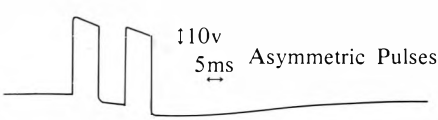
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



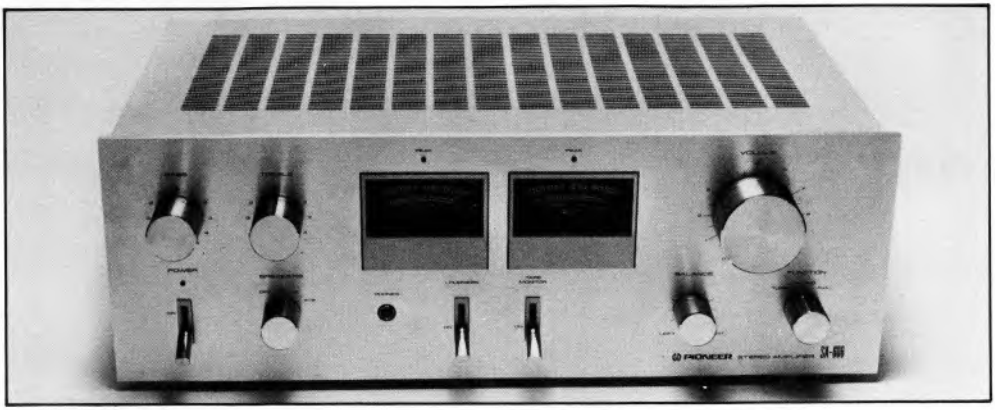
Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



Asymmetric Pulses

Pioneer 606

Pioneer UK Ltd., Shriro House, The Ridgeway, Iver, Bucks. SL0 9JL.
0753 652222/7



Presentation, facilities etc.

The Pioneer 606 is the middle model in a series of three which use very similar pre-amp facilities, but provide power increases commensurate with their cost. The fairly shiny brushed-aluminium fascia is dominated by two large power meters whose activities are supplemented by an LED peak indicator for each channel. The ventilated case is finished in cream, and while the standard of finish is more than adequate, it is not quite as good as that offered on more expensive machines.

Facilities are fairly basic, with 'phono' sockets throughout, but DIN duplication on the single tape input/output. The simple tone controls cannot be defeated, and loudness is provided but no filtering. As the peak indicators are likely to be much more effective at indicating clipping than the meters themselves, and we can see little other purpose in fitting voltmeters 'disguised' as power meters, it is perhaps a pity that some possibly more useful facilities have been omitted.

Lab performance

No problems should be encountered with the various inputs, all of which offer reasonably typical loads and sensitivities; in contrast with the *506*, the capacitance on disc is a more normal 130pf, which is unlikely to cause problems with most cartridges. The outputs are unlikely to pose any problems in practice, though the DIN tape is a little on the low side and the headphone socket gives a fairly high output for high impedance models.

The bandwidth was a little too extended, for comfort, but better than the *506*, and the squarewaves showed some ringing, but all the other measured distortions were quite good, and results on crosstalk, assymetric pulse and noise quite satisfactory.

Power output was quite generous for the price, but again significant increase was obtained with only one channel driven, which suggests that the power supply could be improved with advantage (though the 4lb weight increase over the *506* is presumably due primarily to a larger transformer.)

The power delivery was quite well maintained into lower impedances, particularly if the distortion criteria are relaxed slightly; the toneburst capability was notably generous.

Subjective impressions

The first listening sessions produced some inconsistency between 'hands-on' and 'blind' tests: in the former the performance was considered to offer a general slight improvement over the *506* at the expense of rather more 'fizz', but the bass control and definition was again consistently criticised.

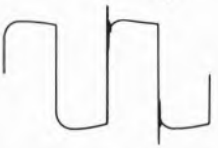
The second listening sessions again commented on poor bass definition, and also described the sound as rather 'muddled' and 'confused'. As with the *506* the comments tended to be rather negative.

Conclusions

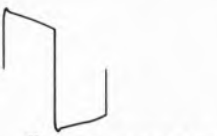
The *606* would seem to offer some minor improvements over the *506* in a number of areas, and there should be fewer problems of cartridge matching; the higher price is reflected in the 50% power increase, although this is not a great deal subjectively. The measured parameters all point towards good value for money at this price/power

level, though once again our subjective impressions were rather negative, so we would strongly advise prospective purchasers to listen before they decide.

10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £120
Approx size (w × h × d) ..... 17(42) × 6(15) × 12(30) ins (cm)
Approximate weight ..... 17 lbs (kg)
Presentation (fascia, case etc) ..... shiny silver, cream
Quality of external finish ..... f. good
Listening impression summary ..... below average

Features and Facilities

Tape facilities ..... one machine, DIN or phono
Tone controls/switchable? ..... simple/no
Filters/loudness ..... none/yes
Others ..... large power meters, peak LEDs

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 52/51 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 46/46 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 51/50 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 62/83/79 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 60/75/70 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 80/113/130 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 50kΩ/130pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.33/2.8/28.5mV
Disc: overload 20Hz/1kHz/20kHz 36/37/26dB
Tuner: impedance/sensitivity 104kΩ/170mV
Aux: impedance/sensitivity 104kΩ/170mV
Tape phono: impedance/sensitivity 132kΩ/170mV
Tape DIN: impedance/sensitivity 132kΩ/170mV

Outputs

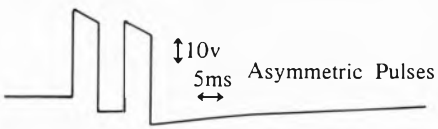
Tape phono: for 5mV disc/for .5V aux/imp 240mV/380mV/2.9kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 30mV/52mV/80kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 0.145V/2.2V/2.7V

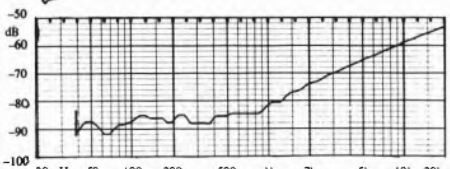
Noise (ref 1 watt, A wtg)

At zero volume ..... –84dB
Aux, ref vol, 1kΩ source ..... –77dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –76/–74dB

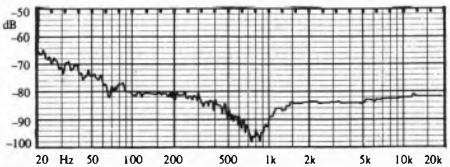
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 65/65/49
DC offsets L/R 13.7/14.7mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 10Hz—70kHz
Total Harmonic distortion (inc noise) ..... above average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... above average
* See text

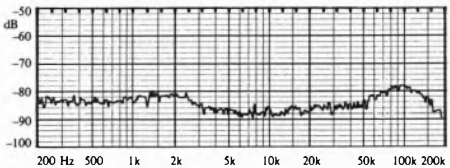




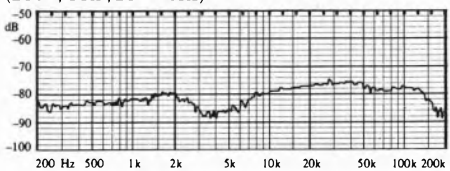
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

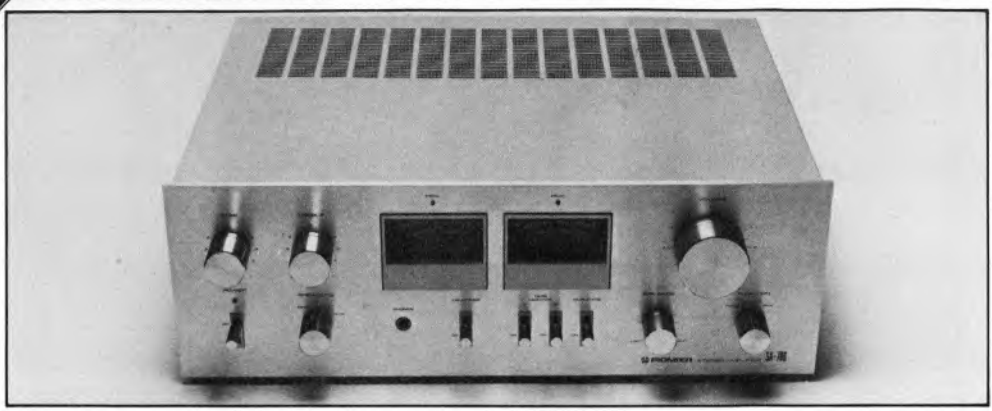


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Pioneer 706

Pioneer UK Ltd., Shriro House, The Ridgeway, Iver, Bucks. SL0 9JL.
0753 652222/7



Presentation, facilities etc.

This is the most expensive model of the three in Pioneer's popularly-priced '06 series. The shiny brushed-aluminium fascia is dominated by large power meters which are supplemented by potentially more useful (and cheaper to fit) LED peak indicators. Obviously some careful economies have been made in manufacture (if partly discarded by the meters), and the finish is not quite to the standard of the more expensive Pioneers, but is more than adequate nevertheless.

Facilities are fairly basic, with predominately phono inputs, DIN duplicated on tape, offering one-way dubbing. Tone controls are simple and cannot be defeated, and no filters are provided, although there is the inevitable loudness control. One curious function was labelled 'phono interference', and despite examination of the manual we were unable to determine its precise purpose; as we have an innate prejudice against having our phonos interfered with, we did not pursue the matter.

Lab performance

The high capacitance of the disc input is something of a worry, because there is little one can do to lower it, and when the capacitance of arm leads is added the total is likely to be too high for the optimum loading of many cartridges, and so some care will be needed in cartridge selection. Headphone output is a little on the high side, and the phono tape output of line input reference level is rather low, particularly when compared to disc; DIN was also on the low side.

Most of the measured performance parameters were above average or better, though some increase in HF distortions was noted. The amp did show some possible slew limiting effects, however, and the higher the power the lower the frequency this takes place: at 70 watts the bandwidth extends to 65kHz, but slew limiting was noted above 40kHz. It is difficult to pin down the exact cause or severity of this effect but some inbuilt HF filtering would have helped to ensure that it could not occur under any circumstances. The drop in damping factor and pickup overload at HF is also a possible cause for concern, as well the greater than usual overshoot on squarewaves with capacitive loading.

Power delivery was quite generous, and showed little difference between single and double channel drive, and pretty good delivery into low impedances.

Subjective impressions

Some inconsistency was noted between the two sets of tests. In the first the amp was rated above average, and considered to give good detail and integration, but at some expense of control, some muddling and treble coarseness.

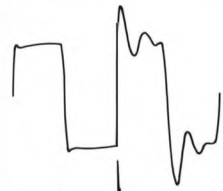
The second sessions were less positive, and while some listeners found the sound quite to their taste, others described brightness and aggression as the dominant characteristics.

Conclusions

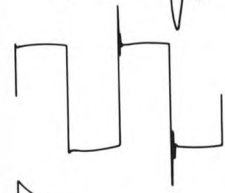
This amp is extremely difficult to summarise. power delivery is very good, especially for the price, and the subjective impressions were fairly reasonable. However doubts raised on disc and tape compatibility, and some aspects of the high

RECOMMENDED

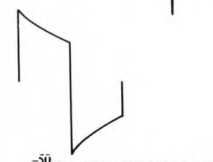
frequency performance do somewhat cloud the picture. Prospective purchasers should certainly listen before committing themselves, and also try to ensure compatibility with their other components.



10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £160
Approx size (w × h × d) ..... 17(42) × 6(15) × 14(36) ins(cm)
Approximate weight ..... 22 lbs
Presentation (fascia, case etc) ..... shiny silver, cream
Quality of external finish ..... f. good
Listening impression summary ..... average

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing, 1 DIN dup
Tone controls/switchable? ..... simple/no
Filters/loudness ..... no/yes
Others ..... 'phono interference', power meters

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 70/72 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 66/67 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 56/60 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 76/112/120 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 77/112/105 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 82/137/197 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 49kΩ/268pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.33/2.4/25mV
Disc: overload 20Hz/1kHz/20kHz 37/38/28dB
Tuner: impedance/sensitivity 106kΩ/150mV
Tape phono: impedance/sensitivity 136kΩ/150mV
Tape DIN: impedance/sensitivity 136kΩ/150mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 235mV/38mV/3.2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 32mV/17mV/79kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 150mV/2.2V/2.6V

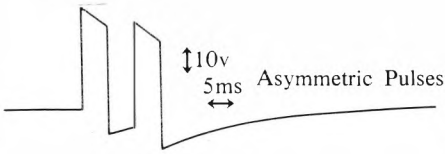
Noise (ref 1 watt, A wtg)

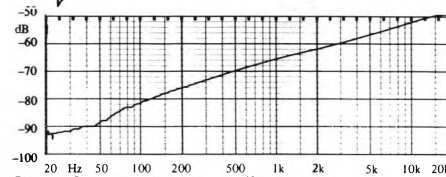
At zero volume ..... –82dB
Aux, ref vol, 1kΩ source ..... –75dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –73/–71dB

Other technical parameters

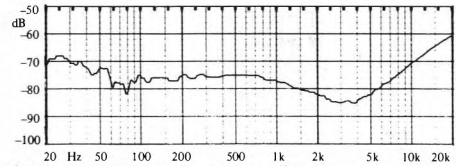
Damping factor 30Hz/1kHz/30kHz 92/89/40
DC offsets L/R ..... –2.9/–3.0mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 13Hz—72kHz*
Total Harmonic distortion (inc noise) ..... average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... v. good

* See text

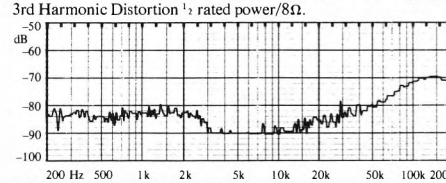




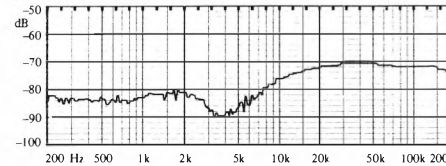
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF, DF = 70Hz

Pioneer 8500II

Pioneer UK Ltd., Shriro House, The Ridgeway, Iver, Bucks. SL0 9JL.
0753 652222/7

Presentation, facilities etc.

The *8500 II* has been around for some time now, having just been introduced when included in the last *Choice: Amplifiers* some eighteen months ago. However we understand that there are no imminent changes in mind, and despite inflation and currency movements this model is frequently available for less than the typical price quoted then! The standard of finish is notably better than for the cheaper *'06* series, and the amp has a matt brushed-aluminium fascia with 'bright' highlights and a grey case; the plethora of knobs and switches gives a rather 'butch' appearance.

Facilities are very comprehensive, and include the very useful variable capacitance provision on the disc input. All inputs are phono apart from one DIN tape duplicate, and the tape socketry offers crossdubbing between two machines. Complex tone controls offer a switched turnover-frequency and defeat, while LF and HF filters and loudness complete the battery of 'sound-shapers'. A -20dB mute extends the range of the volume control, and pre-/power split sockets are also fitted. The high total weight and required depth (partly due to protruding mains input) may require special shelving arrangements.

Lab performance

This model offers variable capacitance on the disc input which should facilitate optimum cartridge matching; unfortunately we found a channel imbalance of 50pf at all settings, which is a minor irritant but should only marginally affect results. DIN tape output was a little on the low side, but in contrast to the *706* more so via the disc input, and headphone output levels were similarly a little high.

Measured performance parameters were generally quite good, but there was some evidence of below average HF behaviour. Power bandwidth seemed fine on tuner input, but was rather too extended in our opinion *via* disc input, and there was evidence of some potential problems within this bandwidth, but above 73kHz. The disc CCIF intermod figure was below average, and the swept intermod showed deterioration above 50kHz into 8 ohm, but above about 10kHz when driving a loudspeaker. Squarewaves with capacitive loading showed significant overshoot, but this was controlled quite quickly. Separation was quite good, reflecting perhaps the twin power supplies fitted.

The generous power delivery was reasonably well maintained into low impedances, particularly on tonebursts, and the dual power supply was presumably responsible for the rock steady delivery when either one or both channels were driven.

Subjective impressions

Certain aspects of this amp were quite well received with good agreement, but consistent criticisms were also made, and overall it would appear that the *706* was marginally preferred. The generous power capability was recognised and liked, but there was general criticism of a 'loose', 'sloppy' bass performance, and harshness at HF, particularly when driven hard.

Conclusions

The *8500 II* would not appear to offer significant improvements over the *706* in power delivery or our listening panel findings; however the possible areas

of ancillary incompatibility have been markedly improved, rather more facilities are provided and the finish is significantly better. It must remain on the borderline of recommendation at its currently available prices, with our suggestion that listening is undertaken before purchase.

GENERAL DATA

Typical price (inc VAT) £240
Approx size (w × h × d) ..... 17(42) × 6(15) × 17(42) ins (cm)
Approximate weight ..... 30 lbs (kg)
Presentation (fascia, case etc) ..... matt silver, grey case
Quality of external finish ..... v. good
Listening impression summary ..... below average

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing, DIN dup
Tone controls/switchable? ..... comples/yes
Filters/loudness ..... HF, LF/yes
Others ..... van cap. disc input

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 83/83 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 80/80 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 79/78 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 83/117/125 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 83/117/107 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 116/196/226 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 2 phono, 50kΩ/var pf*
Disc: sensitivity 20Hz/1kHz/20kHz 0.34/2.9/29mV
Disc: overload 20Hz/1kHz/20kHz 40/41/39dB
Tuner: impedance/sensitivity 60kΩ/160mV
Aux: impedance/sensitivity 60kΩ/160mV
Tape phono: impedance/sensitivity 69kΩ/160mV
Tape DIN: impedance/sensitivity 69kΩ/160mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 220mV/380mV/3.2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 28mV/52mV/80kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ ... 150mV/2.0V/2.7V

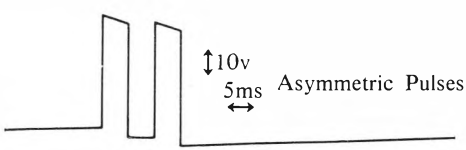
Noise (ref 1 watt, A wtg)

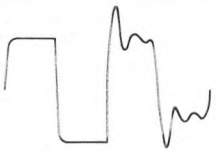
At zero volume ..... –81dB
Aux, ref vol, 1kΩ source ..... –78dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –77/–76dB

Other technical parameters

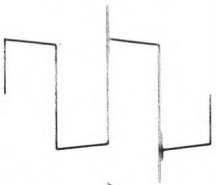
Damping factor 30Hz/1kHz/30kHz 72/72/30
DC offsets L/R 0.5/0.6
Power bandwidth, –3dB ref max power 8Ω disc ..... 5Hz—104kHz
Total Harmonic distortion (inc noise) ..... good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... Below Average
Hum performance ..... Average

* See text

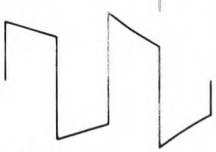




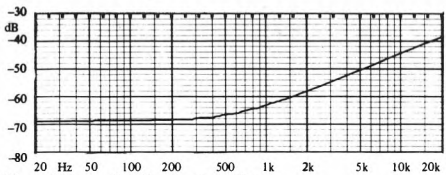
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



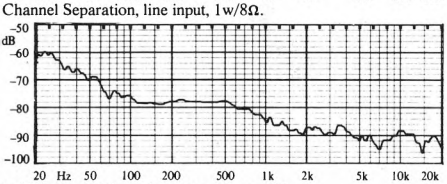
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



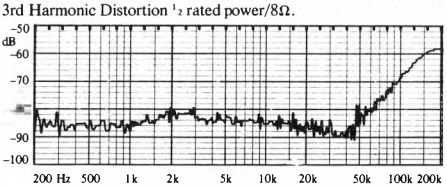
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



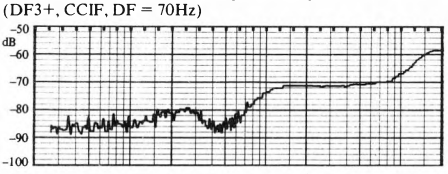
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

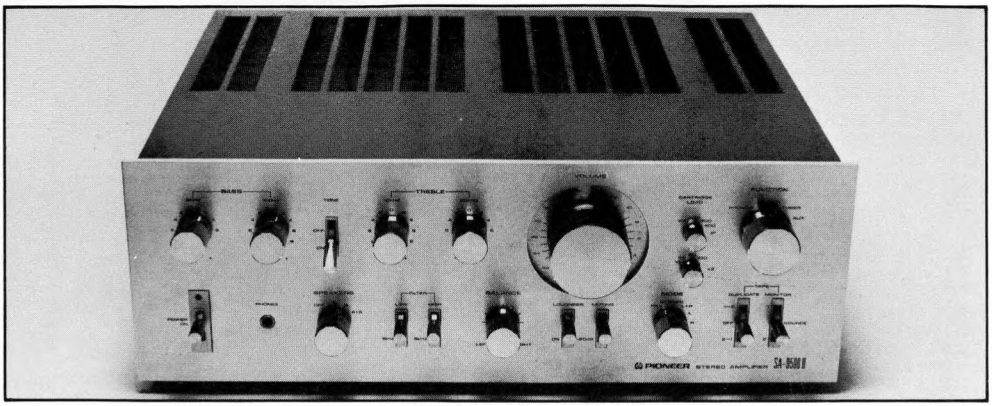


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Pioneer 9500II

Pioneer UK Ltd., Shriro House, The Ridgeway, Iver, Bucks. SL0 9JL.
0753 652222/7



Presentation, facilities etc.
This is currently the largest, most powerful, and most expensive Pioneer model on the UK market. Like the *8500 II* it has been available at the time of writing for some eighteen months, and the visually virtually identical Mark I models go back further still, which does go to show that amp design has changed little cosmetically even amongst the oft-revamped imported models, as it by no means looks dated. It is perhaps evidence that most model changes have been introduced as much for reasons of economy as anything else.

Facilities are very complex, and virtually identical to the cheaper model, as is the excellent finish and rather aggressive styling. The only difference is that the variable loading disc input now varies resistance as well as capacitance, but this is not normally necessary anyway, as it tends to have a coarser effect than capacitance tuning. The inputs are phono apart from one DIN tape duplicate, and the tape socketry offers crossdubbing. Variable turnover-frequency tone controls may also be defeated, and LF and HF filters and loudness are all provided. Volume control range is increased by a mute switch, and pre-/power split sockets are provided.

Lab performance
Similarities between the *9500 II* and the *8500 II* are reflected in the lab performance too, even down to the slight miscalibration of the useful variable disc input capacitance! Once again the DIN tape output is a little on the low side, particularly *via* disc, and the headphone socket on the 'strong' side.

Performance parameters were slightly better than with the *8500 II* on the whole, notably the improved CCIF disc intermod figure and improved HF separation, though the higher than usual swept intermod results, showing a rising characteristic even in the audio band, is again a cause for some concern, and perhaps reflects the fact that this design is not in its first flush of youth. Squarewaves were reasonable, and asymmetric recovery quite good. The fairly wide power bandwidth is also a source of some concern, since some form of slew limiting may occur above 40kHz at high powers.

Power delivery was both generous and of high 'quality', being quite well maintained into lower impedances, particularly on toneburst, and with no interchannel reflection effects, presumably because of the twin supplies.

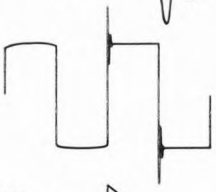
Subjective impressions
Results of the listening tests were not entirely consistent, but a fairly favourable pattern seemed to emerge. The overall feeling of power without effort was consistently liked, particularly in the bass, though with individual dissenters commenting on poor definition nevertheless. Some comments regarding treble problems such as sibillance exaggeration were also recorded, but these were neither consistent nor severe. The overall consensus was that the good power delivery was to some extent compromised by a certain coarseness and lack of control.

Conclusions
The high power delivery, first class finish and

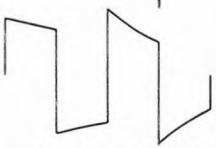
RECOMMENDED

comprehensive facilities represent rather an enticing package at the currently low price of under £300. Subjective impressions were on the whole quite encouraging, but personal listening is again advised before purchase.

10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

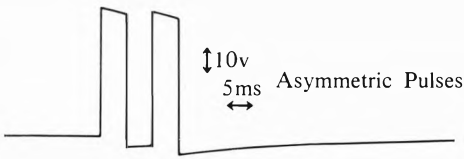


100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

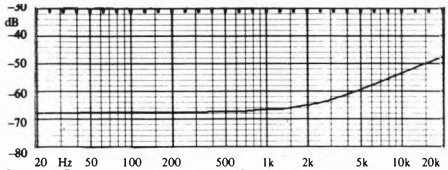
GENERAL DATA

Typical price (inc VAT)	£300
Approx size (w × h × d)	17(42) × 6(15) × 17(42) ins (cm)
Approximate weight	34 lbs (kg)
Presentation (fascia, case etc)	matt silver, grey case
Quality of external finish	v. good
Listening impression summary	above average*
Features and Facilities	
Tape facilities	2 sets, crossdubbing, DIN dup
Tone controls/switchable?	complex/yes
Filters/loudness	LH, HF/yes
Other	var cap, imp on disc input
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	100/100 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	100/100 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	100/100 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	100/150/138 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	100/150/136 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	122/217/326 Watts
Inputs	
Disc: sockets, impedance/capacitance	2 phono, var, kΩ/var/pf*
Disc: sensitivity 20Hz/1kHz/20kHz	0.3/2.8/27mV
Disc: overload 20Hz/1kHz/20kHz	43/43/41/dB
Tuner: impedance/sensitivity	60kΩ/160mV
Aux: impedance/sensitivity	60kΩ/160mV
Tape phono: impedance/sensitivity	68kΩ/160mV
Tape DIN: impedance/sensitivity	68kΩ/160mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	215mV/380mV/2.2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	28mV/50mV/80kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ	140mV/ V/2.8V
Noise (ref 1 watt, A wtg)	
At zero volume	80dB
Aux, ref vol, 1kΩ source	−78dB
Disc, ref vol, 1kΩ/M75EJ sources	−78/−77dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	77/76/33
DC offsets L/R	0/0.3mV
Power bandwidth, −3dB ref max power 8Ω disc	5Hz−78kHz
Total Harmonic distortion (inc noise)	Average
Intermodulation dist (CCIF 19/20kHz RIAA)	Above average
Hum performance	Average

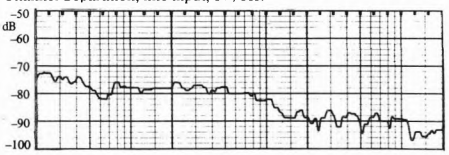
* See text



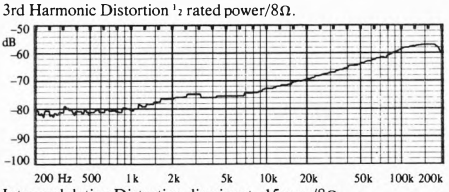
Asymmetric Pulses



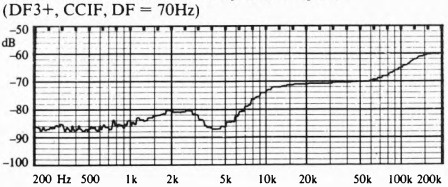
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

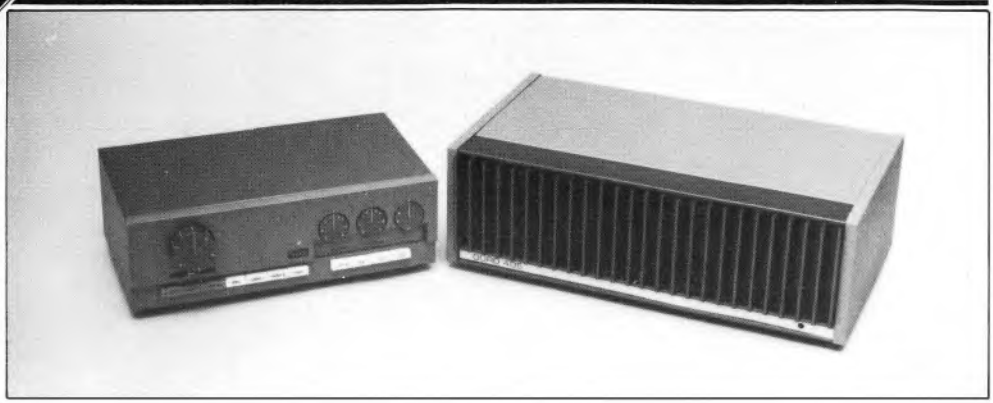


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Quad 33/405

Quad, Acoustical Manufacturing Co Ltd., 30 St Peter's Road, Huntingdon, Cambs. PE18 7DB. 0480 52561



Presentation, facilities etc.

This doyen of British amplification typifies in many ways the individualism of products from the specialist manufacturer. Quad are justifiably proud of the fact that model changes only occur about once in ten years (sometimes much longer!) which means that depreciation is negligible, obsolescence rare, while the legendary standards of servicing and reliability (of models going back even 30 years) are all factors that must carry some weight with the prospective purchaser, even if they are not directly susceptible to measurement! For a couple of years now rumours have been rife concerning a new pre-amp; while obviously not wishing to have their quintennial product launch 'scooped', Quad have confirmed that something is 'in the wind', but that any new model will neither replace nor compete directly with the *33*

Styling is typically Quad, typically idiosyncratic, yet it settles well into the domestic environment, is unobtrusive, and surprisingly timeless. The colour is predominantly khaki, with different shades of brown highlighting, plus orange and cream pushbuttons and trim. DIN sockets are used for disc, 2 tuners and tape inputs, and considerable variation is provided *via* plug-in boards at the rear on tape in/out levels and disc input matching; a separate tape replay socket avoids cross-talk when monitoring off tape. Simple tone controls are defeatable, no loudness is offered, the disc input has LF rolloff built in, and HF filter facilities are the most complex available amongst commercial amps that we know of, with three turnover frequencies and variable rate of cut. The balance control does not provide full muting, and this can be mildly inconvenient when using the volume control at its lowest settings, where channel tracking may have some error.

Lab performance

The plug-in disc input offers two m-m sensitivities plus ceramic matching, and allows the 69kohm impedance or low capacitance to be simply modified if desired; the HF overload is lower than most, so cartridges with a large ultrasonic resonance may be better avoided. The DIN tape sockets are to 'phono' standards, and offer useful alternative output levels and sensitivities.

The highish noise figures perhaps reflect the age of the pre-amp, but the tightly limited bandwidth is eminently worthwhile in our opinion. Swept intermod showed a noticeable rise with loudspeaker loading. The squarewaves showed some reactive load ringing and the fixed LF filter phase shift, which was also reflected in the pulse; pulse recovery showed an odd 'overshoot' effect which was ameliorated by a change of pre-amp, but interpretation remains obscure.

Power output was very generous for the price on 8ohm rating and showed minimal single/dual drive difference and good transient capabilities, but limited power into low impedances, so 'easy-to-drive' 8 ohm speakers should be used to exploit the power.

Subjective impressions

While acknowledging Quad's undoubted success in forcing us to consider whether amps really do sound different, some comments under our conditions are nonetheless pertinent. Our overall ratings were fairly consistently at the top of the 'average' grouping, and quite consistent comments

RECOMMENDED

were made concerning a lack of bass 'weight' and some treble 'fizz'; some listeners also claimed to prefer alternative pre-amps.

Conclusions

Undoubtedly recommendable on price/power alone if used correctly, the unusual and to us attractive presentation, good finish, versatility and aforementioned 'intangibles' also add their weight. We nevertheless advise prior listening and some care with loudspeaker and cartridge matching, while retaining some reserve regarding the pre-amp.

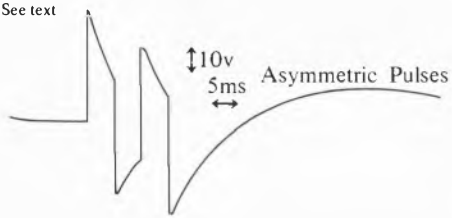
GENERAL DATA

Typical price (inc VAT)	£280
Approx size (w × h × d)	pre: 10(26) × 3½(9) × 8(20), power: 13½(34) × 4½(11) × 8½(22) ins (cm)
Approximate weight	6/19 lbs
Presentation (fascia, case etc)	khaki
Quality of external finish	v. good
Listening impression summary	average*
Features and Facilities	
Tape facilities	1 machine, variable levels
Tone controls/switchable?	simple/yes
Filters/loudness	complex/no
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	110/110 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	100/105 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	100/103 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	115/90/32/ Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	115/81/28 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	157/105/39 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 DIN, 69kΩ/20pf*
Disc: sensitivity 20Hz/1kHz/20kHz	0.34/2.15/24mV*
Disc: overload 20Hz/1kHz/20kHz	25/27/15dB*
Tuner: impedance/sensitivity	94kΩ/80mV
Tape DIN: impedance/sensitivity	45kΩ/83/360/940mV*
Outputs	
Tape DIN: for 5mV disc/for .5V aux/imp	7/39/195mV/18/90/480mV/830Ω*

Noise (ref 1 watt, A wtg)

At zero volume	−73dB
Aux, ref vol, 1kΩ source	−73dB
Disc, ref vol, 1kΩ/M75EJ sources	−71/−70dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	196/180/66
DC offsets L/R	+5/+3.5mV
Power bandwidth, −3dB ref max power 8Ω disc	18Hz—35kHz
Total Harmonic distortion (inc noise)	above average
Intermodulation dist (CCIF 19/20kHz RIAA)	average
Hum performance	below average

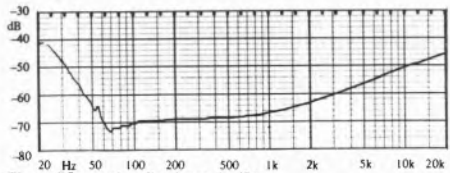
* See text



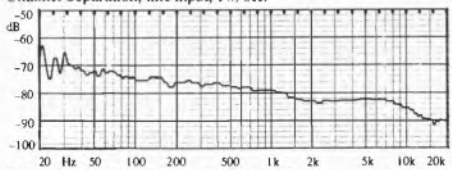
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

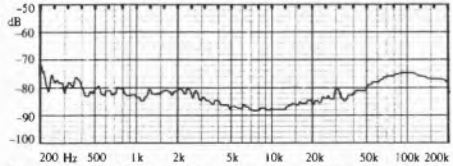
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



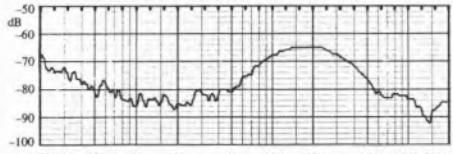
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



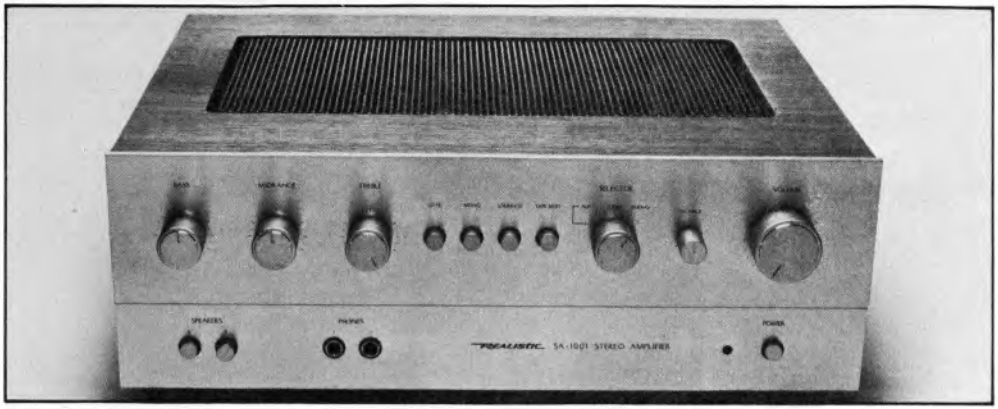
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Realistic SA-1001

Realistic, Tandy Corporation, Branch UK, Bilston Road, Wednesbury, W. Midlands. (021) 556 6101



Presentation, facilities etc.

