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hi Fi for pleasure

cassettes digest

TEST REPORTS ON 50 CASSETTE DECKS & 77 BLANK TAPES

BY GORDON KING

If your tape deck sounds like this, eject the cassette.

Do you recognise the problem? Mozart's Horn Concerto turned into Mozart's Foghorn Concerto by even the more expensive tape decks, when the trebles become misty, and the basses blurred?

It's the cassette that's taking the shine out of the music, not the deck.

The fact is, until Sony's new Metallic tapes, there hasn't been a cassette as sensitive as the most sensitive players.

True, in early 1979 a couple of manufacturers launched their own metal tapes. But it seems they dropped a clanger.

Within months one was said to be withdrawing his product from the market, and another to have hastily brought forward a major redevelopment programme.

Sony, on the other hand, took the pains to get their Metallic tapes right first time.

To improve retentivity and tape-to-head contact they wanted each and every microscopic needle-shaped metal particle to lie flush beside the one next to it, herringbone fashion.

Recent reviews in the hi-fi press suggest that this extra attention to detail has been more than worthwhile.

Since a poorly constructed cassette allows wow and flutter to sabotage the music it plays, Sony redesigned the mechanical parts of all the cassettes in their range.

The result, their unique SP mechanism. It works like this.

Adopting the same engineering principle which keeps a High Speed Train on the tracks at 125 mph, the hubs of every cassette have a deep groove running around their circumference.

The parallel ribs moulded onto the polyester inner liner slot into this, and prevent wobble, sticking and jamming.

Sony tapes are tested for their heat-resistance in an oven hot enough to bake a loaf of bread, and then run for 2000 km to make certain they are vibration-proof. The point being, every Sony cassette is a better made cassette, whether it's the inexpensive CHF or the new Metallic tape.

And that means better performance.

Unlike some of their competitors, Sony tapes are here to stay.

Sony tape. Remarkably close to original sound. **SONY**

JUNE 1981 No 2 IN A SERIES BY

HI-FI FOR PLEASURE

cassettes digest

by GORDON J. KING

CASSETTE DECKS & TAPE

With dozens of different cassette decks in the shops — and about as many types of tape — you are faced with a daunting task of finding the right model for your pocket and purposes. Ferreting out suitable tapes isn't easy, either, without guidance. This is where our Digest comes in. Gordon King has thoroughly tested 50 cassette decks, and broken down the results in various ways to help you identify what you want. In particular two ranking systems have been developed: ratings on a scale of five for technical merit, without regard to price, and another scale yielding ratings of value-for-money. We have also introduced a tie-up between the decks' tape requirements and the characteristics of the tapes themselves. So now it is easy for you to pick the best tape for your chosen deck.

Spend wisely.

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PREFACE

I was glad to have had this opportunity of writing a 'review' book without having to compile for publication elaborate lists and charts of all the measured results that I obtain in the lab. I often wonder how many people really read and study them. They are probably of assistance to designers and researchers, but my task is essentially one of writing for the ordinary consumer especially in this book. My feedback indicates that on the whole the reader of reviews first looks at the last couple of paragraphs to try to get a bird's eye impression of the product. If he is thus motivated he then goes back to study the review in greater depth.

You will see that in the deck reviews I have adopted the excellent 'plot' applied in other of my writings, whereby the first part discloses the facts, the second part my findings and the third and final part my verdict. The lack of parameter tabulations gives more room for this important text.

However, as I am dealing with a technical subject it is essential to make technical measurements. To this end, therefore, each deck was subjected to lab scrutiny and maximum effort was applied to the assessment of those technical things which, in my opinion, have an influence on the overall listening experience. Rather than being presented in the form of figures which the test instruments read, I have translated some of the main test results to well-understood bar graphs (the taller the bar, the better the technical result), which are then collectively contained, out of 'harms way', at the back of the book.

Some of the more important things which you may wish to know about straight away, such as the relative biasing of the deck (which helps you to tie it up with suitable tapes), how well it performs with metal tape, the usefulness of the metering, and a few other results are exposed in each review. You will see that I have used a very simple 'code' for biasing, which is fully explained elsewhere, along with a five-point bar graph format ranking system — the higher the bar, the better the result.

Each review is also supported by an oscillogram of 1kHz squarewave performance and by a pen chart of frequency response for two or more tapes. Being 'pictures' they are far easier to assimilate than tabulated figures, but it must be understood that the frequency responses, which also reveal Dolby or noise reduction integrity, reflect the magnetic properties of the tapes used as well as the equalisation accuracy and the low bass performance of the decks. Different tapes could give different results. However, because the tapes used are named and you can thus refer to their bias demands in the cassette tape section, they give further valuable support with respect to the set-bias of each deck.

The squarewaves, on the other hand, are hardly affected at all by the tape, despite the fact that they were recorded and replayed for examination and photographing. In all cases there are two squarewaves, one showing the result with the 19kHz (MPX) filter off and the other with it on, plus Dolby where necessary.

Overall assessment must, of course, include the features provided by a deck, and to help you along these lines you will find a comprehensive list at the back of the book, with the features present on any particular deck ticked. Any feature not listed is generally referred to in the review.

Each deck was connected to a hi-fi system and auditioned, and to some degree it was examined for 'electronic quality'. After taking account of all these things, my findings and the price, each deck is credited with a two-component ranking or grading value, which you will find fully explained elsewhere in the book (the contents list will tell you where).

Having now been running my ***Tape Check*** series in ***Hi-Fi For Pleasure*** for more than four years, the wealth of experience that I have acquired on the different makes and formulations during this time is reflected in the Cassette Tape section. Additional tests were made where necessary to recheck certain properties, to detect changes in updated formulations

and to establish the bias demands for deck linkage in this book.

It has not been possible to evolve relative 'ranking values', as with the decks themselves, because the ultimate performance of a cassette is much dependent on the deck. However, there are cassettes which seem to suit a wider range of decks than others, and you will see which these are from the reviews. So-called, 'low bias' 120μs oxides just cannot perform well in decks of higher bias, for working under over-biased conditions it is natural for such tapes to show a poor high frequency performance. With low-bias decks and those with adjustable or auto-setting bias and eq they can perform quite well and generally have the advantage of lower price. Conversely, 'high-bias' (normal bias) 120μs oxides working in a low-bias deck will exhibit high frequency emphasis. It is all a matter of balance.

Each cassette tape review shows by the five-point ranking system my experience of its performance on six counts when operating in a test machine at the bias setting indicated. Possible deviations and other comment are given in the text of the reviews.

I must mention that my measurements over the years have shown that a tape of particular type can measure differently when taken from a different batch. The general trend is for progressive improvement after a formulation has been launched; but, sadly, it would seem that in some instances there can be a deterioration in later production with respect to the results obtained from the first samples, though this is by no means commonplace and is not usually applicable to firms who manufacture their own oxide.

I would also like to make it perfectly clear that I operate a small consultancy service and I am sometimes called upon by tape manufacturers and distributors to undertake for them independent lab tests of their products, for which they pay me. Looking through the cassette tape reviews I find that over about five years, six of the firms whose tapes are included have consulted me in this way. A consultant would not remain in business if he was swayed in any way by such association, and the Editor is aware of the firms for whom I have undertaken private tests. I am not on the pay-roll of any firm except my own; neither am I nor my Company employed as a 'retained' consultant, nor has either shares in any company which seeks it services. I have been running my consultancy Company ay Brixham since 4th May 1960, so it has almost come of age!

While on this 'delicate' subject I would also like to say that the copyright of a lot of the work that I publish is vested in my Company. At one time extracts from it and my name were published in advertising and promotional matter without permission. I have since halted this practice. When our permission is sought we invariably give a licence for re-use of the material, provided it is not presented unfairly out of context and that the Editor of the magazine in which it was originally published raises no objections. We then usually make a charge to the firm for the use of the copyright and our name. I made this perfectly clear several years back in most of the hi-fi magazines.

Finally, I would like to thank the several people who assisted with the lab work and the preparation of this book; also my listening assessors; my long-suffering wife and family who were obliged to live with stacks of hardware and software for several months. I would also like to thank Trevor Preece, the Editor, and the publisher for giving me the opportunity of writing this book for you, the reader. I hope you enjoy it.

Gordon J. King ***Brixham, Devon, 1981.***

GETTING DOWN TO BASICS

A cassette deck does two things. It serves as a programme source in the same way as a record deck or radio tuner, delivering programme signals which you can connect to the tape input of your amplifier. It also allows you to make up your own programme material from any other signal source, and then replay it through your amplifier. It is one of the most versatile of hi-fi items.

For replay only you can buy pre-recorded cassettes which are the equivalent of gramophone records.

Noise Reduction

It is now widely known that 'Dolby' refers to a noise reduction system. Noise in hi-fi terminology is the 'hiss' which you can sometimes hear behind the soft passages of music, especially when the volume control of your amplifier is set fairly high for listening loud. This 'hiss' is one of the biggest banes of hi-fi, which is accentuated by the small particles of oxide or pure iron on the tape passing the replay head. The gramophone record equivalent is the 'hiss' (and 'clicks' in this case) produced by the stylus of the pickup cartridge scraping along the groove of the record.

Over the years audio engineers have sought to reduce this 'hiss' or noise, without unduly impairing the wanted programme material, by thinking up and developing clever electronic circuitry. Many noise reduction systems have been evolved over the years, some of which give a greater noise reduction than others. The one which has acquired the greatest momentum is a system which was developed by Ray Dolby for domestic cassette recorders, known as 'Dolby B'.

You will see that virtually all the decks investigated in this book are equipped with Dolby B noise reduction. Moreover, pretty well all the music cassettes you buy will have been recorded with Dolby B so that you can play them properly on your cassette deck with the Dolby switch on, thereby achieving the advantage of background 'hiss' reduction.

You will come up against different noise reduction systems, some of which provide an even greater decrease in background 'hiss' than Dolby B. But most of them, like Dolby B, are two-way' systems. This means that the circuit needs to be active while you are recording and also active in a reciprocal sense during replay. This is sometimes called ***encoding*** during recording and ***decoding*** during replay. The net result of this scheme is that the noise is reduced without the frequency integrity of the programme material itself being impaired.

Dolby B reduces the effective ***power*** of the noise by ten times. Thus, if the noise without Dolby B is, say, X, then the noise power with Dolby B will be X divided by ten, or X/10. The result is that the ***subjective*** impression of the 'hiss' might be judged to be approximately halved, which is very useful.

There are noise reduction systems which do even better than this, reducing the integrated and weighted noise power by a hundred times or sometimes more. The very recent 'Dolby C' noise reduction system, which at the time of writing had not percolated very deeply into domestic cassette decks, provides a hundred times integrated noise reduction. It is impossible to deal with all the noise reduction systems, Dolby being emphasised because it is found on virtually all hi-fi decks, but you will have heard about the others, which include names like 'dbx', 'High-Com', ANRS, ADRES, and so forth.

Dynamic Range

Dynamic range refers in essence to the 'volume range' between the softest sounds that you will record to the very loudest ones. To 'capture' these on your cassette tape it will be necessary for the background 'hiss' not to be louder than the softest sounds while at the same time the deck and tape should not overload badly and hence cause severe distortion on the loudest sounds. Clearly, then, the effective dynamic range of the system is improved by noise reduction.

Now, when you are recording the tape is

passed at a constant speed against the pole faces, separated by a very fine gap, of an electromagnet. This is called the record head. Most of us know what an electromagnet is. If you were taught about it at school you used to connect a coil of wire (the winding), which surrounded an iron bar, across the terminals of a battery, and were delighted to discover that the iron bar turned into a magnet. You also found that the strength of the magnet decreased when you disconnected the battery, and that the magnetism vanished completely when the bar was of 'soft' iron. With 'harder' iron you found that we could make a permanent magnet by this method. You also probably traced the lines of magnetic force using greased paper and iron filings!

These basic experiments of our school days exemplify the principles of tape recording. The winding of the record head is fed with signal current obtained from the programme material to be recorded, and since this current is fluctuating in accordance with the 'message' of the music, for example, the magnetism at the pole faces across the gap is likewise fluctuating. As the tape, which is coated with fine particles which can be magnetised, moves steadily across the head so it becomes recorded by small side-by-side 'magnets' whose strength reflects the loudness of the sound and whose length reflects the frequency.

From our school experiments you also probably discovered that, while the magnetism gradually increased as the current through the winding was increased, there came a point where no more magnetism could be coaxed into the iron bar. You were then told that this is the magnetic ***saturation*** of the particular metal. So it is with magnetic tape. If we pass too much current through the head winding the tape will saturate, and when this happens the signal is grossly distorted.

However, with tape recording we want to keep the distortion as low as possible all the time and we want to get as much magnetism on the tape as we can. Over the years of research and development of magnetic tape recording it has been found that the best way of achieving these requirements, at the bass and mid-range parts of the music spectrum anyway, is to feed to the head winding along with the signal to be recorded another signal, which is called the ***bias signal.*** Like music signal, this is also an alternating signal but it is of a steady strength (amplitude) and is of a fixed high frequency.

Music signal spans a frequency spectrum from about 20Hz to 20,000Hz. The term 'Hz' merely signifies by how many times the signal is alternating positively and negatively each second. At 20Hz, then, the rate is 20 times per second and at 20,000Hz (or 20kHz — the 'k' standing for thousand) 20,000 times per second. The bias frequency is placed well above the highest music frequency, and might be as high as 100kHz, or perhaps even higher, to avoid it interfering with the signal being recorded. The strength of the bias signal has to be matched to the nature of the coating on the tape.

'Chrome' and so-called 'pseudo-chrome' tapes need more bias than 'ferric' tapes, while the latest metal particle tapes need more bias than the chrome types for the best results. This, then, is why there is a switch on your cassette deck to change the bias level to suit the different tape types. It is also necessary to change the ***equalisation*** to suit the different types so that you get a 'flat' frequency response when the recorded tape is played back. You will find that this subject, which is an important one, is considered in some detail in the cassette tape introduction. Anyway, sometimes you are given just one switch which sets the bias and equalisation (eq for short) for the different tape types together. On other decks there are two switches, one for setting the bias and the other for setting the eq.

Unless you switch to suit the tape you are using, the results will be very poor. On some decks the change between ferric (***Fe***), chrome (***Cr***) and recently metal is achieved automatically by coding holes along the bottom edge of the cassette.

When the settings are correct you will then be pretty close to obtaining the maximum output from a given tape up to the point of magnetic saturation and hence very high distortion. You will thus be able to record up to a viable level and secure the best dynamic range as provided by the nature of the tape and the technical quality of the deck itself.

Dynamic range is often looked at over three parts of the music spectrum – up to about 4kHz (low and middle frequencies), from about 4kHz to 10kHz (high frequencies) and from 10kHz to 16kHz (extra high frequencies). Now, while the HF (high-frequency) bias improves the output at low and middle frequencies it tends to reduce the output at the high and extra high frequencies. This is because the bias tends partially to 'erase' the very short wavelength magnets corresponding to those frequencies which it is hoped to record on the tape. This erasure effect depends on how well the tape itself can retain the magnetism – or how easy it is to erase. There is a technical term for this: ***coercivity.*** A tape of high coercivity is less easy to erase than one of low coercivity.

Cr type and metal tapes have a greater coercivity than basic ***Fe*** formulations. This means that such tapes can provide a wider HF dynamic range than basic ***Fe*** tapes. The more recent chromium dioxide Mark II tape, for example, has a very good HF performance. Moreover, since its noise or 'hiss' level is low, the dynamic range at HF can be better than chrome substitute or so-called 'pseudo chrome' brands. It must always be remembered that the dynamic range of a tape of high output but of relatively high 'hiss' level may not be any better (it could be worse, in fact) than a tape of lower output but of low 'hiss' level!

The amount of output that a tape can provide, and hence one factor of the dynamic range equation at low and middle frequencies, is described by another technical term: ***remanence.*** I have more to say about this in the introduction to cassette tapes.

Erasure

Your recorder will also have an erase head and the tape passes over this before it arrives at the record head. This is another 'electromagnet' whose winding receives a strong signal, generally from the HF bias generator, but only when the deck lies in the record mode. The strong magnetic flux across the gap of the erase head pole faces has the effect of erasing any previously recorded material. The tape thus arrives at the record head 'clean' of previous signal and ready to be recorded again. You can erase and record many times over before the tape wears out!

From what I have already said about coercivity, it follows that, for deep erasure of a high coercivity tape such as chrome and particularly metal, an extra powerful erase flux is necessary. This is generally provided by those decks which are engineered for proper exploitation of the metal particle tapes.

Replay

Although I have considered the replay function in the foregoing, a few non-technical words about what happens may prove instructive. Two-head decks use the same head for both recording and replay. The second head in this case is the erase head. Switching changes the mode of the first head mentioned for recording or replay. In the replay mode the HF bias is switched off (also the HF signal to the erase head) and the head then acts rather like a miniature dynamo. The winding is coupled to the input of a sensitive amplifier whose signal then passes through the eq circuits and out to the deck's replay sockets.

As the changing magnetic pattern which is recorded on the tape passes the head pole faces, a correspondingly changing magnetic field is developed across the head gap and a changing flux cuts across the winding. The net result is that a small voltage develops across the winding. This is called the ***signal voltage*** since it carries the 'message' of the signal which was used to make the tape recording in the first

place. This is equivalent to the signal voltage which is developed across the output of a pickup cartridge when it is 'playing' the modulated groove of a gramophone record. That is all there is to it really — in basic terms, anyway!

Three-head decks use separate magnetic poles, gaps and windings for recording and replay, but the heads work in exactly the same way as I have already explained. There are advantages of separate record and replay heads and these I have brought to light in a separate story.

Dolby Headroom Extension

Several ideas for improving the effective dynamic range at high and extra high frequencies have been brought to fruition, and one which is beginning to appear on some decks is called 'Dolby Headroom Extension' or 'Dolby HX' for short. You will remember that I said that one of the problems of HF bias is the erasure effect that it has on high and extra high frequencies, corresponding to the very short wave-lengths (eg, very short 'magnets') recorded on the tape. This can be reduced by using tape of higher coercivity, because the very short recorded magnets are then that much more difficult to erase — the higher-frequency signals 'stick' on the tape better.

Even so, the output which you can obtain at such high frequencies is often significantly less than you can obtain at low and middle frequencies when the tape is biased properly for the least distortion at these frequencies. You can obtain a greater high-frequency output by reducing the bias but only at the expense of reduced low- and middle-frequency output, higher distortion at those frequencies and, if the bias is turned down too much, an increase in a certain kind of noise: *modulation noise.*

What happens is that, if you attempt to obtain more output at high frequencies, instead of the replay output increasing the distortion rises dramatically while the output holds fairly steady. Actually, if you go on increasing the recording level the distortion will hit a ceiling and the output will start to fall. This is sometimes called high-frequency ***saturation,*** which implies that the tape is unable to accommodate any more magnetism over that particular range of frequencies. It is not really saturation in the true sense of magnetism. It is more of a 'self-demagnetising' process which has a similar effect to saturation in that the high-frequency signals which do 'stick' to the tape are ***compressed***. They fail to expand to their true level and they are accompanied by very heavy distortion.

Now, because you can record a tape at high frequencies to a higher level, before the effects of compression start, by reducing the bias, Dolby HX has been cleverly engineered to exploit this well known principle. When the circuit senses that the programme signal is rich in strong high-frequency components which would be likely to run the tape into compression, it automatically turns down the bias while those components prevail and in this way provides an enhanced high-frequency ***headroom.*** This simply means that there is more room for the high-frequency signals to work in before compression starts.

Unfortunately, when the bias is reduced the tape becomes more sensitive at high frequencies so, unless something is done about this, ***low-level*** (meaning fairly weak) signals will be replayed with an unnatural treble emphasis, resulting in a shrill, too 'bright' type of sound. If you read the section on equalisation in the introduction to cassette tapes you will discover that, before the recording signal is fed to the winding of the record head, the treble is deliberately boosted to help to achieve a useful overall high-frequency response. Dolby HX thus arranges for the net treble boost of recording (called ***record pre-emphasis***) to be reduced when the bias is turned down on strong high-frequency signals. This neatly restores the frequency response integrity and further helps with the objective of widening the high-frequency dynamic range.

When the strength of the high-frequency components of the programme signal falls,

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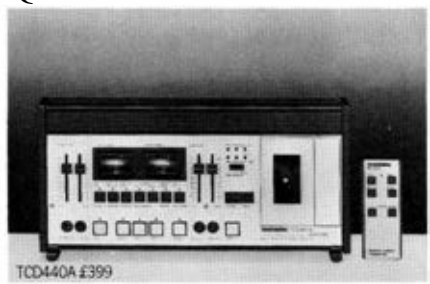
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the bias increases again and the recording pre-emphasis goes back to 'normal'. It would seem that the momentary reduction in bias has little adverse effect on the performance at low and middle frequencies, possibly because, when there is an abundance of treble in the music, there is probably reduced bass, anyway. From tests that I have made there is also reason to believe that when the bias is turned down to accommodate the higher frequency components better, the strong high-frequency components of the programme signals themselves serve to help complement the tape's bias at the lower frequencies.

Although not working in the same way, JVC's automatic noise reduction system (ANRS) in so-called 'super' mode also enhances the high-frequency dynamic range. In addition to the normal noise reducing action, the system automatically decreases the level of strong high-frequency music components for recording and restores the level integrity during replay.

Output Signal and Monitoring

After the equalisation which takes place in the deck itself, the replay signals are coupled to the tape replay sockets of the hi-fi amplifier. Equalisation is thus not required in the amplifier. This means that you can connect the replay outputs of your cassette deck to the tuner or auxiliary sockets of the amplifier.

Most amplifiers are equipped with sockets specially designated 'tape play', so it is best to use these. They are brought into operation by setting the amplifier's tape switch to 'monitor'. When you switch to 'source' the output part of the amplifier is then set to receive signals from the input part, which itself is in receipt of signals from the radio tuner and record deck. In the 'monitor' position of the switch you will get no output from the speakers from these sources — only an output from cassette deck replay.

If you have a three-head deck you can compare between 'monitor' and 'tape' either by operating the deck's 'tape/source' switch or the amplifier's 'monitor/source' switch. In the latter case the deck's switch must lie in the 'tape' position. The signal levels at the replay outputs of a cassette deck are suitable for direct connection to the tape play inputs of the amplifier when the sockets are 'phono' type on both items. It is not easily possible to connect a 'phono' circuit to a DIN circuit. Adaptors are available but unless you know exactly what you are doing you could get into problems and spoil the quality of the reproduction. The rule, then, is 'phono' to 'phono' and DIN to DIN. If you have a choice always use the 'phono' sockets because you invariably get the best quality of signal (in terms of interfacing)

Similarly, the signal levels at the recording outputs of the amplifier are suitable for direct connection to the record inputs of the deck when the sockets are 'phono' on both items. The rule is again 'phono' to 'phono' and DIN to DIN unless you know just what you are doing (if you have trouble consult a reputable dealer).

You will see from the reviews that some decks are equipped with a replay output level control. One advantage of this is that it allows you to match the volume of tape replay to that of the radio tuner or record deck, thereby avoiding the need for adjusting the amplifier's volume control when you change from tape to one of the other programme sources, or *vice versa*. It can also help to establish the same speaker volume when you change between 'source' and 'monitor' at the amplifier.

Remember that, when the amplifier's tape switch lies in the 'monitor' position while you are recording, you are not hearing the signal from the tape but merely that from the early stages of the cassette deck electronics. To monitor the signal from the tape while you are recording you need a three-head deck with off-tape monitoring facilities.

When the deck is equipped with a replay level control this also invariably controls the level of the signal from the headphone jack socket.

CASSETTE DECK FEATURES

Features are not for nothing, so to help you compare the cassette decks in terms of these I have compiled a list at the end of the book with blobs at the appropriate places. Any feature in addition to those noted is referred to in the review.

A goodly number of features are common to almost all decks, and some have more value to the user than others. In this section, therefore, I propose briefly to run through what you can expect, bringing out the more important ones as separate stories.

Bias and Eq Switching

All the decks in this book have some sort of switching to suit the important classes of cassette tape, at least. There are two ways of doing this, excluding the auto-setting decks, either with separate switches for bias and eq or with ganged switches which set the bias and eq together. The second way is more convenient to the user as he then only has one switching operation to bother with. For example, when a change is made to Class II tape the eq is set to 70μs and the bias level switched accordingly.

When there are separate bias and eq switches you need to set one to suit the eq of the tape and the other to bias the tape as closely as possible to its requirements. The switches generally have some sort of labelling which lets you know (approximately) what to do. Separate switches do provide a little more versatility over the ganged ones, particularly when there are two bias settings, say, for Class I 120μs oxide tape. You can set the eq to 120μs and then the bias switch to the position which suits the tape best. This means that with such a deck you might be able to use Fe tapes with bias codes of (0) and (−1).

Even greater versatility is provided by a fine bias control which the user himself can adjust (there are always bias setting presets inside the machines). This control sometimes operates on all the switch-set bias positions, but since (as you will see from the cassette tape reviews) the 120μs Class I oxides have the greatest range of bias demand, the fine bias control may only be operative when the bias switch is set to the bias for this sort of tape.

However, when there is a fine bias control the user is often at a loss to know just where to set it for any given tape. Some users' instruction booklets issued with the decks are more helpful in this respect than others. Some are hopeless and often out of date so far as tape types are concerned. You might have to make experimental recordings to find the best setting. If the treble is too bright and brittle turn up the bias; if too dull then turn it down. The cassette tape bias codes will help you. On some decks the fine bias control swings from (+2) to (−2), with the (0) bias reference at the centre. On others the swing may only be from (+1) to (−1), again with (0) at centre.

More sophisticated three-head decks might be equipped with some method of telling you when the tape is properly biased. Auto-setting 'computer' decks do everything for you.

Metering

With fast metering you can usually obtain better recordings than with slow metering. See my story on the metering problem elsewhere in this book.

Tape Transport Keying

There are mechanical and logic decks. The latter are certainly better than the former in my opinion, though possibly more expensive, but the price of logic is falling. Rather than having to work mechanical levers by pressing keys, the logic decks have 'soft-touch' buttons and the work load is done for you by a solenoid (electromagnet) or motor. It is difficult easily to fool the logic, which means that when you are playing you can go straight to fast-spooling and when you are fast-spooling you can go straight to play. Logic lends itself to remote control working either through wires or infra-red rays. It also facilitates cueing and reviewing, such that in play mode you can drive the tape at fast-spooling rate or above normal speed and

sometimes hear the fast-passing recording from the speakers. This is said to help find a place on the tape quickly, but I prefer doing this in video or, at least, on reel-to-reel decks. Some mechanical decks also have cue and review and direct change of mode.

Signal Controlling

For recording level control there is a knob or sliders. When there is a knob the left and right channels are commonly separately adjustable by two friction-coupled sections, so by working one against the other you can achieve optimum level balance. This is the most convenient method of recording level control, in my opinion. With sliders and some knobs you have one for each channel.