Realistic is the hi-fi trade mark of products that are exclusively marketed in Tandy stores. While this does limit their freedom of availability, the countrywide network of some 200 shops seemed sufficient justification for including two of their interestingly styled amps. The presentation of the *SA-1001* is somewhat unusual with a 'split-level' fascia, and simple 'clean' pushbuttons and knobs plus an all-too-rare wooden case.

Phono sockets are used predominately, with DIN duplication for the single tape connection. Two headphone sockets are provided. Tone controls operate on bass, treble and mid, and no defeat is offered. Loudness functions, an LF filter and mono switch button are also provided. External finish was to a high standard, and the appearance was generally considered a cut above the average, particularly when considering typical domestic surroundings.

Lab performance

Inputs and outputs are all quite typical and should give no problems in matching with ancillary equipment, though as usual the headphone output was a little high into high impedance 'phones.

Measured performance seemed reasonably competent, though the hum spectrum contained a number of higher harmonics. The swept intermod showed some HF rise into the loudspeaker load, similar to the *2001*. The squarewaves are quite reasonable, but show the usual overshoot and ringing into capacitive loads, and a very small overshoot can also be detected on the asymmetric pulse, which was otherwise well controlled. The bandwidth was in our view rather excessive, extending above 100kHz.

Power delivery was reasonable, but by no means exceptional for the price, and a significant difference between single and dual channel drive was noted. Delivery into very low impedances was rather restricted, but was maintained reasonably well into 4ohms.

Subjective impressions

In the first listening sessions the *1001* was considered generally quite pleasant at modest levels, but with consistent criticism of a 'splashy', 'gritty' treble region, which downgraded it somewhat. It was also described as becoming progressively – and perhaps unacceptably – 'untidy' as it was driven harder.

The second sessions tended to confirm the criticisms of 'fizzy' high frequencies and high level breakup, but additional comments were made regarding rather poor definition, particularly in the bass region.

Conclusions

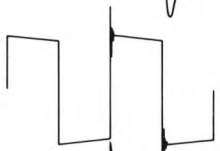
While the presentation was liked and considered more domestically appropriate than many models, this amplifier is on the expensive side for the power offered, and this observation was not counteracted by encouraging listening test results. While undoubtedly a competent product, the *1001* was not considered competitive enough to merit general recommendation.

GENERAL DATA

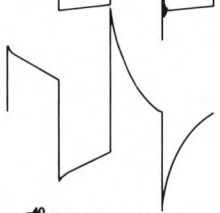
Typical price (inc VAT)	£130
Approx size (w × h × d)	16½(42)×6(15)×14(35) ins (cm)
Approximate weight	19 lbs
Presentation (fascia, case etc)	silver, wooden case
Quality of external finish	good
Listening impression summary	below average*
Features and Facilities	
Tape facilities	1 machine
Tone controls/switchable?	bass, mid, treble/no
Filters/loudness	LF/yes
Others	
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	48/46 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	45/44 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	45/45 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	56/74/15 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	55/77/15 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	70/113/17 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 51kΩ/90pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.28/2.3/22mV
Disc: overload 20Hz/1kHz/20kHz	36/37/36dB
Tuner: impedance/sensitivity	89kΩ/140mV
Aux: impedance/sensitivity	89kΩ/140mV
Tape phono: impedance/sensitivity	100kΩ/140mV
Tape DIN: impedance/sensitivity	100kΩ/150mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	220mV/280mV/5.5kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	42mV/56mV/190kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	70mV/1.7V/2.5V
Noise (ref 1 watt, A wtg)	
At zero volume	–88dB
Aux, ref vol, 1kΩ source	–79dB
Disc, ref vol, 1kΩ/M75EJ sources	–76/–74dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	80/80/29
DC offsets L/R	–35/–39mV
Power bandwidth, –3dB ref max power 8Ω disc	12Hz—108kHz
Total Harmonic distortion (inc noise)	below average
Intermodulation dist (CCIF 19/20kHz RIAA)	above average
Hum performance	below average

* See text

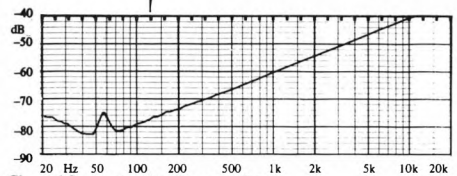
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



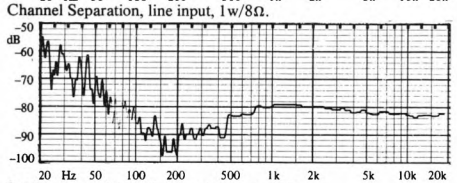
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



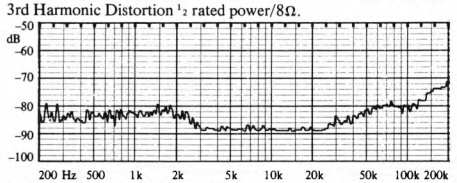
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



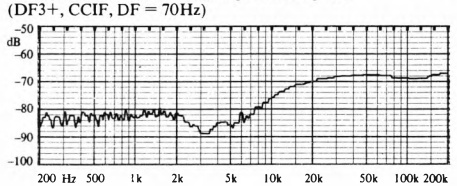
Channel Separation, line input, 1w/8Ω.



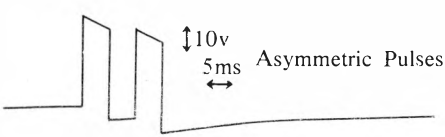
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

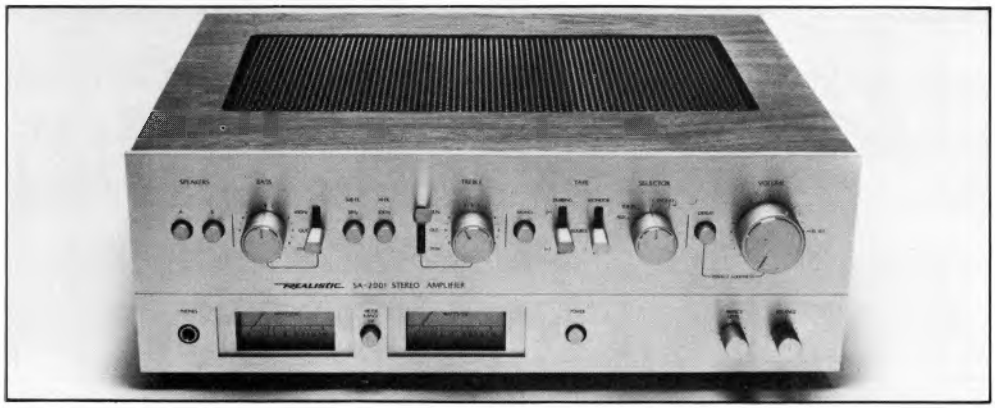


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



Realistic SA-2001

Realistic, Tandy Corporation, Branch UK, Bilston Road, Wednesdbury, W. Midlands. (021) 556 6101



Presentation, facilities etc.

This is the top model offered in the Realistic range, which is only available in Tandy stores. However these shops are sufficiently widespread, and are frequently heavily promoted locally, that we felt the inclusion of these unconventionally styled models was worthwhile. The *2001* offers a slight power increase over the *1001*, but a much larger range of features and facilities. The standard of finish was very good, and the split-level matt silver fascia and wooden case were generally liked, but the extra facilities gave a less 'clean' appearance than the *1001*, and the meters continually gave us the impression we were using the thing upside-down!

Inputs are predominately phono with one tape connector DIN duplicated. Crossdubbing was provided between the two tape connectors, and the disc input offered three different sensitivities. The middle tone control of the *1001* is eschewed in favour of two turnover positions and defeat switching on bass and treble. LF and HF filters are fitted along with a variable loudness control, the front legend making in our view the dubious claim for 'perfect loudness', though with the loudness defeated this could usefully expand the volume control range; mono switching and variable sensitivity meters of dubious usefulness are also included.

However for those who find the loudness contour useful, this variation offers useful practical flexibility, and like the Visonik enables the function to be tailored to room and system sensitivity.

Lab performance

Inputs and outputs should not give any problems, and the variable sensitivity on the pickup input gave useful alternatives of 1.5, 3, and 6mV.

Performance measurements revealed few problems, noise being generally good, and the 'average' hum characterisation being confined to the 50Hz fundamental, with no significant harmonics. While harmonic distortions seemed pretty good, the swept intermod revealed a significant rise within the audio band at high frequencies when driving a loudspeaker. Squarewaves generally showed very good control and the asymmetric pulse likewise, but the rounded leading edge at 10kHz/8ohms is a trifle odd. Although the bandwidth is not exceptionally extended, some slew limiting problems were noted on one channel above 50kHz.

Power delivery was healthy but not excessive for a model at this price, and showed some shortcomings at low frequencies. A largish difference between single and dual channel drive was noted, but reasonable power was available into low impedances.

Subjective impressions

The first tests rated the *2001* about average on sound quality, with a generally good balance between control and detail described. The bass was considered better than average, but some middle 'thickness' and treble 'hardness' were also noted. The second sessions were rather less favourable, and in fact comments were made about preferring the *1001*. The treble harshness was again described, but the bass was adversely described as having 'thump' rather than delicacy or presence; the adjective 'plodding' being used in the blind sessions.

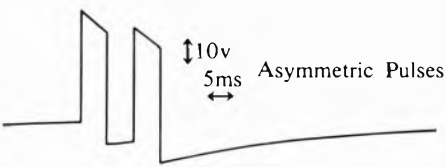
Conclusions

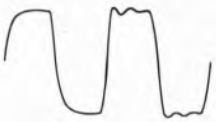
While the presentation was well-liked, revealing a high standard of construction with comprehensive facilities that are probably reflected in the price, power output was only about average, and the results of the listening tests insufficiently encouraging to place this model amongst the recommended group. This by no means implies that it does not merit consideration by those who are particularly attracted by the presentation and facilities offered.

GENERAL DATA

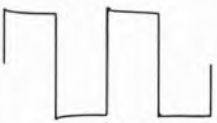
Typical price (inc VAT)	£190
Approx size (w × h × d)	16½(42) × 6(15) × 14(35) ins (cm)
Approximate weight	22 lbs
Presentation (fascia, case etc)	silver, wooden case
Quality of external finish	v. good
Listening impression summary	below average*
Features and Facilities	
Tape facilities	2 phonos, crossdubbing, DIN dup
Tone controls/switchable?	complex/yes
Filters/loudness	HF, LF/complex*
Others	meters
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	78/77 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	62/62 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	75/73 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	90/115/55 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	89/110/53 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	111/163/82 Watts
Inputs	
Disc: sockets, impedance/capacitance	2 phono, 52kΩ/120pf*
Disc: sensitivity 20Hz/1kHz/20kHz	0.4/3/28.5mV*
Disc: overload 20Hz/1kHz/20kHz	36/37/36dB
Tuner: impedance/sensitivity	70kΩ/200mV
Aux: impedance/sensitivity	70kΩ/200mV
Tape phono: impedance/sensitivity	77kΩ/200mV
Tape DIN: impedance/sensitivity	77kΩ/200mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	200mV/300mV/6.5kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	40mV/60mV/195kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	48mV/1.4V/2.4V
Noise (ref 1 watt, A wtg)	
At zero volume	–99dB
Aux, ref vol, 1kΩ source	–84dB
Disc, ref vol, 1kΩ/M75EJ sources	–80/–76dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	53/53/31
DC offsets L/R	–4/–23mV
Power bandwidth, –3dB ref max power 8Ω disc	11Hz—75kHz*
Total Harmonic distortion (inc noise)	above average
Intermodulation dist(CCIF 19/20kHz RIAA)	excellent
Hum performance	average

* See text



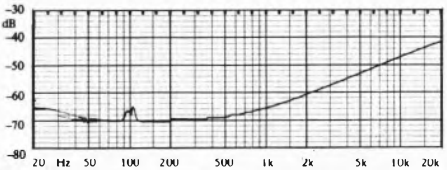


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

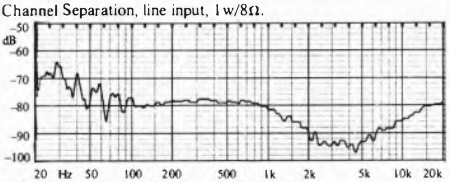


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

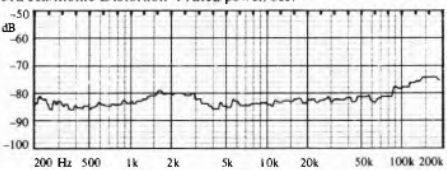
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



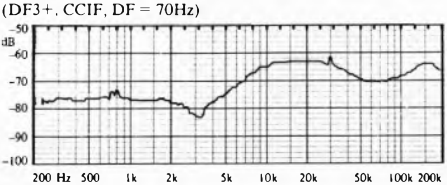
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Revox B750 II

Revox, F.W.O. Bauch Ltd., 49 Theobald Street, Boreham wood, Herts. WD6 4RZ. (01) 953 0091

Presentation, facilities etc.

This large, expensive, but beautifully finished amp somehow manages to look restrained and yet 'flash' at the same time! The styling is of course designed to blend with Revox' popular *B77* reel-to-reel tape recorder and the rest of the '*B*' series, so the predominant colour is matt grey with some silver trim. This is clearly no economy model, and if some of the frills seem a trifle superfluous, there are nevertheless some elegant touches which one cannot help but admire: for example the design enables the top and front of the amp to lie flush with room and shelf boundaries, thus concealing wiring and enhancing the appearance *in situ*. In addition a number of the less frequently used controls are located behind a spring loaded panel, and therefore remain concealed when not required.

Facilities are lavish, with predominately phono inputs with tape DIN duplication, and naturally quite complex tape interconnections: crossdubbing is available between two machines permanently connected at the rear, for example, but can be overridden from a front accessed socket. The disc input offers variable impedance and sensitivity, but not capacitance, which is a pity as in our view this is the most useful. Bass, mid and treble tone controls are fitted, plus HF and LF filters and loudness, volume mute, and pre-/power split sockets. Some mechanical hum was noted, but our sample was from early production and hopefully this is not typical.

Lab performance

The disc input offers a sensible variable sensitivity (between 1.2mV and 7.4mV) and impedance may also be varied, but not capacitance which is unfortunately already set to an uncomfortably high 285pf, which may cause some cartridge matching problems. The headphone socket output was unnecessarily and undesirably high.

The intermod distortion at HF via disc input was not as good as at lower powers, and at maximum power slew limiting could be induced at 20kHz, although at 45 watts it did not occur before 90kHz. Servicing should be very easily carried out, as the majority of this amp is built on plug-in components and modules (even the driver and output transistors!) The majority of the performance measurements returned reasonable values, though the squarewaves showed some capacitive ringing and some HF overshoot.

Power delivery was reasonable but by no means excessive for this price level, and showed some difference between single and dual channel drive. A reasonable excess was available into 4ohms, but the amp did not like driving 2ohms continuously, although it gave a resonable 'burst' delivery. As Revox' own *BX350* speaker dips below 4ohms on three occasions in the audio band, the low impedance delivery is not entirely appropriate.

Subjective impressions

Despite the high price, this model was only rated average overall, albeit at the upper end of this group. While not particularly disliked, consistent mention was made of a rather 'thin' sound, lacking 'impact'. A somewhat 'untidy' treble with some tendency to 'spit' was also described, but detail in the midband was praised. The second sessions confirmed the 'average' rating, and also the 'thin' sound quality with unexceptional definition, describing the bass as being controlled but again lacking some punch.

Conclusions

While the *B750 II* has a pleasantly discreet presentation and offers a wide variety of facilities, the measured performance and power output are unexceptional for the price; moreover the sound quality did not endear itself greatly to the panels, so general recommendation is not appropriate.

GENERAL DATA

Typical price (inc VAT) £460
Approx size (w × h × d) ..... 18(45)×6(15)×13(33) ins (cm)
Approximate weight ..... 28 lbs
Presentation (fascia, case etc) ..... grey, silver trim
Quality of external finish ..... v. good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... complex*
Tone controls/switchable? ..... bass, presence, treble/yes
Filters/loudness ..... LF, HF/yes
Others ..... various*

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 92/91 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 88/88 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 90/89 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 100/132/– Watts*
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 100/132/– Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 100/191/226 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 2 phono, 48kΩ/285pf*
Disc: sensitivity 20Hz/1kHz/20kHz 0.22/1.2/12mV*
Disc: overload 20Hz/1kHz/20kHz 33/36/35dB
Tuner: impedance/sensitivity 112kΩ/190mV
Aux: impedance/sensitivity 112kΩ/190mV
Tape phono: impedance/sensitivity 112kΩ/190mV
Tape DIN: impedance/sensitivity 112kΩ/190mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 620mV/400mV/2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 180mV/110mV/272kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 235mV/2.55V/3.1V

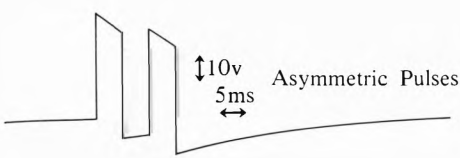
Noise (ref 1 watt, A wtg)

At zero volume ..... –83dB
Aux, ref vol, 1kΩ source ..... –81dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –81/–81dB

Other technical parameters

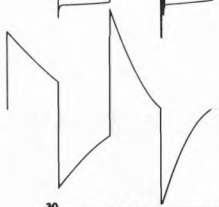
Damping factor 30Hz/1kHz/30kHz 85/80/37
DC offsets L/R ..... –20/+24mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 20Hz—90kHz
Total Harmonic distortion (inc noise) ..... average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... below average
Hum performance ..... average

* See text

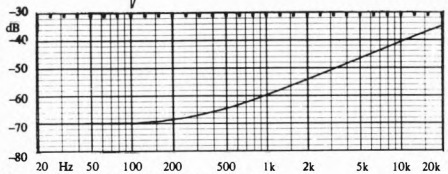


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

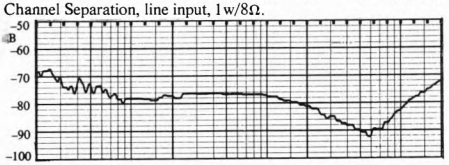
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



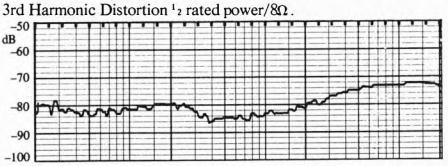
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



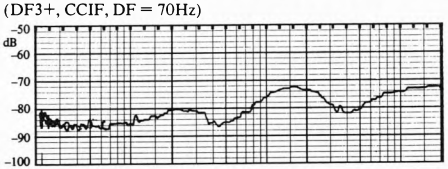
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz

Rotel RA714

Rotel UK, 2-4 Erica Rd., Stacey Bushes, Milton Keynes, Bucks. 0908 317707

Presentation, facilities etc.

The *714* is the largest model in the cheaper Rotel range, priced below the other more powerful models reviewed here, and has been established for some time now. Finish was very good, and the presentation felt to be nicely 'domestic' compared to many models including its new big brothers, with the matt silver front encased in a wooden sleeve. Facilities are fairly basic, with phono inputs predominately used, but DIN connection for one of the tape inputs and as an alternative on disc; crossdubbing is available on the tape connections. Simple tone controls are fitted, and no defeat is provided; loudness, HF and LF filters plus a volume mute are also fitted.

Lab performance

No problems of ancillary incompatibility are likely to be encountered, though as usual the headphone output is a little high into high impedance models.

Hum was rather below average, and some higher harmonics predominated, but noise figures were reasonable, and swept and spot distortions were generally very low. The rise into loudspeaker load on swept intermod was very slight. The squarewave and asymmetric pulse performances were quite untidy however, with some ringing and overshoot apparent. The bandwidths were unnecessarily extended to about 100kHz, and slew limiting could be induced above 51kHz at high powers.

Power output was quite healthy for the price,was well maintained across the audio band, but showed a rather large difference between single and dual channel drive. A reasonable increase was available into low impedances particularly under 'burst' conditions.

Subjective impressions

Although preferred to the newer more expensive Rotels, the *714* was still not particularly well received, although some listeners found it more acceptable than others. Balance was considered quite good in the first tests, and detail quite reasonable, but there was consistent though not severe criticism of treble 'hardness' and a degree of muddle.

The second sessions gave some confirmation of these findings, but with additional reservations concerning a 'heavy' and rather 'confused' bass. General lack of clarity was also noted.

Conclusions

This Rotel model offers a quite competitive package for the price – significantly more so than its big newer brothers in our opinion. The appearance is attractively 'domestic' with the wooden case, good finish and comprehensive facilities, and the power output is quite generous for the price. However the results of the listening tests were not particularly favourable, and at our estimated typical price the *714* does not really qualify for recommendation. However Rotel products are frequently heavily discounted, and if the sound quality is checked out and found favourable, this could be an attractive proposition.

GENERAL DATA

Typical price (inc VAT) £125
Approx size (w × h × d) ..... 17(43)×6(15)×14(35) ins (cm)
Approximate weight ..... 22 lbs
Presentation (fascia, case etc) ..... silver, wooden sleeve
Quality of external finish ..... v. good
Listening impression summary ..... below average*

Features and Facilities

Tape facilities ..... 1 phono, 1 DIN, crossdubbing
Tone controls/switchable? ..... simple/no
Filters/loudness ..... HF, LF/yes
Others .....

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 59/58 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 56/58 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 57/58 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 68/105/113 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 68/103/113 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 77/137/183 Watts

Inputs

Disc: sockets, impedance/capacitance .... 1 phono, DIN, 49kΩ/160pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.34/2.8/26mV
Disc: overload 20Hz/1kHz/20kHz 33/34/28dB
Tuner: impedance/sensitivity 49kΩ/165mV
Aux: impedance/sensitivity 49kΩ/165mV
Tape phono: impedance/sensitivity 56kΩ/165mV
Tape DIN: impedance/sensitivity 56kΩ/165mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 250mV/450mV/1.0kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 60mV/100mV/89kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 68mV/1.75V/2.5V

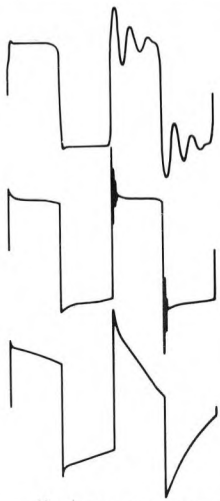
Noise (ref 1 watt, A wtg)

At zero volume ..... –81dB
Aux, ref vol, 1kΩ source ..... –77dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –75/–74dB

Other technical parameters

Damping factor 30Hz/1kHz/30kHz 82/82/66
DC offsets L/R ..... –11/+16
Power bandwidth, –3dB ref max power 8Ω disc ..... 8Hz—100kHz*
Total Harmonic distortion (inc noise) ..... good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... excellent
Hum performance ..... below average

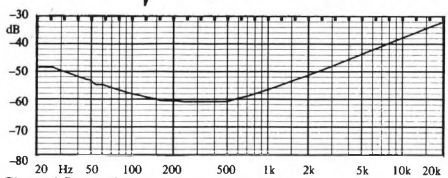
* See text



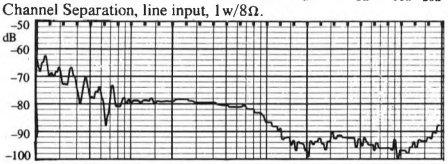
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

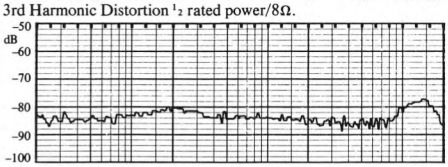
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



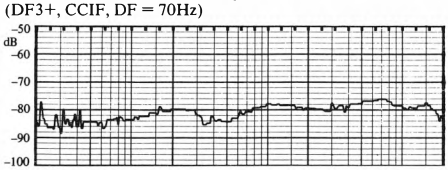
Channel Separation, line input, 1w/8Ω.



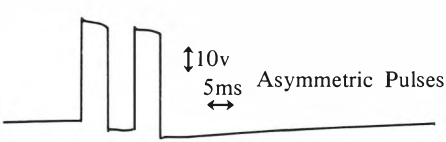
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

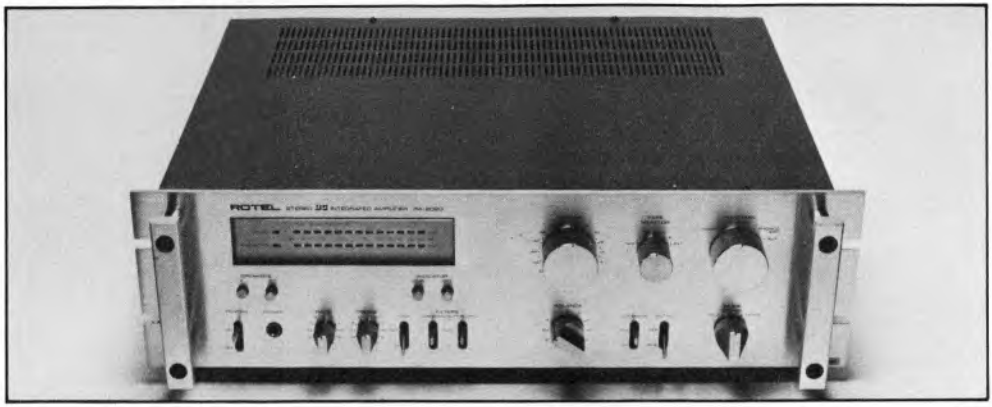


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz



Rotel RA2020

Rotel UK, 2-4 Erica Rd., Stacey Bushes, Milton Keynes, Bucks. 0908 317707



Presentation, facilities etc.

This large and heavy amp is nevertheless the cheapest in Rotel's new series of direct-coupled high powered models. Its rather aggressive styling features a fairly unsubtle 'light-bar' power metering system; while this presumably works adequately in indicating voltage clipping, its 'light show' effects were difficult to ignore, and some might eventually find them irritating. Rack handles in our opinion do nothing to enhance the domestic appeal and acceptability of this model, but then this must remain a matter of personal taste.

Facilities include a built in head-amp for moving coil cartridges, as well as the more normal moving magnet type input, which we feel is a particularly worthwhile inclusion at this price level, as it is much cheaper for an amp manufacturer to include such circuitry within the amp than to produce special 'black boxes' for separate purchase. All inputs are phono type; two tape machines may be connected with crossdubbing switching provided. Simple tone controls are fitted with defeat switching, HF and LF filters curtail the bandwidth beyond the audio range, loudness, pre-/power splitting, and volume mute are all included. We felt the selection of the facilities fitted was particularly sensible and well thought-out.

Lab performance

Inputs and outputs should pose no compatibility problems, although the m-c sensitivity is a little low for some low impedance models like Ortofons; however the noise figure is considerably better than the *2040*, which should help avoid any interface problems.

Hum was not good, with a fair amount of the subjectively more annoying higher harmonic variety, but noise was significantly better than the larger model. In general most distortion measurements were above average, although the very high frequency/high power intermod rise was disturbing in view of the wide input bandwidth, indicating potential slew limiting problems. Squarewaves were generally well-controlled, far better than in the *2040*, but a slight 'rounding' effect was noticed on the pulse, which was otherwise well behaved. The meters were not found to be particularly effective at reading peaks.

Power delivery was healthy but by no means generous for the price, and significant single/dual channel differences were noted. A fairly healthy power level was available into low impedances, but without the maximum voltage being maintained.

Subjective impressions

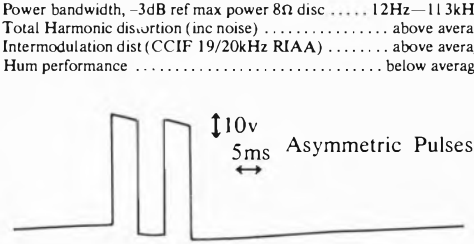
The overall reactions to both this model and the bigger *2040* were rather disappointing. In the first tests the sound was described as 'bright', 'muddled' and 'untidy', with rather poor detail and general lack of integration across the audio band. While these criticisms may seem rather negative, they were nevertheless quite consistent. The second session's comments are likewise peppered with comments concerning HF 'fizz', 'screech' and the like, with the observations that matters seemed to worsen at higher levels, and that the overall sound was 'disjointed'.

Conclusions

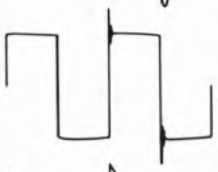
Although the presentation and facilities are lavish, the power output is not over-generous for an amp at this price, and while performance was generally competent, there remain some reservations. Furthermore, the results of the listening tests were generally rather negative, so we do not feel that recommendation is appropriate.

GENERAL DATA

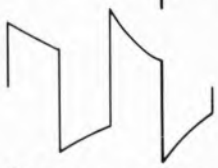
Typical price (inc VAT)	£240
Approx size (w × h × d)	19(49)×6(14)×15(38) ins (cm)
Approximate weight	30 lbs
Presentation (fascia, case etc)	silver
Quality of external finish	v. good
Listening impression summary	adequate*
Features and Facilities	
Tape facilities	2 sets crossdubbing
Tone controls/switchable?	simple/yes
Filters/loudness	LF, HF/yes
Others	'light' meters*
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	76/76 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	70/70 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	70/70 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	84/89/55 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	84/81/50 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	106/113/80 Watts
Inputs	
Disc: sockets, impedance/capacitance	MM51kΩ/113pf, MC50Ω
Disc: sensitivity 20Hz/1kHz/20kHz	MM0.32/2.7/26.5mV, MC48/285/2700μV
Disc: overload 20Hz/1kHz/20kHz	MM39/40/39dB, MC38/39/31dB
Tuner: impedance/sensitivity	40kΩ/150mV
Aux: impedance/sensitivity	40kΩ/150mV
Tape phono: impedance/sensitivity	45kΩ/150mV
Tape DIN: impedance/sensitivity	45kΩ/150mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	230mV/460mV/2.6kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	55mV/95mV/90kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	70mV/1.65V/2.5V
Noise (ref 1 watt, A wtg)	
At zero volume	−95dB
Aux, ref vol, 1kΩ source	−83dB
Disc, ref vol, 1kΩ/M75EJ sources	MM−78/−76dBMC(10Ω)−73dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	73/70/62
DC offsets L/R	+13/−9mV
Power bandwidth, −3dB ref max power 8Ω disc	12Hz—113kHz*
Total Harmonic distortion (inc noise)	above average
Intermodulation dist (CCIF 19/20kHz RIAA)	above average
Hum performance	below average*



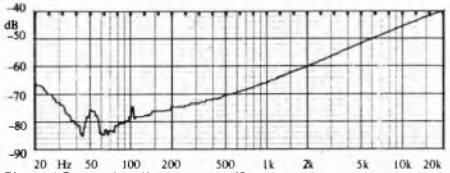
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



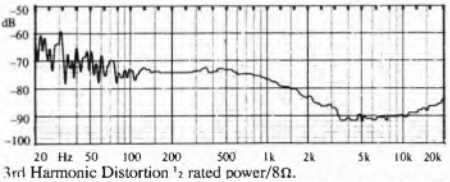
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



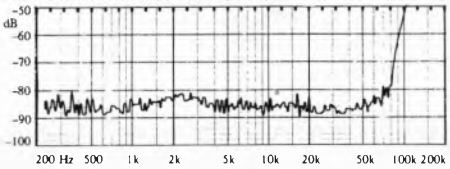
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



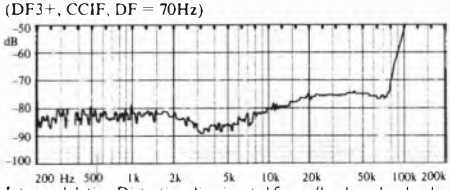
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF, DF = 70Hz

Rotel RA2040

Rotel UK, 2-4 Erica Rd., Stacey Bushes, Milton Keynes, Bucks. 0908 317707

Presentation, facilities etc.

Most expensive of Rotel's integrated amplifier range, this is undoubtedly a whole lot of amplifier, and its 18" depth and 42lbs weight may require some care in installation. The fairly aggressive styling, emphasised by the illuminating 'light bar' power meters set in the shiny brushed-aluminium fascia, does nothing to minimise the bulk, and the rack mounting handles further stress the pseudo-professional styling approach. While we felt the bright metering could prove distracting and irritating in the long term, there is no doubt that they are a slightly more efficient form of voltmeter than most of the swinging-needle types, clearly indicating when clipping is reached; however a similar function could presumably be more cheaply and discretely accomplished by means of two or three LEDs per channel, as used in some cassette decks.

Such carping aside, the *2040* carries a large range of sensibly chosen facilities, including a built-in head amp for moving-coil cartridges, DIN duplicated tape socketry with crossdubbing switching, switchable turnover points and defeat for the tone controls, HF and LF filters, loudness and volume muting. The three position options for disc input impedance and capacitance on the moving magnet sockets should also prove most useful. External finish was very good, but some mechanical hum was noted, which may be peculiar to the sample but should not really be present in an amplifier at this price level.

Lab performance

The three disc inputs offer a large range of matching alternatives. The m-c input should match most models satisfactorily, though some of the low-output/impedance models (eg Ortofon *MC10*) might perhaps tax the sensitivity and stretch the marginal noise threshold. Other inputs and outputs should pose no problems, though the 'phones socket is as usual a little too strong into high impedances.

Performance parameters on this ambitious model proved something of a disappointment, with below average hum having a significant harmonic content. Noise was likewise comparatively poor. A very wide bandwidth was in evidence together with some slew limiting problems from about 30kHz at high power levels, and some swept intermod increase was also noted into loudspeaker load. The squarewaves showed a number of overshoot and ringing effects, with both resistive and reactive loading. The meters did not prove to be fast enough to read transients accurately.

Power output was very high, with some channel imbalance from our spec due to a minor misalignment on one channel increasing distortion earlier than the other; the manufacturer's spec was however met. The difference between single and dual channel drive was quite small. Power was maintained but not significantly increased into low impedances.

Subjective impressions

Like its smaller brother, the *2040* was not well received in the listening tests overall, although the results of the first tests were around average. In these the model was described as having quite a decent bass and detail rendition which was dominated and spoilt rather by a coarse 'squeaky' top, which provoked fairly strong negative reactions. The second sessions confirmed an unpleasantly 'harsh' HF, but was less impressed by the bass

which was described as 'heavy' and 'dominant', giving an overall 'muddled' sound.

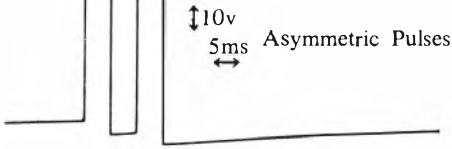
Conclusions

This design offers a multiplicity of facilities in an impressive if rather aggressively styled package, capable of large power outputs. However the rather indifferent performance on a number of counts and the negative subjective reactions preclude recommendation.

GENERAL DATA

Typical price (inc VAT)	£450
Approx size (w × h × d)	19(48)×6(15)×18(46) ins (cm)
Approximate weight	42 lbs
Presentation (fascia, case etc)	silver
Quality of external finish	v. good
Listening impression summary	adequate*
Features and Facilities	
Tape facilities	2, complex, crossdubbing
Tone controls/switchable?	complex/yes
Filters/loudness	HF, LF/yes
Others	'light' meters etc*
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	150/120 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	140/115 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	140/115 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	160/156/105 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	130/110/66 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	176/181/127 Watts*
Inputs	
Disc: sockets, impedance/capacitance	2MM, 1MC. MM50kΩ/135pf or var. MC33Ω
Disc: sensitivity 20Hz/1kHz/20kHz	MM0.32/2.7/24mVMC27/135/110μV
Disc: overload 20Hz/1kHz/20kHz	MM43/44/42dBMC38/43/43dB
Tuner: impedance/sensitivity	25kΩ/190mV
Aux: impedance/sensitivity	25kΩ/190mV
Tape phono: impedance/sensitivity	25kΩ/190mV
Tape DIN: impedance/sensitivity	25kΩ/190mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	300mV/480mV/2.2kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	70mV/100mV/88kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	68mV/1.8V/2.5V
Noise (ref 1 watt, A wtg)	
At zero volume	–67dB
Aux, ref vol, 1kΩ source	–67dB
Disc, ref vol, 1kΩ/M75EJ sources	MM–67/–67dBMC(10Ω)–65dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	87/85/52
DC offsets L/R	55/74mV
Power bandwidth, –3dB ref max power 8Ω disc	7Hz—100kHz*
Total Harmonic distortion (inc noise)	good
Intermodulation dist (CCIF 19/20kHz RIAA)	average
Hum performance	below average*

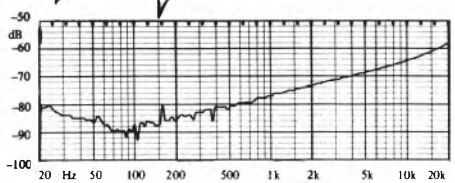
* See text



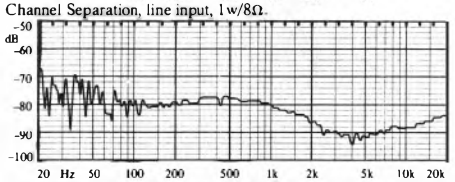
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

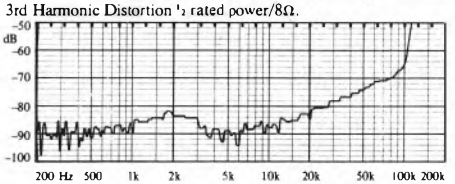
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



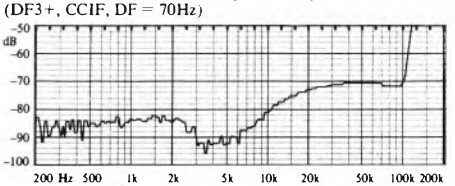
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

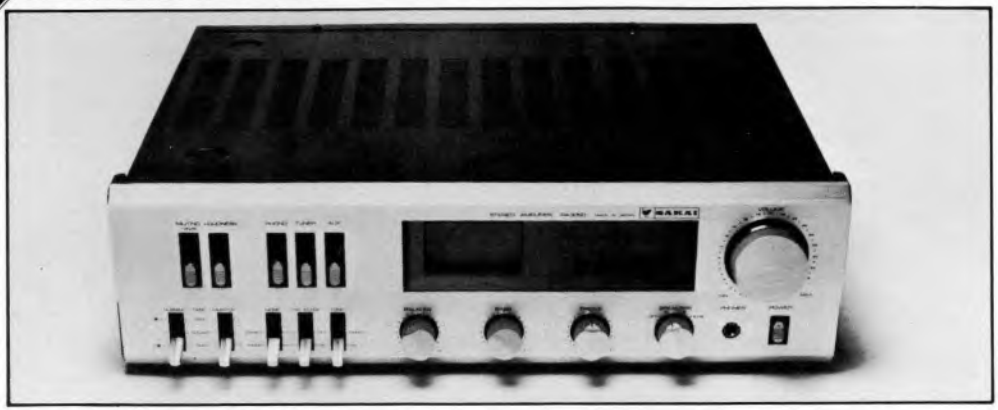


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Sakai PA 3050

Sakai, Wren Electronics, Dawson Rd., Mount Farm Estate, Milton Keynes, Bucks.



Presentation, facilities etc.

Sakai are a new brand to the UK market, and should not be confused with their near namesakes! The products originate from Japan, and are handled internationally by the Wren group, who are a fairly new operation, but one that has been built upon many years experience and personal expertise amongst its management in hi-fi marketing. The Sakai products are very well finished and the styling is both interesting and unusual; slightly aggressive with silver front, large meters and 'chunky' knobs, it is nevertheless nicely laid out and noticeably slimmer than most, which helps to make it reasonably discrete. Sakai as a brand are expected to be handled by specialist dealers on a restricted franchise and when one also takes the standard of finish into account, this is bound to be reflected to some extent in the price.

Phono sockets are fitted throughout, and cross-dubbing switching is available on the two tape connections. Simple tone controls are fitted and are provided with defeat switching; an LF filter and loudness contour are also available, together with mono and volume mute switching.

Lab performance

The disc input capacitance is a little lower than average, and this should be borne in mind when selecting a cartridge; (it can of course be easily increased). Other inputs and outputs give no cause for compatibility concern, though the headphone output was as usual a little strong for high impedance models.

Hum was somewhat below average, though not sufficiently so to cause any real concern, and 2nd harmonic distortion on the high side. Other distortions were under quite close control, although the swept intermod showed a significant rise at HF when loudspeaker-loaded. Squarewaves were very clean and symmetrical into resistive loads, but showed the usual ringing into capacitance, while the pulse was well controlled if slow to recover. Bandwidth was rather on the wide side in our view, with slew limiting possibilities above 47kHz.

Power delivery was quite generous at the price, but showed quite a large increase when only one channel was driven. Drive was fairly well maintained into low impedances with a quite healthy-looking 'burst' output characteristic.

Subjective impressions

Some disagreement was evident in the first listening sessions, with the amplifier receiving quite strong criticism 'hands on', yet scoring quite well blind. A common factor was the description of a peculiar 'wiry' top, but in other respects comments were inconsistent. The second sessions described the amp as a little 'thin', with a tendency to aggressiveness at high levels. The bass was described as a bit 'thumpy', but the amp was quite liked overall, and felt to have good transient abilities.

Conclusions

This Sakai model offers a high standard of finish with unusual presentation that was considered smart; a competent technical performance and a healthy power delivery at a very fair price. Although the listening test results were not entirely consistent, they nevertheless added up to an 'above average' overall rating, which suggests that this model can be recommended with some confidence, though prospective purchasers should audition for themselves.

Sakai PA 3050

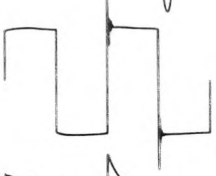
RECOMMENDED

GENERAL DATA

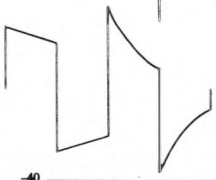
Typical price (inc VAT)	£140
Approx size (w × h × d)	17½(44)×5(12)×14(36) ins (cm)
Approximate weight	19 lbs
Presentation (fascia, case etc)	matt silver
Quality of external finish	v. good
Listening impression summary	above average*
Features and Facilities	
Tape facilities	2 phono, crossdubbing
Tone controls/switchable?	simple/yes
Filters/loudness	LF/yes
Others	meters
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	63/62 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	59/59 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	61/60 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	76/112/128 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	75/103/91 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	91/163/218 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 51kΩ/60pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.3/2.7/26.5mV
Disc: overload 20Hz/1kHz/20kHz	36/36/35dB
Tuner: impedance/sensitivity	58kΩ/165mV
Aux: impedance/sensitivity	58kΩ/165mV
Tape phono: impedance/sensitivity	57kΩ/165mV
Tape DIN: impedance/sensitivity	kΩ/mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	280mV/430mV/558Ω
Tape DIN: for 5mV disc/for .5V aux/imp	mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	82mV/1.8V/2.6V
Noise (ref 1 watt, A wtg)	
At zero volume	–86dB
Aux, ref vol, 1kΩ source	–78dB
Disc, ref vol, 1kΩ/M75EJ sources	–76/–74dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	85/85/40
DC offsets L/R	–3/–13
Power bandwidth, –3dB ref max power 8Ω disc	5Hz—80kHz*
Total Harmonic distortion (inc noise)	good
Intermodulation dist (CCIF 19/20kHz RIAA)	average
Hum performance	below average

* See text

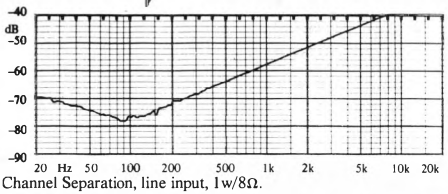
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



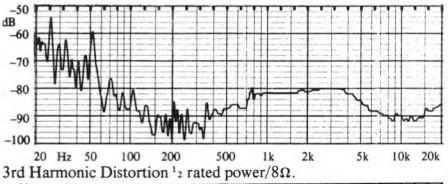
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



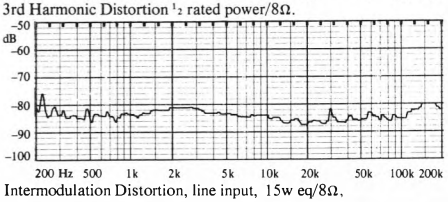
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



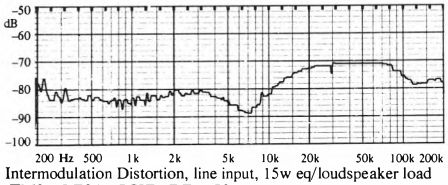
Channel Separation, line input, 1w/8Ω.



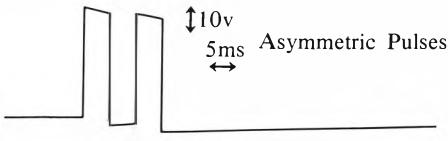
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



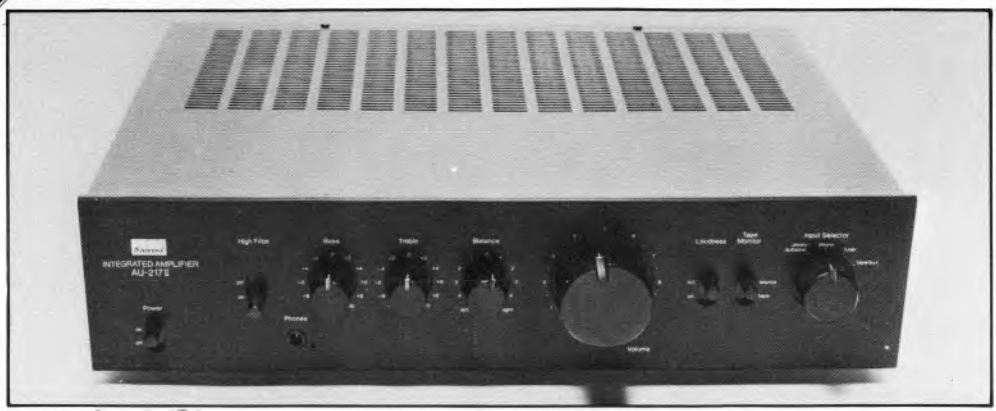
Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF, DF = 70Hz



RECOMMENDED

Sansui AU 217 II

Sansui UK, Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Mddx. UB6 0AA. (01) 575 1133



Presentation, facilities etc.

Sansui's *17* series was first launched in the UK in early 1978, and has since received considerable critical acclaim as well as international commercial success. We were therefore particularly pleased to receive the latest variants for this project, including this Mark II version of the compact 217, which occupies that commercial hotseat at £120. Styling is somewhat unconventional, and in our opinion this model is commendably discreet. The lower-than-usual profile has an entirely matt black finish, which is perhaps a little severe but at any rate doesn't 'wink' at you from the shelf! Creditably, finish is very good for this price range.

Facilities are fairly limited, but this would appear to be part of deliberate policy to concentrate on the best sound for the money, by keeping expensive frills out of the way. Inputs are phono only, and one tape machine is catered for with monitoring switching; a subsonic filter is optional on the disc input. HF filters, loudness, and simple unswitchable tone controls are also included. Only one set of speaker terminals is fitted, but the addition of the headphone socket without special precautions *à la* A&R*A60* presumably does not allow the 'direct connection' which is regarded as desirable in some quarters.

Lab performance

Inputs and outputs have sensibly chosen values for compatibility, though some cartridges may benefit from a little extra disc input capacitance, and the headphone output was rather excessive.

Hum was on the high side with 100Hz and higher harmonics also evident. Bandwidth was limited to a reasonable 60kHz on disc, and an even more sensible in our opinion 44kHz on tuner, and no slew limiting problems were noted. Swept intermod was well controlled but showed an HF rise with speaker load. Squarewaves showed the usual capacitive load overshoot but with reasonable control, while the pulse gave a slightly 'rounded' shape.

Power delivery was pretty generous for an amp at this sort of price, but showed a significant difference between single and dual channel drive. Power delivery was well maintained into low impedances especially on toneburst measurement.

Subjective impressions

The *217 II* scored well and was consistently well received in all of the tests bar one, and this wide divergence in the first tests makes corellation nigh impossible, but some common factors included a description of a rather 'loose' bass and 'thickened' treble.

The second sessions described a slightly 'bright' sound and confirmed the bass 'looseness', while comments described the loud notes as tending to dominate music signal at the expense of delicacy. Overall the amp was quite liked but with reservations.

Conclusions

The unusual, and in our view attractively compact, presentation, good measured performance and generous power output dictate recommendation at the price; moreover the overall subjective portents were quite favourable, if inconsistent, and prospective purchasers are advised to check these findings for themselves.

Sansui AU 217 II

RECOMMENDED

GENERAL DATA

Typical price (inc VAT) £120
Approx size (w × h × d) ..... 17(43)×4¼(11)×13½(34) ins (cm)
Approximate weight ..... 18 lbs
Presentation (fascia, case etc) ..... matt black
Quality of external finish ..... v. good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 1 set, monitoring
Tone controls/switchable? ..... simple/no
Filters/loudness ..... LF, HF/no

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 54/54 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 52/52 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 53/53 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 64/90/50 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 64/90/50 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 86/145/197 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 50kΩ/70pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.32/3.0/30mV
Disc: overload 20Hz/1kHz/20kHz 39/39/29dB
Tuner: impedance/sensitivity 84kΩ/200mV
Aux: impedance/sensitivity 84kΩ/200mV
Tape phono: impedance/sensitivity 79kΩ/200mV
Tape DIN: impedance/sensitivity ..... kΩ/mV

Outputs

Tape phono: for 5mV disc/for .5 V aux/imp 260mV/380mV/2.3kΩ
Tape DIN: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 100mV/2.0V/2.5V

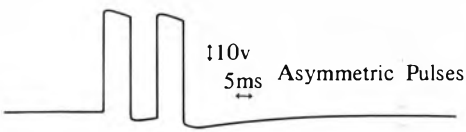
Noise (ref 1 watt, A wtg)

At zero volume ..... –83dB
Aux, ref vol, 1kΩ source ..... –75dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –74/–72dB

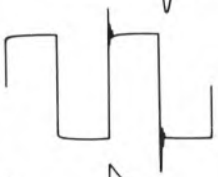
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 93/93/45
DC offsets L/R 5/0mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 10Hz—60kHz
Total Harmonic distortion (inc noise) ..... good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... good
Hum performance ..... below average

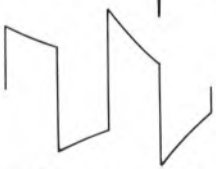
* See text



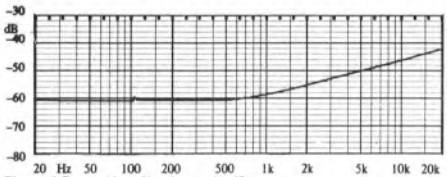
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



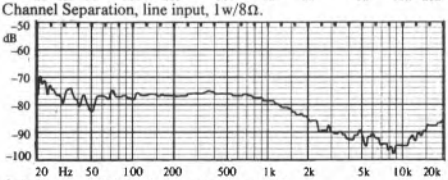
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



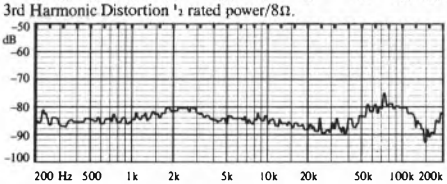
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



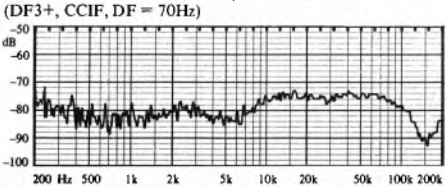
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

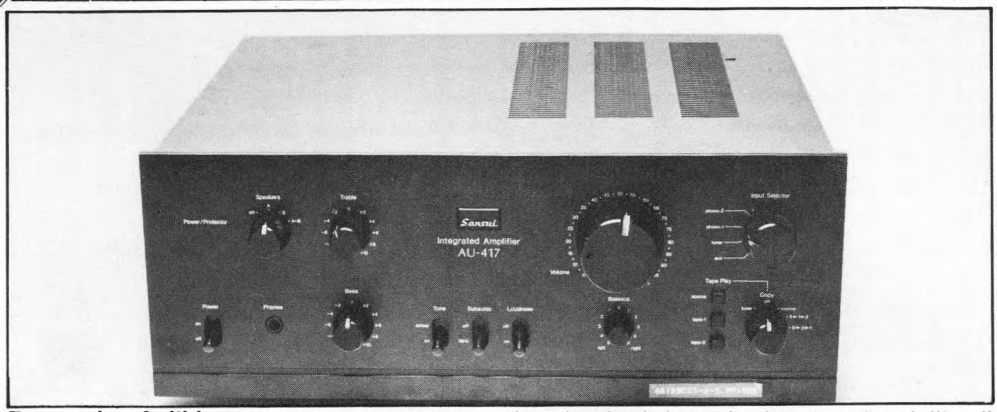


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Sansui AU 417

Sansui UK, Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Mddx. UB6 0AA. (01) 575 1133



Presentation, facilities etc.

This is the second new addition to the popular and critically acclaimed Sansui' *17* series of amps; at the initial launch there were gaps between the *317, 517* and *717*; the *417* slots in neatly at just under £200 (and I should think there is a fair chance of a *617* at some stage...?) Though similarly finished in matt black, the *417* presents quite a contrast to the neat little *217 II*, with a much 'fatter' box and quite comprehensive facilities, in addition to the power increase.

All inputs are phono types, and crossdubbing switching is provided between the two tape recorder connections; in addition the tape record function can be switched to any input independently of the signal source which is being routed to the loudspeakers, so one can, for example, record from the radio while playing records. Simple tone controls are fitted and provided with defeat switching, while loudness contour and LF (subsonic) filtering are also provided. External finish is to a very high standard, but the large expanse of matt black was felt to be a bit forbidding, especially when contrasted with the much less obtrusive *217 II*.

Lab performance

Input and output values appear to show no potential ancillary compatibility difficulties.

No particular problems appear evident on the different measured parameters, with low hum and distortion and reasonable noise. Separation might have been better maintained at high frequencies, and the bandwidth was rather wide, extending to 90kHz which in our view is rather excessive. The DC offset on the left channel was also on the high side. Swept intermod showed an in-band plateau rise when loaded by a loudspeaker, though like all measured distortions it remained at a low level, and despite the extended bandwidth no slew limiting problems were observed. Squarewaves showed some overshoot on both resistive and reactive loads, but this was quite well controlled.

Power output was generous for the price, and although significant single/dual channel drive differences were noted, the delivery into low impedances was very good, particularly on tone-burst.

Subjective impressions

The *417* was well received throughout the listening tests. In the first sessions it was felt to be 'open' and 'detailed', albeit with a degree of sibillance exaggeration, and lack of bass 'bite'; generally quite well-controlled, it perhaps lost some precision when compared to the very best performers, but was well-liked nonetheless.

The second sessions confirmed these findings quite closely, with the general feeling that the amp tended to offer more brute force than delicacy. It was quite liked, but not wholeheartedly in these sessions.

Conclusions

Offering a very impressive combination of high power, comprehensive facilities, good presentation and good measured performance for a realistic price, the listening tests also gave an overall 'above average' rating, so this model can be warmly recommended.

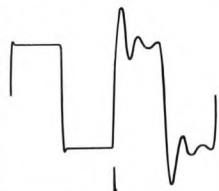
Sansui AU 417

RECOMMENDED

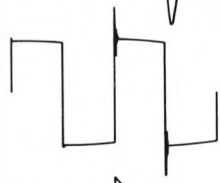
GENERAL DATA

Typical price (inc VAT)	£185
Approx size (w × h × d)	17(43)×7(17)×16(41) ins (cm)
Approximate weight	25 lbs
Presentation (fascia, case etc)	matt black
Quality of external finish	v. good
Listening impression summary	above average*
Features and Facilities	
Tape facilities	complex*
Tone controls/switchable?	simple/yes
Filters/loudness	LF/yes
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	87/89 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	81/81 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	81/82 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	102/149/162 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	104/150/171 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	130/211/300 Watts
Inputs	
Disc: sockets, impedance/capacitance	2 phono, 49kΩ/125pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.3/2.9/28mV
Disc: overload 20Hz/1kHz/20kHz	42/41/41dB
Tuner: impedance/sensitivity	55kΩ/175mV
Aux: impedance/sensitivity	55kΩ/175mV
Tape phono: impedance/sensitivity	55kΩ/175mV
Tape DIN: impedance/sensitivity	kΩ/mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	280mV/460mV/555Ω
Tape DIN: for 5mV disc/for .5V aux/imp	mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	70mV/1.2V/1.75V
Noise (ref 1 watt, A wtg)	
At zero volume	–83dB
Aux, ref vol, 1kΩ source	–78dB
Disc, ref vol, 1kΩ/M75EJ sources	–76/–74dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	82/80/38
DC offsets L/R	–110/–17mV
Power bandwidth, –3dB ref max power 8Ω disc	7Hz—90kHz*
Total Harmonic distortion (inc noise)	good
Intermodulation dist (CCIF 19/20kHz RIAA)	good
Hum performance	good

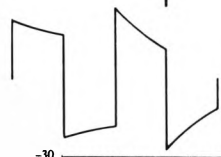
* See text



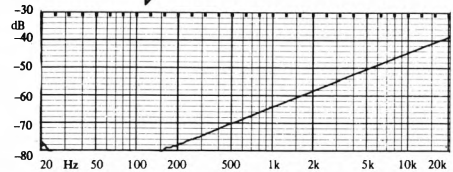
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



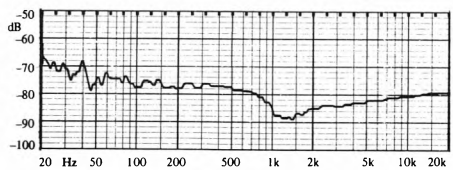
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



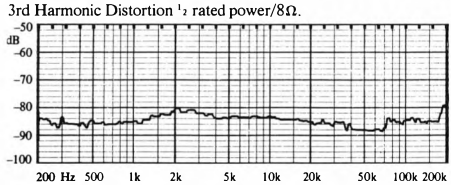
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



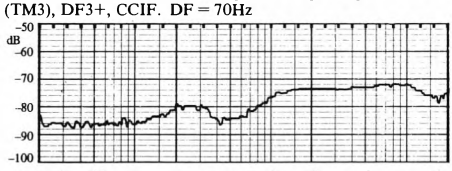
Channel Separation, line input, 1w/8Ω.



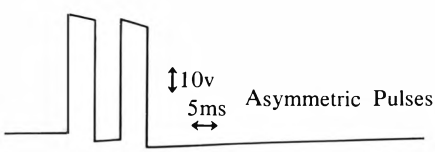
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz



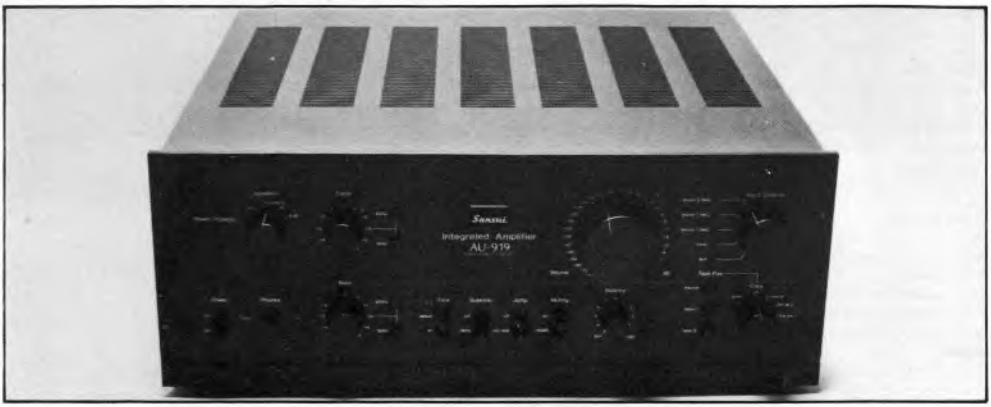
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



RECOMMENDED

Sansui AU 919

Sansui UK, Unit 10A, Lyon Industrial Estate. Rockware Avenue, Greenford, Mddx. UB6 0AA. (01) 575 1133



Presentation, facilities etc.

This new flagship of Sansui's integrated range is a logical development from the *717*, but in fact contains a number of internal technical changes which are claimed to benefit the sound quality significantly: indeed it is reckoned to comfortably outperform the separate *CA/BA 2000* combination on sound quality, though we understand that 'separate' derivations may soon be available incorporating these latest refinements, and were in fact shown at the Paris Show in March 1979. Presentation is in the familiar Sansui livery of matt black with white lettering, and the unit is very bulky and heavy (due no doubt to the multiple power supplies). It therefore presents a rather 'forbidding' appearance, and may need careful siting.

This model has extensive facilities, yet is an obvious attempt to provide 'all things to all men' by incorporating elaborate bypass-switching circuitry. The all-phono inputs include moving-coil and moving magnet cartridge inputs, plus complex tape recording connections to allow crossdubbing and permit recording to be undertaken independently of the signal being played through the power amp. Tone controls have switchable turnover points and 'defeat' is provided; possibly more significant is the 'jump' switching which routes the signal so that it avoids this amplification stage entirely. Subsonic LF filtering and volume muting are also provided. Considerable attention in the accompanying propaganda is paid to a number of technical features, many of which are also being pursued by other Japanese manufacturers in their 'flagship' models. These include the use of no less than five power supplies, straight-through DC coupling, particular attention to high current handling and speed capability throughout, and extremely high slew rates and rise times.

Lab performance

The moving magnet input capacitance is rather on the high side, so some care should be taken to avoid unsuitable cartridges. The m-c input has rather a low impedance, but should nevertheless have sufficient sensitivity and overload headroom to cope with all types.

There are few criticisms that can be made of the measured performance. All distortions were very low, with only a slight increase driving a loudspeaker on swept intermod. Squarewaves and asymmetric pulse were competently handled, the slight anomalies showing generally good control. Separation might have been better maintained at HF, and we feel that the bandwidth was unnecessarily wide. The DC offset showed well matched but slightly large values, and hum performance was only average.

Power delivery verged on the prodigious; some difference between single and dual channel drive was noted, but steady state drive into low impedances was very well maintained, and on toneburst approached the theoretical 'voltage source' ideal.

Subjective impressions

The *919* consistently received some of the highest marks in the tests. In the first sessions the bass control and detail were particularly commended, with generally good detail, control and information through most of the frequency range; some comments concerning a slight treble 'fizz' were also noted. The second sessions confirmed these findings quite closely, with other comments expressing slight unease over some high level 'muddling'.

RECOMMENDED

Conclusions

The 919 combines a plethora of facilities, a high standard of presentation, and outstanding power output at a not unreasonable price. Additionally it consistently ranked as one of the best in the report on subjective grounds; though some listeners found it a little untidy, all approved of the detail rendition and information. It can therefore be confidently recommended.

GENERAL DATA

Typical price (inc VAT) £480
Approx size (w × h × d) ..... 17(43)×7(18)×17(43) ins (cm)
Approximate weight ..... 43 lbs
Presentation (fascia, case etc) ..... matt black
Quality of external finish ..... v. good
Listening impression summary ..... v. good*

Features and Facilities

Tape facilities ..... complex, 2 sets*
Tone controls/switchable? ..... complex/defeat and 'jump'
Filters/loudness ..... LF/no
Others ..... various*

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 135/135 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 130/120 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 125/125 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 145/217/288 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 140/210/264 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 164/314/543 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 2 phono, MM50kΩ/211pf, MC6Ω
Disc: sensitivity 20Hz/1kHz/20kHz ... MM 0.28/2.8/27.5mV, MC 29/89/800μV
Disc, refvol, 1kΩ/M75EJ sources ... MM –78/–77dB, MC(10Ω) –78dB
Disc: overload 20Hz/1kHz/20kHz ..... MM 45/44/41dB, MC 38/43/45dB
Tuner: impedance/sensitivity 65kΩ/170mV
Aux: impedance/sensitivity 65kΩ/170mV
Tape phono: impedance/sensitivity 65kΩ/170mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 290mV/450mV/550–
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 100mV/1.9V/2.6V

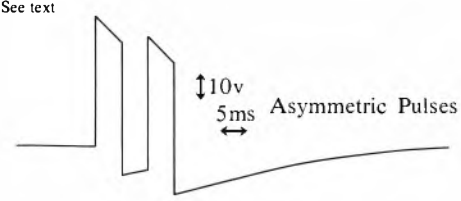
Noise (ref 1 watt, A wtg)

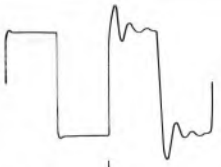
At zero volume ..... –84dB
Aux, ref vol, 1kΩ source ..... –82dB
Disc, ref vol, 1kΩ/M75EJ sources ... MM –78/–77dB, MC(10Ω) 78dB

Other technical parameters

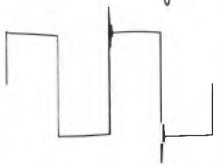
Damping factor 30Hz/1kHz/30kHz 190/160/74
DC offsets L/R ..... –49/–44mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 3Hz—90kHz
Total Harmonic distortion (inc noise) ..... good
Intermodulation dist (CCIF 19/20kHz RIAA) ..... good
Hum performance ..... average

* See text

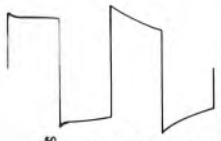




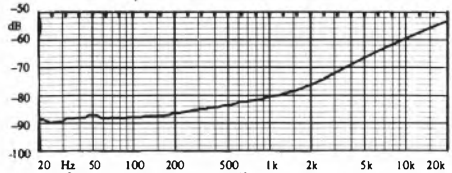
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



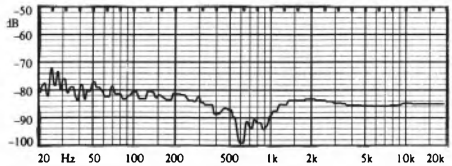
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



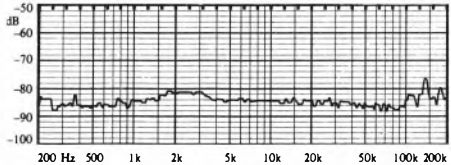
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



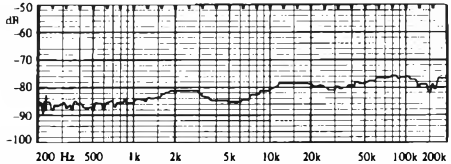
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Solavox SA2020

Solavox, Comet Discount Warehouses, 78 Armley Road, Leeds LS12 2EF. 0532 40551

Presentation, facilities etc.

This is the cheapest model in the survey, by a significant percentage, and is available in this matt black finish as an 'own-brand' product from the large Comet and McOnomy retail chains. Virtually the same model is available in silver finish as the Amstrad *EX220* from other sources. In view of the almost silly price, it is not surprising that the standard of finish is compromised slightly (the fascia is formed from pressed rather than machined metal for example), but this is by no means obtrusive except under careful inspection, and should not trouble most users.