Not very many popularly-priced decks are equipped with separate controls for mic mixing. Instead, the line input is defeated when the mic jack is plugged in, the recording level control then acting on the mic instead of the line signal.

However, even with this type of deck a form of mic mixing is often possible, in mono, anyway. This is because the changeover switching often happens independently at each mic jack. This means that you can record on one stereo track from line and on the other from mic. On replay you thus get the line signal from one speaker and the mic signal from the other. If you can switch your amplifier to mono mode (L + R) then you get a mix of the two signals in both speakers (who said that mono amplifier switching has no further uses?).

With proper stereo mic mixing, of course, you have two sets of recording level controls, one set for the line signals and the other for the mic signals, and you can adjust the mix as required, fading in and out at will.

On a good few decks the level of the replay signal is fixed. This is no hardship because the level set is suitable for interfacing with most hi-fi amplifiers. Where you can adjust the level, however (control at front or rear), it becomes possible to equalise the ***level*** of the signals between, say, tuner and cassette deck and source and monitor, so that when you switch from one to the other there is no appreciable volume change at the speakers. It is not a very important feature, though.

Socketry

More and more cassette decks are being made exclusively with phono signal interfaces, rather than being DIN-exclusive (thank God!). One or two still have a DIN socket in addition to phonos, which is less bad and gives versatility to the poor chap stuck with a DIN-exclusive system (sorry about this, but as you might guess I am not a DIN-socket fan — not so much from their mechanical viewpoints but from the electronic interfacing aspects — the sockets themselves as sockets have quite a bit on their side).

I detest DIN mic and headphone sockets. Standard ¼-in. jack sockets should be fitted for both of these, and most Japanese and 'Western' decks oblige. There are adaptors which change DIN to standard jack.

Monitoring

Some European deck makers and sellers can see no need for monitoring at all on two-head decks. DIN socketry does not provide for deck-to-amplifier monitoring while recording, so if there are no headphone facilities you are stuck — for testing, if nothing else. Agreed you only monitor the signal from the deck electronics (unless you have a three-head deck and can monitor off-tape), but it is nice to know that something is going on in addition to the kick of the metering.

Headphone facilities are handy for private listening and programme seeking. Level is fixed in a good few decks, as already noted, but where there is a replay level control this same control often also adjusts the headphone level. More elaborate machines might have small amplifiers and controls specially for 'phones.

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Noise Reduction

Dolby B is still the most popular, with the Dolby C giving a deeper noise floor. Other noise reduction systems are not generally all that compatible with Dolby-encoded software — and this means music cassettes — except for JVC's ANRS, which is reasonably compatible. High-Com machines sometimes have a switch for replaying Dolbyized tapes, but the net frequency response integrity is rarely good.

You really need noise reduction for the greatest dynamic range, but there are people I know who still prefer to record and play without the assistance of any noise reduction. Sometimes I use it and sometimes I don't — it is switchable so you can choose.

Tape Counter and Memory rewind

All decks have a tape counter but not all with a memory rewind button, which is of value. At any point on the tape you set the counter to zero with the memory button active, and then on fast rewind the tape stops at that point. It is a good way of returning to one particular point on the tape.

Automatic Rewind and Repeat

If you want to find out how long a tape or, indeed, how long the machine will survive in continuous use, switch to repeat and the deck will rewind at the end of the tape and keep replaying the same side of the tape over and over again! This, of course, is not the purpose of the mode — I don't think so, anyway! If you switch to auto-rewind the tape will rewind after it has been played. Incidentally, some machines limit the number of repeats, so it cannot be for testing deck and/or tape life after all!

Auto-Programme Locate

This is a feature going under various names, which in essence detects the silent parts between recorded items on a tape as a means of swiftly locating any part. Microchips are often used in this 'computing' process, and it can be quite effective provided the circuits are not triggered when classical music falls to *ppp* by the electronics being fooled into believing that they have detected a deliberate pause. You can put your own hum and noise-free pauses on to a tape while it is running by pressing a button marked 'record mute'. Digital displays are sometimes linked to this sort of programme finding.

External Timer Switching

More decks are appearing with timer setting switches for record and play. This means that if you run the deck from the mains through an external timer (clock), you can ensure that it goes immediately into play or record mode (as selected) when the power comes on. In this way you can time a recording or replay, for example, to wake you up in the morning. Sleep learners also use replay timing.

The other items in the list at the back of the book are fairly obvious, and on these you can get more information from the reviews themselves.

MPX filtering

It is useful to have the MPX filter switchable. Its purpose is to filter out any 19kHz pilot tone which may emanate from a stereo radio tuner which could otherwise affect the tracking performance of Dolby noise reduction. When the filter is active, therefore, not only does it tend to impair the extreme upper-frequency response, but it also adds extra 'rings' to signal transient as the squarewave oscillograms in the reviews reveal. Where it is not separately switchable it generally comes into operation automatically when you switch Dolby on, so even if your tuner is not producing a lot of 19kHz signal at the output you are stuck with it. On some decks the filter is active all the time, whether Dolby is on or off.

UNDERSTANDING CASSETTES

Magnetic tape consists of a plastics film coated with a magnetic material. The grains of the coating are roughly needle-shaped (acicular) and each grain might have the approximate dimension of 0.6μm length and 0.2μm diameter, depending on quality and magnetic properties. The grains account for about 50% of the coating volume, they being suspended in solidified plastics binder and their major axes orientated along the length of the tape.

Total thickness is determined by length and hence playing time. The tape in a C60 cassette (30 minutes playing time each side) has a total thickness around 18μm, that in a C90 (45 minutes playing time each side) about 12μm and that in a C120 (60 minutes playing time each side) about 9μm. The coating occupies approximately one-third the total thickness of the tape, which means that the plastics film of C90 tape has a thickness of around 8μm and the coating a thickness around 4μm, giving a total thickness around 12μm, as mentioned.

The thin tape of C120 cassettes is not generally recommended by deck manufacturers owing to its greater stretching tendency and possible 'tangling' hazard than the thicker tapes in C60 and C90 cassettes. Moreover, owing to its thinner film base and consequent reduction in separation between the spooled coatings it tends to have a relatively worse print-through ratio, thereby exposing more the symptoms of pre- and post-echo after storage. The thinner coating also results in a change (sometimes for the worse) of the magnetic properties. These things are a great pity because a C120 cassette yields a particularly useful playing time, and I must personally admit to using the odd C120 when I have required a greater uninterrupted playing time than provided by a C90. I have not experienced many mishaps with top-flight decks and upper-brand C120 cassettes.

The C90 cassette is the most popular size, and the data given in this book refer essentially to the tapes contained in C90 cassettes.

Cassette tape is 3.81mm wide (+0 -0.05mm) and, apart from coating, its quality is also reflected by the mechanical aspects of the polyester film base. To avoid undue stretching in use the film base is often pre-tensilised, especially the films of the thinner tapes. How well the tape is sliced from the wide rolls of tape during manufacture is also a reflection of quality. Poor slicing can cause the coating material to crumple away from the sides when the tape is used, resulting in premature clogging of the head gaps with a consequent loss of treble sounds. In fact, in bad cases the sound will vanish completely!

The tape should run freely between the spools without signs of twisting or curling. How well a tape is transported depends not only on the deck mechanics but also on the mechanical quality of the cassette. This itself is quite formidable, depending on close-tolerance mechanics and must not be overlooked. The tape-loaded hubs should be free inside the casing and heard to rattle when a cassette is shaken, and it should be easily possible to transport the tape manually from one hub to the other using a suitably-sized pencil or ball-point pen. It is always desirable to fast-wind and then rewind a tape before recording on it from new. This will show up any problems and loosen the spooling tension.

It is, of course, essential for the leader tape, connected between the ends of the tape proper and the hubs, to be securely fixed. The torque-loading can be quite high.

The body sections of a cassette need to conform to tight tolerances and the net result should be a rigid cassette which cannot easily be distorted. There are two types of body section fixing — by screws or welding. The screw fixing method has the advantage that the screws can easily be removed and the body sections parted for attending to internal tape problems. Whether or not it is worth trying to service a cassette with broken or multilated tape is a question of personal judgement, skill and economics. It is certainly not an easy

matter, and the messed-up tape section would be pretty useless for serious recording, anyway. The welded cassette gives you less choice in the matter. At one time welded cassettes were more rigid mechanically than the screwed variety, but this is no longer as clear cut, for the latest screw-securing techniques also provide good rigidity.

If you take a cassette to pieces you will find slip foils between the tape-loaded hubs and the inner sides of the body. These reduce friction and encourage faster spooling. The nature of the foils also has a bearing on the noise produced by a cassette, especially when fast spooling. Some of the latest cassettes use lubricated plastic foils. These are quieter than some of the earlier or less expensive cassettes which may use siliconised paper foils.

The tape is transported through a cassette over a number of guides, including two rollers, which have to be on a very accurate common axis to ensure that the tape under normal load runs without wobble, tilt or curling along the centre of the cassette cut outs. Mechanical accuracy of the rollers is particularly important, and they should run perfectly concentrically, freely and noiselessly. Cassettes with a well engineered guidance system are among the quietest runners.

Most cassette decks rely on the cassette pressure pad to provide the required tape/head intimacy, which is very important for a steady treble response and good tracking of the tape across the head. The pressure pad is contained within the cassette and might consist of a phosphor-bronze spring carrying a felt pad which gives the required pressure from beneath the tape so that it presses firmly against the head. The pad should not be abnormally slack in the moulding and should be correctly positioned over the head gap. Fluffless felt pads are the best in my opinion.

Because the pressure pad can influence the performance of a cassette deck, some (Nakamichi) decks employ a device which lifts the pad away from the tape, the required tape/head pressure then being applied by the nature of the deck mechanics which is under the control of the manufacturer.

Below the pressure pad is found a flat piece of metal. This is the hum shield. It, too, is important because owing to the high gain of the deck in replay mode the head is particularly prone to respond to extraneous mains hum fields from drive motors, transformers and so forth. When this happens a low-level hum at 50Hz and/or harmonics of the mains frequency can be heard from the speakers, especially when they have a good bass response and the amplifier volume is set high for hi-fi listening. Although mu-metal or similar is the best for hum shielding, the pressed-steel shields used in many cassettes are rarely very troublesome at normal reproducing levels in hi-fi decks.

CLASSIFICATIONS

Cassette tapes are classified according to their equalisation (eq) and bias requirements, which are determined by the nature of their magnetic coatings. In recent times four general classifications have been established, and to help to make it slightly easier for the user some of the more recent decks have the four classifications marked on their tape switching.

CLASS I Fe TAPE

This class of tape uses a coating of gamma iron-oxide particles. The tape is commonly known as 'ferric' which in this book and other of my writings I have shortened to Fe. Fe tape has undergone many stages of development since its inception some 40 years ago when, in its earliest form, it used a paper backing instead of the plastic film of today's tapes. The latest Fe tapes, especially the up-market formulations, have some useful magnetic properties for recording audio signals.

All cassette decks are equipped with a tape switch position suitable for Fe tape.

This is also the type of tape which would be used with simple, inexpensive cassette tape equipment on which there may not be a tape switch. To work properly it is now widely known that tape needs to be biased, not by an electrical signal exactly, as with transistors and thermionic valves, but by an alternating magnetic field. This is obtained from a high-frequency (HF) signal which is applied to the record head (and to the erase head, but sometimes at a different frequency) along with the audio signal it is required to record. It is referred to as HF bias — or merely bias. Frequency of the HF signal is well above the highest audio-frequency (AF) signal to avoid interaction and resulting beat tones.

While the 120μs eq (and I have more to say about equalisation generally later and elsewhere in this book) was established a long time ago for Fe tape working in cassette decks, a similar 'standard' for bias level (that is, the current of the HF bias signal flowing through the record head) cannot be so clearly defined because for 'optimum' performance the different Fe formulations require different bias levels. More recent Fe tapes require a greater bias level than many earlier tapes, which means that if a deck is biased to 'optimise' on the latter-day tapes, the use of earlier or lower energy Fe tapes, which are still available today, will result in weak treble and a general 'dullness' of sound which lacks music attack.

Conversely, if a recent high-energy Fe tape is used in a deck which is biased to suit the lower-bias species of tape there will be treble emphasis and a possible metallic 'hardness' to the reproduction. A good few of the recent cassette decks, especially those from the Orient, are biased on average more to suit the higher energy and hence higher-bias Fe formulations than the lower bias ones. This, though, applies more to hi-fi decks than the lesser-fi portables and machines which are contained in relatively inexpensive music centres. There are some quite reasonable, and relatively inexpensive Fe tapes on the market which, provided they are not over-biased, can perform adequately for many basic domestic applications. It is economic folly to use a high-energy tape on which to record music of limited LF dynamic range and HF signal content if the machine can be biased-down to suit the less costly tape.

Owing to the quite wide range of Fe bias requirements, machine designers often include a so-called 'fine bias' control which can be readily adjusted by the user to suit the brand of Fe tape selected. Indeed, in some cases this control works only when the tape switch lies in the Fe (Class I) position, which is perfectly logical because the bias span of the other classes of tape is generally less wide. If a fine bias control is not fitted, some decks have a two-position switch which operates in the Fe position of the main tape switch to provide 'low' or 'normal' Fe bias.

Many decks, though, are devoid of easy means of bias 'optimisation'. The instruction booklets of such decks may or may not recommend tapes compatible with the biasing of the deck. If there are recommendations it is not uncommon to find that some of the tapes listed are not available in the UK or that they are 'old' tapes which have since been superseded by better ones. Moreover, my researches have indicated that because a tape has been so 'recommended' it is not necessarily the best tape for the machine in its class and price bracket.

This, of course, is where the user requires some really practical assistance, and one plan of this book has been to identify for you the tapes which are suitable for the numerous decks reviewed. For other decks and tapes my continuing series of Tape Checks which are published monthly in Hi-Fi For Pleasure will hopefully help you over your own tape selecting problems. At the time of writing I have tested more than 100 different decks each with eighteen different tapes, so the likelihood of your particular deck being included is increasing monthly!

Of course, even if the deck has a fine bias control you may have to adjust this by ear, turning the bias up if the treble is too

bright or turning it down if the treble is too dull. There are some decks, usually the more expensive three-head ones, which show by meters or flashing lights when the bias is set close to 'optimum' for any tape. This saves you having to rely on your ears and the overall results are then generally more accurate, for there is more to biasing than small-flux frequency response.

The microprocessor is automating deck biasing, for all you do with machines so equipped is to load the tape and press a button and all the adjustments are done for you as the tape is running and its parameters being sampled by the microprocessor. After about a minute the tape automatically rewinds and you are then fully set to record with the knowledge that the tape is working very closely to its optimum. Machines of this type are expensive, but they are falling in price with the mass production of suitable silicon chips.

The equalisation works on both replay and record, but it is mostly replay eq which ensures that a tape recorded on one machine will have the correct frequency integrity when played on a different machine, and this applies also to pre-recorded cassettes. The record eq, or record pre-emphasis, gives a boost to the higher recording frequencies to help to make good some of the treble losses which occur during the recording/replay processes. There are one or two machines equipped with switchable record pre-emphasis which, from a fixed bias datum, makes it possible to improve the upper-frequency response even when a tape is being intrinsically 'over-biased' or 'under-biased' at the fixed bias setting. I often feel that it is wrong to correct the HF response by bias adjustment, anyway, so I am in favour of this scheme, though there are very few decks at present which adopt it.

If your deck is without ready bias adjustment, being equipped only with the basic tape switching then, without access to other guidance data, you will be obliged to experiment with a number of tape brands to find the brand and formulation which suits you (and the machine) best. For example, if you find that the treble is too bright you should opt for a tape requiring a higher bias or if too dull for a formulation requiring a lower bias. In the tape reviews which follow I have indicated the 'normal' bias for each class of tape by shading the central position in a five point bar graph. Tapes requiring less than the normal bias level are identified by moving the shaded area down, and tapes needing more bias have a higher shaded position.

Using this coding, therefore, slightly too much treble calls for a change to a (+1) tape, excessive treble a change to a (+2) tape, inadequate treble a change to a (−1) tape and a dull treble with impaired music attack a change to a (−2) tape. These changes must still be regarded as an 'experimental exercise', for there are other factors than frequency response involved, but at least the coding does give you some sort of rough guide line. As I have already mentioned, changes like these will be more applicable to the Fe class I formulations, which is why I have emphasised them under the heading of Fe class I tape.

Unfortunately, there are no hard and fast rules about tape biasing, and it is extremely difficult to express an 'optimum' value, let alone be dogmatic about it. My judgements of biasing values for Class 1, 2 and 3 tapes refer to my test deck (lab-optimised Aiwa AD69001) with the bias adjusted for equal 400Hz and 8kHz −20dB sensitivities, the bias current then being read from a meter. Readers requiring a greater insight into this are referred to my 'tape biasing' article which was published in the January 1981 issue of Hi-Fi For Pleasure. Also see under 'biasing' later.

Fe class I tape might also be referred to as 120μs oxide.

CLASS II Cr AND 70μs OXIDES

Chromium dioxide (shortened to Cr) coated tapes exhibit in the main better upper-

treble performance than basic Fe tapes. For proper exploitation of this class of tape the bias needs to be higher than the 'nominal' of Fe tapes. On some decks the bias level is indicated as 100% for 120μs oxides and as 140% for Cr tapes.

However, even when operating at this higher bias level the upper-treble would still be over-emphasised with the Fe eq of 120μs. It was thus agreed internationally some years ago to adopt the time-constant of 70μs for Cr tapes, for which reason Class II tapes are sometimes referred to as '70μs oxides'.

Chromium dioxide is better able than basic ferric oxide to retain the very short wavelength magnets recorded by upper-treble signals. At the cassette speed of 4.75cm/s and at a frequency of 15kHz the signal wavelength works out to 3.16μm, but for each signal wavelength two magnets are recorded on the tape, one corresponding to the positive-going half-cycle and the other to the negative-going one.

The length of each magnet recorded at 15kHz is thus 1.58μm. Assuming that such small magnets are, in fact, recorded on the tape, they will only give a response when the length of the gap between the pole faces of the playing head is less than a recorded wavelength. When the two magnets to a complete signal cycle appear across the gap together the response falls to zero owing to flux cancellation (this is because the poles of the two magnets of one wavelength appear side-by-side as SN-NS). The frequency corresponding to this zero response is called the extinction frequency.

To ensure a viably high extinction frequency, therefore, the designers of cassette decks are obliged to use heads of very small gap length. Some of the latest cassette deck replay heads have gap lengths less than 1μm. Upper treble also falls due to flux spreading and poor or variable intimacy between the tape and the head pole pieces. These are tantamount to an increase in replay gap length.

How well a tape retains the very short wavelength magnets corresponding to a given high-frequency signal depends on its magnetic properties. As the length of a magnet is reduced so it becomes more difficult to retain the field strength. This is because of self-demagnetisation as the poles of each magnet become closer together. The technical term which describes the tape's ability to retain high-frequency signals is coercivity. The higher the coercivity the more difficult it becomes to demagnetise the tape.

Cr tape is basically of higher coercivity than Fe tape. This, then, is why Cr tape is capable of a better HF performance than ordinary Fe tape. Now, it is because of this improved upper-treble performance that the eq has to be changed from 120μs to 70μs.

Although the HF performance of Cr tape can be very good, the output at LF referred to a given distortion value can be relatively poor, calling for a greater bias level than provided by the deck in Class II mode. If the LF performance is improved by advancing the bias, then the edge is taken from the HF performance! Some of the recent so-called 'super' Cr tapes are better in this respect, it must be admitted, but much depends on whether an extra high bias is required to bring up the LF MOL and hence reduce the LF distortion at a given recorded level. Some of the recent Crolyn Mark II tapes, such as used in the Yashima UCD cassettes, seem to give quite a useful LF performance without the Cr bias having to be turned up particularly high. These tapes also have an encouragingly low noise floor.

Apart from the LF shortfall, Cr tapes fail to perform very well at middle frequencies in the presence region, which is, in my opinion, a very important part of the frequency spectrum. Again, the 'super' and Mark II chromes are better here, too, but they do not have the LF and MF performance of top-formulation ferric oxides or, indeed, metal tapes. I think I can sum this up by saying that I very rarely use Cr tapes myself.

Another type of tape which falls in Class

II and which thus requires 70μs eq is the cobalt 'doped' formulation, sometimes referred to as 'pseudo chrome'. There are various formulations of this type, well known ones being Maxell UDXLI, XLIS and TDK SA(X). These and other up-market brands score over basic Cr in terms of MF performance and sometimes LF performance, and have an HF performance on par with chrome, but not always with such a low noise floor as the latest Mark II and 'super' chromes. Moreover, some of the 'S' versions require more bias than the average deck is set to yield in Class II mode for the best LF performance.

CLASS III FeCr OXIDES

This type of tape uses a dual coating of chromium dioxide or cobalt-doped oxide on top of ferric oxide. The dual coating was developed initially to provide the good HF performance of chrome and the good LF performance of ferric oxide, but they are difficult tapes to 'optimise'. The trend is for 70μs eq and a bias about 10% above that required for Fe tapes, but this may not be the best way of running them, even though the deck may switch the bias and eq in this way.

Their primary shortfall lies at the 'turnover' frequency where the change occurs between the Fe and Cr coatings, and quite substantial and very unhappy dips in response have been measured in my lab in the 2-4 kHz region. Again, this is the important presence region where the ear is quite sensitive to frequency aberrations.

Frankly, on the whole I do not like FeCr tapes, though I must admit to having tested some which were significantly better than early versions.

CLASS IV METAL PARTICLE TAPES

Instead of using particles of oxide (rust!) these tapes use particles of pure iron. They have the highest coercivity of all tape types currently on sale and for this reason are capable of astonishingly good HF performance. Because of the retained upper-treble they run with 70μs eq, but I am not convinced that this is the best time-constant for use with them. There is no doubt that it is at the HF end where metal scores over all other tapes, and this can be useful when you are recording very high quality programme material containing high peaks and transients well up into the treble and over-tone regions. The tapes provide much more HF headroom than the other formulations (though it must be admitted that some of the 'pseudo chromes' are beginning to catch up, as witnessed by TDK's recent SAX, for example), which means that when recording wide dynamic range material you are not bugged so much by having to keep a very tight control on recording level peaks for a given high quality of reproduction.

In a well engineered deck the tapes also give very good LF and MF performance, but in decks not so well 'matched' to the higher 'energy' potential of metal the LF and MF outputs for 3% distortion might not be any better than obtained with good quality 120μs oxides! One reason for this is that metal tape requires more record head drive than Fe or Cr tapes and also a substantially higher bias. For these reasons it may happen that the record head runs into magnetic saturation, hence 'overloading' and causing distortion, before the magnetic potential of the tape itself has been fully exploited. The extra high bias plus the extra high level of audio signal which metal tapes are expected to accommodate can put low quality heads into serious saturation trouble.

My lab uses a special flux-coupling probe to detect when a record head starts to approach magnetic saturation, and it is surprising to see how fast the saturation distortion can increase from a given high level of recording current when the bias is switched to the metal high. Saturation distortion is less of a problem in replay mode because then there is no bias current

flowing through the head winding at the same time as the audio signal. At one time it was thought that the electronic circuits would also overload earlier in metal mode, but my findings have shown that the record head is the most vulnerable in this respect.

I have measured very high LF MOLs and correspondingly low Dolby level LF distortion with metal tape in well engineered metal capable decks but, as mentioned, relatively poor results in decks not man enough to handle the extra metal urge.

Because of the high coercivity of metal tape, full erasure, especially of the lower frequencies, demands an erase flux greater than that to erase to a similar depth corresponding signals recorded on Fe or even Cr tape.

In summary, then, metal tape usage should take account of the quality of the material to be recorded and the performance of the deck in metal mode. To my mind it is madness to pay 40% or more for metal tape if you can obtain virtually the same result from good quality 120μs oxide with respect to the nature of the programme material. Although you get the noise advantage of 70μs eq, metal tapes on average do no have a particularly low intrinsic noise floor. Mark II chromes and FeCr formulations can invariably do better. Having said all these things, metal tape in partnership with a top-flight metal capable deck is undoubtedly capable of very impressive recordings of high quality programme material — if you have the source.

EQUALISATION

If any tape is recorded at a constant level from low to high frequencies (a frequency sweep recording, for instance) and then replayed, it will be found that the replay head output rises at a rate of 6dB/octave. This is to say that each time the frequency is doubled the output also doubles. This goes on to the upper-frequency where the head and tape losses come into play. The output then starts to fall as the frequency is further increased.

Assuming that the turnover frequency is not influenced more by the head and electronics than the tape (which is true of hi-fi decks), the frequency where the turnover starts is higher with Cr than basic Fe tape. It is obvious that we could never tolerate this sort of frequency response from the replay outputs of our cassette decks, so to achieve a 'flat' overall frequency response the deck electronics incorporate eq circuits. These provide the basic 6dB/octave correction, along with upper treble lift to help combat the falling HF output due to the head gap.

The frequency where the 120μs time-constant comes into effect (the −3dB point) is close to 1,327Hz, while for 70μs it is close to 2,275Hz. This means that the effective treble lift at a given high frequency is greater at 120μs eq than at 70μs eq, the latter thus taming the rising treble of correctly-biased Cr tape. Moreover, because there is less effective HF lift there is less amplification of HF noise signals at 70μs than at 120μs. On a weighted basis the noise improvement at 70μs with respect to 120μs is around 4dB, which is a very useful bonus. If you run a non-recorded blank tape in your deck and set the amplifier volume high you can hear the noise as a 'hiss' (like car tyres running on a wet road) from the speakers, and you will discover that by switching from the Fe to the Cr position on the deck the strength of the noise will fall.

Of course, you can't operate in 70μs mode with basic Fe tape as this would result in the treble as well as the noise being attenuated.

A time-constant of 3,180μs is also used, and as this corresponds to a turnover of 50Hz it effectively attenuates the low bass in replay mode as a means of reducing mains hum, there sometimes being a corresponding boost in record mode.

In record mode a boost is given to the high-frequency signals according to the 120μs or 70μs time-constant selected, and some decks provide for a greater upper-treble lift (record pre-emphasis) than others

to achieve an extended overall frequency response or to compensate for excessive head loss. Although this gains a few dB of signal/noise ratio, excessive record pre-emphasis can encourage HF compensation and in-band intermodulation distortion owing to the reduced recording headroom, and this can be worse than a curtailed frequency response. On a few decks it is possible to adjust the record pre-emphasis over a few dB either side of nominal to help improve the HF response of some tapes without having to change the bias.

Record eq is rarely indicated by the meters of Oriental decks, though the reading of meters of European decks might be seen to rise with frequency.

TAPE PARAMETERS MEASURED

In the tape reviews which follow I have based judgement on a number of measured parameters and I think it would be a good idea to run through these briefly.