Despite the low price, facilities are quite comprehensive enough to satisfy many users, and seem quite sensibly chosen. Phono sockets are used for all inputs, provision being made for one tape machine but without the off-the-tape monitoring that is useful for three-head machines (though in view of their high prices these would seem an unlikely partner for the *2020* in any case.) Simple tone controls do not possess defeat switching, HF and LF filters, loudness and mono/stereo are also provided. Two sets of DIN speaker outputs are provided, but these are not switched (except via the headphone socket); it is perhaps a slight pity that the output could not have been re-routed to directly connect to one set, while switching the other via the headphone socket *à la* A&R *A60*. The control layout was well liked, with logical ergonomics.

Lab performance

The pickup input is rather insensitive, so higher output cartridges may be desirable. The tape output shows significant differences between the aux and disc inputs at our reference levels, and also a high output impedance, so some care may be needed in selecting a suitable matching tape unit.

The performance of the amp tended to be dominated by the poor hum figures (which were being induced in the pre-amp rather than endemic to the power amp), and these varied between -47dB and -59dB on our spot measurements, which some may find intolerable. The pickup overload margin has almost disappeared at HF, but the power bandwidth is so tightly controlled (-6dB at 20kHz) that the practical implications do not appear to be that serious. Harmonic distortion levels are generally quite high and the intermodulation sweeps are fairly poor (but ironically similar to the most expensive amp in the book!) The difference between resistor and speaker loading is quite slight, and much of the rise is beyond the audio band – in spite of the limiting! Square-waves show no ringing and evidence of the bandwidth curtailment at HF.

Power output is low and curtailed at the frequency extremes, but reasonably maintained into low impedances on toneburst. The voltage increase into 4ohm on the right channel remains something of a mystery.

Subjective impressions

Listening tests gave reasonable agreement in finding this amp rather 'muddled' with bass 'looseness'. Individual reactions to the hum varied, some barely noticing it and others finding it intolerable, but it was felt to add unwanted mid coloration. Though treble definition was not particularly good, the lack of aggressiveness was considered a worthwhile attribute in the low-budget system.

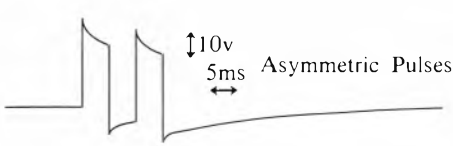
Conclusions

This model would appear to have a fair amount of potential for the price, but is let down by the hum problem. So much of the design illustrates sensible decisions to maximise performance within strictly defined price limits, that it could become a logical choice to match a minimum budget system, being less susceptible to being upset by poor signal sources than many others, if some of the problems were overcome.

GENERAL DATA

Typical price (inc VAT)	£50
Approx size (w × h × d)	17(43) × 6(15) × 12(33) ins (cm)
Approximate weight	15 lbs
Presentation (fascia, case etc)	matt black
Quality of external finish	f. good
Listening impression summary	see text
Features and Facilities	
Tape facilities	1 set
Tone controls/switchable?	simple/no
Filters/loudness	HF, LF/yes
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	17/17 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	12/14 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	14/16 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	21/25/not taken Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	22/60/not taken Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	30/50/64 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 46kΩ/67pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.73/4.5/87mV
Disc: overload 20Hz/1kHz/20kHz	32/28/3dB*
Tuner: impedance/sensitivity	144kΩ/130mV
Aux: impedance/sensitivity	144kΩ/130mV
Tape phono: impedance/sensitivity	144kΩ/130mV
Tape DIN: impedance/sensitivity	kΩ/mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	84mV/400mV/146kΩ*
Tape DIN: for 5mV disc/for .5V aux/imp	mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	80mV/1.8V/3.0V
Noise (ref 1 watt, A wtg)	
At zero volume	-69dB
Aux, ref vol, 1kΩ source	-69dB
Disc, ref vol, 1kΩ/M75EJ sources	-69/-69dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	17/17/13
DC offsets L/R	-/-mV
Power bandwidth, -3dB ref max power 8Ω disc	21Hz—15kHz*
Total Harmonic distortion (inc noise)	poor
Intermodulation dist (CCIF 19/20kHz RIAA)	poor
Hum performance	poor

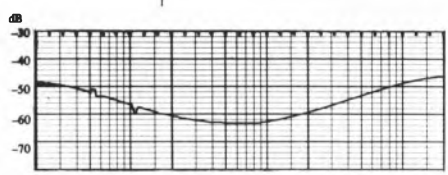
* See text



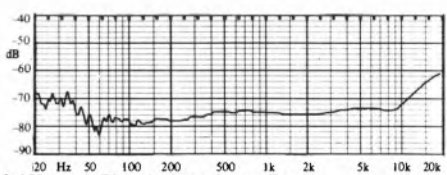
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

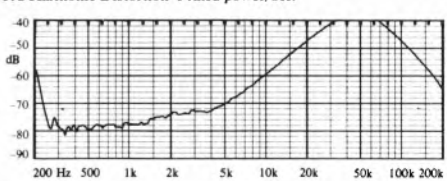
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



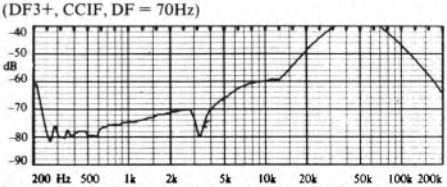
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz

Sony TA212

Sony (UK) Ltd., Consumer Inf. Dept. Showroom, 134 Regent Street, London W1.
(01) 439 3874

Presentation, facilities etc.

The Sony *212* perhaps marks the dividing line between hi-fi and audio. Despite its low price, the standard of finish is pretty good, if not quite to the standard of more expensive models; it is perhaps surprising in view of the evidently careful cost engineering that such relatively unnecessary features as large power meters and a front panel mixing mike input were included, while the practice of providing a volume control with a built-in loudness contour that cannot be bypassed does seem to be going a little too far (and makes any controlled listening tests virtually impossible!)

In other respects the machine is fairly basic, and tape monitoring is not possible, though an amp of this price is perhaps unlikely to be used with a three-head machine in any case. No filters are providsed, and the tone controls cannot be defeated. Inputs are only provided for two high level inputs in addition to the disc and mike sockets.

Lab performance

The limited inputs should not pose any serious compatibility problems, but it is worth noting that the disc input capacitance is very low, and many cartridges will benefit from the addition of a little (and in some cases quite a lot) of extra capacitance, by means of equaliser plugs or similar, assuming that the accompanying turntable adds the expected 100-150pf. The tape output is a little on the low side, and the headphone output on the high side, but neither of these are likely to cause practical difficulties.

The measured performance showed that some compromises have been accepted in the design. While noises, hum and harmonic distortion levels were below average, the intermod distortion was significantly worse than most. Note that the rise at high frequencies on the intermod sweeps is merely due to the fact that the 15 watt level used throughout the tests exceeds the high frequency power capability of the amp, with inevitable ensuing distortion.

If the swept intermod causes clipping this merely emphasises the rather restricted power delivery of this model under all conditions; for several measurements our normal distortion criteria had to be relaxed. In its favour however is the fact that the bandwith of the pickup input is rolled off before the onset of slew limiting, at around 50kHz, though the high level inputs are 'wide open' up to 110kHz.

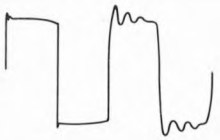
Subjective impressions

The relevance of these observations was naturally hampered by the permanent 'loudness' conditions. Reactions were fairly consistent throughout, and were surprisingly favourable all things considered. Definition and detail were considered fairly poor, and the bass was described as lacking weight and sounding 'detached'. However within this context and at modest power levels the treble was described as pleasantly unexaggerated and relaxed, if again lacking detail.

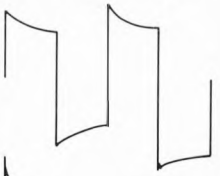
Conclusions

It would be tempting to merely write this design off on the grounds of its comparatively poor measured performance, restricted power delivery, and the abnegation of accuracy criteria implied by the fixed loudness function. However the fact that it was considered subjectively quite pleasant despite poorish detail must weigh in its favour, and is

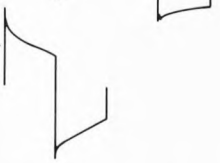
perhaps a tribute to the designer's abilities to get away with corner cutting! While the loudness function itself perhaps disqualifies this model from being taken seriously as a hi-fi amp and thus recommended, there is some evidence to suggest that it will nevertheless provide pleasant results in a fairly limited system.



10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £75
Approx size (w × h × d) ..... 16(41) × 6(15) × 12(30 ins (cm)
Approximate weight ..... 10 lbs (kg)
Presentation (fascia, case etc) ..... 'bright' silver pale grey
Quality of external finish ..... good
Listening impression summary ..... average

Features and Facilities

Tape facilities ..... 1 machine, no monitoring
Tone controls/switchable? ..... simple/no
Filters/loudness ..... no/permanently connected
Others ..... meters, mike with mixing

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 19/18 Watts*
Both channels driven 8Ω 20Hz .1% dist L/R ..... 12/12 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 17/17 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 22/27.5/prot Watts*
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ... 21/27 .5/prot Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 15/26/33 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 50kΩ32pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.42/2.6/23mV
Disc: overload 20Hz/1kHz/20kHz 32/31/31dB
Tuner: impedance/sensitivity 163kΩ/142mV
Aux: impedance/sensitivity ..... kΩ/mV
Tape phono: impedance/sensitivity 163kΩ/142mV
Tape DIN: impedance/sensitivity ..... kΩ/mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 100mV/190mV/15kΩ
Tape DIN: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
MIC ¼ Jack impedance/sensitivity 8.2kΩ/4.2mV
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ 50mV/1.5V/2.4V

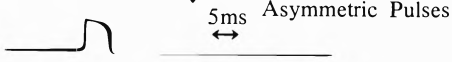
Noise (ref 1 watt, A wtg)

At zero volume ..... –82dB
Aux, ref vol, 1kΩ source ..... –74db
Disc, ref vol, 1kΩ/M75EJ sources ..... –74/–72dB

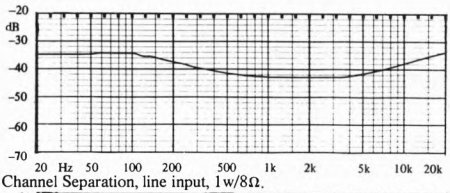
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 51/49/43
DC offsets L/R ..... /mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 13Hz—50kHz*
Total Harmonic distortion (inc noise) ..... below average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... fairly poor
Hum performance ..... below average

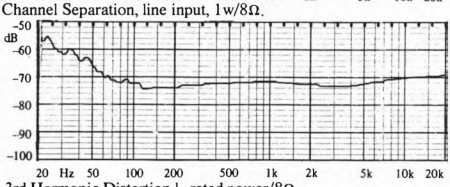
* See text



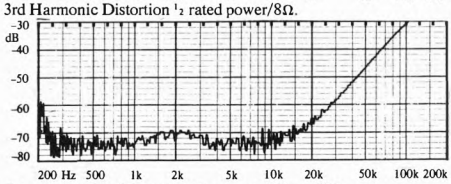
Asymmetric Pulses



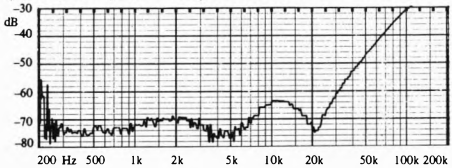
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



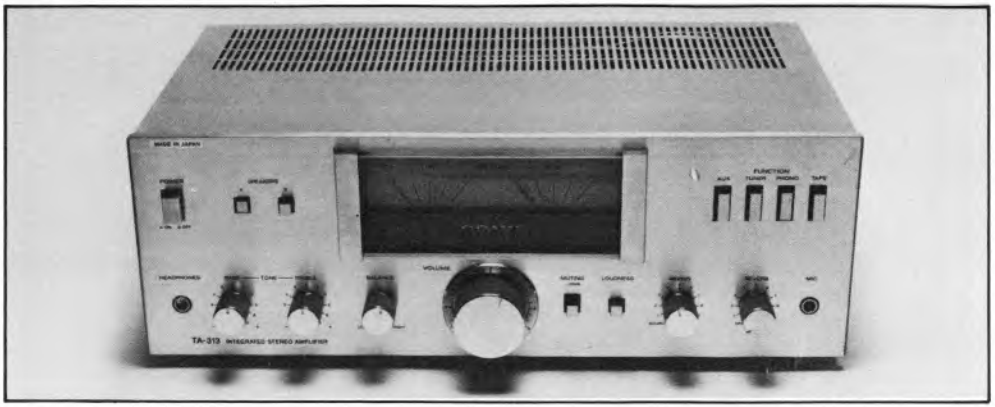
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Sony TA313

Sony (UK) Ltd., Consumer Inf. Dept. Showroom, 134 Regent Street, London W1.
(01) 439 3874



Presentation, facilities etc.

The Sony *313* is a logical development of the *212*, offering slightly more facilities and about double the power. Once again the choice of facilities is rather odd, with the same expensive-looking meters while the mike socket is further elaborated by the addition of reverberation for all you budding DJs out there . . . Once again the single tape input/output does not offer monitoring, though fortunately loudness is now switchable. Phono sockets are used throughout except for the mike jack, while three high level inputs and two sets of speaker sockets are now provided, though surprisingly no qualification regarding their impedance is made on the case. The bright 'silver' fascia and pale grey case are well finished, and the ergonomics were felt to be particularly logical, with pushbuttons switching and knobs 'gaining'.

Lab performance

The very low capacitance of the pickup input is by no means cause for criticism, but is nevertheless a point to watch; the recommended loading for most cartridges is greater than that offered by most turntable systems, and the use of added capacitance through phono equalisers and the like will probably be beneficial (Shure and Ortofon users in particular please note.) The other inputs were quite typical, but offered no variation, and a channel impedance imbalance of 20kohm, while unlikely to affect quality, is perhaps a point that should have been spotted in manufacture. A frequency response rise of 1db at 30Hz was also noted on all inputs. Outputs should present no difficulties.

No real problems were encountered on the performance parameters, and the amp seemed to behave itself well under most conditions. A below average figure was recorded for the intermodulation distortion via the disc input, however, and the square waves showed reduced gain at 1kHz, and higher gain at 100Hz. The bandwidth was limited to 38kHz on disc, which in our view is most sensible.

Power delivery was quite satisfactory for the price, but the capability into low impedances was somewhat restricted unless distortion criteria were relaxed under steady state conditions; however the toneburst results were more satisfactory, and are in any case perhaps more representative of typical use conditions. Slightly higher powers were obtained when only one channel was driven.

Subjective impressions

In the first listening sessions, the *313* was criticised, but not as strongly as some of its contemporaries. In the 'hands on' test it was considered reasonably pleasant, though a trifle bland, and was rather more strongly criticised on the blind test, characterised as 'sloppy' in the bass and 'jangly'.

The second sessions also produced some negative comments, relating to a lack of punch, some muddling, and a general worsening as the amp was driven hard. While the *313* was again preferred to some immediate contemporaries, the listening reports were not very enthusiastic.

Conclusions

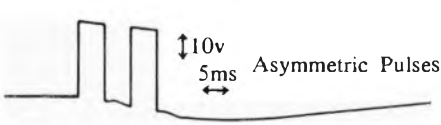
The *313* offers reasonable power delivery for the price, but is not exceptional in this respect. The facilities provided are rather unusual and perhaps not entirely necessary, and this presumably reduces

its competitiveness. But the ergonomics were liked, and the subjective impressions, while not outstanding, were by no means bad for the price.

GENERAL DATA

Typical price (inc VAT)	£10●
Approx size (w × h × d)	16(41) × 6(15) × 11(28) ins (cm)
Approximate weight	14 lbs (kg)
Presentation (fascia, case etc)	'bright' silver, pale grey
Quality of external finish	good
Listening impression summary	average*
Features and Facilities	
Tape facilities	1 machine, no monitoring
Tone controls/switchable?	simple/no
Filters/loudness	no/yes
Others	meters, mike i/p inc mix, reverb.
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	30/30 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	26/25 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	28/28 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	35/22/protection Watts*
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	34/17/protection Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω	54/79/72 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 50kΩ/11pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.31/2.7/27.5mV
Disc: overload 20Hz/1kHz/20kHz	34/34/25dB
Tuner: impedance/sensitivity	230kΩ/155mV
Aux: impedance/sensitivity	230kΩ/155mV
Tape phono: impedance/sensitivity	230kΩ/155mV
Tape DIN: impedance/sensitivity	kΩ/mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	130mV/240mV/11kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	mV/mV/kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ	37mV/1.0V 1.4V
Noise (ref 1 watt, A wtg)	
At zero volume	–88dB
Aux, ref vol, 1kΩ source	–83dB
Disc, ref vol, 1kΩ/M75EJ sources	–77/–dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	41/41/36
DC offsets L/R	–32/–35
Power bandwidth, –3dB ref max power 8Ω disc	10Hz—38kHz*
Total Harmonic distortion (inc noise)	average
Intermodulation dist (CCIF 19/20kHz RIAA)	below average
Hum performance	below average

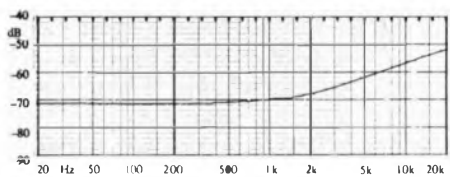
* See text



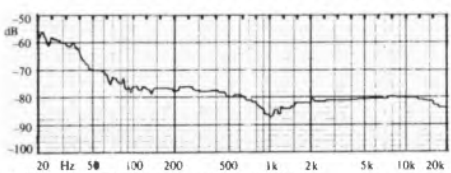
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

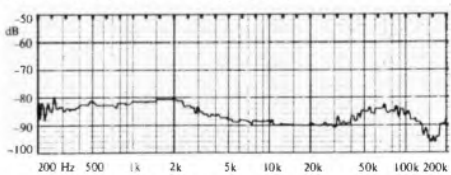
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



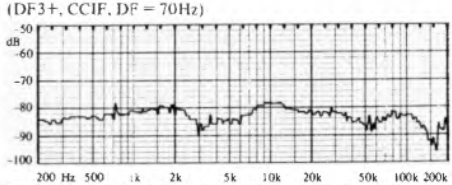
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



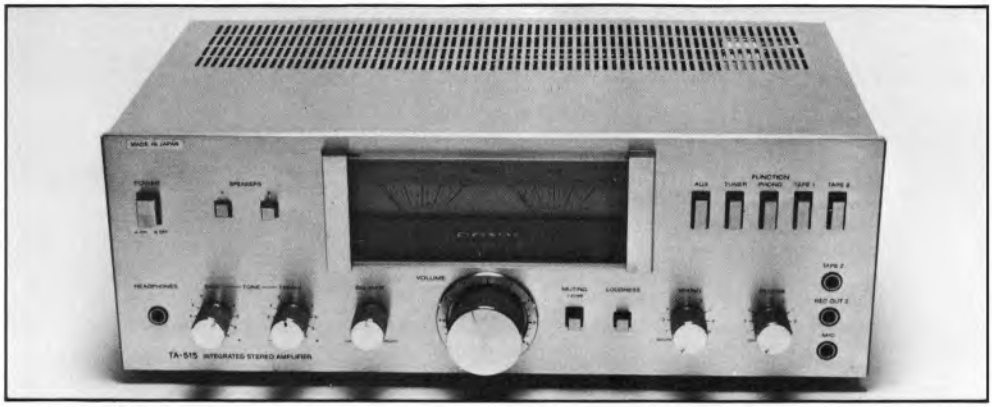
Intermodulation Distortion, line input, 15w eq/8Ω.
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF, DF = 70Hz

Sony TA515

Sony (UK) Ltd., Consumer Inf. Dept. Showroom, 134 Regent Street, London W1.
(01) 439 3874



Presentation, facilities etc

The *515* is in the same series as Sony's *212* and *313* models, offering some 50% more power and a few more facilities than the latter in a similar looking package, with 'bright' brushed-aluminium fascia and a pale grey case. Once again the styling is dominated by the large power meters, and other less-than-essential features include the mike input with reverb and lights which indicate the input selected. A second tape recorder may be connected via jack sockets fitted to the front panel; the choice of jack connectors could pose some matching difficulties, and we feel this would have been more useful in DIN format for the European market; no cross-dubbing switching is provided. The other facilities are fairly basic: simple unswitchable tone controls and loudness functions are provided, but no filters.

Lab performance

No compatibility problems are likely on the normal inputs, though a channel impedance imbalance between 40kohm and 59kohm on the high level inputs was noted, which will affect sensitivity slightly and could have been improved. The jack tape input had a rather low input impedance which could cause difficulties with a high impedance tape source, but is presumably less likely to be used than the back panel input. The headphone output is a little on the high side into high impedance 'phones.

Most of the measured performance parameters were quite adequate, although the separation and the 'spot' intermod were below average, as were hum and noise. Harmonic distortion worsened a little near full power, so some readings were taken with a relaxed criterion of 1% THD, and these showed quite a generous power capability which was reasonably well maintained into low impedances. The single channel drive gave a significant increase over the both-channel figure, and the toneburst capability was not much greater than the continuous capability, so the power supply could probably be increased with advantage. The power bandwith on disc was restricted to a sensible 19kHz-38kHz range.

Subjective impressions

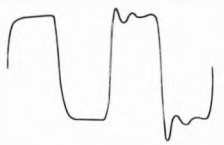
The first listening tests gave quite positive results for this Sony model, describing quite reasonable detail and a generally tidy sound, marred by some 'fizz' and rather loose bass control. It was rated well above average on the blind tests, in a similar class to the well-received A&R *A60*.

The second tests were not quite as enthusiastic, but the amp was still rated at average overall. Comments included some irritation with the treble, though the amp was not considered unduly bright, some criticisms of the behaviour when being driven hard, and an unexceptional bass performance.

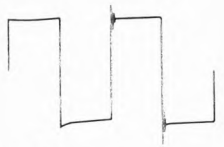
Conclusions

The *515* appears to be a curious mixture of strengths and weaknesses. Certainly its competitiveness must have been compromised to some extent by several unnecessary features, and the mixture offered in this respect is a rather curious one. Measured performance was adequate rather than good, and the power delivery was not exceptional for the price either However the subjective impressions were quite encouraging, if

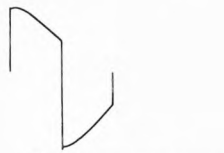
rather inconsistent, so we would recommend prospective purchasers to audition this model.



10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £140
Approx size (w × h × d) ..... 16(41) × 6(15) × 11(28) ins (cm)
Approximate weight ..... 16 lbs (kg)
Presentation (fascia, case etc) ..... ,bright' silver, pale grey
Quality of external finish ..... good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 2 machines*
Tone controls/switchable? ..... simple/no
Filters/loudness ..... no/yes
Others ..... meters, mike i/p inc mix, reverb, function lights

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 48/44 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 42/34 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 34/37 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 61/75/44 Watts*
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 61/75/46 Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 73/106/62 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 50kΩ/100pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.41/3.2/30mV
Disc: overload 20Hz/1kHz/20kHz 37/37/31dB
Tuner: impedance/sensitivity 40kΩ/204mV*
Aux: impedance/sensitivity 40kΩ/204mV
Tape phono: impedance/sensitivity 40kΩ/204mV*
Tape DIN: impedance/sensitivity ..... kΩ/mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 150mV/236mV/10kΩ
Tape DIN: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ 70mV/1.8V/2.6V

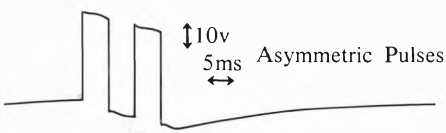
Noise (ref 1 watt, A wtg)

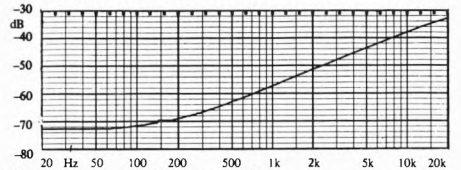
At zero volume ..... –82dB
Aux, ref vol, 1kΩ source ..... –79dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –77/–75dB

Other technical parameters

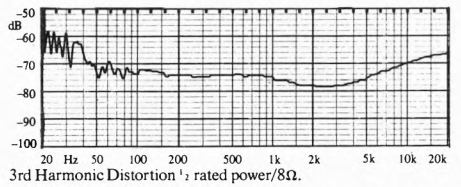
Damping factor 30Hz/1kHz/30kHz 38/36/25
DC offsets L/R 8.0/8.0mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 19Hz—37kHz
Total Harmonic distortion (inc noise) ..... average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... below average
Hum performance ..... below average

* See text

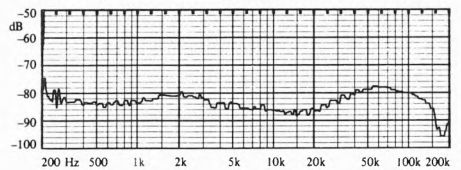




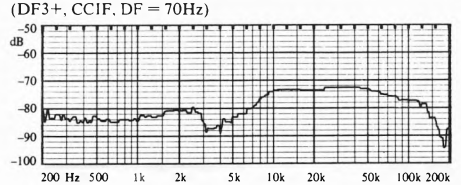
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



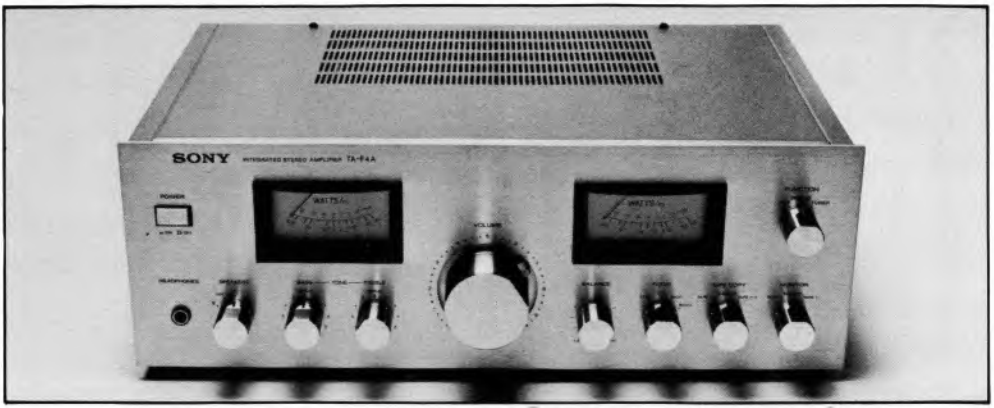
Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF, DF = 70Hz

Sony TA F4A

Sony (UK) Ltd., Consumer Inf. Dept. Showroom, 134 Regent Street, London W1.
(01) 439 3874



Presentation, facilities etc.

This model is part of a range of Sony amps which runs parallel with 313 etc series through the budget range, but extends to some fairly exotic and costly models. The appearance and facilities were generally slightly preferred, although the ergonomics were not quite as logical. Power meters are again fitted, but at last the loudness control is eschewed in favour of HF and LF filters, and the tone controls may be defeated.

The overall finish was also considered superior to the other Sony range, and used a 'bright' brushed-aluminium fascia and light grey case. The inputs were mainly 'phono' sockets, but the second tape socket was of the DIN type, and crossdubbing was offered between the tape sockets.

Lab performance

No problems are likely to be experienced with any of the inputs and outputs, all of which are fairly close to the norm, including the disc input capacitance.

Some of the performance parameters do give cause for a little concern, however, and the swept harmonic distortions gave fairly poor results at high frequencies: the 3rd harmonic being -50dB and the 2nd about -45dB at 20kHz. Hum, noise, and intermod distortion measurements were about average, the squarewaves showed some ringing, and the swept intermod showed significant increases at supersonic frequencies, which may be the result of slew limiting or protection circuitry operating. The bandwidth would appear to be intrinsically rather wide, which may permit lack of control under some circumstances.

Power delivery is pretty good for the price, and indeed quite similar to Sony's rather more expensive *515*. The delivery is somewhat restricted into lower impedances, but is nevertheless maintained at a modest level into 2ohms. A significant increase in single over dual channel drive is by no means unusual, but is nevertheless indicative of power supply economies.

Subjective impressions

The TAF4A was not very well received overall in either of the listening tests, although there were one or two dissenters. In the first 'hands-on' session it was considered to work fairly well at low levels, but was felt to get progressively 'untidier' as levels were increased. The 'blind' test gave rise to complaints of sloppy bass, a rather coloured midrange sound and some fierceness.

The second sessions again described the treble as potentially fatiguing, the mid coloured, and the bass rather loose; the comments thus showed quite close correspondence generally.

Conclusions

The high standard of finish, generous power delivery for the price, and a sensible choice of facilities suggest that this amp should receive a firm recommendation. However the measured high frequency distortion problems may well be significant, and the results of the listening tests were disappointingly negative, so any commendation must remain qualified, and we feel strongly that potential purchasers should listen before they buy.

GENERAL DATA

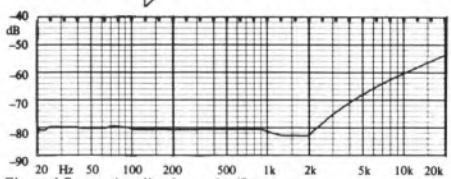
Typical price (inc VAT)	£110
Approx size (w × h × d)	16(41) × 6(15) × 13(33) ins (cm)
Approximate weight	16 lbs (kg)
Presentation (fascia, case etc)	'bright' silver, light grey
Quality of external finish	v. good
Listening impression summary	adequate*
Features and Facilities	
Tape facilities	2 machines (1 DIN, 1 phono), crossdubbing
Tone controls/switchable?	simple/yes
Filters/loudness	HF, LF/no
Others	power meters
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	48/48 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	40/41 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	40/40 Watts*
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	57/60/45 Watts*
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	57/60/50 Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω	77/100/64 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 phono, 50 kΩ/130pf
Disc: sensitivity 20Hz/1kHz/20kHz	0.24/2.2/21mV
Disc: overload 20Hz/1kHz/20kHz	40/39/34dB
Tuner: impedance/sensitivity	40kΩ/140mV
Aux: impedance/sensitivity	40kΩ/140mV
Tape phono: impedance/sensitivity	43kΩ/140mV
Tape DIN: impedance/sensitivity	43kΩ/140mV
Outputs	
Tape phono: for 5mV disc/ for .5V aux/imp	200mV/320mV/5.6kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	26mV/40mV/71kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ	44mV/1.45V/2.2V
Noise (ref 1 watt, A wtg)	
At zero volume	–83dB
Aux, ref vol, 1kΩ source	–81dB
Disc, ref vol, 1kΩ/M75EJ sources	–79/–75dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	59/55/41
DC offsets L/R	3.5/2.0mV
Power bandwidth, –3dB ref max power 8Ω disc	4Hz—54kHz*
Total Harmonic distortion (inc noise)	above average
Intermodulation dist (CCIF 19/20kHz RIAA)	average
Hum performance	average

* See text

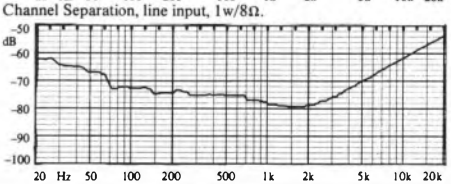
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

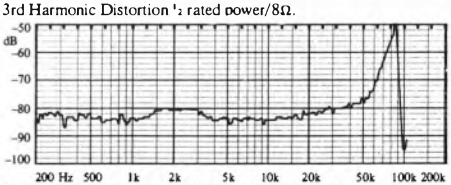
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



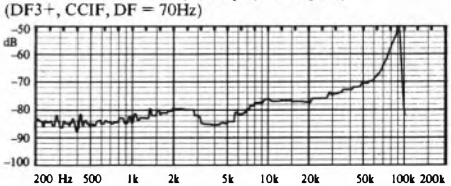
Channel Separation, line input, 1w/8Ω.



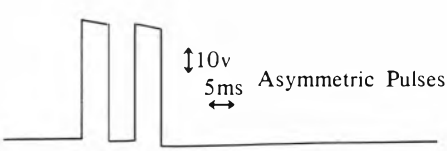
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



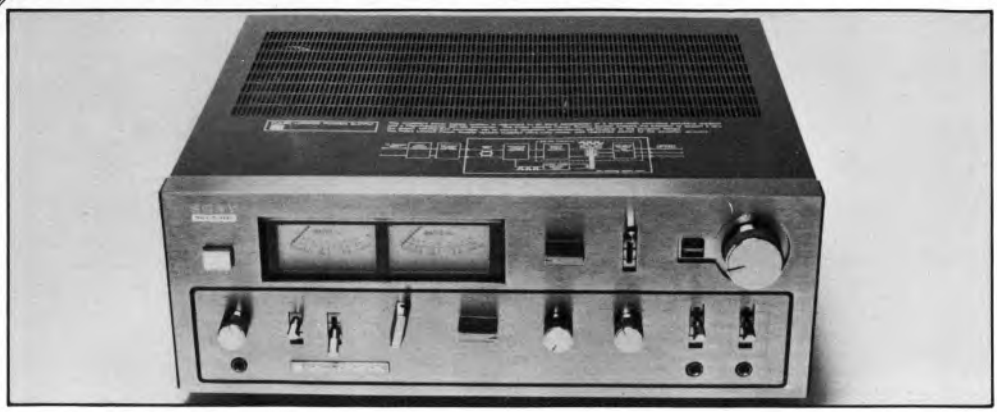
Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



RECOMMENDED

Sony TA-F6B

Sony (UK) Ltd., Consumer Inf. Dept. Showroom, 134 Regent Street, London W1.
(01) 439 3874



Presentation, facilities etc.

This is the second most expensive integrated amp in Sony's large and comprehensive range. It is physically quite large, fairly heavy and expensive, but the choice of gunmetal fascia finish with silver knobs and a black case makes it fairly unobtrusive; the standard of finish is very good indeed. The volume control was particularly liked, combining detent action at high levels with an infinitely variable low end, and supplemented by 20dB muting it offered good control over a 90dB range. This model uses Sony's new pulse-locked power supply system; the legend on the rear of the case restricts the speaker choice to 8–16 ohm models, and only one set may be selected at any one time. As true 8ohm minimum speakers are by no means the norm (and may even be nonexistant if the fruits of current research are confirmed), and bearing in mind the fact that many of the more expensive speakers likely to be used with an amp of this type tend to offer quite 'difficult' loads, this qualification may be somewhat inappropriate.

Facilities are elaborate, consisting of front panel power meters, pre-/power split socketry, simple tone controls which claim defeat at their centre indent position, filters, but no loudness. Phono inputs are provided for moving-coil and moving magnet cartridges, three high level inputs, plus connections for two tape machines offering crossdubbing; tape 2 is duplicated by jack sockets on the front panel. The choice of jack sockets may be rather inconvenient, but presumably they have been chosen for their switching function which permits this socket to over-ride any machine simultaneously connected to the rear.

Lab performance

Inputs and outputs seemed generally well optimised, the m-m disc imput was quite normal, and the m-c input should match most types effectively though its overload could perhaps have been better maintained at HF.

Hum was excellent and noise very good via the line inputs, but only average via disc and less good still via the m-c input; it should nevertheless be adequate for all practical purposes. The swept intermod showed a tendency to rise a little at very high frequencies, which was somewhat exaggerated into the speaker load. The power delivery was very healthy into 8ohms, but showed the same characteristic as the other 'pulse-locked' Sonys and the regulated Spendor in producing limited power into low impendances even under 'burst' conditions. The lack of difference between single and double channel output is indicative of tight control in the power supply, but there must remain some doubt whether this is the best approach for transient control and driving some of the more difficult speakers on the market. Some slew limiting problems were detected at high powers and high frequencies, above 30kHz on high level inputs, but at a safer 70kHz on disc.

Listening impressions

This amp produced some mixed reactions, some listeners finding it generally likable, but there were also criticisms of bass 'looseness' and treble 'tizz', which were considered to become worse as levels were increased.

RECOMMENDED

Conclusions

While this amp would appear to offer a very competitive package, with its high standard of finish, comprehensive facilities plus high 8ohm power delivery, there remain a few doubts about the HF performance, and care must be taken to use speakers of quite high impendance. Listening test results were fairly inconclusive, but suggest that this form of power delivery may have some limitations at high levels

GENERAL DATA

Typical price (inc VAT) £330
Approx size (w × h × d) ..... 17(43) × 6½(17) × 17(43) ins (cm)
Approximate weight ..... 28 lbs
Presentation (fascia, case etc) ..... gunmetal, black
Quality of external finish ..... v. good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing*
Tone controls/switchable? ..... simple/yes*
Filters/loudness ..... yes/no
Others ..... meters

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 120/120 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 116/110 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 110/107 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 121/56/21 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 120/56/21 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 120/82/33 Watts

Inputs

Disc: sockets, impedance/capacitance ... MM & MC, MM 51kΩ/124pf, MC 106Ω
Disc: sensitivity 20Hz/1kHz/20kHz ..... MM 0.22/1.9/19, mV, MC 20/70/620μV
Disc: overload 20Hz/1kHz/20kHz ... MM 42/43/42, MC 33/41/31 dB
Tuner: impedance/sensitivity 90kΩ/120mV
Aux: impedance/sensitivity 93kΩ/120mV
Tape phono: impedance/sensitivity 85kΩ/120mV
Tape DIN: impedance/sensitivity 85kΩ/120mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 200mV/320mV/5.6kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 45mV/90mV/31kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 40mV/1.0V/1.2V

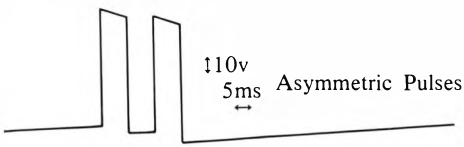
Noise (ref 1 watt, A wtg)

At zero volume ..... –95dB
Aux, ref vol, 1kΩ source ..... –90dB
Disc, refvol, 1kΩ/M75EJ sources ... MM –69/–75dB, MC –63dB (10Ω)

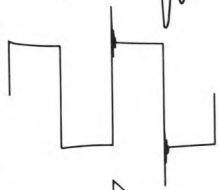
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 40/40/32
DC offsets L/R ..... –34/–30mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 3.2Hz—70kHz*
Total Harmonic distortion (inc noise) ..... average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... excellent

* See text

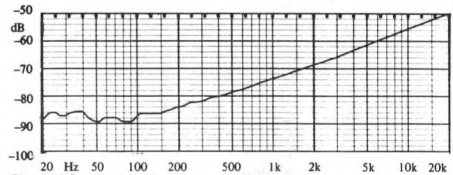


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

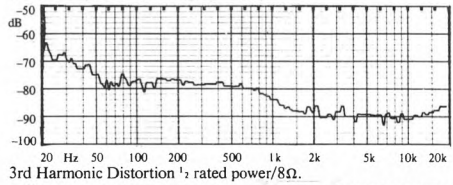


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

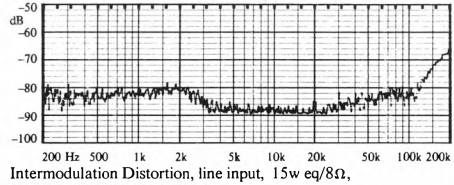
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



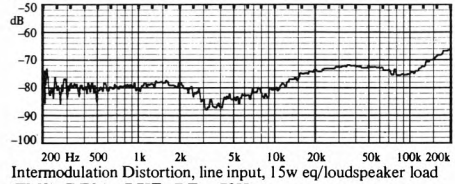
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



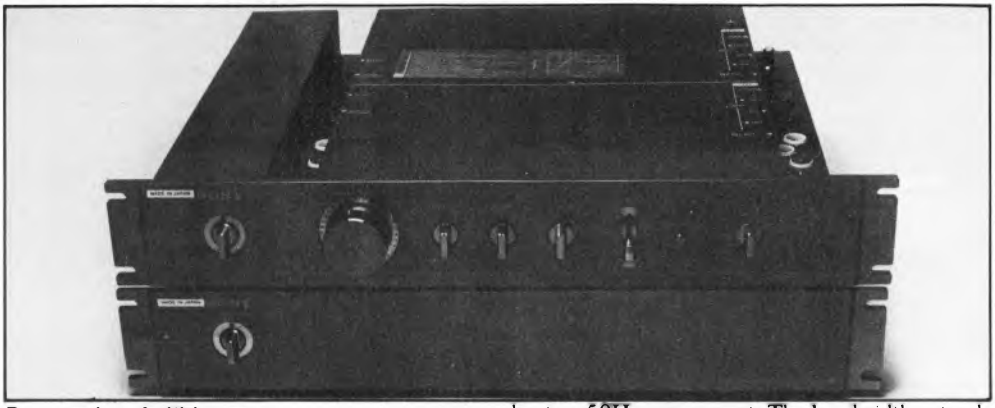
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Sony TA-E86B/TA-N86B

Sony (UK) Ltd., Consumer Inf. Dept. Showroom, 134 Regent Street, London W1.
(01) 439 3874



Presentation, facilities etc.

This exquisitely finished pre- and power amp combination is rather less expensive than its 'jewellery' standard of finish would indicate. It is very much an 'audiophile'-oriented product, in that facilities are fairly sparse and some attention has been paid to avoiding interference with the signal path. The standard rack width gunmetal cases with 'dull' silver knobs take up a fair amount of space, and are fairly heavy, but nonetheless manage to look both discrete and extremely 'classy'.

The four sets of phono connectors are recessed in the top plate so that access is easy and the wires can be led out the back neatly. The disc input can be used with either low output moving-coil or normal cartridges, and offers matching for 3Ω or 40Ωm-c models, and rather coarse 25kΩ, 50kΩ or 100kΩ matching for m-m types: a single tape machine is catered for. The only 'sound-shaper' provided is an LF filter, though a set of pre-amp outputs have a degree of bass boost built in (the reason behind this eludes us.) The power amp may be operated in direct or capacitor-coupled and in class A or B modes. The large lever clamps used for the single speaker outputs were considered particularly convenient, and yet seemed to offer as good a connection as 4mm binding posts.

Lab performance

The moving-coil input offers two matching impedances which is the ideal compromise for coping with the various models available. Tape output impedance is rather on the high side.

All performance measurements were pretty good, though hum was perhaps surprisingly only average considering the HF-type power supply, due to a 50Hz component. The bandwidth extends to an extraordinarily high 240kHz, which in our view is rather unnecessary, but creditably no slew limiting problems were encountered. The measured distortions were quite low and the swept intermod showed little change with loudspeaker loading. Squarewaves showed some ringing into reactive load and a slight overshoot at high frequencies into 8ohms.

Power delivery followed the same pattern as the other Sony models using pulsed power supplies, delivering its maximum into 8ohms with current limited capabilities into 4 and 2ohms, and very little difference between single and dual channel drive. In the class-A mode output powers were 25/45/60 watts into 8/4/2ohms respectively, while in the bridged mono mode 16/8/4ohms gave 225/160/85 watts.

Subjective impressions

In the first sessions this amp was used as one of the 'blind' controls, and very good agreement – and indeed identification – was obtained. The sound quality was described as very 'tidy' and controlled, with good though not exceptional detail and a slightly 'splashy' treble; generally a 'tight' and well liked amp. Results were not quite as favourable 'hands on', but were nevertheless fairly good.

The second sessions confirmed the generally positive feelings, commenting on the generally 'tight' sound with slight 'brightness' and 'harshness'. Transients were felt to cause some strain when the amp was driven hard, and some considered the sound was potentially rather fatiguing.

Some listeners noted a distinct improvement in the class-A mode, with less sense of fatigue and a more 'open' sound.

Conclusions

The exquisite standard of construction, 'audiophile-oriented' facilities, and quite favourable sound quality comments make this an interesting product, but it does not really offer the sort of value for money to merit general recommendation.

GENERAL DATA

Typical price (inc VAT) £550
Approx size (w × h × d) ... total 19(48) × 6(16) × 16(41) ins (cm)
Approximate weight ..... 16/16 lbs
Presentation (fascia, case etc) ..... silver grey
Quality of external finish ..... exceptional
Listening impression summary ..... above average*

Features and Facilities

Tape facilities ..... one set
Tone controls/switchable? ..... no
Filters/loudness ..... LF/no (LF boost pre-amp output)
Others ..... MC input

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 100/100 Watts*
Both channels driven 8Ω 20Hz .1% dist L/R ..... 98/98 Watts*
Both channels driven 8Ω 20kHz .1% dist L/R ..... 98/98 Watts*
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 102/56/28 Watts*
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 102/56/28 Watts*
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 110/92/46 Watts*

Inputs

Disc: sockets, impedance/capacitance ..... MM or MC, MM 50kΩ* /140pf,MC37,110Ω

Disc: sensitivity 20Hz/1kHz/20kHz MM0.2/2/19mV
Disc: overload 20Hz/1kHz/20kHz ..... MM 43/44/43dB
Tuner: impedance/sensitivity 47kΩ/120mV
Aux: impedance/sensitivity 47kΩ/120mV
Tape phono: impedance/sensitivity 47kΩ/120mV
Tape DIN: impedance/sensitivity ..... kΩ/mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp ... 150mV/240mV/14kΩ*
Tape DIN: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ ..... V/V/V

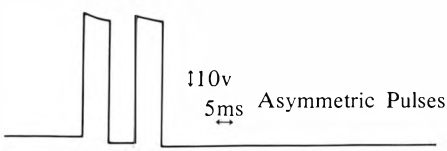
Noise (ref 1 watt, A wtg)

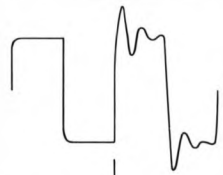
At zero volume ..... –84dB
Aux, ref vol, 1kΩ source ..... –81dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –75/–72dB

Other technical parameters

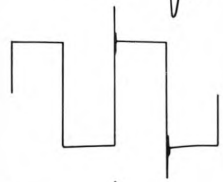
Damping factor 30Hz/1kHz/30kHz 93/85/62
DC offsets L/R ..... –16/–2
Power bandwidth, –3dB ref max power 8Ω disc ..... 5Hz—240kHz
Total Harmonic distortion (inc noise) ..... above average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... above average
Hum performance ..... average

* See text



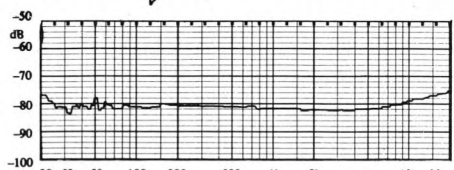


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

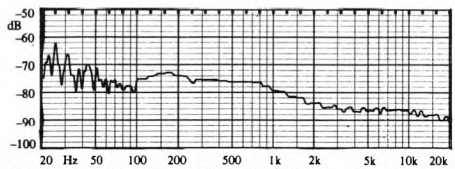


1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

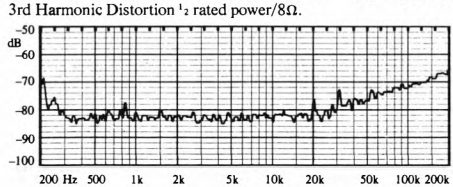
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



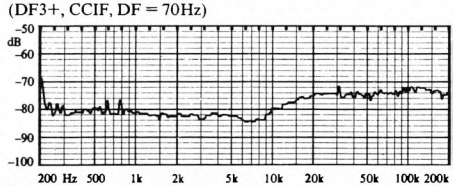
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Sony TA-E88B/TA-N88B

Sony (UK) Ltd., Consumer Inf. Dept. Showroom, 134 Regent Street, London W1.
(01) 439 3874

Presentation, facilities etc.

This combination is superficially very similar to the *86* combo featured on the preceding pages, but with one or two extra facilities. However it costs rather more than twice the price, and operates on an entirely different principle to any other amp in the book (or available commercially anywhere at the moment we believe.) All amps to date have attempted to process and enlarge the audio signal by preserving it in its sinewave-based format, and this is known as analogue (or modelling) operation; the *88* uses PWM digital techniques, based on breaking the signal into tiny parts that can be represented by either an 'on' or 'off' pulse, and by means of high speed computer-type processing circuitry enlarging and altering this signal before reconverting to 'analogue' to drive the speakers.

The presentation of this combination is the same as that described for the *86*; exquisite 'jewellery' finish gunmetal cases with dull silver knobs. Weight is up to 43lbs *in toto*. The infinitely variable volume control is now calibrated over an extraordinary 110dB dynamic range (70dB on the *86*.) The all phono socketry now permits two disc and two tape connections, but no crossdubbing is provided. Both disc inputs have moving-coil or normal input options, and on one the m-m impedance and capacitance can be 'dialled in' with 10kΩ and 100pf steps respectively. We understand that iridium plating has been used on some sockets! Lever-type output speaker connector sockets (which we liked) are again used.

Lab performance

Disc inputs offer exceptional matching versatility, although HF overload on the two m-c impedances inputs was rather lower than one might have expected (20kHz: 40/16dB, 4/25dB.)

Because of its entirely different mode of operation, the normal performance parameters are likely to give peculiar results, which indeed they do! Deciding exactly which of the results are due to the mode of operation, and what relationship they bear to the listening experience would involve considerably greater research than our resources and time permit unfortunately. Even though the 3rd harmonic and swept intermod distortions are amongst the worst recorded in the book, this was by no means reflected in the results of the listening tests. There are at least two possible implications: first that the mode of operation itself interferes with the measurement techniques or test equipment used; second that there remain distortion mechanisms that are as yet unmeasured and unpostulated, on which the *88* might perhaps show comparably superior results to conventional amps!

Power output was high, as might be expected at the price, but showed a significant difference between single and dual channel drive; output into 4ohms was significantly reduced, and very little was available into 2ohms.

Subjective impressions

This unusual model received some mixed comments in the first sessions but was generally quite well liked. Consistent comments were made concerning a 'tidy' well-controlled sound, albeit with a rather 'flabby' bass; detail was quite good, but not exceptional, and some comments were made concerning a slight mid colouration. The second sessions also gave mixed but generally positive comments, with good overall control and smoothness again qualified by descriptions of 'woolly' bass and occasional harshness.

Conclusions

This model was included partly for its technical interest, and was hardly expected to justify its extravagant cost; it certainly did not disgrace itself on listening, and consequently raises interesting questions regarding performance measurement. While clearly not a 'value-for-money' product, its high power output versus small size and minimal waste heat production makes it highly suitable for certain professional applications.

GENERAL DATA

Typical price (inc VAT) £1400
Approx size (w × h × d) ..... total 19(48)×6(16)×16(41) ins (cm)
Approximate weight ..... 20/23 lbs
Presentation (fascia, case etc) ..... silver grey
Quality of external finish ..... outstanding
Listening impression summary ..... f. good*

Features and Facilities

Tape facilities ..... 2 machines, phono
Tone controls/switchable? ..... none
Filters/loudness ..... LF/no

Others ..... Class D power amp (PWM)

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 160/160 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 160/160 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 160/160 Watts*
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 180/132/20 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 180/150/25 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 308/266/60 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 2, mm or mc, mm variable, mc4Ω, 40Ω
Disc: sensitivity 20Hz/1kHz/20kHz ..... mm 0.26/2.5/23.5mv, mc1kHz4Ω100μV, 40Ω95μV
Disc: overload 20Hz/1kHz/20kHz mm42/41/40dB, mc4Ω32/45/25dB,40Ω35/42/16dB
Tuner: impedance/sensitivity 50kΩ/150mV
Aux: impedance/sensitivity 50kΩ/150mV
Tape phono: impedance/sensitivity 50kΩ/150mV
Tape DIN: impedance/sensitivity ..... kΩ/mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 270mV/440mV/1.1kΩ
Tape DIN: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ ..... V/V/V

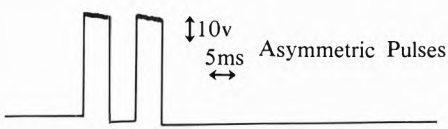
Noise (ref 1 watt, A wtg)

At zero volume ..... –79dB
Aux, ref vol, 1kΩ source ..... –79dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –78/–76dB

Other technical parameters

Damping factor 30Hz/1kHz/30kHz 30/31/71*
DC offsets L/R 76/14mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 3Hz—104kHz
Total Harmonic distortion (inc noise) ..... below average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... below average
Hum performance ..... average

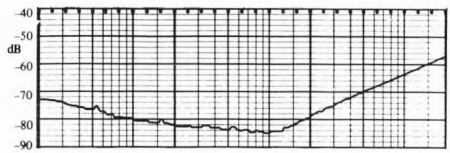
* See text



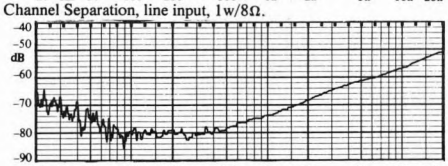
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

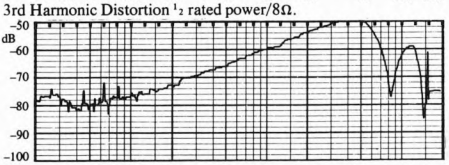
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



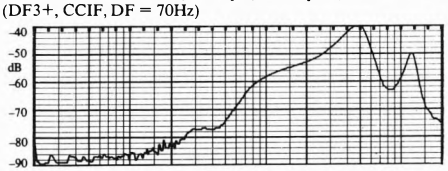
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Spendor D40

Spendor Audio Systems Ltd., Unit 12, Station Road Industrial Estate, Hailsham, Sussex. BN27 2ER. 0323 843474

Presentation, facilities etc.

The presentation and styling of the *D40* is definitely out of the ordinary, and in a world where designs have become increasingly similar, this model makes a refreshing change. Spendor are best known for their BBC-inspired monitor loudspeakers, which for professional applications are often supplied with built in power amps; the D40 is an integrated model designed for domestic use, presumably primarily with their speakers also in mind.

This very compact design is housed in a wooden sleeve and uses a black fascia with silver lettering and knobs. The large knob controls the volume (with an expensive high quality attenuator according to our engineer), and two smaller knobs combine balance and mono left/mono right switching, on/off and input selection. The external finish was to a high standard.

Lab performance

The disc input has negligible capacitance, and so many cartridges will be improved by the addition of a little extra by means of phono equalisers and the like. The disc input also uses passive equalisation at high frequencies in order to avoid intermodulation effects (though our measurements on disc intermod did not show any real evidence of improvement); perhaps unfortunately this also reduces the disc overload margin markedly at high frequencies, so it is probably inadvisable to use a cartridge with sizeable supersonic resonance (some of which were used extensively in our listening tests for technical reasons.) Other inputs and outputs were quite normal, though no headphone output is fitted.

The hum spectrum was excellent, and this is no doubt partly due to the stabilised power supplies, of which more later. The bandwidth is reasonably well controlled, with LF rolloffs at the bass end giving –3dB points at 27Hz on disc and at 20Hz line; being capacitor coupled the amp will not produce any very low subsonics in any case. Separation was quite good on disc and line inputs, though deteriorated somewhat at HF.

Power delivery was a little unusual, as the performance was tightly controlled by the regulated power supplies which fixed tight limits on voltage and current supply. While presumably helping the amp to keep itself well under control, this does mean that transient power into difficult loads may not be available. Naturally there were no changes between single and double channel drive.

Subjective impressions.

Some inconsistencies existed in the value judgements applied to the sound of this model, although the characterisations were quite similar. The amp was described as rather soggy in the bass and lacking energy, while the mid thickened as power was increased. A rather 'thin' but quite controlled and pleasant sound, lacking some detail but only sounding unpleasant when driven hard. The volume control steps were a little far apart at very low levels, which could be irritating with efficient loudspeakers in a quiet domestic setting.

Conclusions

Conclusions about this amp are difficult to formulate, as its 'differentness' is not limited to the

surface. It is expensive for the power and facilities offered, though the engineer commented on the high quality of the components used. The sound quality impressions were mixed, and suggest that the amp works rather well when not driven too hard; while its general appeal is perhaps limited, it nevertheless appears to fulfil the designer's intention of producing a high quality low power design quite well.

GENERAL DATA

Typical price (inc VAT) £200
Approx size (w × h × d) ..... 13(33) × 4½(11) × 10(25) ins (cm)
Presentation (fascia, case etc) ..... black and silver, teak case
Quality of external finish ..... v. good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 1 machine, phono
Tone controls/switchable? ..... none/—
Filters/loudness ..... none/none

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 50/47 Watts*
Both channels driven 8Ω 20Hz .1% dist L/R ..... 33/43 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 29/22 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 50/36/16 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω 47/30/15
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 51/58/25 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 54kΩ/12pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.5/2.7/26mV
Disc: overload 20Hz/1kHz/20kHz 30/36/15dB
Tuner: impedance/sensitivity 50kΩ/80mV
Aux: impedance/sensitivity 50kΩ/80mV
Tape phono: impedance/sensitivity 50kΩ/80mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 115mV/460mV/980Ω

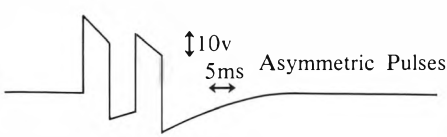
Noise (ref 1 watt, A wtg)

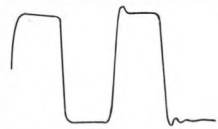
At zero volume ..... –80dB
Aux, ref vol, 1kΩ source ..... –74dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –75/–73dB

Other technical parameters

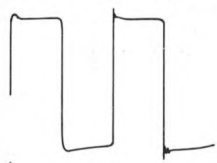
Damping factor 30Hz/1kHz/30kHz 39/29/25
Power bandwidth, –3dB ref max power 8Ω disc ..... 26Hz—60kHz
Total Harmonic distortion (inc noise) ..... average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... average
Hum performance ..... excellent

* See text

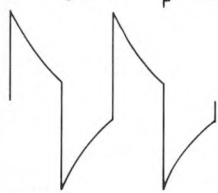




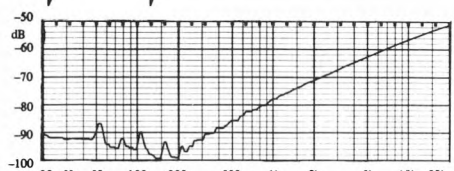
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

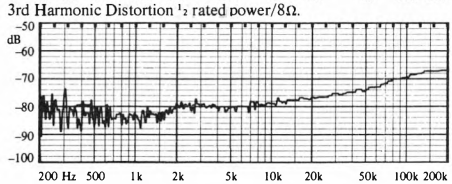


100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

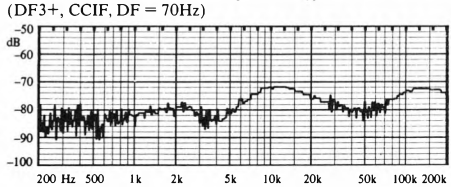


Channel Separation, line input, 1w/8Ω.

3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)

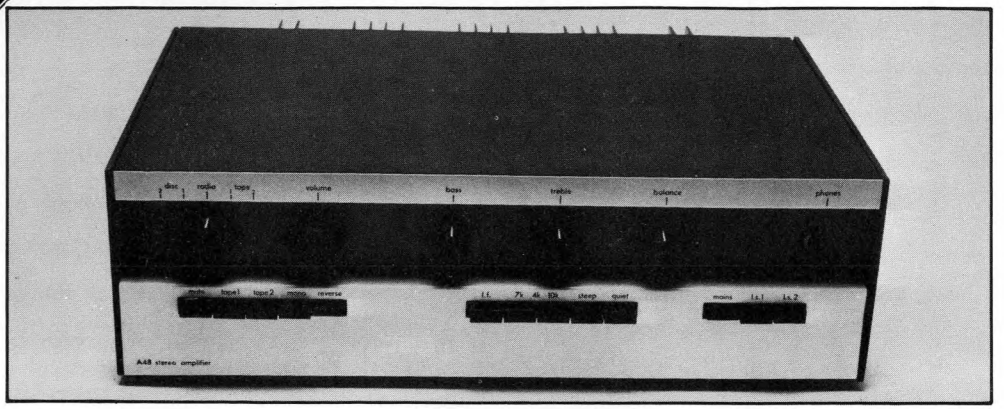


Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Sugden A48 II

J.E. Sugden & Co Ltd., Carr Street, Cleckheaton, W. Yorks. BD19 5LA
0274 872501



Presentation, facilities etc.

This is the latest version of the well-established and much-praised integrated amplifier from this independently-minded Yorkshire company. Some detail modifications have recently been incorporated, including relay settling-time protection, but like the Quad this model has been around in a similar format for some years and shows every signs of continuing, so it presumably will hold its value well. Styling is again 'British idiosyncratic', with black plastic knobs on a beige and red background and a brown case; while this will probably not be everyone's cup of tea, in our opinion it does blend rather better with typical domestic surroundings than many of the more extravagant silver monsters. Finish is very good.

Facilities provided are fairly simple, though again like the Quad complex HF filtering is provided, with three turnover points and two attenuation rates; an LF filter is also fitted, plus loudness. DIN inputs are provided throughout, for disc and three high level inputs; tape monitoring but not cross connection is enabled. Simple unswitchable tone controls are fitted, and full mute switching augments the volume control. The high level inputs use an unusual and rather non-standard arrangement of socket-wiring.

Lab performance

The disc input matching should pose no problems, though the overload level at HF is lower than normal. The tape input/output uses DIN socketry to 'phono' standards. The significant difference between outputs *via* ref disc and aux inputs could pose some problems, and is a point to watch when matching ancillaries.

Like a number of British designs, the *A48 II* has a very tightly controlled bandwidth which ensures there are no HF slewing problems. Most of the measured parameters gave average or below average results, but none were sufficiently poor to cause any real concern in practical situations. The swept intermod was at a slightly higher level than some models, but showed only minor deviations with a speaker load. The squarewaves showed a remarkable freedom from any overshoot or ringing, which is partly due to the controlled bandwidth, but also indicates that the amp should stay well under control. The bass end shows a significant phase shift due to the capacitor coupling adopted.

Power output is quite modest for an amp at this price level, though still adequate for most domestic applications. The difference between single and dual channel drive is commendably small, and reasonable low impedance drive is available, particularly on 'burst' measurement.

Subjective impressions

The *A48 II* was well received with quite good consistency. The first session commented on a generally nice 'open' sound with quite good detail, perhaps on the 'soft' side and a little 'thin'. One comment suggested that it was nice and easy on the ears! The second session consistently confirmed the overall smoothness, and also commented on a 'punchy' sound with a tendency to boominess in the bass.

Conclusions

Like the A&R, the Sugden scarcely appears to offer particularly good value on a price/power perform-

Sugden A48 II

ance basis, though the presentation is pleasantly unusual and facilities are well chosen. Again however it was consistently very well received in the listening tests, so in the absence of any serious performance anomalies recommendation is mandatory at the not unreasonable price.

10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

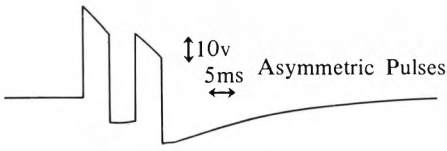
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

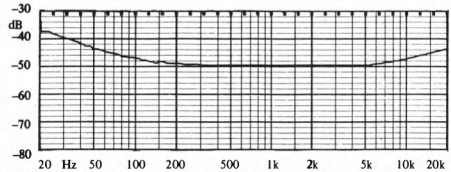
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.

GENERAL DATA

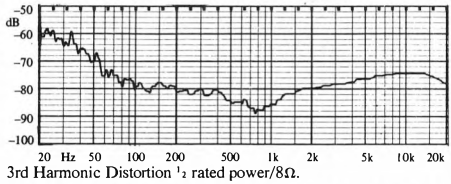
Typical price (inc VAT)	£216
Approx size (w × h × d)	16(40)×5(13)×12(30) ins (cm)
Approximate weight	26 lbs
Presentation (fascia, case etc)	beige, red and brown
Quality of external finish	v. good
Listening impression summary	f. good*
Features and Facilities	
Tape facilities	2 sets DIN*
Tone controls/switchable?	simple/no
Filters/loudness	complex*/yes 'quiet'
Others	mute
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	44/43 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	44/43 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	42/40 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	46/64/66 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	46/60/66 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	60/98/139 Watts
Inputs	
Disc: sockets, impedance/capacitance	1 DIN, 51kΩ/114pf
Disc: sensitivity 20Hz/1kHz/20kHz	057/3.5/38mV
Disc: overload 20Hz/1kHz/20kHz	35/30/23dB
Tuner: impedance/sensitivity	233kΩ/185mV
Aux: impedance/sensitivity	kΩ/mV
Tape phono: impedance/sensitivity	kΩ/mV
Tape DIN: impedance/sensitivity	233kΩ/185mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	mV/mV/kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	15.5mV/460mV/4.9kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	41mV/730mV/1.0V
Noise (ref 1 watt, A wtg)	
At zero volume	–75dB
Aux, ref vol, 1kΩ source	–74dB
Disc, ref vol, 1kΩ/M75EJ sources	–73/–73dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	20/20/20
DC offsets L/R	0./0mV
Power bandwidth, –3dB ref max power 8Ω disc	22Hz—30kHz
Total Harmonic distortion (inc noise)	average
Intermodulation dist (CCIF 19/20kHz RIAA)	below average
Hum performance	below average

* See text

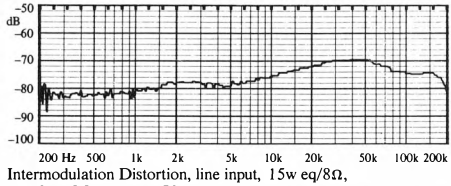




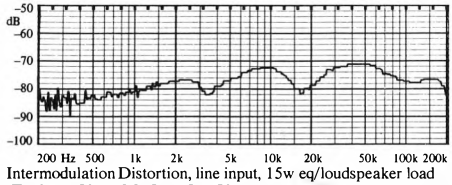
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



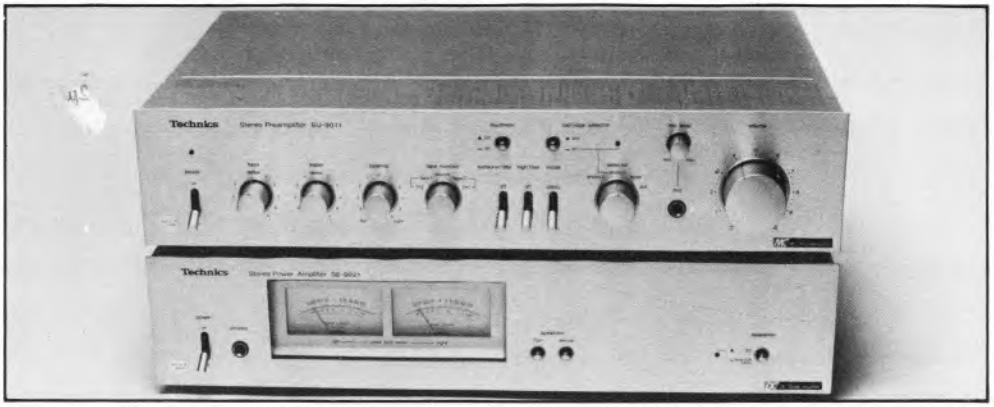
Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Technics SU-9011/SE-9021

Technics, National Panasonic UK Ltd., 107-109 Whitby Road, Slough, Berks. SL1 3DR. 0753 34522



Presentation, facilities etc.

Despite costing about the same price as the *8088K*, the *9011/9021* pre-/power combination could not present a much greater contrast in presentation. In point of fact these two units together probably occupy a rather greater volume and weigh slightly more, but nevertheless somehow manage to look more compact! Finish is of a fairly high standard, with silver fascias and a silver grey case, though the boxes were a little 'tinny', and there was an exposed screw head underneath.

Facilities are quite comprehensive, particularly for the recordist, with the phono connections DIN duplicated, crossdubbing, and a mike mix onto tape capability. The mike input is a front panel jack, and the other phono inputs include two disc, one with moving-coil option. Simpe tone controls are fitted with the centre indent position claiming defeat; HF and LF (subsonic) filters and loudness are also available. The power amp has high quality 'swinging needle' power meters, speaker switching and headphone socket. While it is nice to have the presentation option between these two similarly priced models, it is perhaps surprising that the differences between them in terms of facilities offered are not greater (one could contrast the sparse Sony separates with their complex integrated counterparts.)

Lab performance

Inputs and outputs appear to be fine, and should pose no compatibility problems. The m-c input impedance is a little on the low side. and is perhaps best suited to low source impedance models, but should have adequate sensitivity, overload and noise margins to give no problems with other types.