BIAS

As already mentioned, I have signified the 'nominal' bias by a zero (0). In actual fact, this is really a reference bias as established for equal 400Hz and 8kHz sensitivities at −20dB recorded level (where 0dB corresponds to a recorded flux of 200nWb/m at 400Hz) using a reference tape. The reference tape chosen was one (for each tape class) which I found to be compatible with the bias level provided by the largest number of latter-day cassette decks. For example, the biasing of fixed-bias Oriental decks appears to be focused more towards the higher bias type of 120μs oxide than the lower bias type. Hence the reference tape chosen was one which gave the equal 400Hz and 8kHz −20dB sensitivities at that bias level. This, then, means that such a tape in such an Oriental deck would give acceptable results. That is, a tape with (0) bias entry.

On the other hand, a tape with a bias entry of, say, (−2) would be over-biased by such a deck (because this tape works best with a lower than (0) bias) and the treble would be 'dull' and music attack poor. Conversely, a tape with a bias entry of, (+2) would be under-biased by such a deck (because this tape works best with a higher than (0) bias) and the treble would be emphasised and possibly shrill.

You will see in the cassette deck reviews themselves that I have indicated tapes which would be suitable for use with them. The biasing of decks does differ and, sadly, they also seem to differ somewhat between samples of the same model, so the results given must be regarded

essentially as a 'guide' rather than a dogmatic statement.

In theory, machines with user-adjustable biasing or with auto-biasing should work with most tapes from the biasing point of view, anyway, and where appropriate this is commented upon the deck reviews.

ABOUT DOLBY AND TAPE SENSITIVITY

Although the biasing may be okay for specified tapes, differences between their sensitivities can lead to a lack of Dolby frequency response integrity. This means that a relatively small error in overall frequency response measured without Dolby will be amplified when Dolby is switched on if the Dolby reference level is incorrectly adjusted for the sensitivity of the tape. You will see that the overall frequency responses in the deck reviews show the results with Dolby switched off and switched on. The error is indicated, for the sensitivities of the particular tapes used, by the Dolby on response deviating from the Dolby off response, especially at the higher frequencies.

BIAS LEVELS

At this stage I must make it perfectly clear that the parameters of the review tapes were measured at the indicated bias level. For example, a tape whose bias is expressed as, say, (0) was measured at the corresponding bias level, while a tape whose bias is expressed as, say (−2) was also measured at that corresponding bias level — not at the level corresponding to (0). In other words, the tapes were measured on all parameters at what could be termed the 'optimum bias level' rather than at the 'reference' bias level. This makes a significant difference to the results, because if I had measured a tape with a bias requirement corresponding, say, to (−2) at the (0) ('reference') bias level the results would have been very poor HF performance and 'droopy' small-flux treble, whereas measured at the bias level corresponding to (−2) the HF performance is not abnormally impaired and the treble less 'droopy'.

Clearly, if this same tape were operated in a fixed-bias deck whose bias delivery corresponded to the (0) bias 'reference', then it would exhibit poor HF and 'droopy' treble; but you would be aware of this and obviously choose a higher-bias tape for the deck, as I have already explained.

LF PERFORMANCE

This tells how much output can be obtained around 400Hz before the distortion becomes too bad; also the distortion at Dolby level.

MF PERFORMANCE

This tells how much output can be obtained around 4-5kHz before the distortion becomes too bad.

HF PERFORMANCE

This tells how much output can be obtained at high treble before serious compression sets in and produces bad in-band intermodulation distortion.

SENSITIVITY

As an example of sensitivity, if two tapes A and B were recorded at a common level on the same machine and on replay tape A produced 1dB (about 10%) more output than tape B, then it could be said that tape A is 1dB or 10% more sensitive at the test frequency than tape B. It was on this basis, at a recording level corresponding to about −20dB, that the sensitivities of the tapes were measured. I made two tests, one at 1kHz (MF) and another at 12kHz (HF). It will be appreciated that the more sensitive a tape, the less the recording current

required for a given replay output. Since tapes differ in sensitivity the Dolby presets should be adjusted to suit the sensitivity of the tape employed for maximum frequency integrity over the dynamic range. This is usually an internal adjustment which cannot easily be optimised by the user. Some decks, however, feature Dolby setting user-adjustments.

NOISE

This is a measure of how far below 200nWb/m (corresponding to a recorded level of about +3VU or OdB on the metering) lies the noise floor. The noise was measured with weighting applied and after deck erasure. This is sometimes called "bias" noise.

PRINT-THROUGH

Although my lab has measured the print-through performance of a number of tapes, specific print-through measurements were not made on all the review tapes owing mainly to time and cost. However, where known, comment on print-through is given in the reviews.

Certain tapes, notably Cr varieties, including some pseudo-Cr formulations, are particularly prone to print-through between adjacent layers of spooled tape. Its impact under normal conditions of use and storage tends to be a subject of controversy. There is no doubt that the pre- and post-echo resulting from print-through can be detected on certain music (and speech) from bad tapes, especially after storage in a warm environment. The effect, however, can be reduced by spooling through the tape several times before replay.

Some tapes give more pre- than post-echo, depending on whether or not the tape is rewound when stored after recording, while other tapes give almost equal amounts of pre- and post-echo. My researches have indicated that print-through at the cassette speed is less irritating than print-through at the higher open-reel speeds. The thicker the tape film, the lower the print-through, other factors being equal. This is why studios prefer to use tape of relatively thick film backing.

I have found that at the cassette speed the print-through falls at the rate of about 12dB per 1kHz increase in frequency from about 2kHz upwards, so in terms of frequency it soon falls below the noise floor. The worst frequency seems to be about 600Hz, corresponding to a recorded wavelength of about 78μm at the cassette tape speed. It is both temperature and time dependent, the latter in dB following a 20 log-log function. For example, relative to the print through ratio after 1 day of storage at, say, 20deg.C, it takes approximately 1·6 days for the ratio to worsen by 1dB; relative to 33 months of storage, it takes 278 months for the ratio to worsen by 1dB; and to go to the ridiculous, after 318 years of storage it takes 4,961 years for the ratio to worsen by 1dB. At the other extreme, after 60 seconds of storage, it takes about 39 seconds for the ratio to worsen by 1dB. The precise value of the print-through on a specific tape is also related to its temporal and thermal coefficients.

If you want the least print-through store your recorded tapes in a cool environment, use C60 cassettes if possible and fast-spool several times before replaying. Also, of course, select a tape which is not particularly prone to print-through.

COATING QUALITY AND DROP-OUTS

Again, although my lab has measured many tapes to determine coating quality (how the steady-state output varies with time and to determine the drop-out tendency — that is, where particles are missing from the film, the output then dropping suddenly before it returns), specific tests in these respects were not applied to the review tapes. Nevertheless, where these data are known suitable comment is given in the reviews.

The relative values of the parameters

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Off the Record

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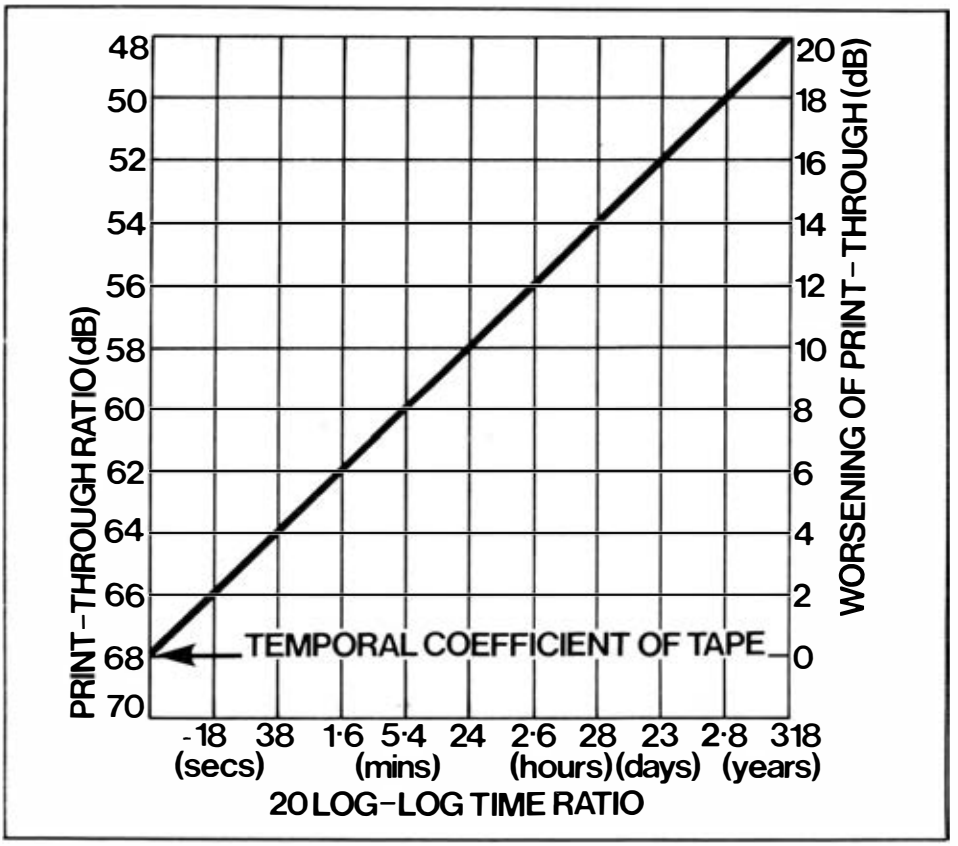
measured are expressed in bar graphs.

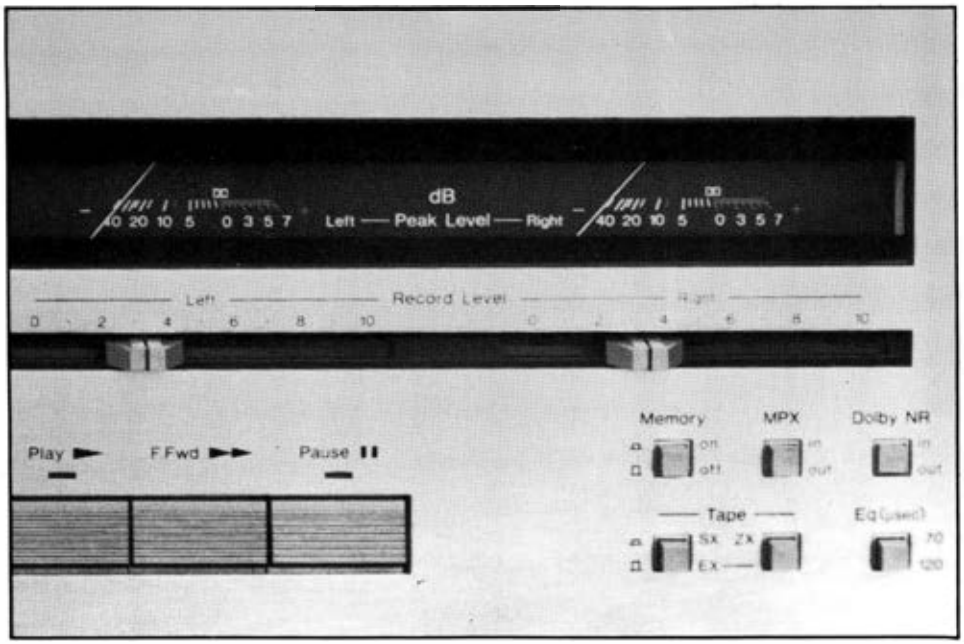
Although an expensive formulation may not appear to equate well with 'value-for-money', it may nevertheless be the right tape for you if the quality of the programme source warrants the high rankings.

Although I would have favoured measuring and reviewing every single tape currently on sale, I'm afraid I was defeated on this by sheer economics and time. I have endeavoured to include most of the brands in the public eye, and can only apologise to any manufacturer or distributor whose wares are not included. As I say, this was certainly not done out of want but out of necessity. It would be hoped to include the missing tapes as time goes on in my continuing Tape Check series in Hi Fi for Pleasure.

HOW PRINT-THROUGH DEVELOPS



METERS & LEDs



The quality of a recording is closely related to the accuracy and speed of response of the meters. If you record too deeply you will suffer bad distortion on the peaks of the programme signal but the noise floor will be that much farther below the peaks, while if you record only lightly the distance between the peaks and the noise floor will be that much less, and because then you will have to replay for a given level with the amplifier's volume control more advanced you will be aware of the noise as a hiss in the background.

There are several types of meter. At one time many cassette decks used VU (standing for 'volume unit') meters. These are still used on some decks and indicate in proportion to the average level of the programme signal and hence to the 'energy' or 'volume' content at any instant. This sort of meter is not very fast responding, so if a fleeting peak occurs there will be only a little momentary increase in reading. The true value of the peak will not be indicated.

With the coming of light-emitting diodes and fluorescent metering the reaction to swift level changes can be very rapid indeed because there is no mechanical inertia involved. A good few decks now adopt this sort of metering in various forms. Decks with VU metering often have light-emitting diodes (LEDs) in addition to indicate the peaks of the signal which the meters themselves cannot read.

There are some decks with special meters which can respond very quickly and thus indicate the peaks of the signal far better than VU meters, and there is at least one deck manufacturer that I know of (Aiwa) who uses meters with two pointers, one indicating the 'average' and the other the peak of the programme signal. Either or both can be switched on.

Using a deck so equipped dramatically reveals the difference between signal average and signal peaks. While the pointer may be reading, say, OdB, the VU pointer may find it hard to get in front of the -10VU mark! The same applies to decks

equipped with VU meters and peak-responding LEDs. the +3dB LED may be flashing when the meter itself is only reading about -8VU or, perhaps, even less.

Now, most VU meters, those in Japanese decks, anyway, are calibrated so that the magnetic flux on the tape (or being applied to the tape) corresponds to the Dolby calibration level (DL) when they are reading +3VU. For the technically minded this corresponds to a magnetic flux near 200nWb/m. With the same flux peak metering might be adjusted to read 0dB (but see the reviews about this). This, then, is where the problems start and is a very real reason why some cassette users get good recordings and others poor ones.

Let us suppose that you are using a tape which approaches saturation at the lower frequencies around 3dB above Dolby level. On steady-state signal, then, you could take a VU meter up to about +6VU before bad distortion starts and a peak meter up to about +3dB for the same effect. This is okay, but music is not steady-state. Its level is continuously changing over the dynamic range of the programme.

Let us suppose, then, that you peak to +3VU on a VU meter when you are recording real music. The meter is reading the 'average' of the signal, remember, and since the peaks could be 10dB above this average you could well be recording them up to 7dB into tape saturation, just imagine the peak distortion that this is going to cause! It makes utter nonsense of amplifier headrooms and speaker interfacing problems.

What of the peak meter — what is this doing? Well, if you record to +3dB on this you are reasonably safe because the meter is reading the real peaks of the signal and not the peaks of the 'average' signal level assuming, of course, that you are using the same tape and 0dB calibration as before. Some tapes arrive at saturation before others as well we know, so the actual level you record at must be dictated by the tape as well as by the nature of the music and type and scaling of the meters.

Where, then, does all this leave us? In a dodgy position really, because if you are equipped with only VU metering you should not, on this basis, record much above a -4VU when the music is of wide dynamic range and rich in peak content, depending on the tape used. With peak metering you will have the same headroom (based on 0dB = DL) when you are speaking to +3dB.

The illustration gives you an approximate idea of what happens.

From the subjective point of view the situation is not quite as bad as the foregoing suggests. This is because the ear becomes less capable of detecting distortion as the duration of the overload which causes it reduces. For example, while you may be able to detect distortion down to, say, 0·1% on a signal of long duration, the distortion due to a 20ms burst causing overloading may have to be ten or more times higher to be audible. This does mean that there is the possibility of a peak-responding meter indicating peaks of such short duration that any moderate level of distortion on them is not heard, anyway. Moreover, because the average level of the signal is indicated by a VU meter, it follows that the distance between the real peaks, which are not indicated, and the noise floor of the tape is greater than when the real peaks are, in fact, indicated and the recording level is adjusted to these. In other words, with peak metering the signal/noise ratio is likely to be marginally lower than when VU metering is used.

However, having said that I still, personally, prefer peak metering for cassette recording because the distortion resulting from tape saturation and compression can be extremely high and thus audible even over relatively small overload times. When a peak meter is scaled so that 200nWb/m (DL) corresponds to 0dB you can peak to +3dB, or sometimes higher with top-flight tapes, with the knowledge that you are not running into serious peak distortion and without badly impairing the recorded dynamic range.

Unfortunately, this is not the end of the

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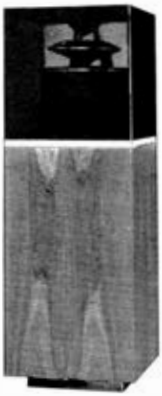

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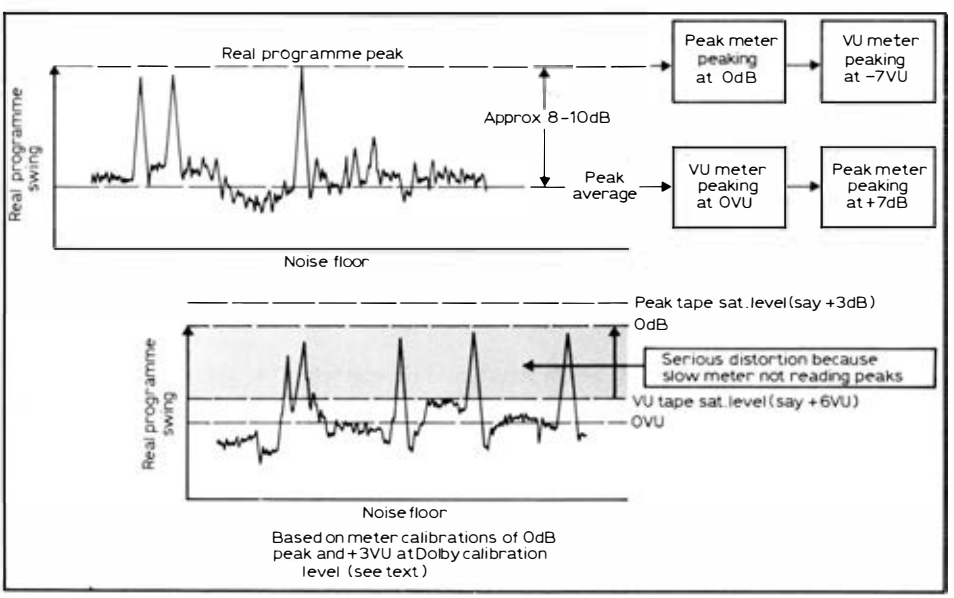
matter, for tape approaches compression at a lower level at high frequencies than at lower ones. Thus, if the music you are recording is rich in high-frequency content you may be obliged to record at an even lower level to avoid completely bad in-band intermodulation distortion resulting from the compression. Fortunately, we are helped in this respect by the nature of music in that its level tends to decrease, on average, at the higher frequencies. Metal tape also helps you to secure a wider high-frequency headroom if not a wider low-frequency one.

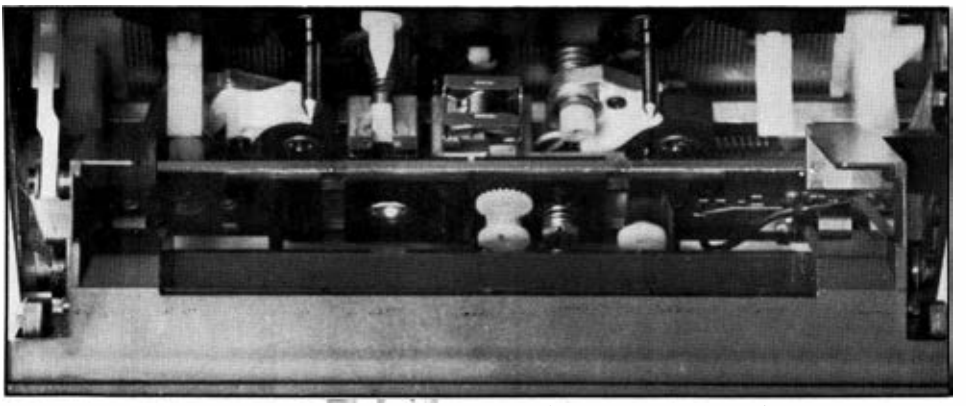
Most meters of Japanese decks are 'flat' in frequency response. This means that at a steady signal amplitude the reading holds fairly constant over the frequency range of the machine. I have investigated equalisation (eq) in the introduction to cassette tapes, so there is no good reason for dwelling further on the subject here. There you will find that eq works both during recording and replay, the former in terms of record pre-emphasis. That is, the current in the record head is caused to increase above a certain high-frequency to help combat the losses of recording.

The meters of some decks, notably European ones, read the pre-emphasised signal and thus have a recording frequency response which rises with frequency in accordance with the record pre-emphasis; or a separate circuit may be used to simulate the effect. This may not be a bad thing when you come to think about it, for it means that when the programme signal carries a lot of high-frequency content the meters will give a greater reading than ones of 'flat' response, thereby encouraging you to reduce the recording level, which keeps the level that much farther away from tape compression.

Yes, there is more to metering that may at first be appreciated. The best plan is to get to know the characteristics of your meters by making test recording with different tapes of the type of music of your interest in an endeavour to find the best 'peaking point' before the onset of audible distortion and high-frequency compression.



ARE THREE HEADS BETTER



All cassette decks must have two heads – one for erase and the other which serves the dual functions of recording and replay by switching. The record/replay head has two sections to accommodate the left and right stereo channels. This two-head scheme works remarkably well in practice, as witnessed by the good overall results achieved by some of the two-head decks reviewed in this book.

One possible disadvantage of the two-head deck is that it is not possible to monitor, through the parent amplifier or headphones, the programme which has actually been recorded on the tape immediately after it has been recorded while the deck is running in record mode. You don't know for certain, therefore, what the recording is going to be like until you have actually made it, rewound the tape and listened to the results in replay mode. If the quality is poor, low or high recording levels on peaks or high background noise, there is nothing you can do about it, apart from making the recording all over again, provided the source is still available.

Because you can actually listen to (monitor) the signal off-tape in almost real time while the recording is taking place with a three-head deck, you are in a position to make small corrective adjustments to the recording level (and sometimes to the bias), and hear the results, as you are recording.

Three-head decks are more expensive than most two-head equivalents, not only owing to the extra head but also because of the extra electronics involved. Completely separate recording and replay sections are required, plus noise reduction decoding in the off-tape monitored circuit if you are to hear the results as they will sound in normal replay. When Dolby is the noise reduction, this extra is referred to as 'double Dolby'.

Three-head decks, therefore, have separate heads and electronics for recording and replay. Now, whether you will be able to justify this extra cost I cannot say. Once you know your deck it is not difficult to make very good recordings when it is of the basic, two-head variety. Even with a two-head deck, or with the majority of them anyway, it is possible to monitor the source signal passing into the recording part of the electronics while you are recording. This is because when the deck lies in record mode the replay outputs deliver the signal which is going to the head for recording. It is then possible to switch the parent hi-fi amplifier to tape monitor and audition the programme from the speakers. This, of course, is not the same as auditioning the signal directly from the tape while you are recording.

A three-head deck might have totally independent record and replay heads (discrete heads), or the record and replay

heads may be integrated into a common housing. Both schemes give exactly the same results as already explained for three-head decks. However, with discrete heads problems arise with respect to azimuth. The azimuth relates to the angle to which the gap of a head is perpendicular to the path of tape travel. For correct replay the azimuth of the replay head must exactly match that of the head which made the recording. Unless this critical condition is satisfied the reproduction will be weak in treble.

The azimuth of the replay head (and this also applies to the record/replay head of a two-head deck) is adjusted on a special test tape of very accurate record azimuth for the strongest treble on both stereo channels. When this adjustment is optimised you are ensured of the best treble results from music tapes and from tapes recorded on a different deck whose azimuth was also correct.

Where there is a separate record head, therefore, it is essential for this also to be optimised in azimuth. Discrete head, three-head decks thus include a method of setting the record head azimuth, which can range from a simple preset adjustment to a complex auto-azimuth system which is found in some of the Nakamichi decks. Basically, a tone is recorded on the tape and while it is being recorded it is monitored off-tape by the replay head, the signal then being directed to some sort of metering or indicating lights. While this is happening the record azimuth is adjusted until the indicator reads 'maximum'. For optimum results it is desirable to perform this adjustment on each and every tape which is to be used for recording, and also again when the cassette is turned over. On auto-systems like the Nakamichi this is no bind because you merely press a button and the adjustment is made for you.

This azimuth setting complication does not arise on three-head decks whose record and replay heads are integrated into a common housing, because when the combined head is manufactured the azimuth angles can be optimised very accurately.

The story is not yet finished because there are other things to consider between two- and three-head decks. For maximum resolution of the very short wave-length 'magnets' corresponding to high-frequency signals recorded on a tape, the length of the gap (between the pole faces) must be very short indeed. I have given the reason for this in the section dealing with cassette tapes and equalisation. Head gaps down to 1μm (millionth of a metre) are commonplace. When a head with this sort of gap length is used also for recording, as it would be in a two-head deck, there is a tendency for relatively early magnetic saturation referred to the gap. This means that magnetic saturation distortion may arise before the tape itself reaches magnetic saturation, so with metal tapes you may not be reaping their full low-frequency potential.

For recording, a wider gap length can be tolerated; it is desirable, in fact. Thus the record and replay heads of three-head decks can be optimised magnetically and gap-wise for the best of both functions. My researches have so far indicated that discrete three-head machines have the edge over integrated three-head machines, but you are then on an ascending price curve.

A final point. When there are separate heads for recording and replay, the winding impedances can also be optimised, the first for maximum recording current transfer and the second for the best possible signal/noise ratio, a point which is very important but rarely considered in reviews.

Remember, too, that for erasing metal tape properly the erase head must handle a large erase current and produce a strong magnetic flux. Dual-gap erase heads are helping in this respect; but poor metal erase is rarely encountered on good decks.

There are one or two three-head decks which have all the advantages except that of off-tape monitoring. The reason for this is that they can be manufactured a little cheaper because then a double-Dolby system is not required.

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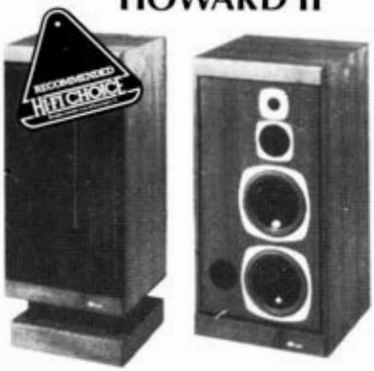

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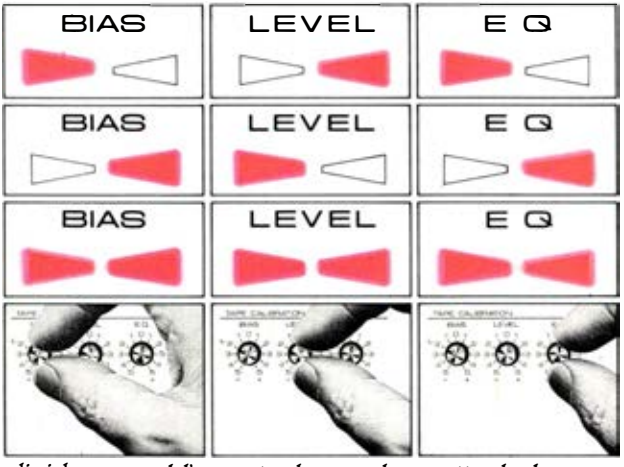

No two brands of cassettes are the same. Because every length of tape varies slightly in character.