Performance parameters were generally very good, if a little inferior to the integrated *8088K*. Separation was perhaps less good than one might have expected on an expensive separates system, being less than –40dB at HF, while the swept intermod curves showed a worsening of 12dB at 20kHz with the loudspeaker load, and an odd-looking 'spike' at 30kHz. Squarewaves and pulse showed reasonably good behaviour. The bandwidth was rather on the wide side, and showed a strange effect, varying according to the level set.

Power output was respectable, but not particularly high at this price level; the difference between single and dual channel drive was commendably slight, and power delivery was quite well maintained into low impedances, particularly on 'burst'.

Subjective impressions

This combination had a somewhat mixed reception, resulting in an overall characterisation slightly lower than its stablemate. The first tests gave fairly consistent comments which were generally quite favourable, with comments of 'crispness' good clarity and firm bass, together with some 'hollowness' in the mid and a slightly 'thick' treble. When driven to clipping during 'hands-on', it was felt to become rather aggressive. The second session listeners were less sure of the bass performance, finding it rather 'detached' and prominent, and there was a definite uneasiness in the reactions of some listeners.

Conclusions

While undoubtedly a capable performer, with good

facilities particularly for the recordist, smart presentation, and good measured performance, the power output is not high for the price, and the listening tests summarised the model as average, which is rather lower than the more powerful, similarly priced *8088K*.

GENERAL DATA

Typical price (inc VAT) £400
Approx size (w × h × d) ..... total17(43)×8(10)×12½(32) ins (cm)
Approximate weight ..... 11/22 lbs
Presentation (fascia, case etc) ..... silver, silver grey
Quality of external finish ..... good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing, mike mix
Tone controls/switchable? ..... simple/yes
Filters/loudness ..... HF, LF/yes
Others ..... power meters, mike

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 75/72 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 71/67 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 73/70 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 76/127/136 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 74/116/121 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 77/132/197 Watts

Inputs

Disc: sockets, impedance/capacitance ... 2 phono, mm 47.5kΩ/174pf, mc10 .6Ω
Disc: sensitivity 20Hz/1kHz/20kHz ... mm0.28/2.4/29mV, mc26/76/720μV
Disc: overload 20Hz/1kHz/20kHz mmmm39/39/37dB, mc33/38/39dB
Tuner: impedance/sensitivity 59kΩ/150mV
Aux: impedance/sensitivity 59kΩ/150mV
Tape phono: impedance/sensitivity 66kΩ/150mV
Mike: socket/impedance/sensitivity ..... ¼ jack/9kΩ/4.8mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 275mV/460mV/578Ω
Tape DIN: for 5mV disc/for .5V aux/imp ..... mV/mV/kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 75mV/1.7V/2.6V

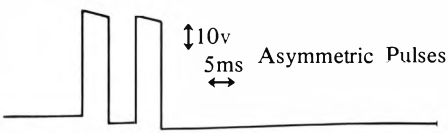
Noise (ref 1 watt, A wtg)

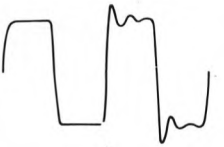
At zero volume ..... –81dB
Aux, ref vol, 1kΩ source ..... –77dB
Disc, refvol, 1kΩ/M75EJ sources .... mm:–77/–73db, mc: –77dB(10Ω)

Other technical parameters

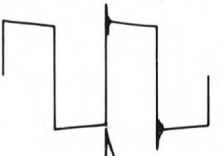
Damping factor 30Hz/1kHz/30kHz 69/69/45
DC offsets L/R ..... –27/–20mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 8Hz—70kHz*
Total Harmonic distortion (inc noise) ..... excellent
Intermodulation dist (CCIF 19/20kHz RIAA) ..... very good
Hum performance ..... above average

* See text

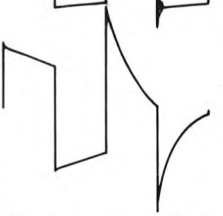




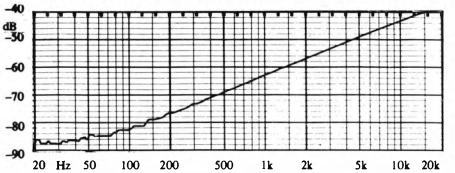
10kHz squarewave
left: 8Ω load
right: 8Ω + f load



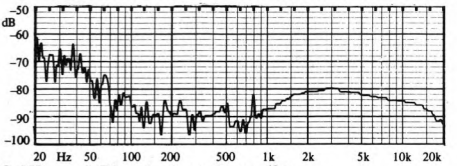
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



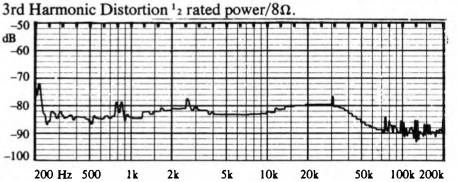
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



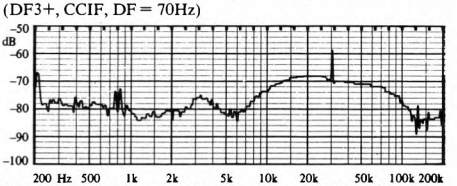
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Technics SU8088K

Technics, National Panasonic UK Ltd., 107-109 Whitby Road, Slough, Berks. SL1 3DR. 0753 34522

Presentation, facilities etc.

One of the newest and largest of Technics' integrated amps, the *8088K* is quite expensive and heavy, but does not look particularly bulky, due to neat 'split' fascia and self-effacing olive brown/green colouring. Although offering complex facilities, the ergonomics are logical and well thought-out, and the standard of finish first class. There are a number of inessential 'luxury' features such as the peculiar indicator lights on tone and mute defeat switches, and these inevitably add to the price without actually contributing to the performance; the reader will have to bear these considerations in mind when assessing value for money.

The comprehensive facilities include fluorescent meters which can be operated 'dim' or 'bright', and at least indicate peak voltages quite reliably. All inputs are phono types, with a built-in head amp on one disc input for direct connection of low output moving-coil cartridges; the two tape connectors provide cross-dubbing. The tone controls have switchable turnover positions, and the centre detent setting is labelled 'defeat'; HF and LF (subsonic) filters, loudness, pre-/power splitting and volume muting are all fitted. The unnecessary 'jargon' front panel label 'straight DC+3DA' rather spoils the subtlety, and presumably refers to a variation on the direct coupling design approach adopted; fair enough to publicise this in propaganda, but why label the amp itself? (In all fairness many manufacturers follow this rather gross practice, some more discreetly than others.)

Lab performance

All inputs and outputs are quite typical and should pose no compatibility problems. The combination of impedance and sensitivity on the moving-coil input should also prove compatible with most models, and is in any case 'buffered' by the very good noise and overload performance.

Measured performance parameters were generally to a very high standard, though the gentle drop to -30dB HF separation could have been better, and a slight increase in swept intermod into loudspeaker load at HF was noted. Asymmetric pulse control was good, though with slow recovery, and the squarewaves were generally tidier than most. The bandwidth showed a similar trait to the Technics separates, varying with the volume control setting, and curiously increasing with power. The value shown was at ref level, and no slew limiting problems could be detected. The meters were the only ones in the tests to give accurate readings on transients.

Power output was quite good, though not exceptional at the price, and showed a significant difference between single and dual channel drive. Delivery was well maintained into low impedances, particularly under 'burst' conditions.

Subjective impressions

Attaining an overall 'above average' rating, this model was well received by a number of listeners, but others retained certain reservations. The first sessions were the most positive, with descriptions of an 'open' sound, albeit with a rather loose bass, good detailing and a feeling of power, marred by less than tight focusing. HF was better controlled than many models, but some listeners felt it was a bit too 'soft' sounding. One of the second session tests gave rather different results, describing sibilant emphasis and HF harshness, but this would seem anomalous as the other came closer to the first

RECOMMENDED

tests in describing a pleasant balance marred by bass 'thickness' and some loss of definition.

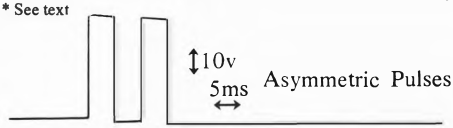
Conclusions

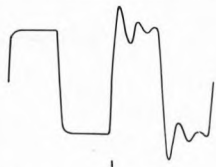
This is undoubtedly a good amplifier, which offers healthy power delivery, comprehensive facilities, a high standard of finish, and good measured performance at an admittedly high price. Our listening tests were also quite positive, and indicate that many will like this model. Its sheer value for money rating must be compromised somewhat by the inclusion of a number of expensive 'inessentials', and the prospective purchaser will have to weigh up their value for himself.

GENERAL DATA

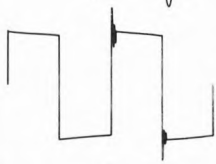
Typical price (inc VAT)	£400
Approx size (w × h × d)	18(45)×5½(14)×14(36) ins (cm)
Approximate weight	31 lbs
Presentation (fascia, case etc)	olive brown
Quality of external finish	v. good
Listening impression summary	above average*
Features and Facilities	
Tape facilities	2 sets, crossdubbing
Tone controls/switchable?	complex/yes
Filters/loudness	HF, LF/yes
Others	fluorescent meters etc.*
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	90/90 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	86/86 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	88/88 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	104/156/176 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	104/156/171 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	110/201/316 Watts
Inputs	
Disc: sockets, impedance/capacitance	2 phono: mm46kΩ/150pf, mc45Ω
Disc: sensitivity 20Hz/1kHz/20kHz	mm0.3/2.85/27.5mV, mc22/150/1 150μV
Disc: overload 20Hz/1kHz/20kHz	mm42/42/42dB, mc37/42/42dB
Tuner: impedance/sensitivity	90kΩ/225mV
Tape phono: impedance/sensitivity	95kΩ/250mV
Tape DIN: impedance/sensitivity	95kΩ/250mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	370mV/490mV/1.0kΩ
Tape DIN: for 5mV disc/for .5V aux/imp	30mV/40mV/83kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	68mV/1.6V/2.5V
Noise (ref 1 watt, A wtg)	
At zero volume	–91dB
Aux, ref vol, 1kΩ source	–81dB
Disc, ref vol, 1kΩ/M75EJ sources	mm–81/–80dB, mc(10Ω)–80dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	85/83/53
DC offsets L/R	–1.5/–2.5mV
Power bandwidth, –3dB ref max power 8Ω disc	4Hz—62kHz*
Total Harmonic distortion (inc noise)	excellent
Intermodulation dist (CCIF 19/20kHz RIAA)	average
Hum performance	very good

* See text

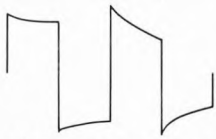




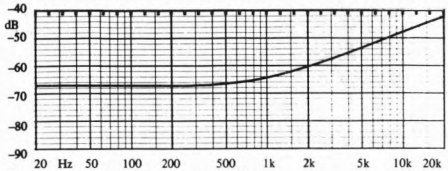
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



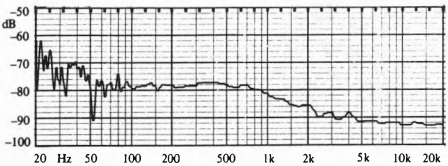
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



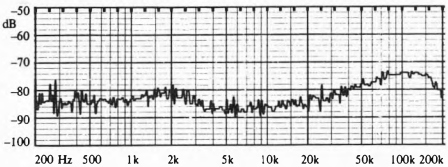
100Hz squarewave
left: 8Ω load
right (if appropriate): 8Ω, LF filter 'in'.



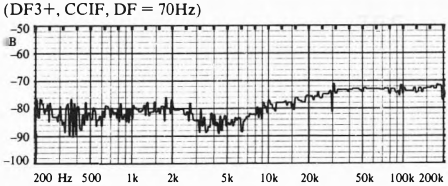
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

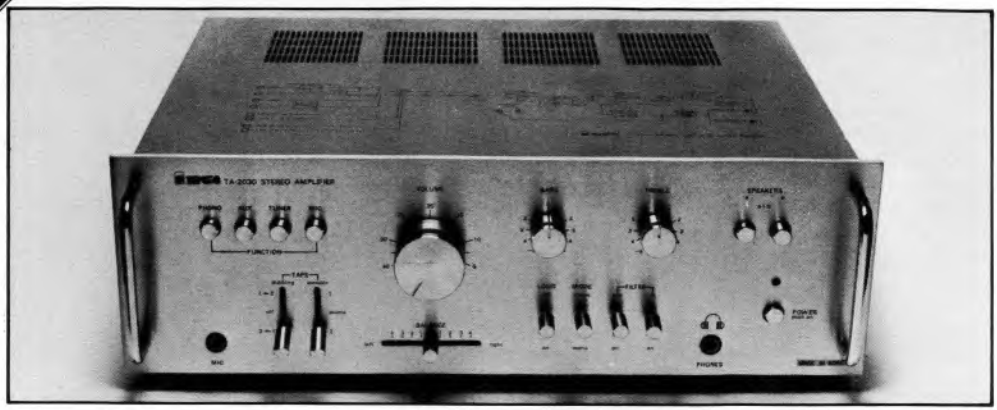


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Tensai TA2030

Tensai, Wren Electronics, Dawson Road, Mount Farm Estate, Milton Keynes, Bucks.



Presentation, facilities etc.

The Tensai range of amps are of Far Eastern manufacture, and are imported and distributed in the UK by the Wren group. Whereas this importer's finely finished but fairly expensive Sakais are intended for franchised specialist dealers, the ultra-competitive Tensais are more cheaply finished, though nevertheless good for the price, and proving worthy contenders in the competitive world of discount sales. The styling is fairly typical of the silly racking handles, the slightly slimmer profile than usual helping to avoid the rather 'squat' look of some competitors at this end of the market.
competitors at this end of the market.

Facilities provided are more comprehensive than one normally encounters at these prices too, with phono inputs DIN duplicated on tape, offering full crossdubbing switching for two machines; a mike input is also provided. Simple tone controls without defeat switching, LF and HF filters and loudness are also provided.

Lab performance

Inputs and outputs give reasonably typical parameters that should give no problems, though the headphone output is as usual a little on the high side.

The performance parameters indicate a number of areas of weakness or compromise that are really only to be expected at the price. Intermodulation distortions were rather on the high side, with a significant rise immediately above the audio band. Noise is quite reasonable, though hum was below average with a rather high 100Hz predominant, so care should be taken to use a speaker with resonance between rather than at 50 or 100Hz. The rise in damping factor at HF is rather unusual. Squarewaves and pulse behaviour were surprisingly clean by any standards. Although the HF bandwidth is restricted to a fairly reasonable 60kHz, it was just possible to start slew limiting within this from 56kHz.

Power output was perhaps inevitably very restricted, but will nevertheless be quite adequate for the modest system. Economies were also evident in the 10% difference between single and dual channel drive, while drive into low impedances was somewhat restricted.

Subjective impressions

Some inconsistency was present in the results for the *2030*. If 'averaging' is adopted, it remains in the 'average' group but nearly makes it into the 'above average' class, which would be very creditable at this price. The first sessions provided the inconsistency, with the amp being described as quite decent if a little coarse and unsubtle with 'hands on', but rather mediocre and unexciting 'blind'. The second tests considered the amp rather undistinguished, lacking power particularly in the bass, but a generally acceptable balance with little of the aggressiveness one normally finds amongst cheaper models.

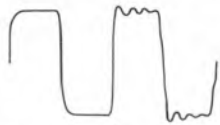
Conclusions

This model combines quite comprehensive facilities and an adequate power delivery and performance for the price, plus a reasonable standard of finish. Despite acknowledged limitations it did not perform at all badly in the

Tensai TA2030

RECOMMENDED

listening tests, and well merits recommendation for the budget system, particularly where ancillaries are likely to produce their own fairly harsh distortions that this amp should avoid emphasising.



10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.

100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.

GENERAL DATA

Typical price (inc VAT) £80
Approx size (w × h × d) ..... 17(43)×5½(14)×14(35) ins (cm)
Approximate weight ..... 20 lbs
Presentation (fascia, case etc) ..... matt silver
Quality of external finish ..... f. good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing, DIN dup
Tone controls/switchable? ..... simple/no
Filters/loudness ..... HF, LF/yes
Others .....

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 29/28 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 8/8 Watts*
Both channels driven 8Ω 20kHz .1% dist L/R ..... 27/27 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω 32/39/20Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 31/36/18 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 39/67/25 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 47kΩ/92pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.34/2.55/23.6mV
Disc: overload 20Hz/1kHz/20kHz 31/33/26dB
Tuner: impedance/sensitivity 88kΩ/160mV
Aux: impedance/sensitivity 88kΩ/160mV
Tape phono: impedance/sensitivity 88kΩ/160mV
Tape DIN: impedance/sensitivity 88kΩ/160mV
MIC ¼Jack impedance/sensitivity 3kΩ/2.6mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 210mV/480mV/4.6kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 65mV/100mV/330kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2. 2kΩ 80mV/1.7V/2.5V

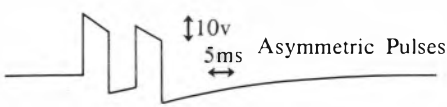
Noise (ref 1 watt, A wtg)

At zero volume ..... -80dB
Aux, ref vol, 1kΩ source ..... -79dB
Disc, ref vol, 1kΩ/M75EJ sources ..... -75/-73dB

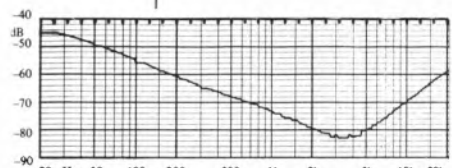
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 136/134/151
DC offsets L/R ..... +13/-20mV
Power bandwidth, -3dB ref max power 8Ω disc ..... 16Hz—60kHz
Total Harmonic distortion (inc noise) ..... above average
Intermodulation dist(CCIF 19/20kHz RIAA) ..... average
Hum performance ..... below average

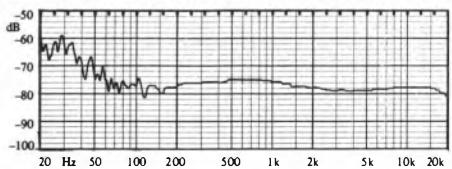
* See text



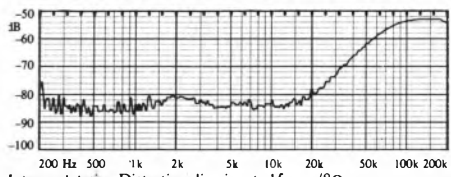
Asymmetric Pulses



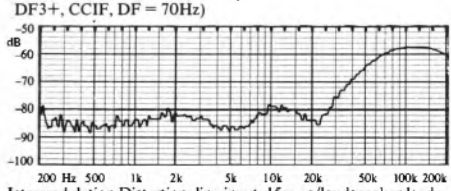
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, DF3+, CCIF, DF = 70Hz)

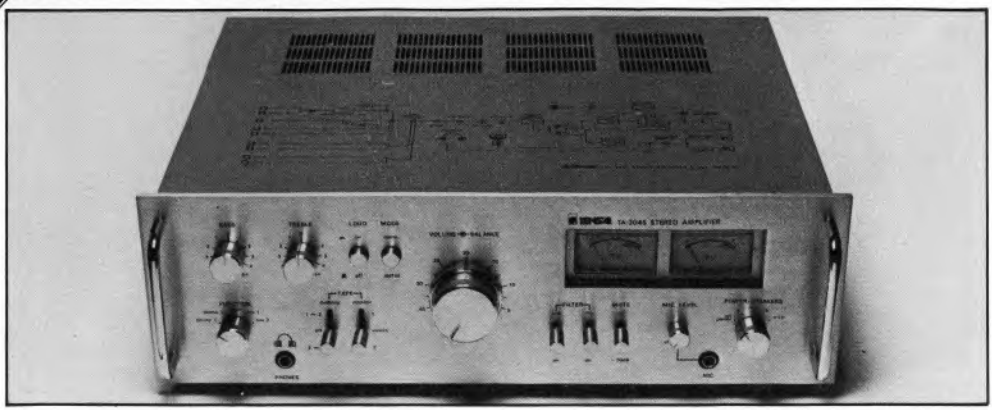


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Tensai TA2045

Tensai, Wren Electronics, Dawson Road, Mount Farm Estate, Milton Keynes, Bucks.



Presentation, facilities etc.

The Tensai *2045* is a step up from the *2030* in this competitive range of electronics imported and distributed by the Wren group, primarily through discount outlets. A 50% power increase and still further facility elaboration seems reasonable justification for the 33% higher price. Finish is fairly decent, and more than adequate, though not to the standards typically found on more expensive ranges. The silver fascia with lower than usual profile sports vestigial racking handles and level meters, and a plethora of knobs and switches; the flatter than usual aspect ratio cleverly tends to give the impression of an amp which is larger and more powerful than in fact is the case.

Phono inputs are provided on a lavish scale for two disc and five high level inputs, one tape connection being DIN duplicated; tape crossdubbing switching is also provided, and a mike input via front panel jack. The simple tone controls do not have defeat switching, and loudness, HF and LF filters, mike level, mono/stereo and muting are all provided.

Lab performance

Inputs and outputs seem to be reasonably typical, and should pose no practical compatibility problems.

Performance parameters were not terribly encouraging, and in a number of areas indicated rather greater compromise than the cheaper model, presumably in order to increase the power output. Noise was adequate, though slightly worse than for the *2030*, and the distortions (harmonic fortunately dominated by the 2nd) were also below average, with the swept intermod and third harmonic rises occurring in the extreme treble of the audio range. The squarewaves and pulse were similar to the 2030, showing quite good control. Despite the fairly sensibly restricted HF bandwidth, slew limiting could be induced above 22kHz.

Power delivery was high for an amp at this sort of price, though it was not very well maintained at the frequency extremes to our spec.; some difference was noted between single and dual channel drive, with reasonable increases into low impedances.

Subjective impressions

Despite its comparatively low price, the *2045* was consistently quite well received by the listeners, comments concerning quite good detail but a degree of 'muddle' and HF 'coarseness' were recorded, together with descriptions of some image 'vagueness' and 'shifting'. Overall results from the first tests were slightly above average, and average on the second, where criticisms of poor definition and harshness were recorded.

Conclusions

The combination of generous facilities, adequate presentation, decent power delivery and a highly competitive price dictates recommendation despite some reservations on the performance parameters. A reasonable rather than inspiring performance on listening tests suggests that this amp will give a lively if rather coarse sound quality, so it should be auditioned with appropriate ancillaries, and will be most suitable for installations where power is important as well as price.

Tensai TA2045

RECOMMENDED

GENERAL DATA

Typical price (inc VAT) £100
Approx size (w × h × d) ..... 17(43)×5½(14)×14(35) ins (cm
Approximate weight ..... 22 lbs
Presentation (fascia, case etc) ..... matt silver
Quality of external finish ..... f. good
Listening impression summary ..... average*

Features and Facilities

Tape facilities ..... 2 sets, crossdubbing, DIN dup
Tone controls/switchable? ..... simple/no
Filters/loudness ..... HF, LF/yes
Others ..... meters, mike input

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 54/54 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 40/40 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 40/40 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 58/81/72 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 60/81/72 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 73/128/100 Watts

Inputs

Disc: sockets, impedance/capacitance ..... 1 phono, 46,kΩ/90pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.38/3.0/30mV
Disc: overload 20Hz/1kHz/20kHz 32/34/35dB
Tuner: impedance/sensitivity 94kΩ/185mV
Aux: impedance/sensitivity 94kΩ/185mV
Tape phono: impedance/sensitivity 94kΩ/185mV
Tape DIN: impedance/sensitivity 94kΩ/185mV
MIC ¼ Jack impedance/sensitivity 13kΩ/3.6mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 210mV/460mV/46kΩ
Tape DIN: for 5mV disc/for .5V aux/imp 65mV/100mV/320kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ 68mV/1.7V/2.5V

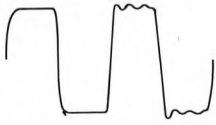
Noise (ref 1 watt, A wtg)

At zero volume ..... –78dB
Aux, ref vol, 1kΩ source ..... –77dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –72/–70dB

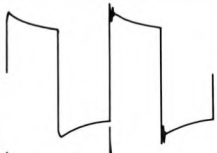
Other technical parameters

Damping factor 30Hz/1kHz/30kHz 125/125/80
DC offsets L/R ..... –52/+4.5mV
Power bandwidth, –3dB ref max power 8Ω disc ..... 14Hz—43kHz*
Total Harmonic distortion (inc noise) ..... below average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... below average
Hum performance ..... below average

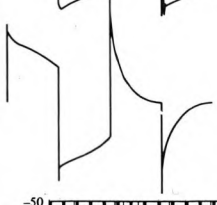
* See text



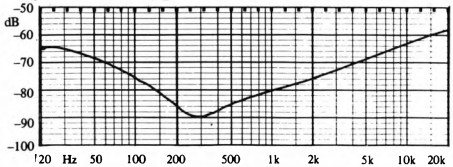
10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load



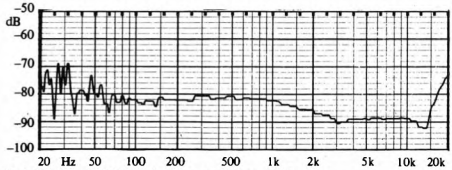
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



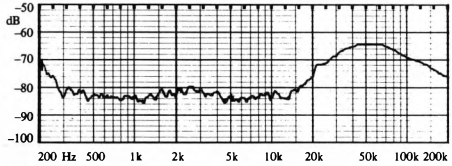
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



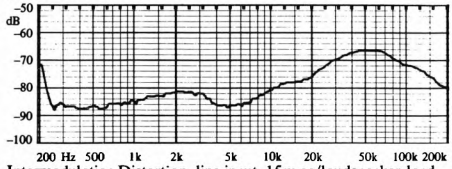
Channel Separation, line input, 1w/8Ω.



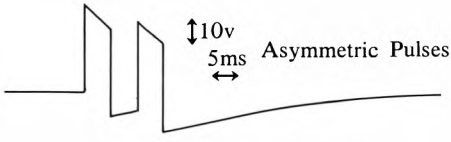
3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω,
(DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load
(TM3), DF3+, CCIF. DF = 70Hz



We want you to hear all of the music.

The ear knows how to deal with gross distortion. It simply stops listening. But what happens when the distortion is so subtle that it is barely perceived? Usually this kind of distortion is accepted by the ear as part of the musical information. It's not until you've listened for a while that you start to sense something isn't quite right, that there's something between you and the music. To some, it's like listening through closed curtains; for others, it's an uneasy, fatigued feeling. What happens, in effect, is that your ears and brain try to listen through the distortion and end up working too hard to hear all of the music.

Harman Kardon's new generation of stereo components are designed, built and tested with new understandings about distortion and what makes one component sound better than another. All Harman Kardon receivers, separates and tape decks are of ultrawideband design for excellent phase linearity and superb transient response (transients are crisp, textures remain clear, open and transparent). The electronics are engineered for low distortion with minimum feedback. Negative feedback is in universal use to reduce conventional forms of distortion. But too much feedback cause TIM (transient intermodulation distortion). At Harman Kardon, we use an 'open loop' design and engineer conventional forms of distortion down to the lowest possible levels without the use of feedback. Then, we add just the slightest bit of feedback to reduce those levels even further while keeping TIM at almost a nonexistent level. You hear all of the music, free from dynamic, as well as static, forms of distortion.

Harman Kardon engineers also use new dynamic list procedures for their cassette decks including critical listening to every sub-component to eliminate or reduce distortion that can be heard but not as yet quantified. Tape drives are designed to eliminate all audible speed variations. Even when they fall outside the scope of conventional measurements. Each of the decks feature ultrawideband response, phase linearity, rugged and precise tape transports, permalloy heads, low noise electronics, Dolby ", and an array of other outstanding features. Whether you use a Harman Kardon stereo cassette deck in combination with Harman Kardon separates or a Harman Kardon receiver, we think you will agree the combination is subtly different and immeasurably better-designed, engineered and tested to let you hear all the music.

Pictured here:

hk670 Twin Powered 60/60 Watts
DC Coupled Ultrawideband AM/FM Stereo Receiver

hk3500 Front Loading Dual Motor
Three Head Stereo Cassette Deck with Dolby "

For complete technical information, write to the following address:

harman/kardon

St. Johns Road, Tylers Green,
High Wycombe, Bucks. HP10 8HR
Telephone: Penn (049 481) 5331

MC 10
MOVING COIL REALISM AT A REALISTIC PRICE

There are as many expert opinions on HiFi as there are experts. With all the variables, an incredible range of systems can be produced and all have their different advantages but almost all experts agree that moving coil is superior to magnetic construction for cartridges.

Moving coil's detailed reproduction of spaciousness, three dimensional imagery and startling transient response surpasses that of even the best magnetic cartridge.

There is really only one choice if you wish to take full advantage of the capabilities of your HiFi system. Until now the high cost of the hand built moving coil cartridge has kept peak performance beyond the reach of all but the most wealthy.

Now Ortofon who have continuously developed moving coil technology since 1948, are able to produce a moving coil cartridge at a price which compares to the cost of medium quality magnetic cartridges.

Ortofon's long experience of cartridge design and manufacture make the finest reproduction available to all discriminating listeners with the MC 10 moving coil cartridge.

The MC 10's cantilever has been designed on new principles, making it easier and faster to produce. It is as light and as rigid as possible, utilizing a new aluminium alloy. The new cantilever design, together with a tiny, specially polished diamond, gives a very low stylus tip mass, excellent tracking ability, easy handling of transients and minimal record wear.

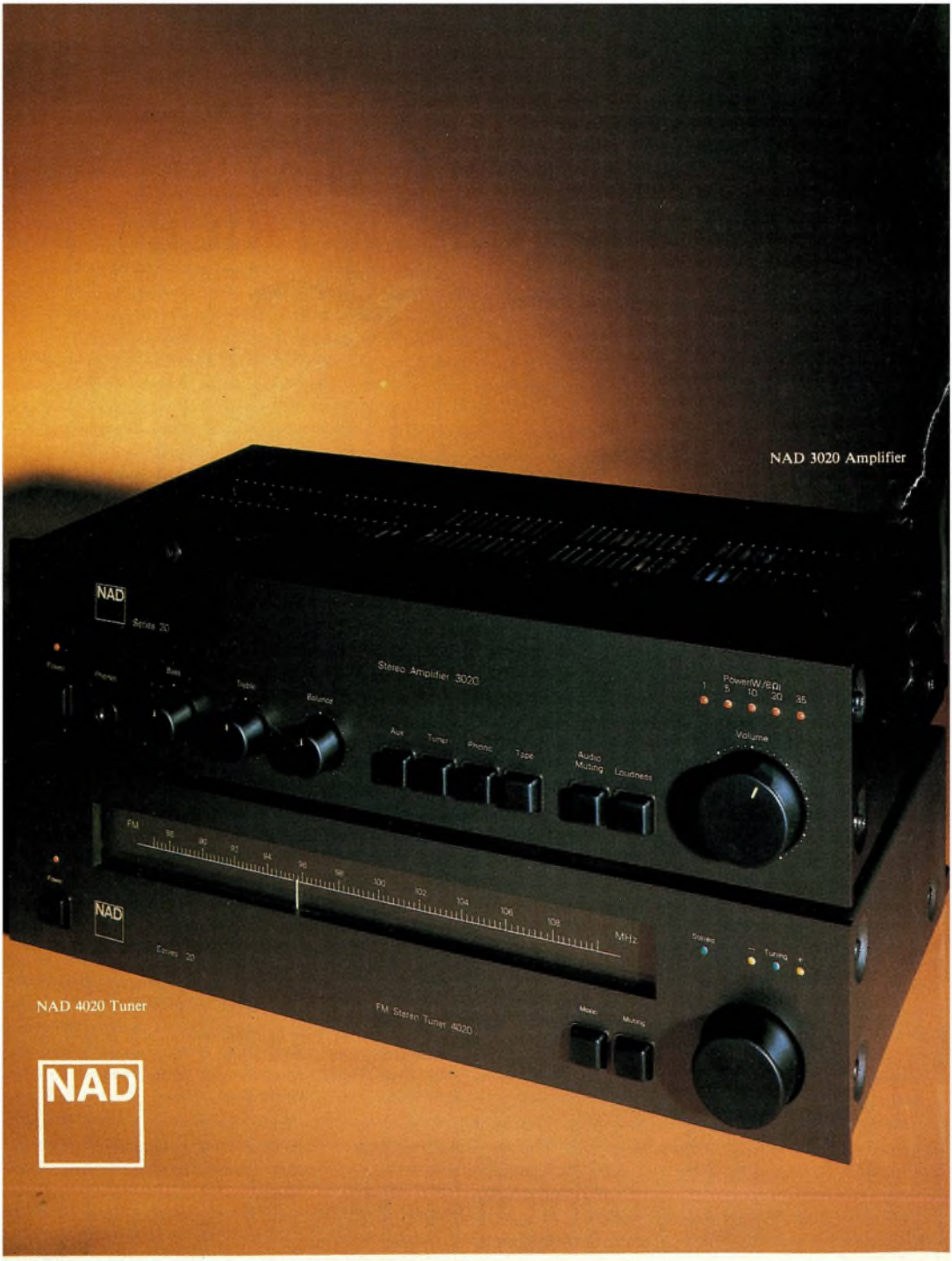
Owing to their small output voltage and low inner resistance, moving coil cartridges cannot be connected directly to a conventional phono input and it is therefore necessary to boost the signal.

MC 10 Cartridges are available separately or in a cost saving pack complete with the specially developed STM 72 step-up transformer for perfect matching to your amplifier.

Ask your dealer for a demonstration or write to:-

ortofon
accuracy in sound

harman UK
St. Johns Road, Tylers Green,
High Wycombe, Bucks. HP10 8HR
Telephone: Penn (049 481) 5331


NAD 3020 Amplifier
NAD
Series 20
Stereo Amplifier 3020
Power/W./8Ω
1 5 10 20 35
Phones
Bass
Treble
Balance
Aux
Tuner
Phono
Tape
Audio Muting
Loudness
Volume
FM
88 90 92 94 96 98 100 102 104 106 108
MHz
Stereo
Tuning
Mode
Muting
FM Stereo Tuner 4020
NAD 4020 Tuner
NAD

NAD 3020 AMPLIFIER

BEST BUY

Specification

Continuous average power output at 8 ohms (min. RMS power per channel, 20-20kHz both channels driven with no more than the rated distortion)	20W
Dynamic headroom at 8 ohms	+3dB
Dynamic power output (maximum short-term power output per channel)	
8 ohms	40W
4 ohms	60W
2 ohms	80W
THD (Total Harmonic Distortion, 20-20kHz), from 250mW to rated power output	<0.02%
SMPTE IM (Intermodulation Distortion 60Hz + 7kHz 4:1) from 250mW to rated power output	<0.02%
IHF IM (CCIF IM Distortion, 19k + 20kHz) at rated power output	<0.02%

Preamplifier Section

Phone Inputs	
Input sensitivity re rated output	2.5mV
re 1 watt output	0.6mV
Signal-to-noise ratio, A-weighted ref. 5mV with cartridge connected	>75dB
Channel separation	>50dB
High Level Inputs	
Signal-to-noise ratio, A-weighted ref. 1W	>90dB
Channel separation	>60dB
Frequency response	±0.5dB, 20-20kHz
Infrasonic filter (24dB/octave slope)	—3dB at 15Hz
Ultrasonic filter (12dB/octave)	—3dB at 35kHz

PRICE AT TIME OF GOING TO PRESS £69·00

NAD 4020 TUNER

This new tuner from NAD takes advantage of the current dramatic advances in FM tuner circuitry to give extremely high performance for just £69.

The front end of the NAD 4020 provides for the connection of either a 75-ohm or 300-ohm antenna cable, and employs a dual-gate MOSFET RF amplifier, producing a good combination of sensitivity, resistance to cross modulation from strong signals, and rejection of interfering signals.

Stereo multiplex decoding is performed by a new phase-locked-loop (PLL) IC for low noise and superb stereo separation. The PLL decoder also yields minimum distortion in stereo reception.

The NAD 4020 tuner has LED indicators for tuning and signal strength, the latter having the dual function of correct tuning within +25kHz guaranteeing lowest stereo distortion, and indicating signal strength by proportional brightness.

NAD 4020 Specification

Input sensitivity IHF, 50dB S/N mono	<3.5μV (16dBf)
S/N stereo	<35μV (36dBf)
Signal-to-noise ratio, A-weighted mono/stereo	74dB/68dB
Selectivity, alternate channel	70dB
THD and IM Distortion at 100% modulation, stereo	<0.3%

PRICE AT TIME OF GOING TO PRESS £69·00

NAD

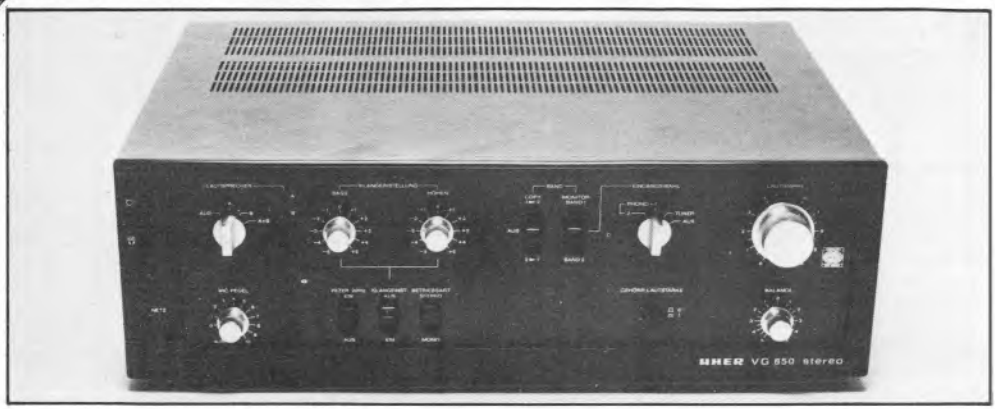
NAD Sales Ltd., 60 Farringdon Road, London E C1. Tel: 01-251 4631.

The above products, being brand new on the market, were not available in time for testing by Hi-Fi Choice but in the opinion of the distributors they represent one of the "best buys" on the market today.

RECOMMENDED

Uher VG-850

Uher Ltd., 24 Market Place, London NW11. (01) 455 1771



Presentation, facilities etc.

This amp is of German design, but appears to be of far eastern manufacture; it is finished in black throughout but with some surface contrast highlighting the fascia. All the legends are in German (!), but the layout is logical enough to prevent any confusion on the main functions, though some of the extra facilities caused a little perplexity.

The standard of finish was very good overall, and the pre-amp was one of the most versatile of all in providing socketry to DIN and phono standards, all the main inputs and speaker outputs being duplicated. Microphone and headphone sockets were to DIN standard, and ancillaries so equipped are a little unusual in the UK. Crossdubbing was provided between the tape connections, and the simple tone controls were fitted with a defeat switch, and a subsonic filter and loudness were also provided.

Lab performance

The disc input is fairly normal apart from a slightly lower than normal sensitivity, though this is unlikely to be of practical significance except perhaps when using some of the lowest of the high (or highest of the low) – output moving-coil models; this will in fact to some extent protect the overload margin which is lower than normal, but again unlikely to be cause for concern. Other inputs and outputs should be fine, although the headphone socket gives a rather high output for high impedance designs (which many models available with DIN connectors are.)

Most of the measured performance parameters were fine, though the bandwidth was rather wide, as any high energy signals above 30kHz could cause a form of slew limiting which is to be avoided, so a cartridge with restricted HF extension and fast rolloff is likely to be a sensible choice. A rather curious 'hump' is seen centred on 30kHz in the swept intermod into loudspeaker load; we can offer no explanation, but it could be indicative of a potential troublespot in the design. The square-waves showed some ringing into reactive loads which is also perhaps undesirable, although the LF phase shift is unlikely to have adverse effects.

The *VG850* showed good power delivery for its price into an 8ohm load, though perhaps surprisingly for a continental design, where 4ohm speakers are still common, it showed steadily reducing powers into low impedances. As the tonebursts followed a similar trend this is presumably a function of the power amp design. The power delivery showed more or less normal variation between single and double channel drive. Separation measurements were however somewhat below average.

Subjective impressions

The *VG 850* produced some of the least consistent results on the listening, so our results should perhaps not be treated too seriously! The first sessions were not encouraging, with a predominant dimness described, which was disliked, and a detached 'soggy' bass giving a generally 'thickened' sound.

The second sessions produced some similar characterisations, but the reactions these provoked were much more positive; the amp was considered smooth pleasant and relaxing at normal levels, tending to become a bit harsh and 'lumpy' when driven harder.

RECOMMENDED

Conclusions

This model would appear to offer versatile facilities and quite high power capability for a fairly reasonable price. The technical performance seemed adequate with certain qualifications, and the subjective results were reasonable though gave contradictory conclusions. We therefore must suggest that the purchaser should determine for himself whether the sound quality appeals.

GENERAL DATA

Typical price (inc VAT) £165
Approx size (w × h × d) ..... 17 (44) × 6 (15) × 13 (33) ins (cm)
Approximate weight ..... 20 lbs
Presentation (fascia, case etc) ..... all black, contrasting finish
Quality of external finish ..... v. good
Listening impression summary ..... average

Features and Facilities

Tape facilities ..... 1 DIN, 1 phono, crossdubbing
Tone controls/switchable? ..... simple/yes
Filters/loudness ..... subsonic/yes
Others ..... mike input (DIN socket)

Power Output

Both channels driven 8Ω 1kHz .1% dist L/R ..... 80/78 Watts
Both channels driven 8Ω 20Hz .1% dist L/R ..... 74/72 Watts
Both channels driven 8Ω 20kHz .1% dist L/R ..... 60/70 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 91/64/28 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω ..... 89/49/23 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω ..... 133/120/68 Watts

Inputs

Disc: sockets, impedance/capacitance ... 1 DIN, 1 phono, 43Ω/215pf
Disc: sensitivity 20Hz/1kHz/20kHz 0.38/3.4/31mV
Disc: overload 20Hz/1kHz/20kHz 34/34/30dB
Tuner: impedance/sensitivity 54kΩ/200mV
Aux: impedance/sensitivity 54kΩ/200mV
Tape phono: impedance/sensitivity 62kΩ/200mV
Tape DIN: impedance/sensitivity 62kΩ/200mV
Mic DIN impedance/sensitivity 5.0kΩ/1.8mV

Outputs

Tape phono: for 5mV disc/for .5V aux/imp 256mV/440mV/380Ω
Tape DIN: for 5mV disc/for .5V aux/imp 62mV/75mV/115kΩ
Headphones: for 5mV disc, ref vol, 8Ω/470Ω/2.2kΩ 80mV/1.7V/2.4V

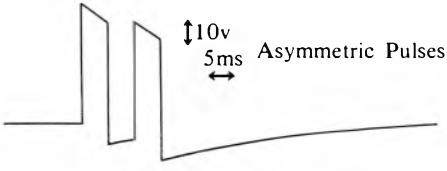
Noise (ref 1 watt, A wtg)

At zero volume ..... –82dB
Aux, ref vol, 1kΩ source ..... –73dB
Disc, ref vol, 1kΩ/M75EJ sources ..... –72/–69dB

Other technical parameters

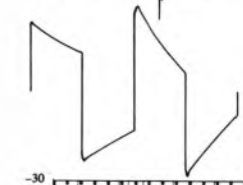
Damping factor 30Hz/1kHz/30kHz 60/60/37
DC offsets L/R 79/79
Power bandwidth, –3dB ref max power 8Ω disc ..... 8Hz—90kHz*
Total Harmonic distortion (inc noise) ..... Average
Intermodulation dist (CCIF 19/20kHz RIAA) ..... Average
Hum performance ..... Above Average

* See text

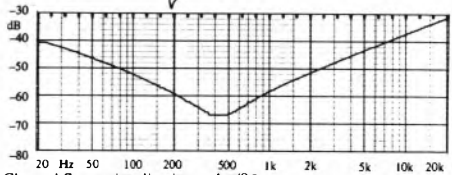


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

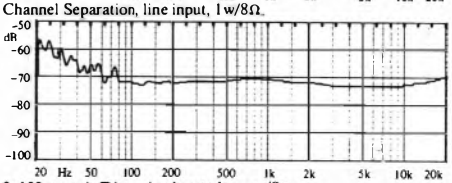
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



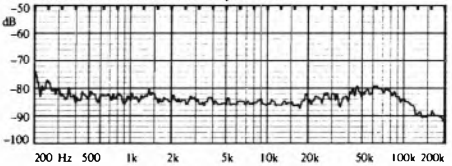
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



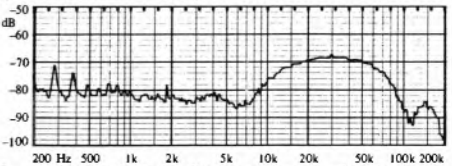
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)

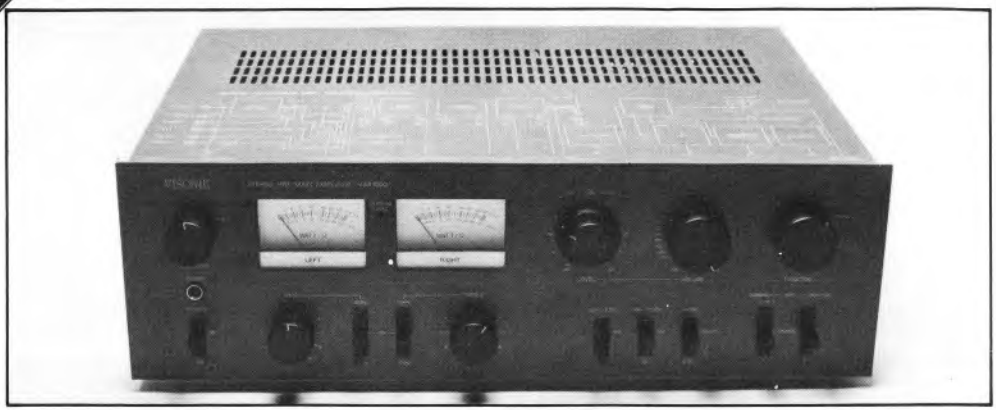


Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

RECOMMENDED

Visonik VSA 1000

Visonik, Uher Ltd., 24 Market Place, London NW11. (01) 455 1771



Presentation, facilities etc.

Visonik is a German company, although the manufacturing of this amplifier would appear to have been carried out in the Far East; however the styling is pleasantly European, and good input versatility with DIN and phono duplication is provided. Finish is matt dark grey with matching knobs and white lettering (in English!) The front panel is dominated by two power meters, which are at least labelled watts/Ω and these are more usefully supplemented by a peak reading LED. Not having an instruction manual, we were a little bemused by the 'loudness' function; to start with the selection switch is on the rear panel! While we still do not feel we have truly mastered this yet, it appears to be used in conjunction with the two volume controls to set the level below which progressive loudness contouring is thereafter provided automatically, according to the specific loudspeakers, room acoustics etc that one listens under. While we remain sceptical about the value of loudness *per se*, many people presumably like using the things, and this arrangement should allow rather more careful tailoring to situations and subtlety in operation than most.

All major inputs and outputs are DIN/phono duplicated, with crossdubbing between tape connectors and pre-/power split available. Switchable turnover points and defeat are offered on the tone controls, together with HF and LF filtering. Some mechanical hum was noted on our sample.

Lab performance

Sensitivities etc are quoted with both volume controls maximum, and should match ancillary equipment without problems, though some increase in disc input capacitance may be desirable for some cartridges.

Hum figures were fine on line inputs, but became only marginally acceptable on disc via headphones. The clipping indicator operated at 50watts equivalent, so there is a reserve to help avoid the 60kHz slew limit problem noted at full power (80watts). The wide overall bandwidth to 95kHz can permit these slewing problems, and would have been better curtailed. The swept intermod shows a supersonic rise, accompanied by some extra rise with speaker load, but only at high frequencies. Squarewaves showed some HF ringing on capacitive load, and a slight overshoot on asymmetric pulse.

Power output was quite generous for the price, but with significant single/dual drive difference. Delivery was quite well maintained into low impedances, with a comfortable toneburst excess available.

Subjective impressions

In the first sessions the Visonik was generally liked, with a slightly rich balance and rather soft sound, perhaps a little heavy in the bass. Reservations concerned some hardening in the treble as levels increased, and a suggestion of nasality in the midband. The second sessions confirmed these findings quite closely, and some felt that the definition was slightly suspect; however the amp was again generally liked and few criticisms were voiced. Mechanical hum was noted.

Conclusions

This amp offers a healthy power output with good versatility, finish, adequate rather than inspiring

Visonik VSA 1000

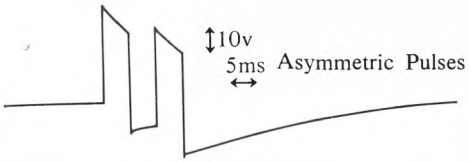
RECOMMENDED

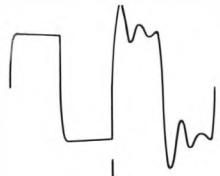
measurements, and comprehensive facilities at a realistic price. Furthermore our listening tests gave consistently high marks, and while we recommend pre-purchase listening, this model clearly merits recommendation.

GENERAL DATA

Typical price (inc VAT)	£250
Approx size (w × h × d)	17(40)×5½(13)×13(31) ins (cm)
Approximate weight	24 lbs
Presentation (fascia, case etc)	dark grey
Quality of external finish	v. good
Listening impression summary	f. good
Features and Facilities	
Tape facilities	2 sets, crossdubbing, DIN dup
Tone controls/switchable?	complex/yes
Filters/loudness	HF, LF/complex
Others	meters, LED
Power Output	
Both channels driven 8Ω 1kHz .1% dist L/R	81/82 Watts
Both channels driven 8Ω 20Hz .1% dist L/R	78/78 Watts
Both channels driven 8Ω 20kHz .1% dist L/R	80/80 Watts
Left channel only 1kHz .1% dist 8Ω/4Ω/2Ω	95/132/128 Watts
Right channel only 1kHz .1% dist 8Ω/4Ω/2Ω	95/132/128 Watts
'Burst' power, 1kHz 8Ω/4Ω/2Ω	133/211/183 Watts
Inputs	
Disc: sockets, impedance/capacitance	DIN or phono, 51kΩ/40pf*
Disc: sensitivity 20Hz/1kHz/20kHz	0.36/3.1/29mV
Disc: overload 20Hz/1kHz/20kHz	34/33/26dB
Tuner: impedance/sensitivity	100kΩ/195mV
Aux: impedance/sensitivity	100kΩ/195mV
Tape phono: impedance/sensitivity	100kΩ/195mV
Tape DIN: impedance/sensitivity	100kΩ/195mV
Outputs	
Tape phono: for 5mV disc/for .5V aux/imp	310mV/460mV/720Ω
Tape DIN: for 5mV disc/for .5V aux/imp	75mV/120mV/266kΩ
Headphones: for 5mV disc, 8Ω/470Ω/2.2kΩ	130mV/1.9V/2.5V
Noise (ref 1 watt, A wtg)	
At zero volume	–96dB
Aux, ref vol, 1kΩ source	–87dB
Disc, ref vol, 1kΩ/M75EJ sources	–78/–78dB
Other technical parameters	
Damping factor 30Hz/1kHz/30kHz	69/69/54
DC offsets L/R	6/4mV
Power bandwidth, –3dB ref max power 8Ω disc	10Hz—95kHz
Total Harmonic distortion (inc noise)	average
Intermodulation dist (CCIF 19/20kHz RIAA)	average
Hum performance	below average

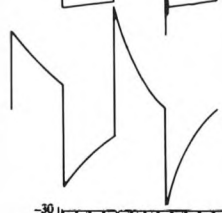
* See text



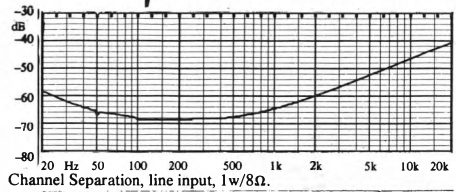


10kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load

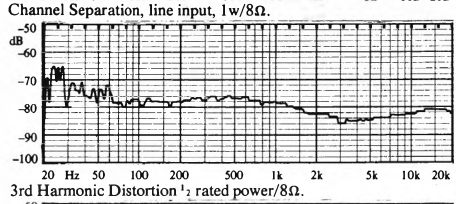
1kHz squarewave
left: 8Ω load
right: 8Ω + 2μf load.



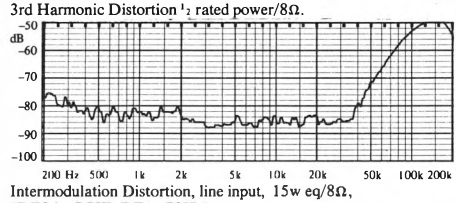
100Hz squarewave
left: 8Ω load
right (if appropriate):
8Ω, LF filter 'in'.



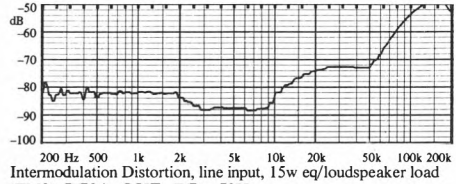
Channel Separation, line input, 1w/8Ω.



3rd Harmonic Distortion ½ rated power/8Ω.



Intermodulation Distortion, line input, 15w eq/8Ω, (DF3+, CCIF, DF = 70Hz)



Intermodulation Distortion, line input, 15w eq/loudspeaker load (TM3), DF3+, CCIF. DF = 70Hz

Hi-fi at home

Tensai introduce a neat touch. . .

The Tensai system TS-4 is a combination of perfectly matched Hi-Fi components housed in a beautifully styled, walnut veneered unit. The system comprises models: TFL-805 Dolby* cassette deck, TA-2045 stereo amplifier, TT-3045 MW/LW/FM stereo tuner, TD-855D direct drive turntable and TS-950 4-way, 50 watt loudspeaker system.

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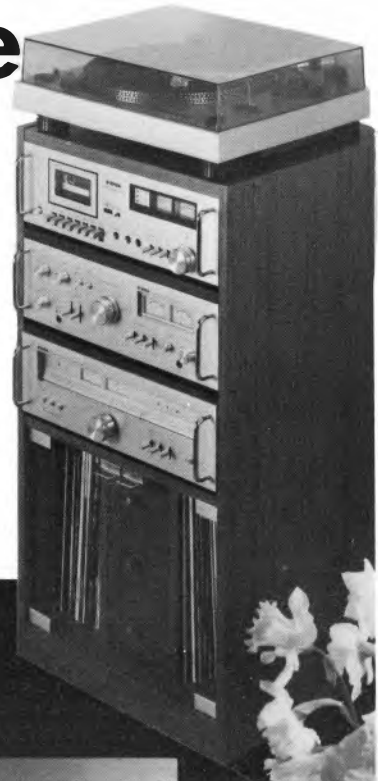
TS-4 – a part of the Tensai systems range.

*Dolby is a trade mark of Dolby Laboratories, Inc.



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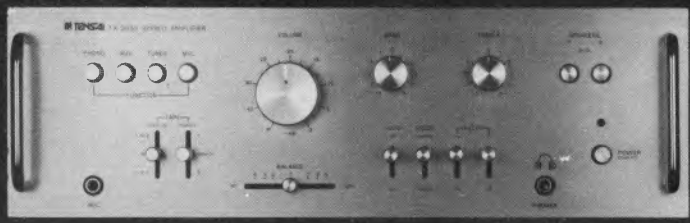

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Conclusions

When we began this project, we personally felt that amps were important influences on the sound quality of a hi-fi system. At the same time we were aware that multiple listening tests (which are the only way in which such a large number of models can possibly be handled) are by no means a reliable means of comparing power amps, although we felt that differences were likely to be greater and more reliably observed with the complete integrated amplifier or pre-/power combination being assessed.

Now that the project is over, our opinions on sound quality differences remain unaltered, and we feel that the listening tests undertaken were both worthwhile and managed to give a reasonable degree of reliability. The decision to try and self-regulate our results by carrying out a minimum of four independent sessions was bound to give rise to some inconsistencies, not only because of the problems of keeping one's bearings and judgements reliable through a hard days' listening, but also because we quite deliberately varied the listening conditions somewhat, so that a fixed set of conditions could not somehow favour one particular design.

In point of fact many of the inconsistencies seemed less related to observations regarding sound quality, than to the reactions of different individuals to those observations. The personal reaction of an individual and his particular tolerance of different shortcomings is one of the hardest things to gauge, yet in the ultimate analysis it is what is really important. So where subjective reactions on our tests were quite critical or inconsistent, we have deliberately recommended that the prospective purchaser should confirm or deny our findings for himself. Indeed we would emphasise again that amp purchase should not be made without prior listening, and that the conditions under which this takes place should be as close as possible to the final situation in the domestic system and surroundings.

Perhaps the most intriguing and satisfying aspect of the listening tests was that amps that we knew fairly well from previous extended experience showed an impressive ability to reinforce these long term prejudices under blind conditions! For example the A&R *A60*, which has attracted plenty of favourable comment concerning its sound quality over the last couple of years, was consistently highly rated under blind conditions; and we feel that this and similar findings on other familiar amps does help vindicate our findings. Incidentally we make no apology for concentrating on listening *via* the disc input; not only is this the toughest for the amplifier, it is also the prime signal source for serious domestic listening, as mastertapes are only available to a tiny minority, musicassettes still offer no real competition, and FM radio usually arrives via second rate disc replay, with live broadcasts both unpredictable and schedule-dependent.

Essentially the listening confirmed our belief that there is no such thing as the perfect amplifier — far from it in fact. The general trend that seemed to emerge was that some amps were more capable than others at revealing musical detail; the snag was that the greater detail often seemed to be accompanied by extra 'nasties' and/or insufficient control. The most highly favoured designs were those that achieved a good compromise between these two extremes, and it is here that personal prejudice can have a significant effect, when the listener has to judge to what extent 'nasties' are acceptable.

Trends also showed that most designs mainly got into trouble at the frequency extremes. In order to avoid unpredictable HF frequency response variations, we were compelled to use low inductance cartridges which inevitably have an extended HF response, and this may have contributed to criticisms that may not be quite as relevant with a more limited bandwidth device. It is less easy to make excuses for LF misbehaviour, as the source was cleaner than most, usually with modest LF resonance rise at a reasonably high frequency (> 10Hz), and the speakers also tended to be dynamically fairly stable at resonance; perhaps the recent suggestion that amps don't drive speaker resonances very well at all is becoming vindicated?

Another very generalised finding, which certainly did have exceptions was that the more expensive and higher powered amps did tend to sound better, and not merely louder. It would be tempting to summarise our findings largely on the basis of power *vs* price, but we did tend to find that the cheapest amps of a certain power rating were the least 'tidy', and hence often the least acceptable. Adding a little money somewhere amongst the 'rude electronicals', perhaps by improving the power supply, for example, tended to give subjective improvement by improving control without (hopefully) losing detail.

If we now turn to the measurements, there is no getting away from the fact that measuring amps is

When a test record is cut, a tiny amount of wow and flutter creeps into it from the wow and flutter of the cutting machine.

We ought to know.

We make what is probably the world's most accurate test record.

And we found that it wasn't accurate enough to measure the extraordinary low level of wow and flutter on our new series 2000 record decks.

Before we tell how we solved the problem, let us tell you how we caused it.

What's wrong with quartz.

Most advanced record decks use an oscillating quartz crystal to help control the revolutions of the platter.

As quartz oscillates accurately at about 1.3 million vibrations a second it makes a perfect standard to judge the speed of the platter.

That's why we use quartz at Denon.

But, and it's a big BUT, quartz does not make a deck accurate. It only measures accurately the inaccuracies in speed rotation.

To make the deck accurate in the first place, we had to invent a new type of servo-mechanism.

We check the speed 500 times a second.

Most advanced record decks have a system that checks their speed about 100 times a second.

That might seem a lot. But, as their specifications reveal, it allows the level of wow and flutter that we at Denon find unacceptable.

So we developed our completely new magnetic pulse system.

First, each platter is placed on the shaft of a special pulse wheel.

Then a magnetic coating of 1000 pulses is recorded on the inside of the platter rim.

Each individual magnetic pulse is placed to within an accuracy of 1 in 10,000.

Then, when the platter revolves the special magnetic head measures the rate at which the 1,000 pulses are passing.

This data is turned, via integrated circuits, into an electronic speed signal and then compared with the electronic speed signal given off by the quartz signal.

Any deviations lead to an instant electronic instruction to the motor.

This means that any speed errors caused by disc warp or excessive tracking pressure are corrected.

So the wow and flutter of the DP 2500, for example, at 0.015% WRMS, is a specification you get in practice. Not just one we get in our laboratory.

The new tests we developed.

With this specification, it's clear that a conventional wow and flutter testing system would only be measuring the inaccuracies inherent in that system.

Why a test record failed

So we developed a magnetic pulse system similar to that used in the deck itself. This gives a degree of accuracy greater than ever previously reached in record deck testing.

We also, incidentally, had to develop a new type of lacquer disc to measure the signal to noise ratio. The 75 DB level was so low, a conventional test record actually creates more noise than our deck itself

AC makes less rumble than DC.

We come now to another revolution in our record deck: an AC motor.

The snag with DC motors is that small amounts of audio contamination are caused by the pulse surge of direct current. By definition, these surges are directly linked to platter speed and it shows up as rumble

Denon have developed a linear flow AC motor that overcomes this problem. And with extra coils and a clean AC voltage system the conventional problems of an AC motor are also overcome.

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*Price without arm. Price with arm is £336

a very frustrating business, and interpreting the measurements even more so. The fundamental trouble is that we are posing questions that have been determined by the current state of measurement technology, rather than by theoretical or philosophical rationale. By the time we have carried out many hours work on each amp, a picture has begun to emerge that does seem to give occasional clues as to how the amp performs subjectively. But one can never extrapolate reliably, so it is fairly obvious that our measurements remain crude tools that are as yet incapable of fine discrimination. Witness the Sony PWM digital amp review: this model certainly did not perform all that well on the measurements that we have derived from testing analogue amps, and yet results on listening were quite favourable; is this not sufficient evidence that the questions need to be improved?

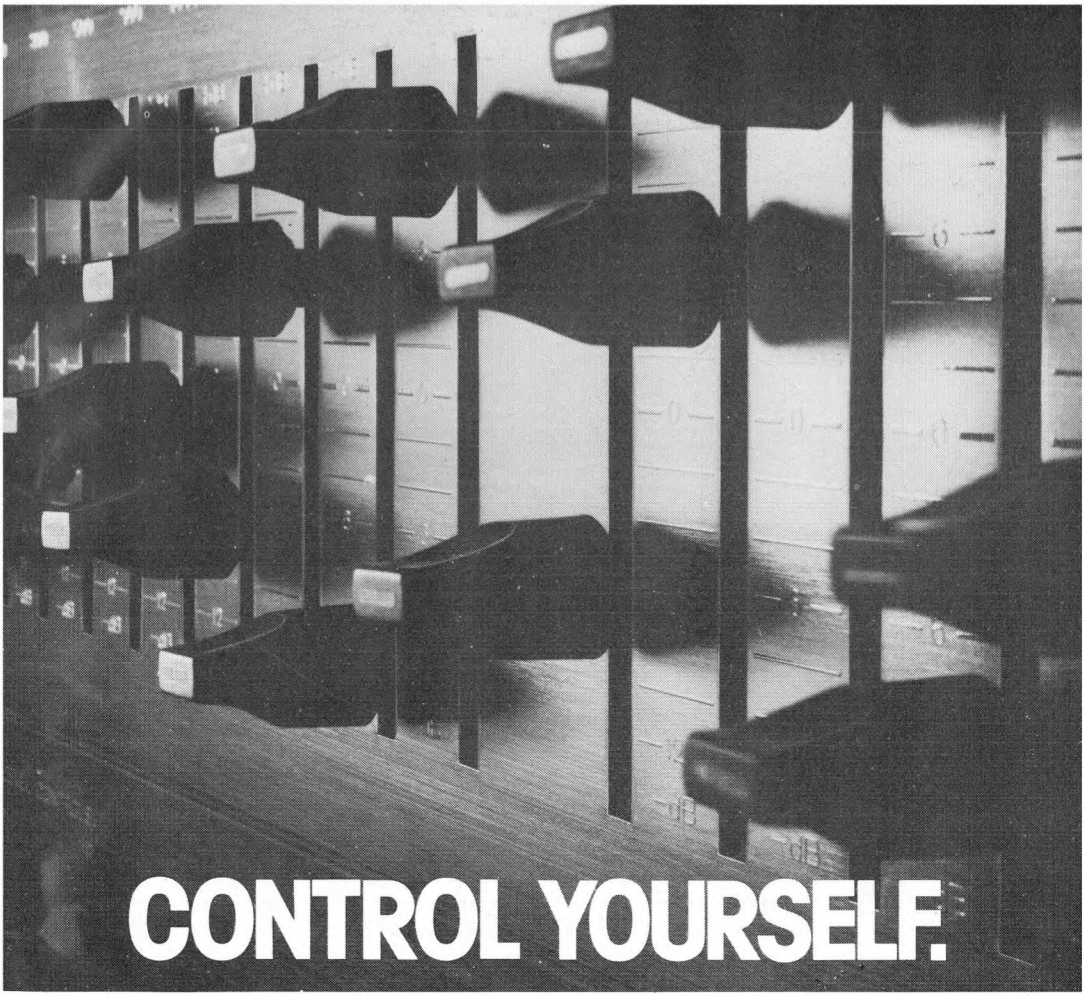
Despite the crudity of current measurement techniques, there do appear to be some general indicators towards practical design considerations that give subjective benefits. The first of these is to avoid the amp receiving a signal that upsets it, and it appears this may be most easily accomplished by bandwidth limiting at the inputs. While there may be fundamental philosophical objections to introducing such compromises, if one accepts that amps are imperfect, it makes some sense to take practical steps to avoid their imperfections, even if this involves sacrificing some philosophical chimerae in so doing! So with the present state of the art, bandwidth limitation may be a small price to pay to avoid introducing some of the cans of worms that appear to lie at the frequency extremes.

The second area which appears to give some subjective correlations is in the matching of stages within the amp, so that no stage runs out of powr or passes signals on to the next stage which cannot be handled. A rigorous application of Murphy's law, which implies that if something can potentially go wrong then it almost certainly will go wrong, would probably pay dividends in certain cases. Subjective correlations in this area remain somewhat vague, but this is perhaps because we do not fully understand all the mechanisms yet, and cannot reliably establish cause and effect.

A third area that also seems to give subjective advantages, providing the potential has not already been thrown away earlier in the chain, is in the approximation to the voltage source, *ie* how independent the amp remains of the load being applied to it. By and large we find that the ability to drive low impedances, and by implication cope with complex loads, does give benefits, but only if the bandwidth and internal control of the amp has already been established; if not, one merely creates an amp that delivers a dirty signal better!

The final area where some correlations were noted is the whole business of cleaning up the signal path, by properly bypassing or omitting tone controls, fitting decent unswitchable speaker sockets and suchlike. There is no way of proving that such techniques do work, but those amps where such techniques have been applied often seem to do pretty well in listening tests! Perhaps the execution of the technique is less important than the attitude of mind of the designer who instituted it, and who consequently tackled other problems from a 'purist' stance!

Perhaps inevitably this survey has ended up with a lot of questions unanswered. Certainly we are left realising how limited our knowledge is, and with enough new ideas to keep us exploring for a lot longer. We would not wish to claim that the results are in any way authoritative, but they represent an honest attempt to come to terms with a difficult problem area. We at least hope and believe that they have some validity, however proving it would be another matter entirely!