Usually identified by differing requirements in bias, level and equalisation. (All necessary evils in magnetic recording).

The fact that there are variations between brands is not that surprising.

What is more surprising, is that variations exist even between cassettes that look identical.

For that reason, the optimum performance can only be achieved from any given tape, if the bias, level and equalisation are individually set.

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And as the number of tapes on the market multiplies, the likelihood of a cassette deck doing justice to every one gets less and less.

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Needless to say, at Pioneer we have the answer. Three independent controls for bias, level and equalisation.

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An extremely accurate system that's suitable for all types of tape. From metal to chrome to standard.

Once the tape is inserted in the deck you twist the controls.

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The EqLB system is not the only feature which makes the CT-F 1250 one of the world's most advanced cassette decks.

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Without it, the CT-F 1250 wouldn't be able to compete with open reels for accuracy.

With it, the quartz direct drive DC motor keeps wow and flutter down to a miniscule 0.03% WRMS (0.12% DIN).

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So that recorded signals retain the same pitch from one end of the tape to the other.

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It's unique, in that, it utilises the two smallest windows that expose the tape at the open end of a cassette.

Leaving the two larger windows on the outside, free to accept pinch rollers for added stability to the tape movement.

This along with the electronic memory control provides the little touch that helps prevent tapes turning into spaghetti inside the deck.

But enough of all these facts about the CT-F 1250.

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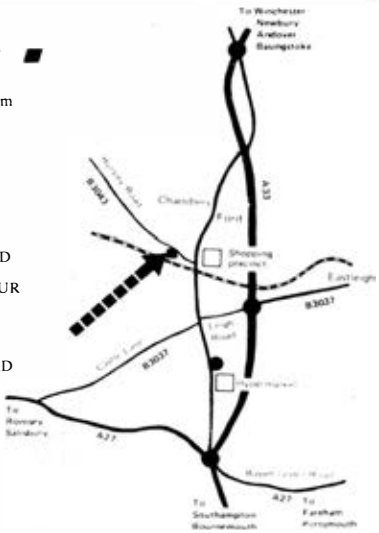

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HEAD CLEANERS

After about twenty to forty hours use, the heads of your cassette deck become sufficiently dirty and contaminated by stray oxide or metal particles to cause a significant shortfall in performance. The symptoms are reduced output, especially at the treble end of the music spectrum, leading to a 'dullness' in the reproduction and lack of transient 'sparkle' and music 'attack', along possibly with an increase in background 'hiss'. In severe cases, where particles of the tape coating have shorted across the narrow gap of the heads, the output can drop virtually to zero at all frequencies and you may then conclude that the deck has sprung a fault, where in actual fact a little *careful* head cleaning will restore normal operation and save you a fair amount of petty cash.

Bad contamination of the erase head or shorting of its magnetic gap by tape particles will impair the efficiency of erasure, especially when you are using metal tape, and you will then hear as a background to a new recording the recording that was on the tape before.

Tape guides, the capstan and pressure roller can also pick up a fair amount of coating over months of use, so when you go head cleaning it is highly desirable also to pay attention to these items.

Another thing which can happen to the heads and tape transport associated ferrous items in the deck is the development of residual magnetism. That is to say, a small amount of permanent magnetism is imparted to these components. This can happen in various ways and, although the magnetism is relatively weak, it can affect the overall nth-degree performance of the deck, especially when the heads are magnetised. The symptoms are reduced upper-treble output, though possibly not as bad as resulting from a badly contaminated head, and an increase in background noise.

Being aware of these problems, what, then, can you do about them? Head and transport cleaning is not difficult. You can buy those little 'cotton wool' buds from pretty well any chemist (the things you clean babies ears with) and, if you wet one of these with a suitable solvent such as isopropyl-alcohol which you can get from most hi-fi shops (but beware of unsuitable solvents), you can clean the muck and caked tape coating (though let us hope that it is not as bad as this!) from the heads without damage. On no account use a blade of any description or abrasive materials. You can then use fresh 'buds' to go round the other items of the transport. It is often possible to slip off the front window of the cassette holder to gain greater accessibility to these vital parts of your deck.

Being fully aware of the problems various manufacturers (including some of the tape people themselves) have designed and developed cassette deck head cleaners. The simplest of these consist of an ordinary cassette loaded instead of tape with a non-abrasive cleaning tape. The plan is to load this cleaning cassette into your deck, rewind to the start and then place the deck into replay mode. This brings the heads up against the cleaning tape, thereby cleaning off the muck as the tape is rolling. You may still need to clean the transport items with 'buds', though, suitably 'wetted'.

It is impossible to name all the people making these head cleaning cassettes, but the well known operators in the hi-fi accessory business can almost all oblige you. I have, personally, just been looking at the latest release in this area from Scotch and found it quite viable and not much different from the cleaners of this type going under other names.

Of different styling, though still contained within a cassette (C-zero) is the remarkable device from American Allsop, handled in the UK by Network. The take-up spindle coupling from the deck operates a cam within the cassette such that a little non-abrasive pad rubs across the replay/record head as the deck is running in play mode. There are also non-abrasive pads within the capstan and pressure roller cutout of the cassette which cleans these items at the same time. A small amount of

pressure is applied to the pads by internal springing. Main disadvantage is that the erase head is outside the cleaning action. Neither is it possible to use the device with certain three-head decks. The torque required from the take-up spindle is not very high but on one or two occasions I found that the available torque from a deck was barely sufficient to get the cam working smoothly, especially after the application of the dissolvent (isopropyl-alcohol) supplied with the device.

However, in the vast majority of decks the device functioned perfectly. One of the decks which I was testing for this book was found on first switch-on not to be working. In fact, the output from my DL tape was some 10dB down. The same applied to both channels. Having the Allsop device at hand at the time, I ran this in the deck for less than a minute and to my astonishment found that full DL output was restored.

I should, perhaps, again mention here that the amount of tape coating that will be likely to accumulate will to some extent depend on the quality of tapes you use. Some 'cheapo' tapes of obscure label have been known to shed abnormal amounts of oxide, which soon leads to head clogging.

That, then, leaves us with the problems of magnetisation — or, at least, how to get rid of it. Special mains demagnetisers are available at hi-fi accessory shops. These are equipped with an end probe where the changing magnetic flux is developed, the idea being to bring this up to the item to be demagnetised and then gradually draw it away to some distance before switching off. If you switch off while the field of the probe lies in the vicinity of the item being demagnetised, you could be left with even more residual magnetism than you started with.

Transistor-operated devices have also been developed and marketed, but I have not tested any of these. In all cases it is important not to apply a too heavy erasing flux as this could overheat the heads and possibly damage them and/or their windings. Also, of course, the recorder should be switched off while the degaussing, as it is sometimes called, is happening.

A novel device, marketed by Ampex and going under the name '220 Demagnetizer and Head Cleaner', is worthy of note. It is built into an ordinary C-zero and in addition to a cleaning tape, as already explained, it also contains a cylindrical magnet which is caused to rotate by the movement of the tape from one spool to the other. As it rotates so the magnetic field that emanates in the direction of the heads in the deck alternates. Now, the rotating magnet is fixed to a lever within the cassette and the lever is spring-loaded so that it is pressing against the spool. When the cleaning tape is rewound for action the magnet lies in the closest position to the heads. When the deck is put into play mode the tape rolls and cleans the heads, the magnet rotates and gives the changing field, and as the tape winds on to the take-up spool so the distance between the rotating magnet and the heads increases, which reduces the changing field strength as 'discerned' by the heads. At the end of the cleaning tape the field relative to the heads is at a minimum and the cassette can then be removed. Before reuse, of course, it must be rewound to the start again.

It is incredibly difficult to measure accurately the efficiency of head degaussing. I have tried numerous tests including measuring the noise and upper-frequency response on a machine known to be unmagnetised, then deliberately magnetising the heads and measuring the noise and upper-frequency response again, and following this by corresponding tests after using the particular demagnetising device. I am sorry to say that none of these tests has been very conclusive. There is need to develop more sensitive test methods. As these can be incredibly expensive I am hoping to tie up with a special 'magnetics' lab sometime in the future to investigate more deeply the subject of tape head magnetisation. I shall keep you informed in my magazine writings!

In the meantime, keep your heads clean!

TECHNICAL TALK

You don't need to understand anything in this section to reap high value information from this book! In fact, it has been our aim to cut technicalities down to a very bare minimum. However, please do not think that we have skimped on lab work. Each deck was put through a fairly rigorous lab routine and auditioned in a hi-fi system before we attempted putting words to paper.

It is not possible to assess any technical equipment, no matter how much is argued to the contrary, without making technical tests on it. At the conclusion of the project I had an incredible amount of technical information to sort through, I can assure you.

The thing is how interested are you in all this data, technical jargon and jumble of figures? I have always wanted to write a book of this kind without having to present reams of figures in the 'old fashioned' form. My researches over the years have revealed that very few readers of technical reviews and books like this one study the technical figures. They are much more interested in conclusions. It would seem, therefore, that such a lot is written and effort expended to minimal effect.

I used a lab full of expensive test equipment to bring my findings and conclusions to you, and for the more technically orientated some of the prime results of my tests are given in the review and presented by easy to understand bar graphs at the end of the book. The taller the bar, the better the performance. These are relative, one deck to another, so you can form your own comparative judgements. I have avoided tables and unnecessary figures, using bar graphs, ranking numbers and letters instead, so you don't need to be technical to understand these.

However, for the technical of our clan I would like to present some of the technical things I explored. It would be singularly unfair not to do so.

METERING

This is much more important on tape machines than many people appreciate. Accurate and fast-responsive metering can make all the difference in the world between a good recording and a bad one. At this point I would like to refer readers to the 'features' section.

Using an accurate test tape I checked calibration on the left and right channels and have indicated the results in the reviews, referred to Dolby level, which corresponds to a recorded magnetic flux close to 200nWb/m at 400Hz for cassette decks. You will see that VU meters read around +3 and dB meters around zero at this level.

Using a 1kHz steady tone I set the recording level to zero dB or VU on the meters and then activated a pulsing circuit on the test instrument so that the tone was switched on for 20ms (twenty-thousandths of a second) and off for 480ms (0.48 of a second) repetitively without alteration to the level or amplitude of the tone burst over its steady level, to see how far the meters deflected on the bursts. Fast-responding metering gives the same zero dB or VU indication on the bursts as on the steady tone. With slow metering, however, the burst can be 10 or more VU or dB points below the indication on steady signal! Just imagine by how much this is going to over-record a tape on peaky transients when the average level is set to peak to meter zero or above! In the reviews I have expressed the 'goodness' of metering by a 'bar graph' ranking system.

SIGNAL/NOISE RATIOS

Dynamic range is the distance between the noise floor and the maximum output to a given distortion (3% in my case). Tape is the prime producer of noise, the electronic contribution of the deck being generally much less. With a special C-zero (cassette with no tape in it) I measured the replay signal/noise ratio referred to Dolby level (DL) with and without weighting, the latter to assess the degree of mains power supply 'ripple' as distinct from 'hiss' noise.

I also measured the improvement to the ratio obtained separately with 70μs eq and

the noise reduction system. Theoretically, with suitable weighting, the former should give an enhancement of about 4dB and the latter, when Dolby, 10dB. The results against the technically possible were assessed.

To see by how much the electronic noise of the deck is likely to impair the off-tape signal/noise ratio I also measured the ratio using Scotch Master II tape (a 70μs oxide of desirably low noise floor) using CCIR/ARM weighting, which also takes account of the noise, if any, produced on the tape as the result of machine erasure (and bias signal impurity). Obviously, the off-tape signal/noise ratio cannot be any greater than the deck's replay signal/noise ratio in 70μs mode. To make any appreciable difference to the off-tape signal/noise ratio, however, the deck's electronic noise was found to have to come within about 6dB of tape noise.

An example will help to illustrate this and prove interesting. Say, for instance, the deck's electronics account for a signal/noise ratio of 60dB, while the intrinsic signal/noise ratio of the tape itself is 54dB. In this case the electronics noise is 6dB below the tape noise, which would impair the overall signal/noise ratio by only 1dB (almost within tape noise spreads), producing a ratio of 53dB. With 10dB difference the impairment is little more than 0.4dB; but when there is no difference, which would be extremely unusual, the impairment is 3dB. In most decks, therefore, the tape noise almost completely masks the electronics noise. I assessed the difference to discover the impairment and ranked accordingly.

I should also mention that the overall signal/noise ratio using the Scotch Master II tape took account of the recording noise at line (suitably loaded) with the recording level control half way advanced, so the assessment is pretty exhaustive. Microphone noise input and sensitivity were judged by using a real mic.

DISTORTION

Distortion at 400Hz was measured at DL using up-market Fe 120μs and metal 70μs tapes whose distortion and LF MOL characteristics were not unduly affected within the bias range or set bias of the decks. This made it possible to use common test tapes in many instances, thereby avoiding complicated variations which would otherwise result from the use of different tapes. Any departure from this procedure or comment pertaining to the results is given in the review. Distortion was measured with the noise reduction system active (Dolby being used when there was a choice). VLF (40Hz) distortion tests were experimented with, but I concluded that the 400Hz results were sufficient, the higher distortion at 40Hz mostly resulting from the tape itself and not the deck. HF distortion was not measured as, again, this is much more a function of the tape than the deck, information in the former respect being contained in the tape reviews.

LF MOL

Maximum output level to 3% 3rd-harmonic distortion (MOL) was measured with the same tapes as used for the DL distortion tests. With a knowledge of the MOLs of the tapes themselves at the operating bias level, the results provide a valid indication of whether the output is being limited by head and/or electronics overload in recording and replay modes (replay output distortion was also measured separately at 10dB). Again, the tests were made with the noise reduction system active, so electronic overload here is also accounted for. For example, Maxell MX (metal) correctly biased can produce an LF MOL in excess of 8dB in good decks, with no dramatic shortfall when the bias is adjusted up or down in level slightly relative to 'optimum'. A result with this tape in any deck of, say, 3dB would not be good! Severe under-biasing would be detected on the small-flux frequency response. If this is not in evidence (significantly rising treble), then the deck is limited in output due to head saturation or other electronic factors.

The 40Hz MOL is commonly lower than the 400Hz MOL owing mostly to tape reasons, as mentioned under distortion, and was not measured. Neither was the HF MOL, which is also essentially a tape function and brought out in the cassette tape reviews themselves.

FREQUENCY RESPONSES

Where possible, common tapes were again used for the overall responses, one for 120μs oxide and another for 70μs metal, and sometimes also with a Class 2 tape each with noise reduction off and on, showing frequency integrity with the particular tapes at −20dB recorded level.

My OdB reference for the frequency responses and, indeed, most other tests, was 200nWb/m at 400Hz (DL). Tape sensitivity variations over the frequency range 20Hz-20kHz are thus indicated by the responses at 20dB below Dolby level. The extreme upper-frequency ends show filtering and/or head losses; also the effective coercivity of the tapes used, while reflecting the biasing conditions. Where possible the responses were plotted with the MPX filtering off.

The undulations at the lower-frequency end stem from head pole piece dimension ratios and are thus essentially a function of the deck rather than the tape. They are rarely audible, but I have down-ranked slightly where they were particularly severe.

Replay eq in 120μs mode was assessed for accuracy at middle frequencies using special test tapes. Good replay eq accuracy is important for the correct play of pre-recorded cassettes and cassettes recorded on different decks.

WOW AND FLUTTER AND SPEED ACCURACY

W&F was assessed with special tapes and was based on DIN weighting. Overall W&F can be expected to be higher, depending on the goodness or otherwise of the cassette mechanics. An accurate tape gave the basis for speed accuracy. An error more than 1% would be poor.

SQUAREWAVE RESPONSES

Rarely do tape machine reviews show 1kHz square-waves — probably to avoid frightening the would be consumer! They are certainly not good compared with the results from amplifiers, for example; but as they are used to help assess pickup cartridges, I felt that their value in cassette deck evaluation should be similar. They all have a general 'nature', resulting from group delay (phase distortion) evoked by the eq filters. Nevertheless, some machines are capable of better results than others. Further improvement would call for phase compensated filtering, which would be fairly expensive if done properly, and there is no overwhelming support indicating that better squarewaves make for better sound despite what the amplifier people try to tell us! I have commented on the results in the reviews. Tests were mostly done with Maxell MX tape. Where it was possible to switch off the MPX filtering, the upper trace shows the result with the filtering off and the lower trace with it on (the latter sometimes with Dolby). You will see that the MPX filtering adds to the 'rings'.

OTHER TESTS

The above refer to the primary tests. A number of smaller tests were also undertaken both in the lab and with each deck connected to the hi-fi system. For example, I assessed the background hum and 'hiss' level from the speakers, checked with microphones and headphones, checked the headphone output into 8 ohms and line interfacing to an amplifier, measured fast spooling time, assessed background noise resulting from inadequate erasure, and so forth. Where appropriate the results of these tests are indicated in the reviews or reflected in the rankings.

RANKINGS-MERIT & VALUE

To keep in line with the gradings adopted in the Systems Digest, book, I have also elected to use the components of MERIT and VALUE. However, for my evaluations of cassette decks I found it necessary to extend the scales over A B C D E for merit and 1 2 3 4 5 for value where, again, A and 1 correspond to the top rankings. Average ranking is thus C3, while a deck boasting a ranking of A1 would be quite outstanding.

The rankings are relative to my findings of the particular test samples submitted. Unfortunately, differences between samples of the same make and model are not unknown, and this applies particularly to cassette decks where fairly small biasing differences can have quite marked effects on the overall results.

Please, therefore, look at the ranking as a 'rough guide' and not as an immutable scientific fact. There are quite a few aspects of design and testing which are less influenced by sample variations, though, and these have been considered particularly when making the evaluations. Also, where it has been possible, I have used common tapes (same samples in each case) to help reduce the differences which could stem from the test tapes themselves.

Merit

This reflects my assessment of the technical results along with a 'accuracy' of auditioning; also, on how well the deck performs with metal tape, goodness of metering, frequency response and eq errors, W&F and so forth.

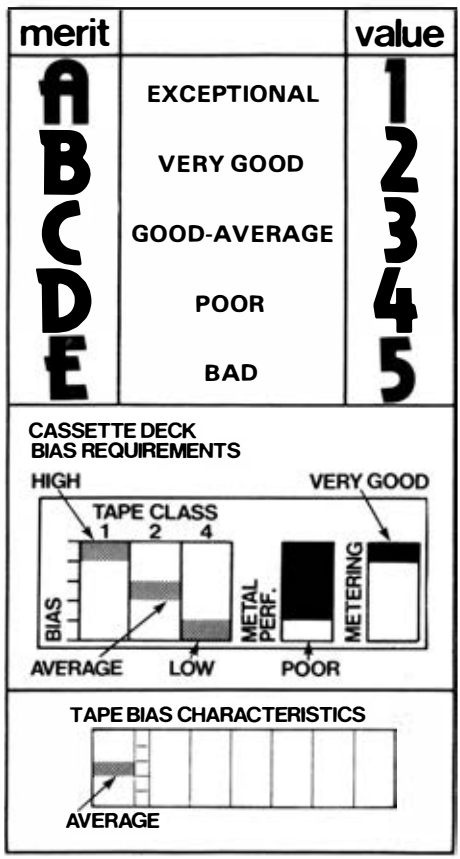
Value

This component of the ranking relates price to the overall performance and the features offered. However, the ranking here would not necessarily be high just because a deck is endowed with a multiplicity of features. Their usefulness is considered as well as their relationship to the net results.

In this way, therefore, there is bound to be some connection between merit and value, so the two components should be viewed as a whole to start with, after which the additional data provided will help you to consider them separately if you wish.

I have also included the prices of the decks, but these can only be regarded as approximate (including the VAT rate applicable at the time of writing), as they can vary from place to place and from source to source.

You will see that each review also concludes with how the deck is biased in Fe, Cr and metal modes in terms of tape bias demands, metal performance and metering. The former links directly to the biasing code given in the cassette tape reviews, while the latter two are assessed by my five-point bar graph ranking system (as also used in the cassette tape reviews).



AIWA AD-L450 £145

Using LED metering instead of VU meter movements, this model Aiwa is otherwise akin to the AD-M450, which may lab has already investigated and which proved to be a desirable deck. It is a two-head front-loader with logic-controlled tape transport, lights showing the selection of pause, play and record. Like the SD-L50, two motors are utilised, one for the tape drive capstan and the other for spooling which also lightens the load on the main motor.

The loaded cassette can be seen clearly through a full-view cassette holder, but rear illumination would have been a useful bonus. The metering, which Awia term 'optical peak display', consists of two rows of twelve LEDs in three coloured segments calibrated from −20 to +10dB. Dolby reference level is scaled to around +3dB.

Recording level is adjusted by a friction-coupled dual-concentric knob, having left and right channel sections, and the mics are engaged when the jack plugs are inserted into front sockets, independently for each channel.

Bias and eq are selected simultaneoulsy by a three-position slider switch for tape classes I, II and IV, there being no specific position for Class III tapes. Bias level for Class I tapes is adjustable by a front control which is roughly indicated by a label for the bias requirements of a number of tapes. Bias yield for Class II and IV formulations is fixed, but as we have seen from the tape section in this book it is the Class I formulations which can differ so much in bias demand, the control thus being very useful.

There is also a switch for recording or replaying when the deck is operated by an external timer. The same switch also has a position for replay repeat. Dolby is operated by another slider switch which applies MPX filtering at the same time. A bright blue pushbutton allows you to defeat the recording while the tape is still rolling, but the meters continue to read.

Amplifier interfacing is by rear 'phono' sockets, with DIN socket option brought in by a switch. Also at the back is a mini-jack socket which can be connected to a species of Aiwa record deck to secure synchronised recording.

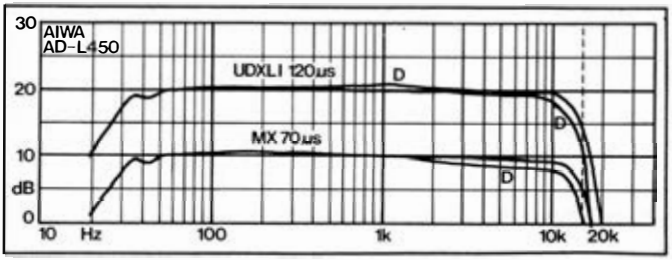
Finish is 'silvery' overall with metal enclosure. Dimensions approximate 420 × 120 × 279 mm (W × H × D) and weight 5·2kg. Selling price is around £145.

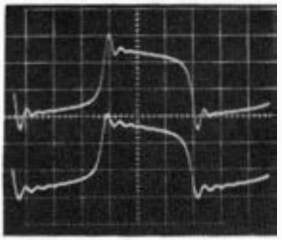
merit **B** value **1**

The verdict

Under audition it was thought that the general colouration was low. Good results were obtained with metal, though there was a trace of stereo image wandering. Deep bass was a shade on the weak side and there was slightly less 'attack' on transient-rich programme material recorded from the master tape than I have detected on decks whose upper-frequency extends to 20kHz. This was barely noticeable when recording from radio or gramophone records.

Taking account of price, overall lab performance and listening experience my awards are B for merit and 1 for value — a deck, I think, many people will like.





The findings

The deck operated quietly and responded without problems or errors in terms of the logic control. It was possible to alternate between fast-spooling and replay modes directly. Metering was not as fast as provided by some peak-responding displays — 20ms bursts under-reading by about 4dB — but it was certainly significantly faster than provided by the VU meters of the M450. The coloured LED segments helped to retain a control on the levels.

Replay signal/noise ratio direct from the deck was up with the highest of the decks in this book, and the hum content was low. The Scotch Master II at 70μs eq and with Dolby returned a ratio as high as 66dB, which is towards the ceiling of any deck with this tape.

The UDXLI frequency response was plotted with the bias set for the 'flattest' overall response, which turned out to be a little less than indicated on the fascia label. (Similar results but with slightly improved HF obtained with UDXLII and SA). Without Dolby you will see that the −3dB point of UDXLI occurred around 14kHz. Metal improved on this but, unhappily, with a little upper-treble droop, but better with TDK MA. Dolby integrity was fair, it being the MPX filtering responsible for the earlier treble roll-off with Dolby on.

LF performance was very acceptable at 0·5% distortion and 6dB LF MOL with UDXLI and 0·7% and 5·5dB with MX. 120μs replay eq could have been a little better adjusted.

The squarewaves (lower with Dolby plus MPX) show a substantial starting overshoot but fewer and lower amplitude 'rings' than from some models. A C90 fast-spooled in 102 seconds.

AIWA AD-R500 £208

This metal-capable two-head front-loader is equipped with reversible tape transport and position switching head operated by low-pressure buttons and logic, which means that a recording or replay can be continued from side 1 to 2 without having to remove the cassette from the deck to turn it over. There are three modes of operation which are normal, reverse and continuous.

In normal mode it is possible to record or replay side 1 in the normal direction from left to right or side 2 from right to left as selected by the appropriate play button — there being a button for each direction. In reverse mode, after the tape has been recorded or replayed on side 1, the deck automatically switches so that side 2 is then recorded or replayed with the tape running in the reverse direction. At the end of side 2 the transport goes into standby. In continuous mode, instead of the transport going into standby at the end of side 2, side 1 is run through again . . . then side 2 again, side 1 and so on. However, when the deck is set for recording the transport goes into standby, even in continuous mode, at the end of side 2 which, of course, is perfectly logical since it prevents accidental recording of new material in place of that which was recorded on side 1 at the start of the cycle.

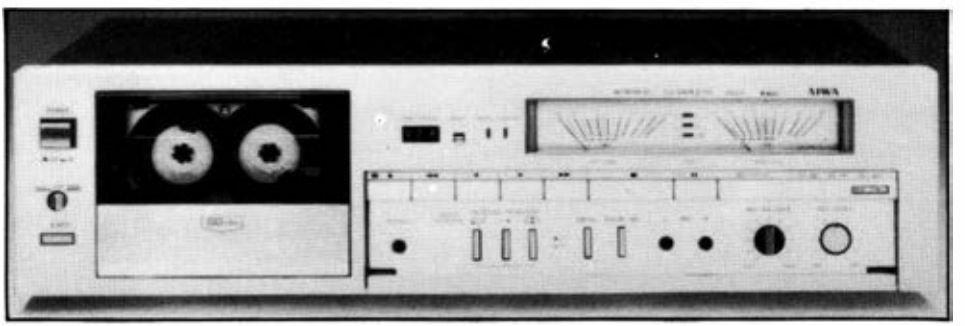
The change from one side of the cassette to the other can be made to occur in less than a second by operating a button labelled 'quick reverse'. This is triggered by a photo-electric device sensing the interface between the leader tape and the tape proper. The instructions say that the changeover happens in 0·4 second (400ms). This can be useful when you require the very least interruption between one side and the other side of a cassette, but to take full advantage of it you need to record right at the start and right to the end of the tape proper. If the 'quick reverse' button is not activated the changeovers will be more protracted since then the cassette has to run to the end of the leader tape.