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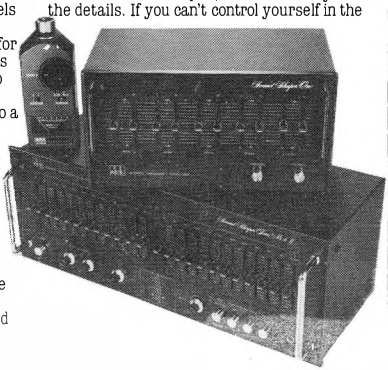

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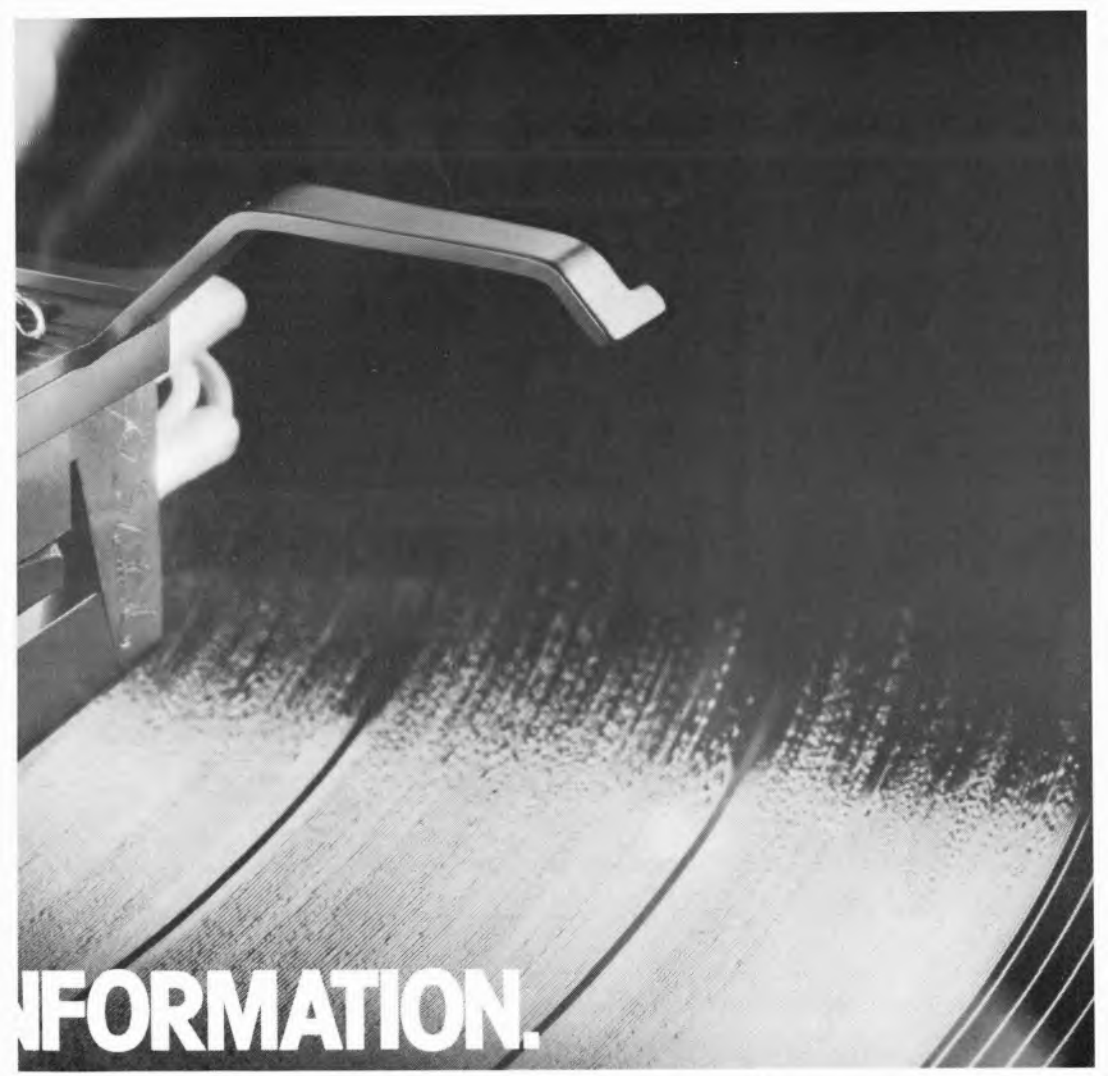

acknowledged contenders in the 'best cartridge currently available' stakes. (Remember the ADC 10E, and the legendary ADC 25 and 26?)

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Our LMF carbon fibre tonearms have been attracting similar comments. "Firm, extended low frequency range...neutral mid-band ...precise stereo imaging...the LMF-1 gains a recommendation..." (Hi-Fi Choice).

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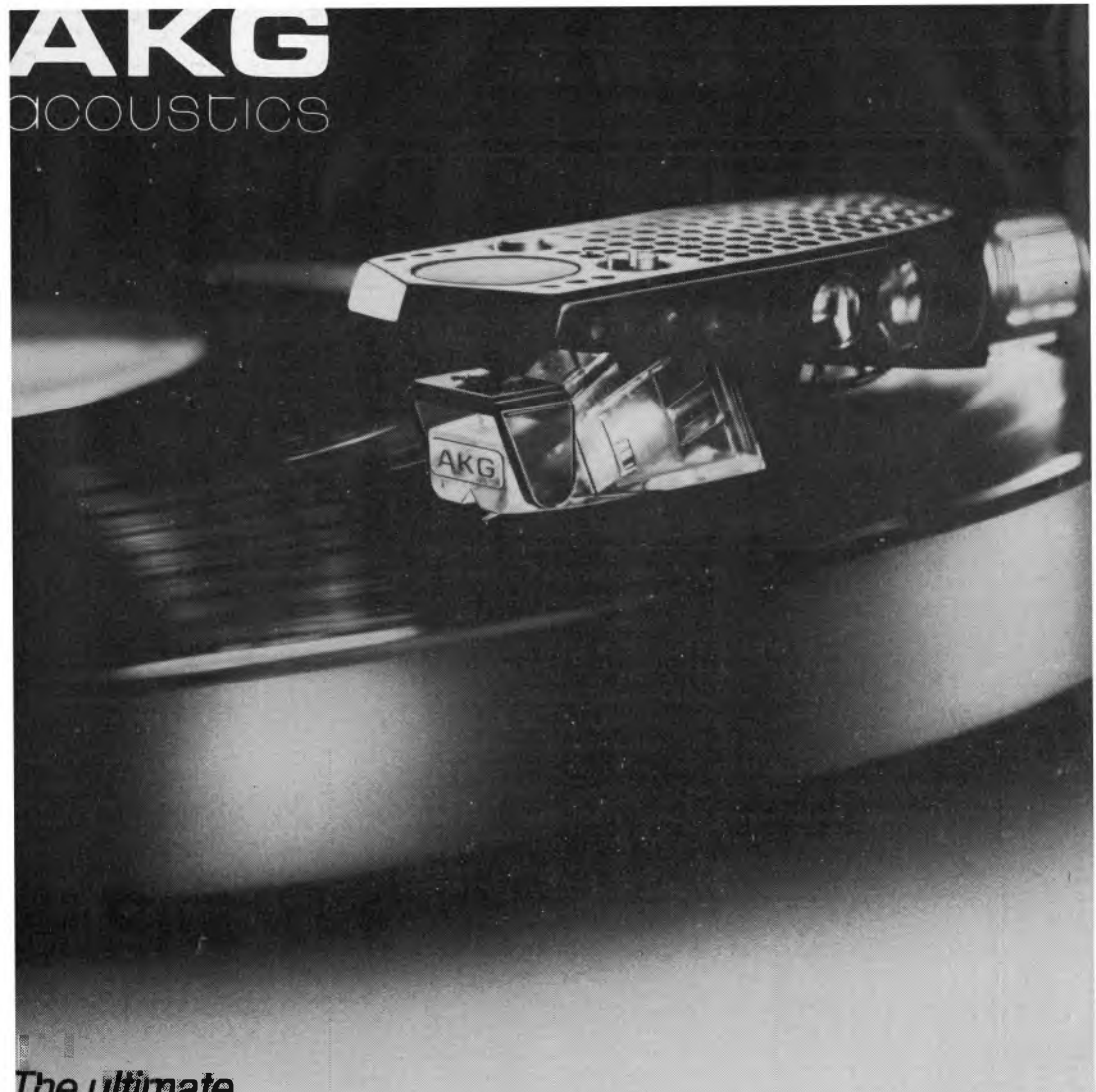

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This is always the most difficult part of a Choice project to put together, doubly so with amplifiers where the criteria for making value judgements remain vague if not indefinable. If we examine the performance measurements it is quickly clear that very few amps actually produce results which one could positively say are responsible for audibly undesirable effects, and indeed one can point to examples where quite poor measurement results in some areas have not appeared to prejudice sound quality (Sony *88* combo, Cambridge *P80.*) Indeed there is rather better corellation between listening and measurement if one goes the other way, because the amps which sounded best under our conditions tended to be the ones that didn't measure extravagently well!

The easiest way to assemble a list of 'Recommendations' would merely be to examine price *versus* power, but as soon as one examines this closely it is clearly full of pitfalls: first because ways of specifying power or indeed designing power vary considerably (compare the pulse-locked Sonys, and Spendor and Quad designs with the Sansui *919*, Technics *8088K* and Meridian *105.*) Secondly power is needed to drive loudspeakers, and these vary quite significantly in their static impedances — even ignoring any possible dynamic effects — and one should not really consider the amp without an eye on the loudspeaker to be used. Thirdly one should not overestimate the importance of differences in power: doubling the power output, with all other things equal, does give an increase in available loudness, but a disappointingly small one; to double the perceived loudness requires ten times the power, which is roughly the difference between the least and the most powerful amps in the book! And the power output is not always the same as the maximum loudness, which really depends more on the various types of distortion generated by the different elements of the system when working hard, and the user's susceptibility to them; the amplifier plays its part of course, but it is not an entirely predictable one.

So price/power is a criteria for judgement, but not an all powerful one, because the power of an amplifier is only part of one element in the equation that determines how loud a system will go. Furthermore a generalisation that seemed to apply to the project as a whole was that the cheap powerful amps were in some ways the least pleasant to listen to, and frequently scored consistently poorly in the listening tests, whereas the more expensive and/or low-powered amps tended to do rather better. So pure price/power-based judgements could be quite misleading and give an 'anti-hi-fi' result.

While we have worked hard to try and give meaningful listening tests results, there must remain significant doubts about their reliability and validity, for reasons discussed elsewhere. However consistency was often surprisingly good, which suggests that they do provide some sort of indicator to what is really the most important criterion of all for many people, the listening experience.

None of the other criteria for choosing or recommending an amp are really susceptible to value judgement by one individual on behalf of others. Physical appearance is a case in point, and numbers or types of features and facilities likewise. Reliability is also of importance to the 'end-user', and is something on which we can hardly pass judgement from evaluation of a single sample. In point of fact sample faults or failures were very few, with instances usually related to apparently random component failures, or the unusual stresses of the test procedure (one model politely died on us at full power, 200kHz when we were assessing the power bandwidth, and we hardly feel this constitutes a relevant criticism of the amp concerned!)

However tradition demands that we select the so-called sheep from the supposed goats and compile a list of 'recommended' products. And for the above reasons this is not a task that we are undertaking with any particular enthusiasm or confidence. Inevitably some personal prejudice will enter into our judgements, and the prospective purchaser would do well to bear this in mind. We decided that the most sensible approach was to divide the amps into price groupings, and then pick the models which we felt represented the strongest contenders, by eliminating any that show some significant technical weakness, then examining the power output and listening test results in relation to the price, while also taking some account of the less easily evaluated considerations such as provision of facilities, individuality of presentation and the like. By this means we hope to highlight some of the more interesting products, while emphasising that the vital price part of the equation has a tendency to vary, and while we have tried to assess the most likely 'typical' price, and base our judgements on this figure, changes in price structuring will affect the often thin dividing line that separates the recom-

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Dear Hedley,
Just wanted to write and say thank you for all the help you gave me in choosing my first HI-FI system. After all the confusion of the HI-FI press and all the rip-off artists in Tottenham Court Road, it was really nice to meet a bunch of guys like Trevor, Lee and yourself who were willing to spend time and patience in helping a newcomer to understand the wonderful world of High Fidelity. I still can't change a lightbulb without an instruction book; but my system is terrific and I really do appreciate all your friendly advice and knowledge, not only of the equipment but also of the needs of yours truly (was it E.S.P. that helped you guess I needed a fully automatic turntable that was ME-proof?)

Anyway, it's good to know that I've found a ship that not only treats you like a human being, but makes great tea as well! Many thanks again for all your help and kindness and I know where to come for any future HI-FI needs.

Best wishes and a Happy New Year

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mended products from the rest. If you must rely purely on this summary there is little we can say that will dissuade you. Far better to go thoroughly into the reviews themselves in the light of your own requirements and prejudices, and then find a dealer who is prepared to demonstrate the products for you.

The following listing is constructed in ascending order of price; it is not purely restricted to 'recommended' products, but attempts to justify the decisions we have made.

The cheapest models in the book are the *Solavox* and *Amstrad* designs which offer a surprising range of facilities but suffered from some hum problems that caused recommendation to be withheld; they nevertheless showed disproportionate potential for their modest prices, which are 20-30% less than the next step up the ladder. The *Sony 212* offered restricted power output and featured a permanent 'loudness' function at low levels, and for these reasons it is not recommended; however some listeners rated it quite highly. The first firm recommendation is the **Tensai 2030**, which offered good power for the price and decent though somewhat inconsistent listening results, plus a lot of not entirely necessary features (rack handles?!) at a modest £85. At a fractionally higher price the **Akai AM2250** offered similar power with a surprisingly good technical performance and listening results — the latter however based on a shortened series of tests; we were particularly impressed by the standard of finish and up to date engineering. The **Marantz 1050** costs a little more than these two, but had good transient power, a nice standard of presentation, and also did reasonably well in the listening tests.

At just over the £100 mark came the other **Tensai** model the **2045** which offers very generous midband power, albeit with one or two technical reservations and a poorer listening ranking than its cheaper brother. A little further up the price scale, the **JVC JA-S22** offered similar power but an improved technical performance and listening test results, though the latter were not entirely consistent. And at around the £120 mark the **Eagle 7400** offers similar power and performance, but seemed a particularly appropriate choice for matching with the budget system because of its well controlled high frequency performance; in many ways we were tempted to recommend the cheaper *7200*, but in this case allowed our subjective judgements to get the better of us! The *Marantz 1072* was something of a 'near miss' around this price, and should not be overlooked, and although its power is a little restricted at the price the *Mitsubishi 210* offered an exceptional standard of finish, provision of facilities and some quite promising technical and listening results in this price area. Another attractive and encouraging performer both subjectively and objectively at around this price is the **Sansui 217 II**, the smallest of three models included from their range which consistently gave very impressive and competitive results. The *Rotel 714* also deserves mention for its good technical performance and attractive 'domestic' styling, though the listening test results were not consistently sufficiently encouraging to merit firm recommendation in this case.

A slight jump in price takes us to the **Sakai PA3050** which offers good power delivery, very nice appearance and finish, and encouraging though not entirely consistent listening results. Slightly more power still is offered by the **Pioneer 706**, though its choice of facilities was a bit odd and listening results a trifle unpredictable. The **A&R A60E** is a different kettle of fish entirely, as its power is rather restricted, but its listening test results were both consistent and very good; presentation is also unusual, and we would advise purchasers in this sector of the market to try and give this model a listen. The **Uher VG850** remained something of an enigma, because of listening test results that were very inconsistent, and sometimes very favourable; it also offers generous power delivery for its price. A little more expensive but offering exceptional power for the price as well as consistently above average listening test results, the **Sansui 417** completes the under £200 recommendations. We remain both perplexed and uncertain about the *Cambridge P80*, which on occasions sounded really impressive and looks both different and smart; the pickup overload problem prevents recommendation but we remain intrigued by this design.

Crossing the £200 barrier we encounter two models that offer by no means exceptional power for their price but did consistently well in our listening tests and consequently merit inclusion: the **Sugden A48 II** (which incidentally and perhaps significantly showed less squarewave ringing than any other amp in the book) and the **Denon PM200**. A little higher in price, complete with extraordinary loudness control, lots of power, as well as a succession of good subjective results is the **Visonik VSA1000**, which also had one of the most

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versatile pre-amp sections. Approaching £300 there are three models that attracted attention, two twin-supply Japanese heavyweights with very similar presentation and performance are the **Optonica 4646** and the **Pioneer 9500 II**; the Optonica gave slightly better subjective results and is a trifle cheaper, but the price of the big Pioneer is a bit unpredictable and it does have a lot of power and some useful facilities. The third model around this price couldn't present a greater contrast, and the **Quad 33/405** demands recognition on price/power alone, before considering the 'intangibles' of depreciation, servicing, and the fact that it doesn't sound bad either! (Speakers should be selected with a little care.)

The same warning concerning speaker matching concerns the **Sony TAF-6B**, which offers lovely presentation and a really seductive volume control, plus lots of 8ohm power and a moving-coil input (with some reservations here.) At a similar price to the Sony, and offering less 8ohm power but a better ability to cope with 'difficult' speakers is the new **Harman-Kardon HK-505** which gave consistently good results as a 'blind' listening reference on one occasion, and has a nicely uncluttered appearance. Slightly more expensive than these, and again offering slightly less power at 8ohms than the Sony or Quad, but a significantly greater amount into lower impedances that should make speaker selection less critical, is the **Technics 8088K**, which also offers an m-c input, superb finish, and the only really accurate meters in the book. Incidentally none of these six high power 'heavyweights' scored as highly on the listening tests as some of the cheaper lower-powered models mentioned earlier (or indeed the similarly-priced *Meridians*), though they all did reasonably well and offer a variety of other inducements to attract one's attention nevertheless!

Ascending the rarefied strata above £400 the **Marantz 1180DC** did a very effective job of delivering a lot of power in a way that satisfied the listening panels pretty consistently at £420, and used a pre-amp that is clearly designed to make work for idle hands, while at £450 the **Denon 850** with a particularly well finished and attractively understated exterior has a similar sort of power delivery plus an m-c input and listening test results that did not fall short of the Marantz, and in fact represented something of a contrast, with an ultra-smooth sound that some found particularly attractive. The big new **Sansui 919** was rated as one of the most exciting-sounding and powerful amps in the tests, and at £485 probably came closest to being 'all things to all men' with Audiophile-oriented tone-jump circuitry, m-c input and complex control facilities in the one package. At just over £500 the **Meridian 105** got very close to the Sansui's power with an utterly dissimilar, and to our eyes rather irresistable, presentation: clean simplicity, with the sort of bass delivery that can make the neighbours aggressive. Also worthy of honourable mention on grounds of very good listening test results, but not formally recommended because of its limited power for the price is the *Meridian 103D*, which some listeners preferred to the *105*, describing a 'sweeter' sound with nice focusing but rather less impact.

Hitting the over £600 mark, but deserving mention for their listening test results are three rather rarefied models that presage things to come from the Far East. First *Hitachi's* big, black and brutal power Mosfet *HCA/HMA 7500* combination had limited power but a versatile pre-amp for the price, and consistently good listening test results, while the *Sony TA-E86B/TA-86B* had a more varied response, but highly consistent 'blind reference' results on one occasion, offered a lower-powered class-A option that was liked, plus a standard of finish that demanded to be stroked and is guaranteed to impress the neighbours. The digital *88* combo may have a silly price tag at present, which it doesn't really justify, but it sounded pretty good despite its measurements, has a lot of 8ohm power without producing much heat, and a similarly inspirational standard of finish.

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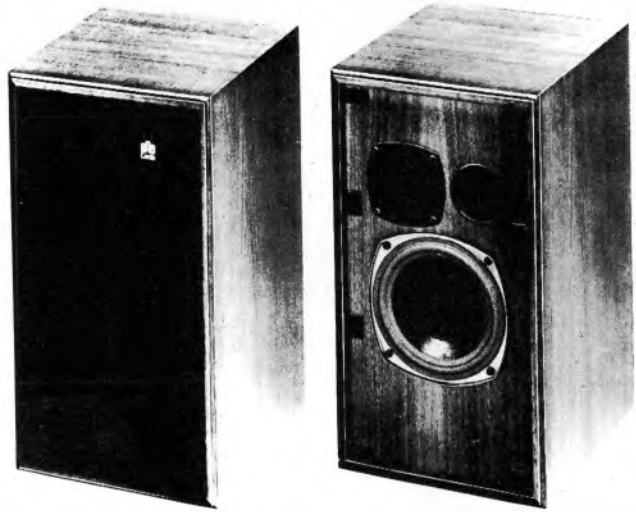

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Overall Comparison Chart

	COMPATIBILITY				PERFORMANCE				
			Tape output, ref 5mV disc						
* See Text	Disc Cap(pf), Sens(mV)	Tape Sens(mV) Imp(kΩ)	phono mV/Ω	DIN mV/kΩ	Noise Aux,disc ref,vol,1kΩ (–dB)	THD (inc noise)	Intermod dist. disc	bandwidth disc i/p (Hz-kHz)	Hum
A & R (Cambridge) A60 (E)	var, 2.1	100/48*	—	235/50*	77,75	ave–	ave	30-70	ave–
Akai AM2250	20,3.2	160/88	240/630	45/31	75,75	ave	ave	12-80	ave–
Amstrad EX330	127,3.5	94/36*	100/2.3k	—	69,69*	poor	poor	23-40	poor
Cambridge P.80	140,1.0	165/98	—	350/4.8*	82,79	ave–	ave–	26-38	ave
Denon PMA-200	15,2.8	175/100	275/550	—	82,79	ave+	ave+	6.5-66	ave–
Denon PMA 400	23,2.8	165/100	300/125	—	80,78	ave+	good	6-107	ave
Denon PMA 830	231,28*	360/47	620/78	—	85,82	good	good	5-114	excell
Eagle A7200	233,3.1	185/78	240/2k	31/78	83,76	ave	ave+	15-44	ave+
Eagle A7400	100,2.55	140/82	205/54k	32/80	75,71	ave–	ave	20-40	ave–
Harman Kardon HK503	130,2.8	170/29	260/1.4k	44/46	79,75	ave	ave	3-163	ave–
Harman Kardon HK505	var, 2.42	145/30*	230/967	42/470	80,79	ave	ave	3-170	ave
Hitachi HCA 7500/HMA 7500	var, 2.45	115/141	230/680	—	86,81	excell	ave	7-85	ave
JVC 22	155,2.55	165/62	300/470	40/77	78,77	good	good	7-60	ave+
JVC JAS 44	90,2.6	140/85	290/470	36/76	78/76	excell	excell	3-140	ave–
JVC JAS 33	62,2.3	180/50	380/100	47/76	83,77	excell	good	4-90	ave
Marantz 1050	80,3	205/36	305/3.5k	34/80	83,78	good	good	10-50	good
Marantz 1072	80,3	190/37	300/260	32/80	82,79	v. good	good	8-49	ave–
Marantz 1180DC	74,2.2	215/17	480/345	52/78	78/75	ave	good	6-80	ave
Marantz 3250B/300DC	80,2.0*	200/33	480/285	55/80	74,73	good	ave+	6-90	ave–
Meridian 101/103	125,2.1*	790/32	—	205/6*	82,79	ave–	ave–	22-50	ave–
Meridian 101/103D	125,2*	790/32	—	205/6*	72,79	ave	ave–	22-50	ave–
Meridian 101/105	125,2.7*	950/32	—	205/6*	84,79	good	ave+	20-50	ave–
Mitsubishi DA-U210	98,2.75	165/153	275/625	135/100	82,77	ave–	ave	11-168	ave+
Mitsubishi DA-U310	190,2.6	155/86	280/570	138/100	77,76	good	good	16-38	good
Optonica SM3636	133,3.4	177/44	210/2k	27/78	81,78	ave+	ave+	7-180	ave+
Optonica SM4646	180,3.3	200/45	210/2k	31/80	80,76	ave+	ave	6-100	ave
Philips 384	115,2.45	190/42	225/6.3k	60/160	82,73	good	ave	11-60	good
Philips 386	100,2.6	200/41	230/5.6k	60/166	80,80	good	good	15-80	good
Pioneer 506	240,2.6	164/131	241/3.2k	34/84	80,75	ave+	ave	12-110	ave–
Pioneer 606	130,2.8	170/132	240/2.9k	30/80	77,76	ave+	ave	10-70	ave+
Pioneer 706	268,2.4	150/136	235/3.2k	32/79	75,73	ave	ave	13-72	v. good
Pioneer 8500 II	var, 2.9	160/69	220/3.2k	28/80	78,77	good	ave–	5-104	ave
Pioneer 9500 II	var,2.8	160/68	215/2.2k	28/80	78,78	ave	ave+	5-78	ave
Quad 33/405	20,2.15	var/45	—	var/.83*	73,71	ave+	ave	18-35	ave–
Realistic SA1001	90,2.3	140/100	220/5.5k	42/190	79,76	ave–	ave+	12-108	ave–
Realistic SA2001	120,3	200/77	200/6.3k	40/195	84/80	ave+	excell	11-75	ave
Revox B750 II	285,1.2*	190/112	620/2k	180/272	81,81	ave	ave–	20-90	ave
Rotel RA714	160,2.8	165/56	250/1k	60/89	77,75	good	excell	8-100	ave–
Rotel RA2020	113,2.7*	150/40	220/2.6k	55/90	83,78	ave+	ave+	12-113	ave–
Rotel RA2040	135,2.7*	190/25	300/2.2k	70/88	67,67	good	ave	7-100	ave–
Sakai PA3050	60,2.7	165/68	280/538	—	78,76	good	ave	5-80	ave–
Sansui AU217 II	70,3.0	200/79	260/2.3k	—	83,74	good	good	10-60	ave–
Sansui AU417	125,2.9	175/55	280/555	—	78,76	good	good	7-90	good
Sansui AU919	211,2.8*	170/65	290/550	—	82,78	good	good	3-90	ave
Solavox SA2020	67,4.5	130/144	84/146k*	—	69,69	poor	poor	21-15	poor
Sony TA212	32,2.6	142/163	100/15k	—	74,74	ave–	f. poor	13-50	ave–
Sony TA313	11,2.7	155/230	130/11k	—	83,77	ave	ave–	10-38	ave–
Sony TA515	100,3.2	204/40	150/10k	—	79,77	ave	ave–	19-37	ave–
Sony TAF4A	130,2.2	140/43	200/5.6k	26/71	81/79	ave+	ave	4-54	ave
Sony TAF6B	124,1.9*	125/85	200/5.6k	—	90,69	ave	ave	3.2-70	excell
Sony TA-E86B/TA-N86B	140,2*	120/47	150/14k	—	81,75	ave+	ave+	5-240	ave
Sony TA-E88B/TA-N88B	var,2.5*	150/50	270/1.1k	—	79,78	ave–	ave–	3-104	ave
Spendor D40	12,2.7	80/50	115/980	—	74,75	ave	ave	26-60	excell
Sugden A48 II	114,3.5	185/233	—	15.5/4.9*	74,73	ave	ave–	22-30	ave–
Tensai TA2030	92,2.6	166/88	210/4.6k	65/3.30	79,75	ave+	ave	16-60	ave–
Tensai TA2045	90,3.0	185/94	210/4.6k	65/320	77,72	ave–	ave–	14-43	ave–
Technics SU9011/SE9021	174,2.4*	150/66	275/578	—	77,77	excell	v. good	8-70	ave+
Technics SU8088K	150,2.85*	250/95	370/1k	30/83	81,81	excell	ave+	4-62	v. good
Uher VG850	215,3.4	200/62	256/380	62/115	73,72	ave	ave	8-90	ave+
Visonik VSA 1000	40,3.1	195/100	310/720	75/266	87,78	ave	ave	10-95	ave–

Overall Comparison Chart

POWER		FACILITIES			GENERAL				
8ohms 1kHz .1% dist both/ single channels	'burst' 8/4/2 ohms	tape connect-ions	tone controls/ switchable?	filters/ loudness?	Present-ation	Finish	Listening impress – ion summary	Price (Typical inc VAT) £	
36/44	57/92/29	1 DIN*	simple/no	HF/no	black	good	f. good	160	**A&R (Cambridge) A60 (E)**
31/37	39/75/77	2 both	simple/no	no/yes	dark grey	v. good	ave+	86	**Akai AM2250**
29/30	41/58/69	1 phono	complex/no	HF, LF/yes	silver	f. good	ave–	67	**Amstrad EX330**
53/64	95/154/211	complex*	simple/yes	2HF, LF/no	black	v. good	ave+	185	**Cambridge P.80**
59/70	91/141/145	2 phono	simple/no	no/yes	silver	v. good	f. good	215	**Denon PMA-200**
62/62	91/146/145	2 phono	simple/no	LF/yes	silver	v. good	ave+	260	**Denon PMA 400**
106/114	134/222/291	2 phono	simple/yes*	HF, LF/yes	silver grey	excellent	ave+	445	**Denon PMA 850**
37/43	49/61/33	1 either	simple/no	no/yes	silver	f. good	ave	80	**Eagle A7200**
44/53	72/89/36	2 both	simple/no	LF/yes	silver	good	ave	120	**Eagle A7400**
54/59	73/121/170	2 both	simple/yes	HF, LF/yes	silver	v. good	ave	250	**Harman Kardon HK505**
77/79	100/172/279	2 both	complex/yes	HF, LF/yes	silver	v. good	ave+	340	**Harman Kardon HK505**
90/91	111/181/90	2 phono	complex/yes	HF, LF/yes	black	v. good	f. good	620	**Hitachi MCA 7500/HMA 7500**
44/53	72/69/36	2 both	simple/no	LF/yes	silver	v. good	ave+	112	**JVC 22**
57/66	79/129/100	2 both	graphic/no	LF/yes	silver	v. good	adequate	190	**JVC JAS 44**
74/84	86/125/100	2 both	simple/yes	LF/yes	silver	v. good	adequate	230	**JVC JAS 55**
31/38	51/91/18	1 either	simple/no	LF/yes	silver	f. good	ave	95	**Marantz 1050**
47/54	65/118/27	1 either	simple/no	LF/yes	silver	good	ave	125	**Marantz 1072**
112/120	145/266/121	2 both	complex/yes	HF, LF/var	gilt silver	v. good	f. good	420	**Marantz 1180DC**
200/210	250/423/176	2 both	complex/yes	HF, LF/yes*	gilt silver	v. good	ave+	720	**Marantz 3250B/300DC**
45/55	68/120/100	1 DIN	no	no	olive green	v. good	ave+	340	**Meridian 101/103**
54/58	73/129/73	1 DIN	no	no	olive green	v. good	f. good	440	**Meridian 101/103D**
110/110	160/289/475	1 DIN	no	no	olive green	v. good	f. good	520	**Meridian 101/105**
29/34	41/63/60	2 both	simple/yes	no/yes	silver	v. good	ave	112	**Mitsubishi DA-U210**
58/70	90/162/257	2 both	simple/yes	HF, LF/yes	silver	v. good	ave–	150	**Mitsubishi DA-U310**
52/53	66/113/150	2 both	complex/yes	HF, LF/yes	silver	v. good	ave–	220	**Optonica SM3636**
90/93	100/181/241	2 both	complex/yes	2HF, 2LF/2	silver	v. good	ave+	270	**Optonica SM4646**
48/55	66/106/42	2 both	simple/no	HF, LF/no	silver	v. good	ave–	155	**Philips 384**
75/85	100/113/61	2 both	simple/no	HF, LF/yes	silver	v. good	adequate	175	**Philips 386**
30/36	49/85/90	1 either	simple/no	no/yes	silver	f. good	adequate	90	**Pioneer 506**
52/61	80/113/130	1 either	simple/no	no/yes	silver	f. good	ave–	120	**Pioneer 606**
71/77	82/137/197	2 both	simple/no	no/yes	silver	f. good	ave	160	**Pioneer 706**
83/83	116/190/226	2 both	complex/yes	HF, LF/yes	silver	v. good	ave–	230	**Pioneer 8500 II**
100/100	122/217/316	2 both	complex/yes	HF, LF/yes	silver	v. good	ave	290	**Pioneer 9500 II**
110/115	157/105/39	1 DIN	simple/yes	complex/no	khaki	v. good	ave	290	**Quad 33/405**
47/56	70/113/17	1 either	complex/no	LF/yes	silver	good	ave–	130	**Realistic SA1001**
78/90	111/163/82	2 both	complex/yes	LF, HF/yes*	silver	v. good	ave–	190	**Realistic SA2001**
92/100	100/191/226	complex*	complex/yes	LF, HF/yes	grey/silver	v. good	ave	460	**Revox B750 II**
59/68	77/137/183	2 both	simple/no	LF, HF/yes	silver	v. good	ave–	145	**Rotel RA714**
76/84	106/113/80	2 both	simple/yes	LF, HF/yes	silver	v. good	adequate	280	**Rotel RA2020**
135/145	176/181/127	2 both	complex/yes	LF, HF/yes	silver	v. good	adequate	480	**Rotel RA2040**
63/76	91/163/218	2 phono	simple/yes	LF/yes	silver	v. good	ave+	140	**Sakai PA3050**
54/64	86/145/197	1 phono	simple/no	LF, HF/no	black	v. good	ave	120	**Sansui AU217 II**
88/103	130/211/300	complex*	simple/yes	LF/yes	black	v. good	ave+	185	**Sansui AU417**
135/143	164/314/543	complex*	complex/yes*	LF/no	black	v. good	f. good	485	**Sansui AU919**
17/22	30/50/64	1 phono	simple/no	HF, LF/yes	black	f. good	adequate	50	**Solavox SA2020**
19/22	15/26/33	1 phono	simple/no	no/fixed	silver	good	ave	85	**Sony TA212**
30/35	54/79/72	1 phono	simple/no	no/yes	silver	good	ave	108	**Sony TA313**
46/61	73/106/62	2 inputs*	simple/no	no/yes	silver	good	ave	155	**Sony TA515**
48/57	77/100/64	2 both	simple/yes	HF, LF/no	silver	v. good	adequate	125	**Sony TAF4A**
120/121	120/82/33	2 phono	simple/yes	HF, LF/no	gunmetal	v. good	ave	350	**Sony TAF6B**
100/102	110/92/46	1 phono	no	LF/no*	silver grey	excell	ave	550	**Sony TA-E86B/TA-N86B**
160/180	308/266/60	2 phono	no	LF/no	silver grey	excell	f. good	140	**Sony TA-E88B/TA-N-88B**
49/49	54/58/25	1 phono	no	no	black	v. good	ave	200	**Spendor D40**
44/46	60/98/139	2 DIN*	simple/no	complex/yes	brown*	v. good	f. good	215	**Sugden A48 II**
29/32	39/67/25	2 both	simple/no	HF, LF/yes	silver	f. good	ave	85	**Tensai TA2030**
54/59	73/128/100	2 both	simple/no	HF, LF/yes	silver	f. good	ave	110	**Tensai TA2045**
74/75	77/132/197	2 phono	simple/yes	HF, LF/yes	silver	good	ave	400	**Technics SU9011/SE9021**
90/104	110/201/316	2 both	complex/yes	HF, LF/yes	olive brown	v. good	ave+	400	**Technics SU8088K**
79/90	133/120	2 both	simple/yes	LF/yes	black	v. good	ave	165	**Uher VG850**
82/95	133/211/183	2 both	complex/yes	HF, LF/yes*	dark grey	v. good	f. good	245	**Visonik VSA 1000**

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