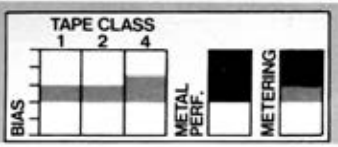
Bias and eq selection for Class I and II tapes is automatic by virtue of the cassette cutouts. For metal it is necessary merely to depress one switch, while a similar switch activates Dolby noise reduction with MPX filtering. Indicator lights show when these switches have been operated. Further indicator lights are present above the record and pause transport buttons to show when these have been depressed.

Metering is by two VU meter movements scaled from −20 to +6 VU, with red at OVU and above, and softly glowing. Dolby level lies at +3VU. The meters are slow-responding but are complemented by three peak-responding LEDs at +4, +6 and +10 dB, common to both channels.

Amplifier interfacing is by 'phono' sockets at the rear with DIN socket option, the change being made by a small rear slider switch. The mic channels are activated by plugging the jack plugs, independently switched. There is also a rear socket for remote control interface.

The deck is good looking, having a 'silver' fascia and metal enclosure of 'silver-grey' finish. Dimensions approximate 450 × 122 × 287 mm (W × H × D) and weight 6·1kg. Selling price is expected to be around £208.



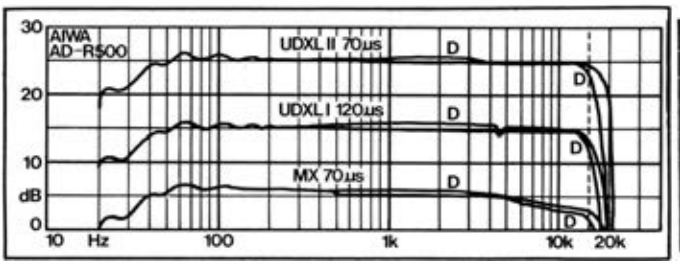


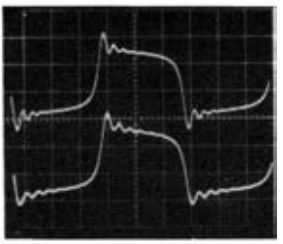
merit **B** value **3**

The verdict

The pièce de rèsistance of this deck is undoubtedly its auto-reversing feature. Recording and replaying with the quick reverse mode operated you can almost always guarantee to achieve virtually 1½ hours uninterrupted running time with a C90 cassette which, of course, is longer than you can get on one side of a C120 (if you are brave enough to use one) with a conventional deck. The feature will thus be of significant interest to recordists of protracted classical music.

If fell short on some technical aspects but not all these influenced the auditioning. The excellence of the quick reverse mode is certainly worthy of merit, and my overall award for this would have been higher had metal performed better and the metering more towards my liking. I thus award B for merit and 3 for value.





The findings

In the lab the deck gave a mixed exhibition. Signal/noise ratios were a little lower than have been measured and the hum content was a trifle higher — though inaudible under normal audition. Neither was the machine highly encouraging with metal brews. LF performance with Class I tapes was excellent, though, with distortion down at 0·65% and MOL as high as 6·5dB, which shamed the metal results of 1·3% distortion and 3.5dB MOL (but Metafine tape gave slightly improved results). Distortion on the signal direct from 'monitor' (machine recording) at 10dB output was a magnitude lower than the distortion from tape at OdB output, so no trouble there. However, it was noticed that the distortion, generally, tended to decay slowly as the output was reduced — there being a sort of hysteresis effect.

The pen-chart reveals acceptable small-flux frequency resposes but with the top end of metal rolling off somewhat. Tapes of higher bias demand were not so bad. Dolby integrity was good in all cases.

W&F was down to 0·07% in one direction but a little higher in the other — up to about 0·1% (replay only). Speed error was very small, and a C90 fast spooled in 97 seconds flat. Metal erased to well below noise floor at 1kHz, and headphone yield was OK for low impedance 'phones. The VU meters were slow, under-reading 20ms bursts by 12dB, but the peak LEDs came to the rescue though were limited in range. It would have been better had more lower-level flashing LEDs been fitted. Dolby level was scaled at +3VU.

The oscillogram shows reasonable squarewaves, again the result with Dolby plus MPX (lower trace) being the best.

Set for auditioning, I was very impressed by the cassette side auto-change. Discontinuity of music was barely noticeable in quick reverse mode. (400ms is not a badly disturbing 'drop-out'). It was found, though, that not all tapes triggered the photo-electric device — but most did. This is one of the best auto-reversing decks I have come across.

There were mixed feelings about the auditioning.

Mid-range was thought to be a little 'muffled' and bass unduly emphasised Degrees of sibilance were also heard on certain programme material. Stereo imagery was fairly stable but some disembodiment of the stereo scene was detected.

AKAI CS-F11 £104

This model uses a Sendust head rather than the Super GX head of the GX-F35; but is that much less expensive. Nevertheless, it has two motors and is an attractive and substantial looking deck. Enclosure is grey-finished metal and the fascia of a 'silvery'-finished metal. The rear is hardboard. Logic looks after the tape control, the buttons being soft to the touch. Those for pause and record light when activated.

The loaded cassette is fully visible through a window on the cassette holder, and rear illumination makes it possible to see what is happening to the tape.

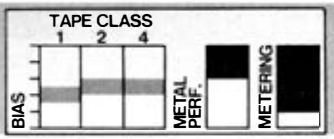
Metering is by LED bars with DL corresponding to +3dB. Response is to VU speed (not peak) and the scaling is from −20 to +6. A single switch has positions for Class I, II and IV tapes biasing and eq being set simultaneously, there being no specific position for Class III Fe Cr formulations. The instructions merely state that 'when playing FeCr tapes set to Cr or metal position'!

Recording level is set by a large dual-concentric friction-coupled knob. Amplifier interfacing is by way of rear 'phono' sockets but with DIN option, the changeover by a switch. Each mic channel is activated by insertion of the appropriate jack plug (standard jack sockets for mics and 'phones at the front). A three-position switch operates Dolby with or without MPX filtering, and there is a switch for starting the deck for record or replay by an external timer.

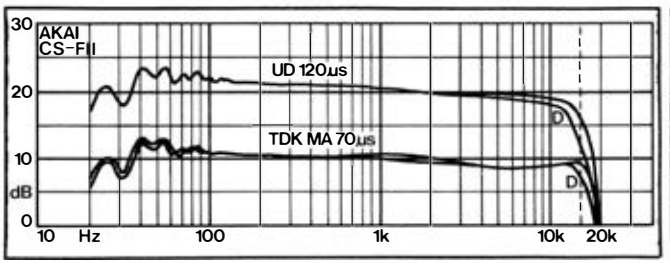
Dimensions approximate 440 × 118 × 285 mm (W × H × D) and weight 6·8kg. Price is around £104.

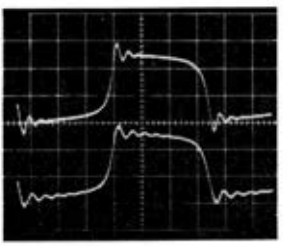
The verdict

Although this deck would not suit the more critical audiophile, it has some good points and is attractively priced. However, I found it necessary to restrict the merit mark because of the bad low-frequency undulations, the unnecessarily slow metering and the auditioning impressions. Account was also taken of the slow tape speed. Accordingly, my judgement is D for merit and 2 for value.



merit D value 2





The findings

As with the GX-F35, the deck was set up in the factory with Maxell UD Class I, TDK SA Class II and TDK MA Class IV tapes, so these were adopted for some of the tests. The pen-chart shows some rather nasty low-frequency undulations and rather a lot of bass lift. Treble, too, tended to start rolling off a little early, but SA gave a flatter HF end. 120µs replay eq (using my particular test tape) was almost 2dB down at 6·3kHz and 0·8dB up at 125Hz, which seems to follow the trend of the overall responses.

Signal/noise ratios were good with 66·5dB being possible with the Scotch Master II at 70µs eq and with Dolby. Ripple content was low. LF performance was quite respectable for the price of the deck, UD returning 0·9% distortion and 4dB MOL and MA 0·9% and 5·5dB (ref.DL) Better results were obtained with UDXLI at LF, at least.

Wow and flutter was veering towards 0·12% (DIN) and the tape was running 1·6% slow, which is bad and should encourage Akai to tighten quality control. A C90 rewound in 122 seconds. Headphone delivery was more suitable for medium/high impedance 'phones rather than very low impedance ones. The squarewaves show quite respectable results, the starting overshoot and 'ring' amplitude being lower with Dolby and MPX active (lower trace)

Under audition colouration was detected with some upper-treble 'tizzle'. Bass was considered 'fluffy' and less well defined than from the GX-F35. Stereo imagery was not too steady, and careful control of recording level was required to avoid the effects of high-frequency compression. The metering was reading some 15dB down on 20ms bursts, which is a lot, so the electronics of the metering could be quickened to advantage. The slow tape speed could be heard by critical listeners of pre-recorded cassettes. Metal tape gave an advantage at upper-treble, but most people would find that UD or UDXLI was equal to the deck's potential.

No trouble was experienced with mic interfacing, the gain being high and the noise low, and the fixed replay output interfaced okay to the test amplifier.

AKAI GX-F35 £148

This very recent Akai deck is competitively-priced in terms of features and performance, as you will see. It is a two-head front-loader incorporating a new type of glass and crystal ferrite head, which Akai call 'Super GX'. This is said to offer several advantages over its predecessor, the 'GX' head, and from the technical data that I have delved through this would appear to be the case.

Metering is by a two-bar fluorescent display which can be changed by a button to VU or peak characteristics. Scaling is from −20 to +8 dB with Dolby reference level residing at +3VU in VU mode and −3dB in peak mode. To help with the reading the last few elements of the bars are held for a few seconds before being updated by the following signal. There is a version which uses VU meters and without the 'music search system' of the GX-F35, which is called GX-F25.

Cassette holder is a full-view type and rear illuminated, opening smoothly when the reject button is depressed. Encasement is grey-finished metal and the fascia 'brushed aluminium', but the rear is a hardboard material rather than metal. Like most of the other decks, a two-core mains cable is used with double-insulation in the deck.

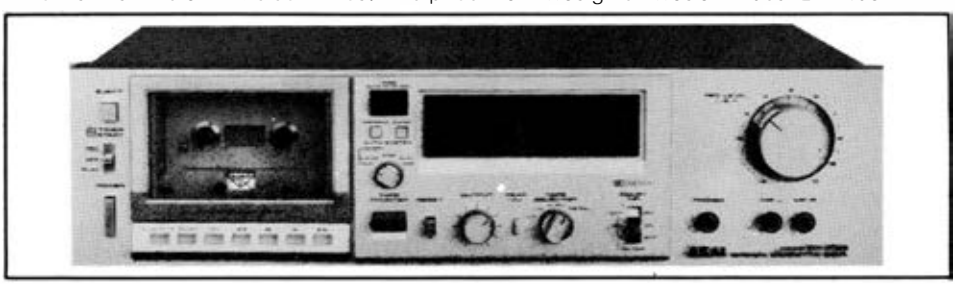
Tape transport is logic-controlled and operated by 'soft-touch' transparent buttons, most of which glow a particular colour when activated. An interesting feature is 'auto mute', whose button flashes on and off for several seconds after being depressed. At the end of this time the play button flashes which signifies that the deck has entered pause mode and that to re-commence the recording the play button has to be depressed. This feature is used to apply deliberate pauses during a recording so that the tape will work the 'instant programme searching system' (IPSS).

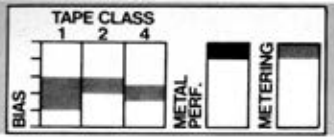
When a switch is set to IPSS an electronic digital display shows zero. By operating a button it is then possible to programme the system to the pause number along the tape preceding the recorded section it is required to listen to. When this is done it is just the matter of activating the fast-spooling in the appropriate direction so when that particular pause is detected the deck goes automatically into play mode!

The switch earlier mentioned also has positions for memory stop (the tape stopping when the ordinary mechanical tape counter passes zero), memory play (auto-replay occurring when counter zero is reached during fast-spooling), auto-stop (the tape automatically rewinding when finished and then stopping) and auto-play (instead of stopping at the end of a rewind the tape is replayed again).

There is also a timer start switch for record and replay and, of course, Dolby with or without MPX filtering. Recording level is set by a large dual-concentric knob, while a smaller knob sets the replay level (also headphone level). Changeover from line to mic occurs when a mic is plugged in the front jack socket, the two channels operating independently. Amplifier interfacing is by 'phono' sockets with DIN option by a changeover switch.

Dimensions approximate 440 × 118 × 285 mm (W × H × D) and weight 6.9kg. Well, how much is this little box of electronics? The price that I was given was a modest £147.93.

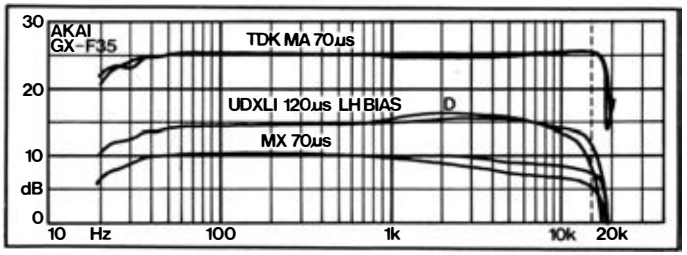


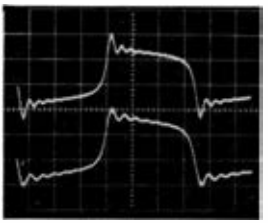


merit A value 1

The verdict

Excluding the last reservation noted, I would rate this deck highly (but Akai must look at their quality control). For the price it represents very good value, especially when linked to the features offered and the general lab and auditioning performance. Discounting the lower performance left channel, therefore, and marking as though the maladjustment did not exist, I award A for merit and 1 for value.





The findings

The operating instructions contain a list of recommended tape, including UDXLI, so this tape was used along with MX. The two lower curves in the penchart show that the results were not particularly impressive. The setting-up Class I tape was Maxell UD, so it is possible that the small-flux frequency response would improve with this. Also it was noted that the setting-up reference was TDK MA, so a metal plot of this was also done (top curve). You will see that the frequency response with this was excellent with extremely good Dolby integrity; but some of the other measured parameters were less good than MX! You can't have it all ways, it seems. TDK SA, the Class II reference, gave a better upper treble than UDXLI.

Signal/noise ratios were very good, the Master II at 70μs with Dolby returning 66·5dB, with very little ripple content. LF performance with UDXLI was towards the top of the line with 0·45% distortion and 6dB MOL ref. DL. MX was a shade down from this and more so with MA. 120μs replay eq was satisfactory and W&F down with the lowest at 0·06% with −0·4% speed error.

Headphone delivery was suitable for most medium/high impedance 'phones, but low impedances ones were a trifle short of voltage. Metering was a little confused by the delayed elements, and the 6dB change in effective sensitivity between VU and peak modes seemed to be a shade out of keeping with the requirements, but there was no under-reading in peak mode. No trouble was experienced with interfacing the test mics, and hum and noise was low. The squarewaves indicate a better performance with Dolby plus MPX (lower trace) than without Dolby. A C90 rewound in 108 seconds flat.

Motor noise was low and overall colouration small. Indeed, with TDK MA metal extremely good recordings were produced, though we did detect a trace of sibilance, but not serious. Stereo imagery was fairly firm and bass end 'clean', with good portrayal of low-level ambience. Unfortunately, the left channel of the deck was not working as well as the right one. Dolby levels between record/replay were maladjusted. Clearly this was not a design aberration, but one of setting up.

ALPAGE AL-50 £160

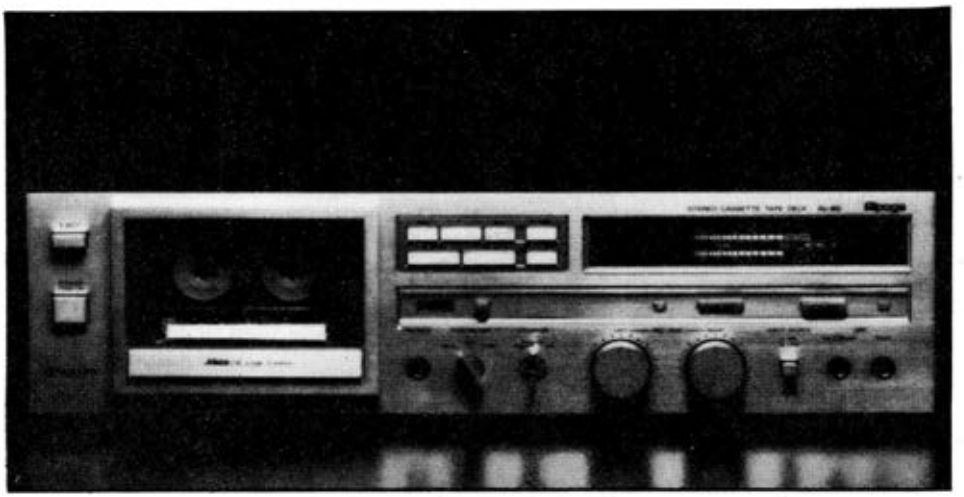
This is a new name in the UK cassette deck arena. The decks are made in Japan by a reputable factory and distributed in the UK by Shure Electronics Ltd, the well-known pickup cartridge people. There are going to be several models in the range but that which was made available for this book falls around the middle of the price scale.

It is a two-head front-loader with logic tape transport control. The cassette holder is essentially the full-view windowed-type but lacks rear illumination. Recording level is handled by two knobs with surround markings for the left and right channels. Replay output is fixed at a convenient amplifer interfacing level. Changeover from line to mic input is accomplished by a front button, and for amplifier connection there are rear 'phono' sockets along with a DIN socket. Standard ¼ in jack sockets at the front accept left and right mics and headphones.

Fascia is of the common 'brushed aluminium' appearance but with rather sharp and jutting corners. Enclosure is metal of 'silvery' finish. Metering is by a true peak-responding fluorescent-type display calibrated from −20 to +5 dB with an extension to +8dB in metal mode. Selection of bias and eq simultaneously for Class I, II and IV tapes is by a three-position rotary switch. Dolby with or without MPX filter is selected by a similar switch. Press-switches are present for auto-rewind (replay starting at the conclusion of a fast-rewind) and auto-replay (the cassette fast-spooling back at the end of replay). By operating both switches it is possible to achieve the continuous replay of a recorded cassette either till the cows come home or until the tape or deck gives up its ghost!

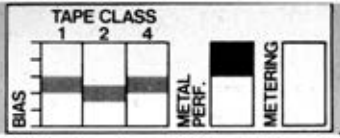
There is also a button allied to the tape transport buttons which provides recording mute. Indicator lights show when the deck is playing, in record mode and in pause mode.

Dimensions approximate 435 × 116 × 254 mm (W × H × D) and weight 5·1kg. The deck is expected to sell around £160.

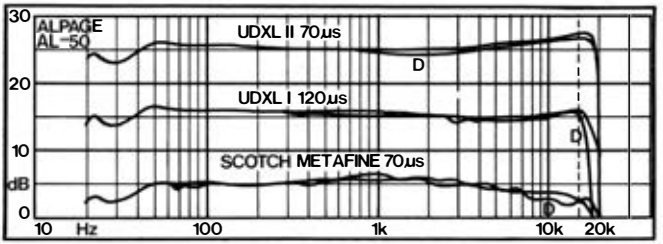


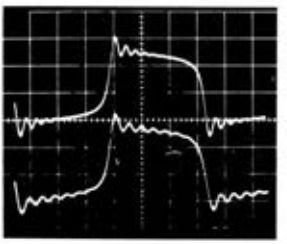
The verdict

Had it been possible to achieve the full LF potential of metal formulations, and had the sample had better tape/head intimacy, my award would have been higher for merit. However, the deck does have a good signal/noise ratio and excellent metering so as it stands I award C for merit and 2 for value.



merit C value 2





The findings

Although the instructions contain a list of different tapes it is obvious that not all these can work properly with the deck. Tests were made in an endeavour to discover suitable tapes, and it was eventually decided to use UDXLI for Class I, Scotch Metafine for Class IV and UDXLII for Class II. Scotch Metafine gave a better LF MOL and lower distortion than Maxell MX, but the upper-frequency response with MX was better.

The pen-chart shows that quite good plots were obtained with both UDXLI and UDXLII with minimal Dolby tracking error at −20dB recorded level, anyway. The slight treble lift with UDXLII could be desirable for some applications, but for a 'flatter' treble result a tape veering between the (0) and (−1) bias points could be chosen. Metafine shows some treble roll-off, as already noted, but the terminal HF response was higher than with UDXLI. The responses also show some tape/head intimacy variations, which were noted on other tests.

Mid-spectrum 120µs replay eq was satisfactory, showing (with the test tape used) a little 125Hz boost. Distortion in record 'monitor' mode was low at +10dB output. Overall with UDXLI it was 0·6% and with Metafine 1·1%. LF MOLs were 6dB and 4·5dB respectively. At HF, of course, the metal was better than the oxides. Here, again, is another deck where at LF, anyway, UDXLI out-performs metal.

I was pleased with the replay signal/noise ratio and the full improvements at 70µs and with Dolby. Overall signal/noise ratio with Scotch Master II was also high, indicating good purity of the bias/erase signal amongst other things.

W&F was also good at 0·08%, the speed error averaging around −0·2% down to zero, depending on tape position in the cassette. A C90 fast-spooled in 130 seconds (fairly swift).

Headphone delivery would drive low impedance 'phones, albeit at lowish volume, the interface being better for medium/high impedance ones. Metering was very good, there being no under-reading at all on 20ms bursts. Dolby level corresponded to 0dB.

The squarewaves show the usual starting over-shoot and following 'rings', the Dolby plus MPX filter result (lower trace) being less good than the Dolby/filter 'off' result with this deck.

Under audition mains ripple components were not obtrusive, frequency response sounded 'smooth' and bass quite healthy and firm. Upper-treble and transients came out well with metal tape, but low-frequency compresion on deep organ music was evidenced with Maxell MX at highish recording level. Wandering of the stereo image was also heard, both with and without Dolby, it being felt that the tape was not riding past the head as well as it could, but the degree of the effect tended to change with different cassettes.

No trouble was experienced with mic interfacing using the Audio Technica test mics. Hum was low and the headroom was about 3dB below 40dB which is not untypical of decks in this category; not good enough for professional applications but often suitable for domestic ones.

AUREX PC-D12 £200

This very neat little deck is from the Aurex range of micro-components. It is a development of the well-reviewed PC-D10 and is equipped with soft-touch buttons instead of mechanical press-keys for tape control. The cassette is loaded straight into the front (with rear illumination) between two protruding upper and lower sections, the latter carrying a row of rubberised buttons for transport control which at first sight seem to be too small for viability yet which work perfectly.

The heads and drive components are readily accessible for cleaning, and to minimise the ingress of dust when the deck lies inactive a clip-over plastic cover is provided. The cassette is 'locked' into position when the transport is operated for replay or record. The pause button seconds as record mute — you hold it down for mute and press it down and release it for pause, another press then defeating pause. All transport buttons with the exception of 'stop' are equipped with small indicator lights.

A four-position rotary switch sets the bias and eq simultaneously for all classes of cassette tape but there is no user-adjustable bias control. A matching control selects Dolby which can be used with or without MPX filtering. A smaller control provides memory rewind in conjunction with a three-digit mechanical tape counter, and a further control matching this one at the other side of the fascia gives you external timer start for record or replay. In the latter position the tape automatically rewinds when it has finished playing.

A small dual-concentric control adjusts the recording levels with friction-coupling between the left and right channels. Replay output is fixed at a convenient interfacing level. Left and right standard mic jack sockets are located at the back along with 'phono' line sockets. When a mic is plugged in the corresponding channel line circuit is disconnected. Although there is a rear DIN socket this is not for signal coupling but for connecting to an optional remote control unit.

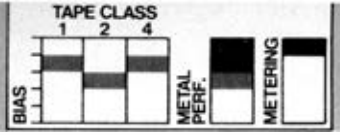
By using the timer switch and memory switch together it is possible to achieve auto-play, auto-rewind (already mentioned) and counter-repeat.

Metering is by two rows of lights, called 'bar optical meter'by Aurex, and is calibrated from −20 to +7 dB.

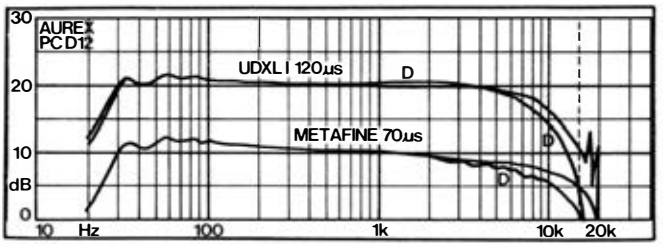
Dimensions approximate 257 × 106 × 214 mm (W × H × D) and weight 3·8kg. Price works out around £200.

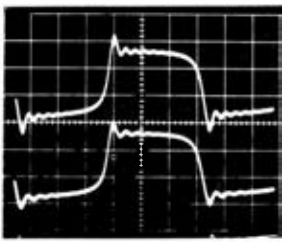
The verdict

The smallness of the deck and neatness of design certainly deserve some acclaim. but the overall results were diminished by the poor small-flux frequency responses and the only moderate metal performance. It is a pleasant little machine that will be liked, and my award is C for merit and 4 for value.



merit C value 4





The findings

A short list of 'recommended tapes' is supplied with the deck, including UDXLI Class I and Scotch Metafine Class IV which were used for the tests. You will see from the pen-chart that both of these tapes suffered from rather premature upper-treble roll-off with some lack of Dolby integrity, especially at the top end. These, of course, are 'high-energy' tapes, so tapes of even lower coercivity would suffer from more droop. Owing to this finding it was rather difficult to establish a bias reference for the deck. Anyway, I would say that it would be imprudent to use a tape with a bias reference below my (0). The list just mentioned also includes BASF Super LHI. This tape was tried but the upper-frequency roll-off was still present. Maxell UDXLIS was about 1dB down at 10kHz, so it would seem that the sample was definitely over-biased! The other channel, though, was slightly better, it being the worst channel shown. Class II tapes, such as UDXLII, showed some HF improvements.

The metering was fast-responsive, there being literally no under-reading of 20ms bursts, but the scale calibrations were not easy to read accurately. The left and right sections were a little imbalanced at DL (a little above 0dB on the scale).

The noise floor of the deck was impressive, my instruments showing around 66dB signal/noise ratio with the Master II at 70µs and Dolby on. UDXLI LF performance was good, too, with no more than 0·4% distortion and 7dB MOL at 400Hz. Metal performance was less good with the distortion at 0·8% and the MOL 5dB.

Mid-spectrum 120µs eq was acceptable, but the W&F was mildly high at 0·09% which varied when the cassette was moved. Speed error was only 0·3% fast.

Headphone yield was more suitable for high/medium impedance 'phones, the DL output being down to 70mV across 8 ohms. A C90 rewound in 102 seconds.

The squarewave shows initial overshoot and 'rings' which are modified with Dolby and MPX filtering on (lower trace).

Under audition using top-grade programme material the best results were achieved with UDXLIS and MX, the latter showing hardly any improvement over the former. With lower coercivity tapes the edge was knocked off the treble with a reduction in music 'attack'. Background noise was remarkably low, though, and the metering facilitated good recording levels. Some wandering of the stereo image was heard, and there was mild mid spectrum colouration. A very slight whine could be heard from the motor. No problems were encountered with mic interfacing.

BIC T1 £163

This is a good looking deck with its dark, wood-veneered case and black fascia carrying white print. It is a two-head front-loader which gives you the option either of running at the normal 4.75cm/s cassette speed or gobbling up your tapes twice as quickly at 9.5cm/s. You certainly gain in overall performance at the higher speed, as you will see.

Tape transport functions are operated by mechanically-linked press keys, and the see-through cassette holder opens smoothly with a trace of buzz when the eject key is depressed. Most of the other operations are handled by lever switches.

The deck is not designed for metal tape, which might seem a pity, but virtual metal results can be obtained from oxides at the higher speed. There are separate switches for bias and eq selection, the latter having just two positions labelled 120 and 70μs. The bias switch has three positions — high, normal and low. The high position sets the bias to the 70 μs oxide requirement, while the normal and low positions provide two levels of biasing for 120μs oxides. Bias level at the normal position refers almost exactly to my (0) bias reference, while the level at low is around (−1), but not (−2), of my bias coding.

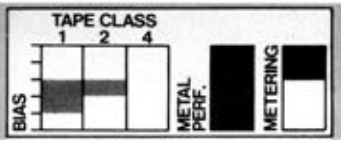
The back of the cassette compartment is illuminated so you can see how the tape is running, and for metering there are two meter movements calibrated in dB from −20 to +5, also illuminated, and indicated as peak. Recording level is adjusted by a two-section control knob, the two sections for left and right channels linked by friction. There is no replay level control nor mic mixing facilities. However, standard jack sockets are present at the front for left and right microphones, the changeover to mic being accomplished by a press-switch. The three-digit mechanical tape counter is not complemented by a memory rewind switch.

The front also carries a standard jack for headphones, and the amplifier interfaces are by phono sockets at the rear. There is no DIN socket.

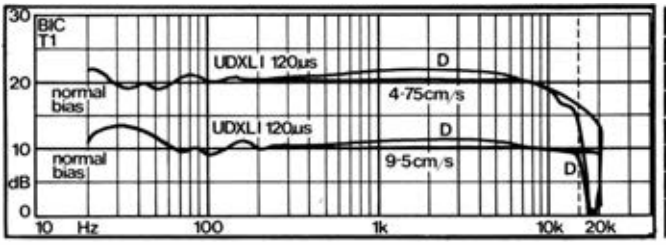
Dimensions approximate 394 × 152 × 236 mm (W × H × D) and weight 5.3kg. Price has been reduced to £162.95

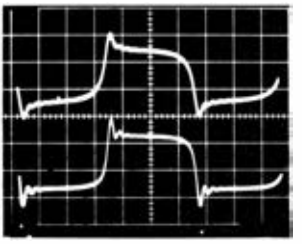
The verdict

Certainly an interesting deck but at the original price (it is understood that by the time this review gets into print the price will be reduced) and judged essentially on the 4·75cm/s performance I cannot get very excited about value-for-money. Account must obviously be taken of the 9.5cm/s speed performance, but weighting for this was not all that easy, since account must also be taken of the halved playing time. I feel that quite a few people would rather opt for a metal deck running at normal speed. Anyway, at the new price I would place it as B for merit and 2 for value.



merit **B** value **2**





The findings

Fe bias setting of the deck at normal bias corresponded to my (0) reference, but you can use tapes of (−1) bias demand successfully by switching to low bias. Cr Bias setting was also close to by (0) reference for Class II tapes, so tape compatibility will not be a problem. There is no specific setting for FeCr bias, but the separate bias and eq switching provides scope for experimentation.

Meter calibration was accurate on both channels, or reasonably so, with DL corresponding to +3VU, but the movements failed to reach their target on 20ms bursts, being 4 to 5 dB short. Weighted replay signal/noise ratio was OK, but unweighted the noise carried a fair amount of low-frequency (emphasised by bass lift). Expected noise improvements were obtained at 70μs eq and Dolby, however. There was certainly no significant signal/noise ratio shortfall overall using the 70μs Scotch Master II, so the electronic noise is mostly masked by the tape noise proper.

DL distortion with UDXLI was 0.6% at 400Hz and the corresponding MOL 6dB at 4.75cm/s. Replay frequency response showed substantial low-bass lift and the 120μs eq was up by 1dB at 125 and 6.3kHz relative to 1kHz. Because there is no metal position I plotted the UDXLI frequency response overall at both speeds, the graphs showing some lack of Dolby integrity but a remarkably extended upper treble at 9.5cm/s with Dolby off. Note the bass boost, especially at 9.5cm/s.

Wow and flutter was 0.09% and speed error a mere +0.2%. The deck favours medium/high impedance 'phones better than low impedance ones. Respooling was very quick at 72s for a C90 cassette. I have shown squarewave performance at both speeds, the lower trace at 9.5cm/s being very acceptable for a cassette deck.

Most measurements improved at the higher speed, the HF MOL of Class II tape then being close to metal. The use of C120s is not recommended, so you are stuck for playing time at the higher speed. I was annoyed by slight motor whirl and found it necessary to rank-down a little due to this.

Auditioning at 9.75cm/s with good tapes and suitable recording levels provoked very favourable reaction; but some listeners commented on bass lift and a sort of low-level background rumble. This was only apparent at high replay level and was slightly above the general hiss level from my IMFs. The enhanced high-frequency head-room was apparent at 9.5cm/s, the results in this respect being comparable to some machines operating with metal tape. Performance at normal speed was judged to be no better than average.

B&O 1700 £169

This is a sleek deck of characteristic Bang and Olufsen styling. It is one of the few machines now around with top-loading. The top panel, where it all happens, is slightly sloping downwards towards the front, and it is mostly black but is tamed somewhat by aluminium exposed edges front and back. Tape transport is worked by piano-type mechanical press keys which are of moderate throw and (some) veering towards the stiff side. Similar keys are also used for mains on/off, Dolby selection, metal tape selection and 'memo' (eg, memory rewind at tape counter zero).

Bias and eq switching for Class I and Class II tapes happens automatically by the 'coding' cutout along the back edge of a cassette, so you have no switching to bother with when using these tapes. For metal, however, one needs to depress the metal tape key to increase the bias sufficiently for Class IV tape.

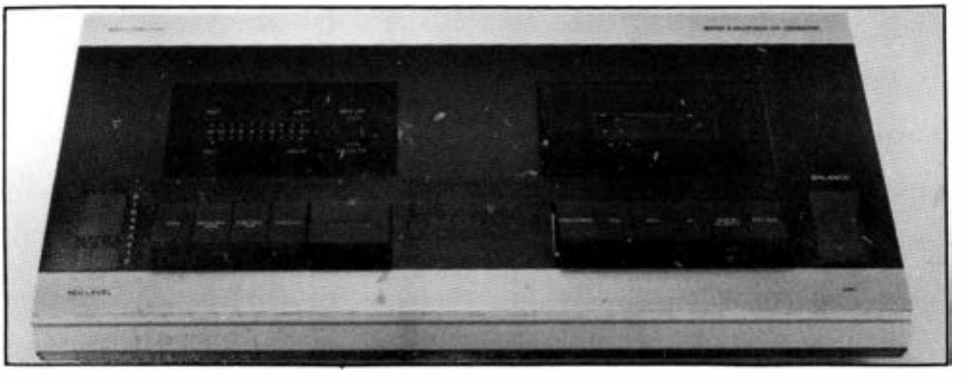
Recording level is set by a special control which slides up and down in an aperture against numbers 0 to 8 printed in white on the black panel. This controls both left and right channels together, while for channel balancing you have a separate slider control which is exposed, along with the mic socket, by sliding open a small cover which matches the sliding level control at the opposite side of the panel.

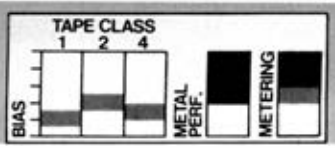
The deck is certainly sparse on features compared with the average Oriental model, but this would not be a hardship if the requirement is for a deck of the least complication and easy to use. There is a three-digit mechanical tape counter which, as already noted, can be linked to memory rewind. The counter is zeroed by depressing a fairly large key in which it (the counter) is mounted. A small window at the top of the cassette holder allows you to see the windowed part of the loaded cassette and the tape therein against a 'silvered' backing, but there is no rear illumination although the tape counter is illuminated. The cassette holder rises under mechanical check when the eject key is depressed.

Indicators light to signify when you are recording and have switched to 'metal'. Metering is by two rows of glowing elements, there being ten in each row calibrated from −16 to +3dB. DL is scaled at 0dB and the elements above this are red-glowing. When the 'metal' key is depressed DL occurs at −1dB. The instructions refer to the metering as 'peak programme'.

The machine is not equipped with any source monitoring at all. There is no headphone socket and only a solitary DIN socket for amplifier interfacing. A DIN socket is also used for microphone.

Top panel measures about 400 × 240mm while maximum height from the shelf on which the deck is stood is about 100mm. It should be noted that the 1700 is coloured to match the Beomaster 1700 receiver. Model 1600 is identical except for the cabinet colour which is geared to the Beomaster 1600. The deck sells for around £169.



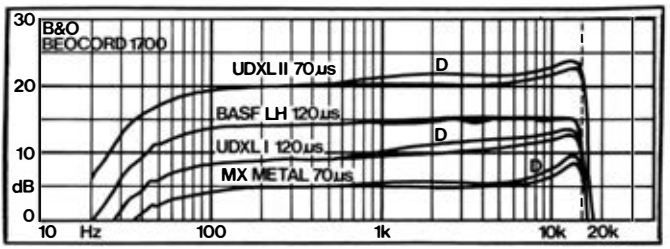


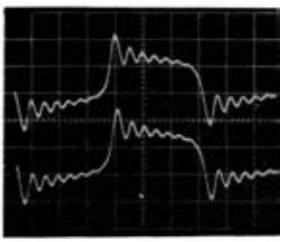
merit D value 3

The verdict

This is a deck which is simple to operate and devoid of those trappings which not all people require or crave for. It is designed essentially to link into a DIN-orientated system.

Metal tape performance can only be regarded as moderate on a relative basis, and the deck cannot do full justice to the latest high-energy Class I formulations. Neither can the metering be classed as particularly good. Lack of source monitoring while recording may not be all that important to some users, however. Construction was considered good. Taking account of all things, then my award is D for merit and 3 for value.





The findings

One problem with the lab measurements was the lack of source monitoring while recording. Different techniques thus had to be adopted to achieve the comparative measurements. One of the first things discovered was that the Class I tape bias was adjusted close to the DIN standard rather than the Japanese standard, which means (sadly) that the latest high-energy Class 1 tapes cannot be used in the deck without a significant rise in upper treble.

You will see in the pen-chart that high-energy Class I Maxell UDXLI penned a response with a steady upward rise from about 1kHz and that the Dolby integrity at the −20dB recorded level was in error. Several lower-bias tapes were tried and one of the best for the deck was BASF LH whose response is also shown. Dolby integrity with this was good. Maxell UDXLII (Class II tape) also exhibited rising upper-treble and poor Dolby integrity. Dolby integrity with metal MX was better but I wasn't encouraged by the 5dB peak at 14kHz.

Replay eq at 120µs mid-spectrum was fairly good, depending on the test tape (the BASF test tape gave the flattest response). LF performance with UDXLI was fair at 0·7% distortion and 4·5dB MOL; but with BASF LH it was significantly poorer. Thus it seems you can either use a high-energy Class I tape and achieve fair LF and rising treble or a lower-energy formulation and achieve a 'flattish' response but poor LF performance! I couldn't help thinking that B&O could obtain better results from both the 'low' and 'normal' bias Class I tapes by incorporating a separate low/normal Class I bias switch.

The metering was found to have a rising response with frequency, and although stated to be 'peak programme' there was about 3dB under-reading on 20ms bursts. Since the scaling only goes down to −16dB low-level signals are not indicated.

Signal/noise ratios were perfectly acceptable, replay measuring 59dB, with the usual 70µs and Dolby improvements, and Master II (70µs) with Dolby giving 65.5dB. The mains ripple content seemed a shade on the high side but it was not particularly discernible under audition. W&F was 0.08% (replay only) and speed error − 0.4%.

The squarewaves show quite significant rings (lower trace with Dolby), which are undoubtedly encouraged by the rising-treble of metal tape and, possibly, by the degree of record pre-emphasis employed.

Under audition the bass response was on the 'weak' and 'fluffy' side. Depending on tape, some string and piano music tended to be a little 'cutting'. Mild response colouration was detected, but stereo imagery was not bad. Provided the recording level was kept below the red elements BASF LH gave quite fair results on most music, but the majority of the metals seemed to to have an unnatural 'sting'.

BOOTS B200 £159

Marketed by Boots and made by Awia the B200 is a two-head front-loader without a metal position. It is Boots' belief that metal tape remains unattractive to the average user because of its relatively high price and because of the problems associated with biasing, head and circuitry, allied with optimised performance within the price range, it being the company's philosophy that, unless it can be accomplished properly at the target price, then it is best avoided.

There are two three-position tape selector switches, though, one for bias and the other for eq, for tape Classes I, II and III. Moreover, there is a user-adjustable fine bias control applicable to Class 1 tapes, which makes the deck compatible with virtually all 120μs oxides except, perhaps, those whose bias demand lies below my (−2) value and would thus **not** be regarded as a viable proposition by the average music lover anyway. A small scale round the control gives an idea of the settings for a number of popular Class I formulations.

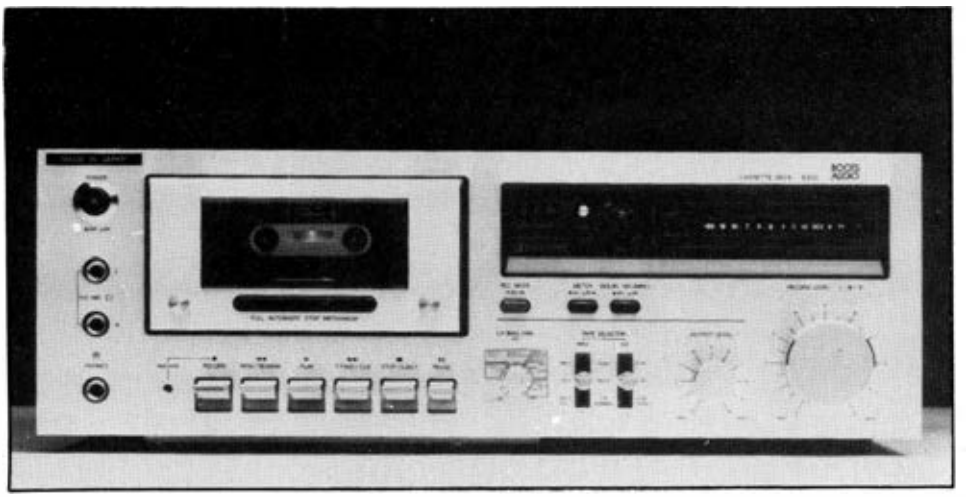
Tape transport is operated by moderate-throw, but not difficult to depress, piano-type keys, and in replay mode it is possible to fast-spool in either direction to achieve cue or review — a decent audible signal then emanating from the speakers. Since the keys latch down, it is possible to obtain timed starts (by way of an external timer) or recording or replay.

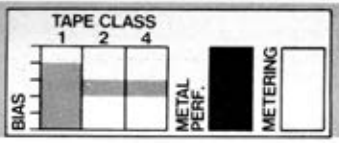
The cassette compartment is rear illuminated and the holder opens smoothly and silently. The front is windowed, and can be removed for head, capstan and pinch-wheel cleaning. A large dual-concentric, friction-coupled knob sets the recording level and there is a smaller replay level control, but this does not adjust the headphone volume.

A good feature is the bar-graph metering which can be switched by a button for peak- or VU-responding. This is brightly glowing, as the calibration numbers from −20 to +7 dB. Dolby level is scaled at +3dB and the scale and indicator colour changes after 0dB. Press-switches operate Dolby with MPX and record mute (a bright blue button). Indicator lights show when Dolby and Peak metering are engaged.

Amplifier interface is by rear 'phono' sockets (no DIN) and standard ¼in jack sockets accommodate headphones and left and right mics, the appropriate line input being disengaged when the corresponding channel mic jack is inserted.

Fascia is brushed aluminium and the enclosure of dark-finished metal. Dimensions approximate 420 × 145 × 330mm (W × H × D) and the price £159.

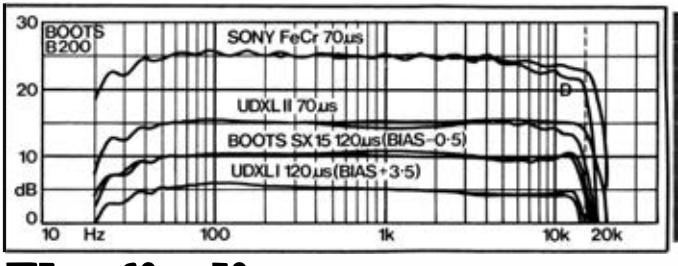


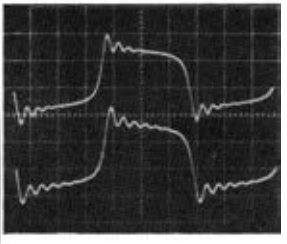


merit C value 3

The verdict

This is one of the few decks in this book without a metal tape position, but I am inclined to agree with Boots that metal is best avoided unless it can be done adequately at the deck selling price. However, the deck is presented in competition with others which can work with metal quite well in the same price range. The non-metal BIC T1 can give virtual metal performance at double tape speed. As a single-speed non-metal deck, therefore, its award for merit must obviously be somewhat reduced. There were one or two points of criticism, but even so my judgement is still C for merit and 3 for value. A deck which would suit those people who are not craving for metal or logic-controlled tape transport.





The findings

The bar-graph metering worked nicely with virtually no under-reading of 20ms bursts in peak mode and only 5dB under-reading in VU mode. It was also found useful to be able to adjust the Class I bias, although some experimentation (see the articles at the start of this book) would be necessary to locate the best position.

The pen-chart shows some acceptable small-flux frequency responses with minimal Dolby error. Since there is no metal position on the deck; I elected to plot two Class I tapes (including the UDXLI), along with the Class II UDXLII and a Class III Sony. The waves on the latter response are due to the tape, not the deck. The two Class I tapes gave good LF performance, the UDXLI with around 0·5% distortion and 6dB MOL. With the Class II and III tapes the distortion was higher and the MOLs lower. Monitor mode distortion was very low indeed and I could detect no head saturation problems.

Signal/noise ratios were also very good, the Scotch Master II (70µs) returning 66·5dB with Dolby. W & F was a trifle higher than I have measured, at 0·1% replay only, and the speed was 0·7% slow, but a C90 fast-spooled in 80 seconds. Class II erase was well below noise floor at 1kHz and the headphone yield was 96mV across 8 ohms. The oscillogram shows the usual 'rings' (lower trace with Dolby plus MPX), these tests with UDXLII.

No problems with amplifier or microphone interfacing, but the mic overload margin could have been wider.

Under audition the deck gave some impressive sounds using UDXLI and UDXLII, the latter found better for music of high overtone and upper-treble urge, but the former playing better on deep organ music. Stereo imagery was not as 'solid' as I would have liked and a little 'fluffiness' of upper-treble reproduction was detected. Improved results from pre-recorded cassettes were obtained after resetting the head azimuth.

DENON DR320 £230

Sporting a 'silvered' fascia and metal enclosure, this deck reflects the general design of prevailing Oriental models. It is a three-head machine providing direct off-tape monitoring, the changeover between source and tape being operated by a press-button with small lights indicating the mode. The front-loading cassette holder, with full-view front window and rear illumination, opens smoothly and quickly by the press of the eject button.

Metering is by brightly illuminated VU movements complemented by three peak-responding LEDs. The movements are scaled from −20 to +6 VU and the LEDs at 0, +5 and +8 dB. Bias and eq are simultaneously switched, the rotary switch having a position for each of the four tape classes, including Class III (*FeCr*). There is no user-adjustable bias control.

Tape transport is operated by a solenoid and logic with 'soft-touch' buttons, there being separate buttons for 'cue' in either direction. The pause button also provides record mute. Indicator lights show when the record, pause/mute, play and cue buttons are depressed.

Recording level is adjusted by a largish dual-concentric knob, with good friction coupling between the two sections, and there is a separate smaller knob for replay level control, which also adjusts the headphone signal level from a front jack socket. Similar 'standard' jacks are present for left and right mics. Each mic circuit is engaged by inserting the jack plug, which automatically disconnects the corresponding line circuit. Amplifier interfacing is by rear 'phono' sockets (no DIN socket).

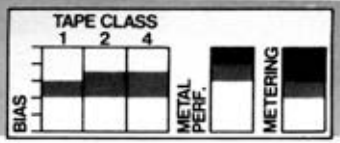
Dolby is button-switched and the MPX filtering becomes active in the Dolby 'on' position. Tape counting is by the usual three-digit mechanical counter but without a memory rewind button. There are also switches for timed record and replay starts (requiring an external timer) and a socket is available for plugging in a remote control unit.

Dimensions approximate 435 × 116 × 280 mm (W × H × D) and price £230.

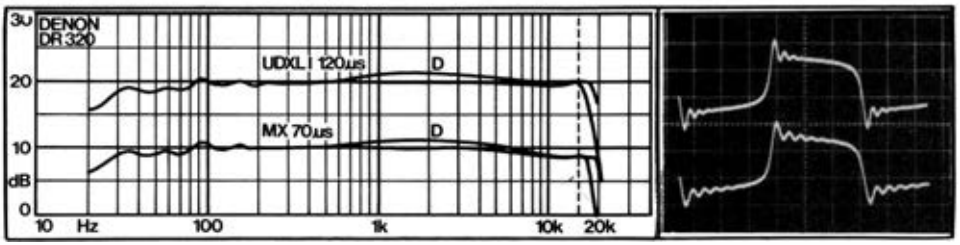
The verdict

This deck would have received a higher acclaim had the metal performance been better and the noise background slightly lower. The metering, too, could do with improvement for although there are peak LEDs they are not channel separated. The sample also appeared to be slightly in error on 120μs replay eq.

However, on the whole, and taking account of the good as well as the less good factors, I award it B for merit and 2 for value.



merit **B** value **2**



The findings

The transport logic worked OK but the cue signals were rather weak, calling for fairly high amplifier gain to hear them distinctly. The VU meter movements were slow-responding, reading about −12VU on 20ms bursts, but this criticism is partly neutralised by the peak LEDs, which were found useful. The two movements were well balanced and DL corresponded to +3VU.

In absolute terms the replay noise was higher than experienced from other decks, and referred to DL the Master II 70µs oxide gave a ratio of 63·8dB with Dolby — a dB or so below other models.

Although metal tape was reasonably well handled, UDXLI gave a lower distortion and higher LF MOL than Maxell MX. Distortion in the replay electronics was low, though at +10dB. It was thought that the 120µs eq accuracy could have been better for the class of the deck, there being almost 2dB undulations mid-spectrum. On the other hand, the overall frequency responses with the test tapes were acceptable without Dolby, but with Dolby 'on' there was a dB or so lift in the presence region of both tape classes, as shown by the pen-chart. Denon DX7 gave an acceptable Class II response.

Deck bias delivery was fairly close to my (0) reference, but the impression was gleaned that Class II and IV tapes with a bias demand slightly positive of my reference would have improved the small-flux upper-frequency response (for metal TDK MA was better). Wow and flutter was low but the tape speed almost 1% fast. The squarewave oscillogram reveals the usual starting overshoot accompanied by 'rings' which were slightly aggravated with Dolby 'on' — lower trace.

Headphone delivery was more compatible with high impedance 'phones, but you should be able to obtain enough volume from medium impedance ones. I had no trouble with mic interfacing, the sensitivity of the circuits being suitable for the test mics. C90 rewind took around 118 seconds.

Good overall results were obtained with Maxell UDXLI and MX, but to achieve this more reliance had to be placed on the peak LEDs rather than the VU meters. High quality music resulted in the OdB LED flashing frequently when the meters were peaking around −7VU. With careful attention to the recording level, though, it was not always easy to say conclusively whether one was hearing the source or the recording, but at high volume setting background 'hiss' gave a clue that the reproduction was from tape. With Dolby active a little stereo image instability was detected, as also a little mid-spectrum colouration.

DUAL C822 £180

This is another direct-loading deck with an open recess at the front for clipping in the cassette — there being no eject key or moving parts. A novel and useful associated feature is a pleasantly curved transparent cover which encloses the heads and vulnerable tape transport components when the machine is not in use. When the mains power is switched on the cover automatically pivots down into the machine out of sight so that a cassette can then be loaded.

Tape transport is controlled by logic and soft-touch buttons, and four buttons allow for the simultaneous selection of bias and eq for the four classes of cassette tape. Two well illuminated meter movements show through a window at the top right-hand corner of the fascia, to which the instructions refer as quasi-peak. Each one has two scales, and that appropriate to the tape class selected is indicated by a light. The only apparent difference between the two scales, apart from the fact that one is larger than the other, is that the red section indicated as appropriate to Class I and II tapes starts at 0dB, while the red section of the other starts at +3dB for Class III and IV tapes. This implies that you can record more deeply with the latter than the former classes! Scaling is from −20 to +5dB.

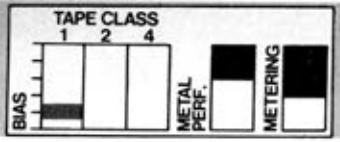
Buttons are also used for switching Dolby and, separately, MPX filtering. Tape transport operations are fairly conventional, including pause, and indicator lights are activated by depression of the stop, play, record, pause, Dolby and MPX buttons.

Recording level is adjusted by two knobs, one each for the left and right channels. There are standard jack sockets for left and right microphones, but mic mixing is not catered for. Changeover from line to mic happens when a mic jack plug is inserted. There is also a standard jack socket for headphone, but no level control for line or headphones. Tape counting is by a three-digit mechanical counter, which is without memory rewind.

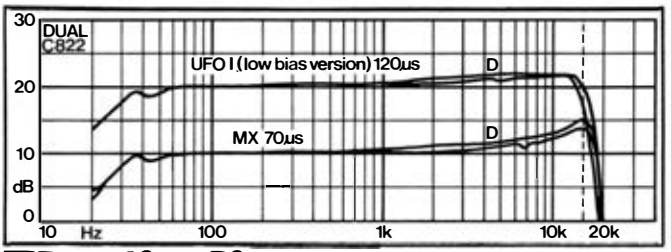
Amplifier interfacing is by rear phono sockets with DIN socket option. The machine is nicely finished and quite aesthetic with its brushed aluminium fascia and 'silvered' metal enclosure. It is said to be made for Dual under their specifications in Japan. It is rather deeper in size than other decks, overall dimensions approximating 436 × 110 × 350 mm (W × H × D). Price is around £180.

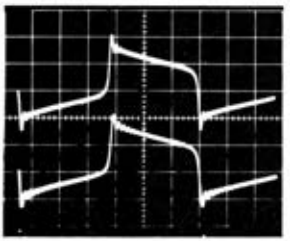
The verdict

For a two-head deck, despite the logic, the price must take the edge off the 'value' a trifle. The deck has some good points and features, but is restricted so far as tape usage is concerned (pity the designers didn't include a fine bias control to cater for a wider range of Class I cassettes). Performance was not as encouraging as some of the decks on metal, W&F was on the high side and the metering I thought disappointing. For merit I thus award it C and for value 3.



merit C value 3





The findings

In Class I mode bias delivery was significantly below the demand of my (0) ref. tape. Tapes so indexed in the cassette reviews would thus exhibit seriously rising upper treble. Testing a wide selection of tapes in this mode I found that one of the best for the machine was Yashima UFOI (the low-bias version) and this was used for for the Class I tape tests. Class II, III and IV tapes with my (0) bias ref. worked OK but the requirement veered slightly towards (−1).

The instructions say that the quasi-peak meters permit optimum tape recordings. Frankly, I cannot reconcile the term 'quasi-peak' since the meters of my sample were reading some 12dB low on 20ms bursts! At DL the left meter read +1dB and the right one +2dB, and the meter response was found to rise with frequency both in record and replay mode (see my opening story on metering).

Signal/noise ratios were very good, with almost the theoretically expected improvements resulting from 70µs eq and Dolby. Overall ratio with Scotch Master II and with Dolby was up to 65dB, which is very good.

Distortion was just below 1% with UFOI and a small shade lower with MX (metal). MOLs were +3dB for UFOI and +5dB for metal. Mid-frequency 120µs eq was very good with swings of only +0.2dB over 125 to 6.3kHz. I was disappointed with W&F which, on average, was greater than 0·1% DIN. Medium/high impedance 'phones are favoured more than low impedance ones, and fast spooling was good at 88 seconds for a C90.

The pen chart shows that even UFOI had a slightly rising treble, with MX peaking to +4dB at 15kHz (Dolby off). Dolby integrity, however, was fair with both test tapes, The squarewaves (upper with MPX filter off) show significant overshoot and HF 'rings'.

Under audition some colouration was heard, the net result being slight 'boominess'. Sibilance was also detected on high quality speech. Background noise was commendably low and, after taking special attention over recording levels, excessive compression was not troublesome. Tape stability was acceptable, the sample exhibiting quite good stereo imagery, depending on cassette quality.

The logic worked without flaw, and I was particularly impressed by a photo-electric system which automatically puts the deck into stop mode if an attempt is made to extract a cassette while the tape is moving. It was impossible to fool this. I found the separate left and right recording level controls less convenient than a single, friction-coupled dual control. Headphone output was adequate with the test 'phones (Sony MDR3), and I experienced no trouble with mic interfacing.

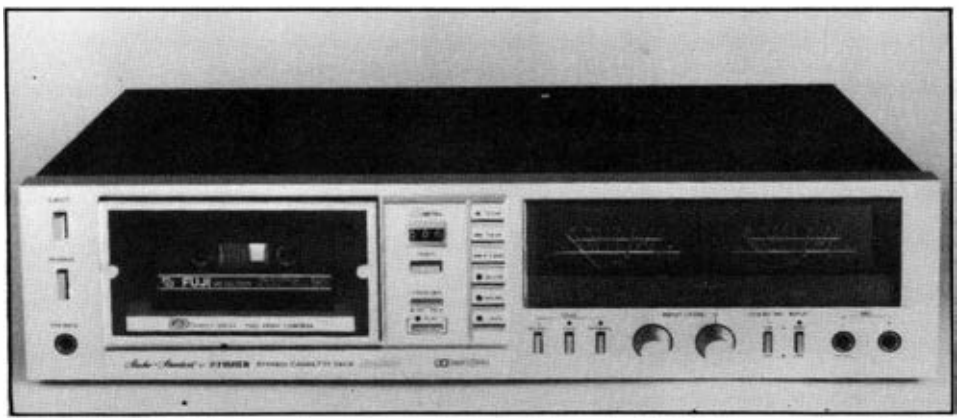
FISHER CR-4140 £139

The sample sent for review was equipped with a 'silver' fascia. A black fascia model is also made with identical specification. It is a smart looking deck using a direct-drive motor and logic tape transport. The full-view windowed cassette holder is rear illuminated and the movements of the VU metering are inclined slightly backwards behind a window, are black-backed and softly illuminated with scale colour change from OVU (+3VU metal) upwards. There are two scales, one applicable to metal from −20 to +8 VU and the other to oxides from −20 to +5VU. Dolby level is located at +3VU on both scales. 3VU reduction in metering sensitivity occurs automatically when switching to metal mode. The movements are complemented by three peak-responding LEDs at 0, +3 and +6 dB.

The logic tape control buttons require only a very light pressure to operate, there being hardly any movement on the buttons themselves. Recording level is adjusted by separate calibration-engraved control knobs for the left and right channels, but replay output is fixed at a convenient amplifier-connecting level. Change from rear line inputs to the front mic jack sockets is by a press-switch. Rear 'phono' sockets with DIN socket option are used. There is also a standard jack socket for headphones.

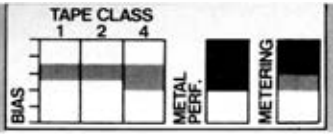
Three press-switches cater for tape classes I, II and IV, bias and eq being selected together. The deck is well equipped with indicator lights, these showing for tape class selection, play, record, pause and mute and also when Dolby is engaged (another push-switch) and when the input is changed to mic, which also brings in the rear DIN socket. There is the usual three-digit mechanical tape counter but no memory rewind. It is also possible to switch the deck for timed recording start (using an external timer) but not for replay. A rear socket gives an interface for a wired-connected remote control unit (optional extra, Model RC-80).

Dimensions approximate 440 × 104 × 280 mm (W × H × D) while the expected selling price is said to be around £139.

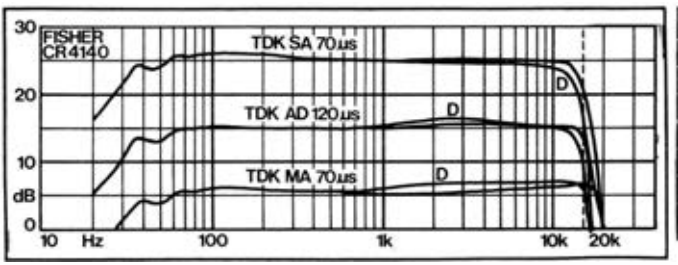


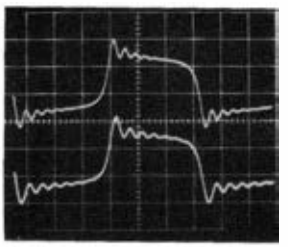
The verdict

It seemed a pity that the metal LF MOL was only low to moderate and the DL distortion rather high with TDK MA. The VU movements themselves were rather slow (though not as slow as some) but to some extent this is counteracted by the peak LEDs. Taking all things into account my award is C for merit and 2 for value. Although not a top-flier it is a fair-performing deck at a very reasonable price equipped with good logic and sufficient plus points to satisfy a number of users.



merit C value 2





The findings

A note accompanying the review deck stated that TDK AD, SA and metal (MA) tapes are recommended to obtain optimum performance. Consequently,. such tapes were selected for testing the deck. The pen-chart reveals that from the small-flux frequency response aspect, at least, the tapes appear to be reasonably suitable. Best Dolby integrity at −20dB recorded level was achieved by SA, the worst in this respect being MA. All responses show upper-treble curtailment with Dolby engaged, undoubtedly owing to the auto-switching of MPX filtering. As would be expected, metal had the widest frequency response; but at LF there was common roll-off from about 50Hz downwards. Replay eq at 120µs was fair at +0·4dB 125Hz and −0·5dB 6·3kHz, but fluctuations at the latter frequency suggested a little problem with tape/head intimacy.

LF performance was not particularly outstanding with either Class I or Class IV tape, the former corresponding to 0·6% distortion and 4·5dB MOL and the latter to 1·3% distortion and 3dB MOL. Distortion on the source signal from the deck in 'monitor' (recording) mode was higher than some at + 10dB output.

On the other hand, signal/noise ratios were very acceptable, the deck showing 4dB 70µs and 9·5dB Dolby improvements. With Scotch Master II the Dolby-on ratio was 66·5dB.

I was also pleased with the low W&F at around 0·06% average with a mere −0·15% speed error. Metal recorded to DIN level at 1kHz was erased to well below noise floor. Headphone delivery was high and suitable for low as well as medium/high impedance 'phones. The VU movements under-read 20ms bursts by 10dB, but the LEDs responded fairly accurately to the peaks. C90 fast-spooling time was around 151 seconds, which is protracted. The squarewaves show the usual overshoot and 'rings' with little difference between the Dolby off and on (lower trace) modes.

Slight mains ripple could be detected behind the replay noise when the volume of the amplifier was set high, but the noise ('hiss') proper was low. The test mics interfaced okay and it was convenient to find that by plugging a solitary mic into the left channel jack socket the signal found its way to both the left and right tape tracks (eg, mono mode). Mic noise level was low and quality good. Headroom was about 37dB, typical of this class of deck.

Excepting LF compression using metal tape at high recording level, the reproduction was regarded as very acceptable. There was a little upper-treble brightness and mild mid-spectrum colouration, but the general music attack was good. A little stereo image wandering was noted and the bass was thought somewhat 'fluffy', but bearing in mind the price of the deck we didn't have a lot to complain about in the listening room.

GRUNDIG CF-5100 £197

This is a DIN-orientated direct front-loader which is engineered to accommodate the cassette between protruding upper and lower sections on the 'brushed aluminium' fascia — at the right-hand side and hence opposite to the cassette loading position of most other decks. The heads and tape drive components are thus readily accessible for cleaning, and to reduce their vulnerability and the ingress of dust when the deck is not being used a transparent clip-on cover is supplied, but since this is not actually fixed to the machine it could easily be mislaid.

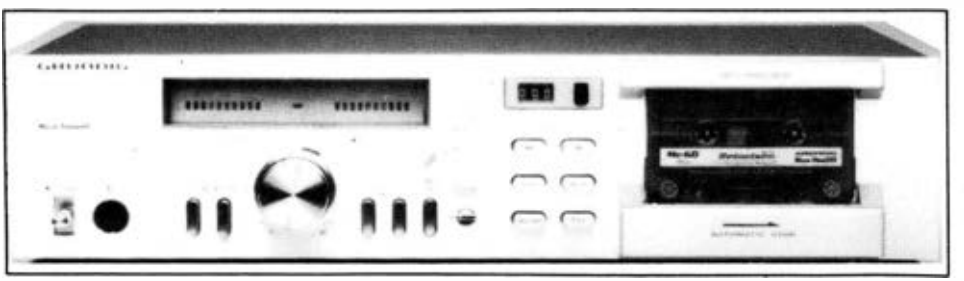
LED metering composed of ten devices per channel and calibrated from −20 to +5 dB is pleasantly styled beneath a horizontally disposed oblong window whose bottom edge is 'mirrored' so that the LEDs can be viewed looking down on the deck. The display lies at the left of the fascia, is black-backed and well illuminated, and between the left and right channel sections is a red recording mode indicator. Recording level is adjusted by a large dual-concentric, friction-coupled knob below the metering — the overall appearance being something like a radio tuner rather than a cassette deck!

Tape bias and eq are simultaneously selected by push switches, there being three for tape classes I, II and IV. For Class III formulations the ***Fe*** and ***Cr*** switches need to be operated together. Tape transport control is also by push-switches but not of the 'micro-switch' variety, so a fair amount of pressure is required, especially for the 'play' switch which also lifts the head assembly mechanically up to the tape. It is possible, however, to alternate between modes (except record) without going through stop.

Instead of Dolby noise reduction, the deck is equipped with Telefunken's High-Com. This is operated by a press-switch, and an adjacent switch labelled NR EXP provides a degree of compatibility when replaying Dolby-encoded tapes. Replay level is adjustable by a small fascia knob, and there is the usual three-digit mechanical tape counter but no memory rewind button.

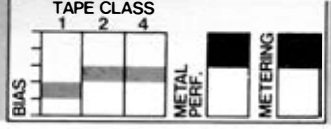
The deck has the greatest interfacing compatibility with DIN-socketed amplifiers — there are no 'phono' sockets at all. Amplifier input/output connections are provided by a solitary DIN plug at the end of a cable emerging from the rear of the deck. Mic connections are also to a DIN socket on the fascia, which yields a 20V supply for a capacitor mic. Enclosure is metal of 'silver' matt finish.

Dimensions approximate 450 × 110 × 330 mm (W × H × D) and weight 6kg. Price lies in the region of £197.

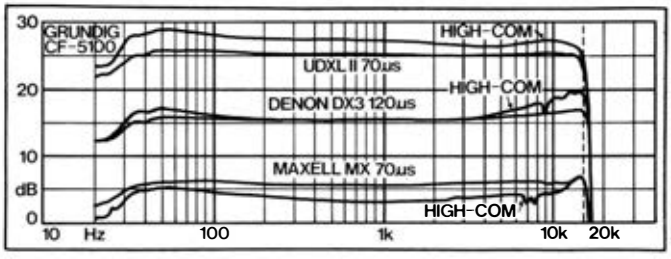


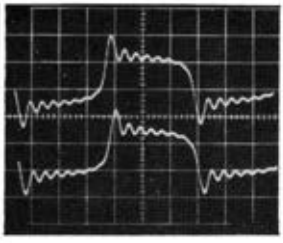
The verdict

Relative to the other decks in this book the Grundig was not an easy machine to place. It is not a particularly 'budget-priced' deck but it does boast High-Com which some people might prefer over Dolby B. Auditioning on the whole was encouraging but one or two curios were picked up in the lab. Taking all factors into account my award (for this book relative to the other decks) is C for merit and 3 for value.



merit C value 3





The findings

We had some difficulty in testing this deck in our usual lab manner owing to the lack of source monitoring. There is not even a headphone socket from which the signal being recorded can be heard (or measured). Anyway, by using very slow sweeps we were able to obtain reasonably accurate frequency plots. Because of the relatively low European Class I bias yield of the deck the recent high-energy ferrics gave a substantially rising upper-treble response. For example, using UDXLI the lift at 15kHz was more than 5dB. After a number of trials I decided on the Denon DX3 (which you will see has a (−1) bias ref. in the tape review), the pen-chart showing that the treble lift with this was tolerable. UDXLII penned a very flat response and Maxell MX (metal) was not bad, either.

You will see that there were some level differences when High-Com was engaged, but unlike Dolby any level difference holds reasonably constant at all frequencies — except, perhaps, at very low and high frequencies.

LF performance was better with High-Com on than off — the distortion being below 1% with both Class I and IV tapes and the MOLs very acceptable though, curiously, lower with High-Com off despite resetting the level datum. Distortion in the replay channel was veering towards 1% at +10dB output, but analysis proved this to be essentially even-harmonic with a desirable spectral distribution.

Replay signal/noise ratio was fairly 'average' with the expected 70µs improvement. The NR EXP improvement was 9.5dB and High-Com more than 20dB. Overall ratio with Master II (70µs) was 65dB with NR EXP and significantly better than 70dB with High-Com, depending on the setting of the recording level control. Because of the low noise output of the replay channel with High-Com, any recording amplifier noise which finds its way on to the tape is virtually unmasked and thus readily detected by instruments during replay. Sadly, the DIN interfacing does not particularly lend itself to the lowest noise and hum free recordings. Anyway, the overall noise floor with High-Com was certainly lower than I have measured with Dolby B.

Replay eq was satisfactory and W&F was no more than 0·07% (replay only), with the tape running less than 1% slow. It took 94 seconds to rewind a C90. Metal tape erased to below noise floor, but I was disappointed to find that the meters were under-reading 20ms bursts by about 6dB. Meter indication rises with frequency, and at DL the indication was +1dB without High-Com, rising to +3 with. The oscillogram shows a run of 'rings' over the squarewaves — lower trace with High-Com.

Under audition we were all impressed by the low background 'hiss', even at high volume, with High-Com engaged, but a little trouble was experienced initially in attaining a low noise amplifier output interface to the DIN plug. It was felt a great pity that the deck was without 'phono' sockets and source monitoring. Critical listeners commented on a vague 'breathing' effect related to high-level transients when High-Com was switched on. The NR EXP position was found to provide some compatibility to Dolby replay, but presence region errors were heard. Low-level ambience was reasonably portrayed but the low bass was a trifle variable with Hi-Com engaged.

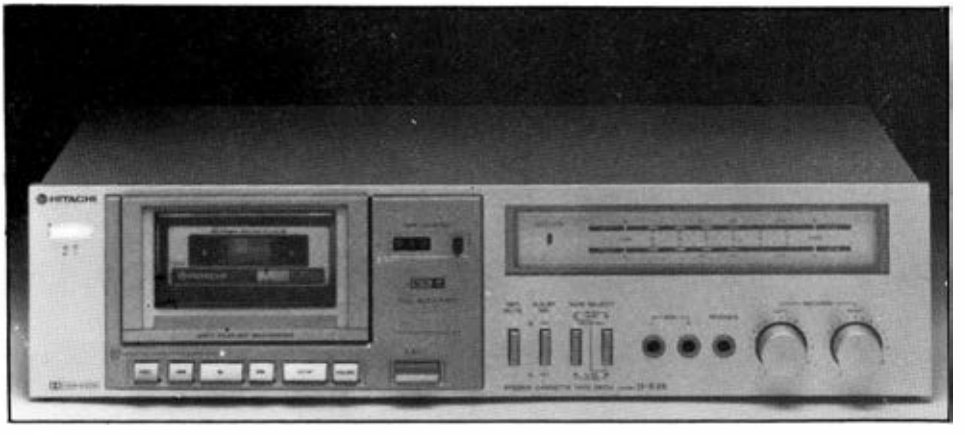
HITACHI D-E25 £89

This is one of Hitachi's latest decks which falls at the 'budget' end of the price scale. It is a two-head front-loader with metal switch position and peak-responding metering. Features offered are relatively basic but tape transport control is by low-pressure buttons which give direct change of mode. Drive motor torque is linked to button operation and with the deck switched off it is possible to latch down the play and record buttons so that when power is applied, by an external timer for example, the deck goes immediately into play or record mode, the buttons then releasing.

Metering uses only six LED elements per channel which limits the readout definition. The first element of each channel is always glowing and labelled 'infinity'. The first active one is at −10dB and the last active one at +7dB. Colour changes from green to red after 0dB which is Dolby level. Two switches are used for tape selection, one of the two or both having to be depressed to select tape Class I, II or IV. Dolby noise reduction and record mute are activated by matching press-switches. Light indicators show when the play button is depressed and when the deck is set for recording. The mains on/off switch also glows when switched on.

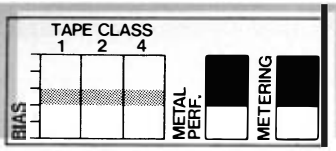
Recording level is adjusted by two control knobs for the left and right channels and change from 'phono' line input to mic happens when a mic jack plug is inserted into a front socket. There is also a rear DIN socket, the changeover from 'phono' to DIN being by a rear press-switch. Replay level is not adjustable, which also applies to the headphone signal delivered by another front jack socket. There is the usual three-digit mechanical tape counter but no memory rewind button.

The deck is smartly presented with a 'silver' fascia and 'grey'-finished metal enclosure. The rear is of a plastics material. Dimensions approximate 435 × 110 × 210 mm (W × H × D) and weight a mere 2·8kg. Price is said to fall around £89.

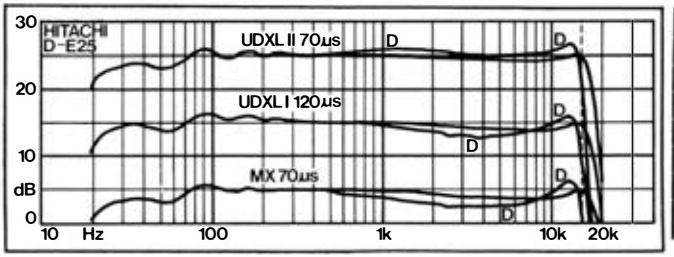


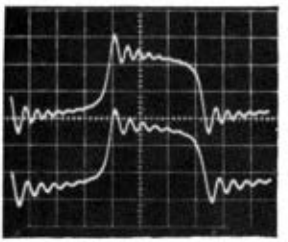
The verdict

This, then, is another deck whose replay channel headroom could be widened to technical advantage. I would also have liked metering the greater definition and a greater MOL from all tapes. At the bass end there was nothing to choose between good Class I and Class IV metal, though the latter would be superior when the music contains high upper-treble energy — unlikely from most ordinary recording sources. Taking all things into account, therefore, my award is D for merit and 2 for value.



merit D value 2





The findings

Although LF distortion with both Class I and IV tapes was commendably low for a 'budget' deck — 0·5% UDXLI and 0·9% MX — the LF MOLs were limited to little more than 3·5dB. To some extent this was thought to be caused by the limited headroom of the replay channel, tests indicating that the output yield to 1% distortion was not much more than 3·5dB via a head flux coupler.

The pen-chart shows fair 'budget' type small-flux responses with varying degrees of Dolby level error with the Maxell tapes selected for tests. You will see a mild presence region depression on all of them.

Signal/noise ratios, on the other hand, were very acceptable for a deck in this price range, though the mains ripple content was higher than from some. With master II (70µs) and Dolby the overall ratio was up to 66.5dB, which is good. Neither Dolby nor 70µs eq quite made the theoretically expected improvements, however. Replay eq seemed to be acceptably adjusted and W&F was not a problem. The tape was running about 0.6% fast and it took 136 seconds to fast spool a C90.

Metering showed no under-reading at all on 20ms burst and a Dolby level test tape gave an indication of 0dB. Sadly, there are insufficient elements for close adjustments of recording level.

Headphone yield was relatively high, my measurements showing around 100mV across 8 ohms at Dolby level. The squarewaves show a substantial starting overshoot and damped oscillation (the lower trace with Dolby).

No problems were experienced in amplifier or mic interfacing and headphones gave a useful volume. Mic channel headroom was typically 41dB and noise not obtrusive at normal level setting. Transport control worked well and the cassette holder snapped open quickly but silently at the press of the eject button. Auditioning for nth-degree assessment revealed that the quality was below that which can be expected from some of the more expensive decks, but despite the limited replay channel headroom it was felt that quite a few normal users would be satisfied with the results. As I have mentioned before, electronic non-linearity encourages even-harmonic distortion while tape distortion is essentially third-harmonic, so it is possible that a dose of the former could disguise and make more palatable the latter!

HITACHI D-E55 £129

Like the less expensive D-E25 this test sample was a very recent Hitachi model, one of the first in the country and arrived for evaluation without an operating manual. It possesses some of the looks of the budget-priced model but boasts more features and has a superior performance. Tape transport control is by soft-touch 'logic' buttons, labelled on the fascia as 'computer mechanism', and the metering has a greater definition than that of the D-E25. Each channel comprises twelve LED-type elements calibrated from −20 to +8dB with those above 0dB, which corresponds to DL, being red-glowing.

Tape transport control buttons are neatly grouped in a square at the centre of the fascia, and a three-position slider switch (centre position off) selects the so-called 'auto/memory rewind' functions for 'stop' and 'play'. In 'play' mode the cassette automatically rewinds after it ends and then commences to play all over again — the cycle repeating. In 'stop' mode there is auto-rewind but no auto-replay.

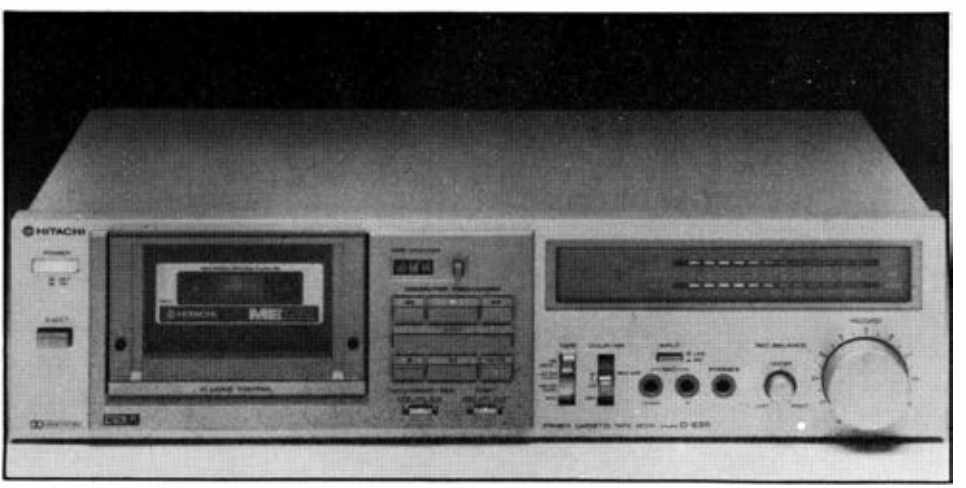
Indicator lights on the buttons show when play, record and pause modes are selected, and when the tape is moving the light on the play button flashes on and off slowly. There are also lights on the metering scale which indicate the selection of metal tape and Dolby noise reduction. Metering scale is not illuminated, nor is the back of the cassette holder.

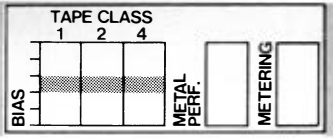
The cassette holder is a 'full-view' see-through type which opens smoothly and swiftly, and it is an easy matter to slip off the windowed front for head cleaning. The deck is two-head.

Recording level is set by a single large knob, channel balance for recording being secured by a smaller knob. Replay level is adjustable by a rear screwdriver-type control, but this does not control headphone volume. Standard ¼in jack sockets are present at the front for left and right mics and headphones, the changeover from 'phono' line to mic is by a press-switch. DIN interface option is also brought into operation by this press-switch. Another socket at the rear caters for optional wire-connected remote control.

A four-position lever switch sets the bias and eq simultaneously for the four tape classes, while a matching three-position switch activates Dolby with or without MPX filtering. To get the deck going for record or replay by an external timer there is a smaller three-position slider switch. The usual three-digit mechanical type of tape counter is fitted and the power press-switch lights when operated.

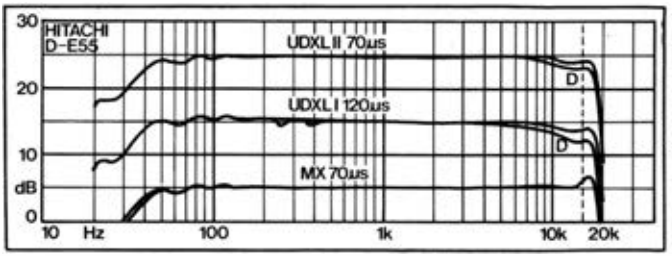
Dimensions approximate 435 × 109 × 290 mm (W × H × D) and the selling price £129.

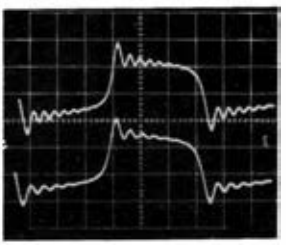




The verdict

This was another favoured deck. I have criticised replay channel headroom but this must be viewed in proper perspective. It is attractive looking with well set out controls on a 'brushed aluminium' fascia. Enclosure is 'grey'-finished metal. Taking all things into account, including auditioning, my award is A for merit and 1 for value.





The findings

Encouraging lab results were obtained from this model, and the biasing for all tape classes appeared to be set close to my (0) reference. The pen-chart reveals some remarkably 'flat' overall small-flux responses with excellent Dolby integrity from the tapes used but with variations at extreme HF. 120µs replay eq was pretty well spot-on using a Hitachi test tape.

LF performance was virtually equal with both UDXLI and MX, with a distortion of 0·5% and MOL of +6·5dB. As I mentioned at the start of this book, the HF performance of almost any deck is essentially a function on the tape, with Class II and IV brews scoring in this respect.

I was pleased to find that Hitachi have widened the replay headroom on this model compared with the cheaper D-E25, but even so I feel that there is still room for further improvement! Replay channel distortion was around 1% at +9·5dB output with the input to the head ***via*** my flux-coupler, rising rapidly with increasing output but being essentially non-obtrusive even-harmonic and thus not adding much to the already high third-harmonic tape distortion at these sort of levels! I don't think the MOLs were limited by replay channel distortion.

Signal/noise ratios came out quite well, the ratio with Master II (70µs) and Dolby being up at 66dB, but ripple content seemed to be higher than from some models although not subjectively apparent at normal reproducing levels. However, high-pass filtering in the test circuit gave a greater Dolby improvement.

Mic sensitivity was OK for most 'domestic type' mics but the headroom barely made 40dB. There was no trouble with amplifier interfacing but headphone volume was slightly low. Across 8 ohms I raised just over 70mV at DL.

W&F (replay only) was commendable and the tape was running only 0·3% slow. A C90 fast-spooled in just over 100 seconds. Metering was excellent with no under-reading on 20ms bursts. The oscillogram shows the usual type of squarewaves (lower trace Dolby on).

Some fine recordings were made on this deck, especially with good metal brews; but unless you can justify by the nature of the programme material the better HF saturation of this more expensive tape, you will probably find good Class I oxide adequate. We made some impressive organ recordings with UDXLI. Class II tape can give more HF headroom than Class I but usually at the expense of LF headroom, depending on noise floor.

We had no trouble with the deck's logic and the 'auto' operations worked OK, though I was working without an Operating Manual!

JVC DD-5 £198

This is one of JVC's latest creations which is longish, sleek and not very high — 'slim-line'. It is a good looking deck and differs from most others in that the see-through cassette holder (with rear illumination) is located at the right-hand side of the fascia instead, as is more usual, at the left. The left-hand upper quadrant sports a black-backed 'fluorescent' type level-indicating display whose calibrations from −20 to +9 dB are softly illuminated, being in red after 0dB. Each element is composed of a multiplicity of small dots which glow brightly and contrast well against the black backing. Those corresponding to the higher levels hold for a short period before extinguishing, thus being continuously updated by the peaks of the signal, which is an aid towards accurate level setting. Readout definition in the upper reaches is also high (1dB intervals), and calibration was found to be accurate, the metering response being true peak.

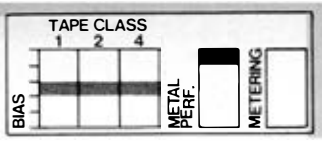
Like the mini DE-5, the deck is equipped with ANRS instead of Dolby for noise reduction; also like the DE-5 this can be switched to basic ANRS or 'super' ANRS. The former selection is also indicated 'Dolby B', the implication being that basic ANRS should be used when replaying tapes which have been recorded with Dolby, to secure the best response integrity. JVC's literature states 'since ANRS is fully compatible with the Dolby B system, the tapes recorded through the ANRS circuit can be played back with favourable results on tape decks equipped with Dolby noise reduction system, and the Dolbyised music cassettes can be played back with full benefits through the ANRS circuit'. I would agree that there is a useful degree of 'compatibility' but not perfect accuracy!

Indicators light to reveal the selection of ANRS ('Dolby'), Super ANRS, metal mode record, play, pause and mute.

Tape transport is logic-controlled and operated by low-pressure buttons, there being the inclusion of pause and record mute. There is the usual three-digit mechanical tape counter (no 'zero' memory) and a switch which provides either auto-rewind after the tape finished or auto-rewind followed by replay. Another switch provides external timer 'standby' for record or replay.

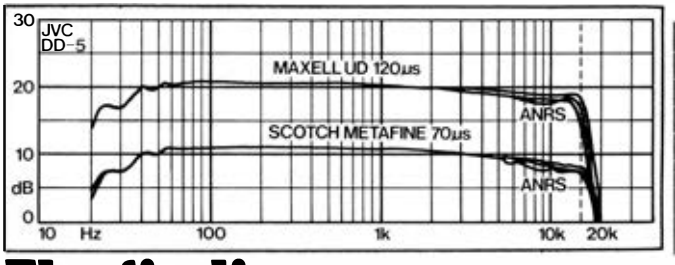
Three press-switches select together bias and eq for tape Classes I, II and IV (metal). User fine bias is not available. Amplifier interfaces are 'phono' and DIN sockets, the change to DIN and the front mic jacks being by a front switch. Recording level is set by a friction-coupled dual-concentric knob, while a slider control adjusts replay level and headphone volume.

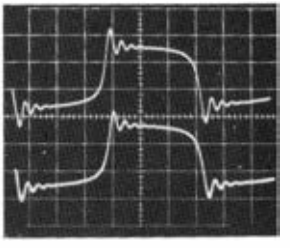
The deck is necely finished in 'silver' and is enclosed totally in metal. Dimensions approximate 420 × 110 × 280 mm (W × H × D) and price is expected to fall somewhere around £198.



merit **B** value **2**

This was another of our favourite decks. One or two shortfalls were detected in the lab, it is true, but I should mention that the sample sent for the review was one of the first in the country, ahead of the selling models. The slight tilt in overall −20dB frequency responses could be improved, but apart from this (which is modified, anyway, by different tape types) I had little to criticise. As it stands, therefore, my award is B for merit and 2 for value.





The findings

I found the deck easy to use and I rather liked the metering. The sample arrived without operating instructions and tape data but since the other JVC models indicated that UD, SA and Metafine were the setting-up tapes these were again used for the frequency response tests, at least. The pen-chart reveals quite fair ANRS integrity at the −20dB recorded level but with a declining response (bass-to-treble) with each tape shown. SA and UDXLII gave similar results but with a higher upper-treble than UD, of course.

Metering indicated +3dB at DL and there was no under-reading on 20ms bursts. Scale accuracy was excellent. Replay signal/noise ratios were also very good, as also with Master II (70μs) with ANRS, indicating low bias noise and hence good waveform purity. LF performance was up with some of the best models returning 0·4% distortion and 7·5dB MOL with UDXLI and 0·6% distortion and 6·5dB MOL with Metafine. Source distortion at monitor was relatively low at +10dB output and not limiting MOLs. Replay eq at 120μs mid-spectrum was acceptable and W&F was very low at 0·06% (replay only) with a mere +0·1% speed error. Metal erase ratio was below subjective noise.

Headphone yield was high and suitable for low impedance 'phones at reasonable volume. C90 fast rewind took 106 seconds. The Audio Technica fixed-charge condenser mics used for the tests interfaced well with plenty of reserve gain and low background noise.

The squarewaves show a rather high initial over-shoot but well-damped 'rings' (lower trace ANRS on) which did not affect auditioning much. In fact, apart from a little upper-treble 'brightness', the listening results were encouraging. Mains ripple content was low and it needed a high amplifier volume to hear this, which was masked by low-level noise. Stereo imagery was thought to be fairly stable, but because of DL being at +3dB on a peak-responding meter the recording level with top-flight oxides and metal could be peaked at +7 without dire compression.

ANRS in both modes worked as per theory, but critical listening revealed slight response errors when replaying a Dolbyised tape through basic ANRS, though compatibility was regarded as acceptable. Super ANRS serves to enhance the HF headroom as well as reducing the noise. High level HF signals are reduced in level before being applied to the tape which gives a greater headroom to saturation. On replay level integrity is restored.

JVC DE-5 £179

Although from a mini-system, this deck is not as small as some. Its 'silvered' fascia carries a fair sprinkling of easy-to-press buttons, some of which operate the logic tape transport. Enclosure is metal which is finished to match the fascia. Overall appearance is quite acceptable with a see-through, rear illuminated, cassette holder at the left of the fascia and a dark-backed metering display beneath a rectangular window at the top-right quadrant.

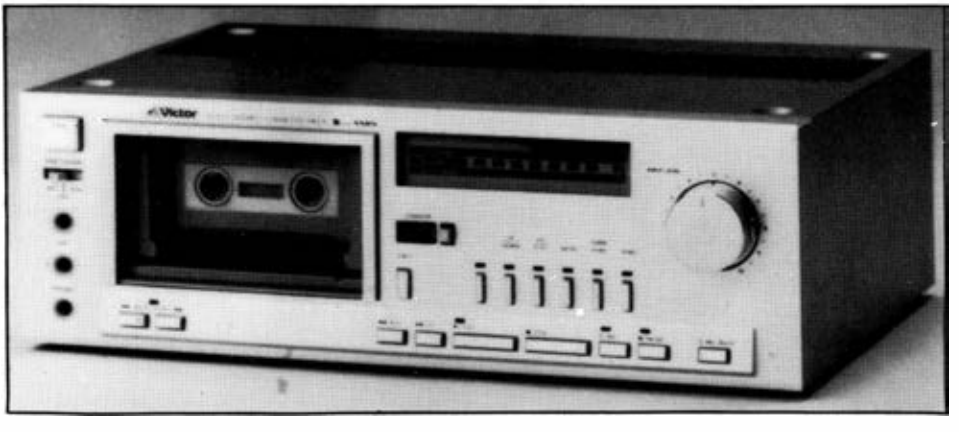
Recording level is set by a friction-coupled dual-concentric knob with resetting marks and numbers printed on the fascia. Replay output is fixed. The metering consists of two lines each of seven LEDs (red-glowing ones after 0dB) calibrated from −20 to +9 dB with DL corresponding to +3dB. The intervals between the calibration levels are fairly large (for example, from 0dB downwards there are only three LEDs at −5, −10 and −20 dB) which tend to detract from the 'goodness' of the metering despite it being peak-responsive. The scale is softly illuminated.

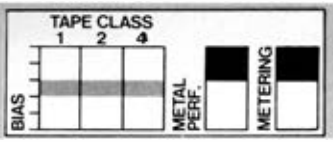
Bias and eq for tape Classes I, II and IV are set together by press-button operation. A press-button also engages noise reduction, while another button gives you a choice between JVC's Super ANRS and basic ANRS, the latter being useful when you are replaying Dolby-encoded tapes and wish for the best response integrity, since ANRS is fairly compatible with Dolby.

The deck is equipped with 'music scan' which means that while in the 'play' mode you can spool the tape quickly in either direction to locate a deliberate pause, at which point the spooling stops and the deck goes into replay mode thereby playing the recorded material following the pause. A record mute button allows you to apply suitable pauses to your own recordings which, for successful operation of the 'music scan' should be 3 to 4 seconds of hum/noise/music-free space. It is also possible to operate either normal fast-spooling button during replay (cue or review), but the speeded-up output is barely audible from the speakers.

Indicator lights reveal the selection of 'music scan' (both directions), play, record, pause, Super ANRS, basic ANRS (Dolby) and tape (a light for each button). The three-digit tape counter is not supported by a memory rewind button, but there is a switch for externally-timed record or play. Amplifier interfaces are by 'phono' sockets (no DIN), while standard ¼ in jack sockets accommodate left and right mics and 'phones. The mic input is engaged by insertion of a jack plug which simultaneously 'kills' the same channel line input.

Dimensions approximate 340 × 115 × 274 mm (W × H × D) and weight 4.8kg. Selling price is expected to be in the region of £179.

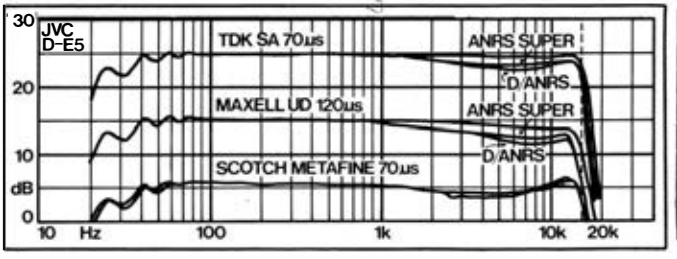


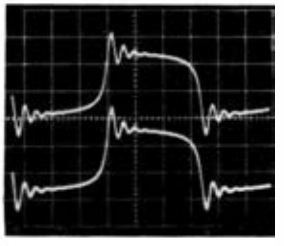


merit C value 3

The verdict

I should mention that the sample sent for review was one of the first models in the country and as such might not have been performing to its optimum. Even so, it showed good promise but fell down a little on overall noise and NR integrity with some tapes. Metering was a little 'compressed' but had the value of being true peak-responding. Metal performance was fairly respectable, though not as good as provided by some decks. Anyway, taking account of all these things, auditioning and price (not forgetting features, my award is C for merit and 3 for value.





The findings

The instructions reveal that the factory-setting tapes were Maxell UD, TDK SA and Scotch Metafine. These were thus used for some of the tests. The pen-chart shows the small-flux frequency responses of these and the response integrity of Super ANRS and basic ANRS (Dolby) for each at −20dB recorded level. Least NR error obtained with Metafine, while UD showed significant basic ANRS (Dolby) error. Upper-frequency response (excluding the ragginess) was best with Metafine, as would be expected, while all tapes exhibited low-bass undulations.

Replay eq at 120µs was fairly accurate, with a trifle of LF lift and mid-treble droop. Replay signal/noise ratio was very good (without tape) with the full 70µs and NR improvements being measured. However, overall with Scotch Master II (70µs plus NR) the ratio was less desirable, indicating the possibility of second-harmonic distortion on the bias/erase signal.

LF performance with UDXLI was also very good at 0.5% distortion and 7dB MOL; but Metafine and MX came out slightly less well at 0.7% distortion and 5.5dB MOL. Distortion on the source monitor signal from the deck in record mode was relatively low at +10dB output.

W&F was not as low as from some decks, but was below the threshold of audibility at 0.1% (though it would be higher overall) with +0.9% speed error. Headphone delivery was high and suitable for low impedance 'phones. Metering read 20ms bursts accurately and a C90 took 124 seconds to fast spool.

I experienced no problems with mic or amplifier interfacing, and although the mic headroom was barely 40dB (to 1% distortion) the overload was 'soft' — meaning a progressive increase in 2nd-harmonic distortion. The squarewaves show significant 'rings' and overshoot (lower trace with basic ANRS — Super ANRS very similar).

Despite the lab noise result, background 'hiss' appeared not to be unduly obtrusive with the test tapes. Metal certainly had the advantage over oxides at HF, but basic ANRS was preferred rather than Super ANRS with metal — the preference reversing with oxides. Shift in stereo imagery was detected, but LF compression was not troublesome at suitable recording levels. Low bass was without the source signal impact and low-level ambience seemed to be somewhat hidden and variable. Little response colouration was heard, but overall the results were certainly not adverse.

JVC KD-A66 £280

This is an up-market two-head, metal-ready front-loader which is equipped with an inbuilt 'computer' for the auto-optimisation of different tape types. Owing to the lack of separate record and replay heads the computer-controlled functions are of necessity more elaborate than those which are engineered into three-head decks, where the signal from the tape being optimised is available during the actual recording process, since the auto-control has to switch the deck from record to rewind and then to replay to secure the information required for the adjustments.

Bias, eq and sensitivity are adjusted or 'tuned' which lead to the initial BEST.

After a little of the tape is fast-forward wound, the deck goes into record mode and the tape is recorded with 1 and 7kHz signals alternately while the bias current is altered in eight steps. Tape then automatically winds back to the start of this test and the deck goes into replay mode. The bias level for the tape is established by comparison of the levels of the 1 and 7kHz signals.

After this the deck goes automatically into record mode and a 12·5kHz signal is recorded on the tape while the eq for both the left and right channels is altered in eight steps. During the same cycle 1kHz signal is also recorded while its level is altered in eight steps, this for sensitivity adjustment.

The tape then automatically rewinds to the start of that test and the deck goes into play mode. Record eq is set separately for the left and right channels for equalised 1kHz and 12·5kHz outputs. Replay sensitivity is set for the same output 1kHz signal as the recording reference.

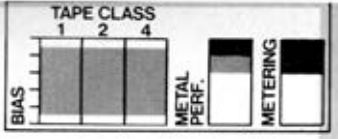
At the end of these four cycles the tape automatically rewinds to the point where the tests started, the deck then being in 'standby' ready for recording, signified by the display panel.

It is possible to set the bias and eq manually by a lever switch which has positions for tape classes I, II, III and IV. Like its 'lowerly' brethren, noise reduction is by ANRS — basic or super, the selection being light indicated. An autorewind switch gives either stop after rewind or replay.

Recording level is set by a two-section friction coupled knob, fascia level-marked, while a smaller knob controls replay level and headphone volume. Other features include a standby switch for externally timed replay or recording, front mic jacks, headphone jack and rear 'phono' amplifier-connecting sockets (no DIN), along with a socket for remote control.

Metering is by VU movements with stripe illumination calibrated from −20 to +7 VU. These fail to follow fast transients, a criticism partly outweighed by a row of peak LEDs on the indicator panel calibrated at −5, 0, +3, +6 and +9 dB. Meter scales are coloured above OVU, but DL corresponds to +3VU.

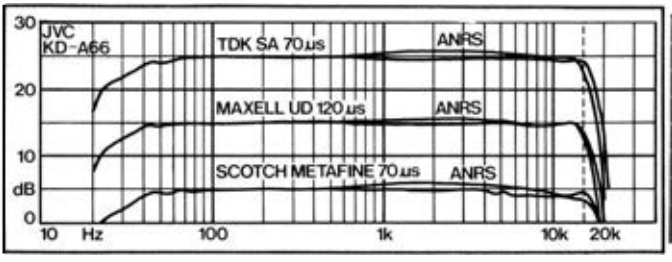
Dimensions approximate 450 × 118 × 331 mm (W × H × D) and weight 7·9kg. Price would appear to be about £280.

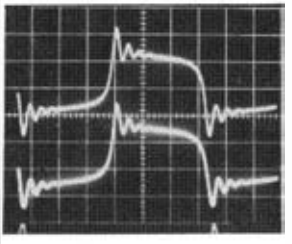


merit **B** value **3**

The verdict

This is not an easy deck to place. It has some good points but for the price I thought the metal performance should have been a bit better. You will be paying somewhat for the convenience of 'computer'-controlled adjustments; but I couldn't help thinking that the tapes were not really being fully optimised and hence exploited by the BEST. There are one or two auditioning reservations so, bearing in mind the nominal price and all the other things, my judgement is B for merit and 3 for value.





The findings

The instructions intimate that UD, SA and Metafine were the factory-setting tapes, so these formulations were used for some of the tests. The pen-chart shows how these fared on small-flux frequency response after the deck's 'computer' gave its BEST! Apart from the low-bass roll-off all responses were fairly flat but I was surprised to find some lower-treble ANRS error. Not bad, it must be admitted, but there nevertheless despite the sensitivity optimisation by 'computer'. The upper-treble of Metafine again showed a trifle of sag; there are metals that can do better in the deck than this.

Anyway, while UDXLI gave very good LF performance at 0·6% distortion and 7·5dB MOL; Maxell MX was less good at 0.8% and 5.5dB respectively. The recent Memorex metal did better than this (better LF performance with MX was also achieved on the cheaper DD-5, as you will see).

Signal/noise ratios were, again, very good, being 61dB replay and 67·5dB bias noise with Scotch Master II (70µs) and ANRS. Hum content was pretty small. Source monitor distortion was very low at +10dB output and was not inhibiting tape MOLs.

I was also very pleased with the low W&F, which read 0.065% (replay only) with −0.1% speed error. Metal erased to below subjective noise level. Headphone yield was high, suitable for virtually all types of 'phones, and a C90 fast wound in 109 seconds. The VU meters under-read by 8dB on 20ms bursts, but the LEDs were true peak-responding, not slowed down by the electronics, though having the disadvantage of not showing the levels separately in the two channels.

The squarewaves show significant overshoot (lower trace ANRS on) which might be resulting from the degree of record pre-emphasis applied to the metal tape during the 'computer' adjusting process.

I had no trouble with mic interfacing or connecting to the test amplifier. As with other JVC models, the mic channel tended towards overload 'softly'.

Under audition we had the impression of upper-treble 'tizzle' which was not present on the source material, also slight mid-range colouration, not a lot but more noticeable, we thought, than from the DD-5. Noise level was low, though, and ripple content on the noise negligible. The noise floor was dictated almost completely by the tape noise itself. Low-level ambience was good and not much comment was directed towards stereo image instability. Bass was not as 'firm' as from some decks and it tended to be a little 'hazy' on heavy organ music, depending on recording level. With this deck we found it desirable to use the VU meters as a guide only, taking account of the LEDs for peaks. With the meters peaking at OdB on high quality music we sometimes got a flash from the +9dB LED!

LUXMAN K115 £220

This two-head deck is suitable for metal tape and is a direct front-loading variety where the cassette is pushed straight into a recess, there being no eject mechanism or moving parts. Head protection is provided by an integral hinged cover. Transport is controlled by soft-touch buttons and logic, and metering is by bright, peak-responding fluorescent elements from −20 to +7 or 8dB but with calibration only to +3dB. 0dB corresponds to DL (200nWB/m).

Bias and eq selection is by a single three-position lever switch, there being no specific position for Class III cassettes. In addition there is a fine bias slider which has a centre setting indentation and calibration marks with respect to this of ±5, which according to the instructions correspond to ±15% relative to 'nominal'.

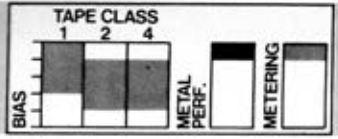
Lever switches are also used for Dolby, with or without MPX filtering, and for line/mic selection (no mic mixing) with a hold-down position for recording mute. A dual-element friction-coupled knob controls the recording level, while a knob common to both channels controls the replay level from line and headphones. Standard front jack sockets are present for headphones and left and right microphones. Amplifier interfacing can be from phono sockets or a DIN socket, both at the rear.

A three-digit mechanical tape counter is complemented by a memory rewind button. Red LEDs indicate the selection of record, pause and memory. Fascia is 'brushed aluminium' (with rather sharp corners) and enclosure black-finished metal.

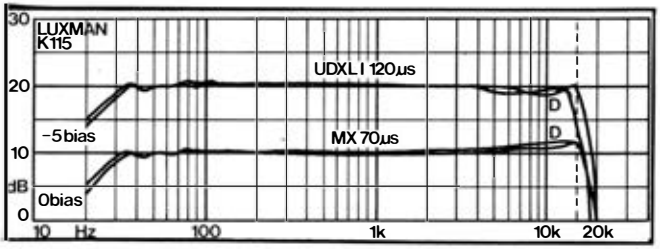
Dimensions approximate 438 × 245 × 140mm (W × D × H) and net weight 5.5kg. Price is around £220.

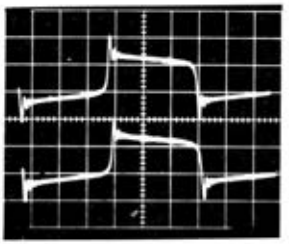
The verdict

This deck was generally favoured, but it does have somewhat of a price premium for a two-head machine. Anyway, taking account of the lab results, auditioning impressions and general construction I award it B for merit and 3 for value.



merit **B** value **3**





The findings

The lab results came out fine, but I was surprised to discover that to achieve my (0) reference bias from the deck in ***Fe*** mode (Class I cassettes) I was obliged to set the fine bias slider to −5 on the scale (hard over to the left). At the centre setting of the control even UDXLI showed upper treble roll-off. The deck's ***Fe*** bias delivery, therefore, is from (0) to (+2), which is silly as it precludes the use of all (−1) and (−2) tapes. For Class II and IV cassettes, however, the centre of the slider corresponded family closely to my (0) bias references (eg, for ***Cr*** and metal tapes).

Small left/right tracking imbalances was noted over the range of the friction-coupled recording level control, but this was not bad.

The transport logic worked OK, but on depressing the stop button the tape did not come to an absolute immediate stop. There was a small trace of over-run. This was more irritating than important, especially when halting a cassette before the recording ends; but may not be noticed on ordinary music. During the lab tests one cassette lost its tape round the capstan, but I think this was more bad luck than transport aberration.

Metering on one channel was dead accurate at 0dB using a DL test tape, but on the other it was about 1dB in error. I was amused to find that while the metering itself (on the deck) is indicated as having 0dB at DL (200nWb/m), the instructions say that 0dB corresponds to 160nWb/m. The instructions should also be brought up to date on tape types, and it was felt that more information should be given to the user on how to set the fine bias slider for the best results. The instructions also say that in the metal position the word 'metal' and a +8dB dot will appear in the indicator, but I couldn't get this to happen on my sample. However, I was pleased to find that the metering responded without any delay on 20ms bursts.

Noise floor was low and the full expected signal/noise ratio on the Scotch Master II was achieved. Dolby also gave the expected noise reduction, but the 70µs eq improvement was a shade below the theoretical. Distortion with both Class I and IV cassettes was very low and the LF MOLs correspondingly high. 120µs eq was 1 dB down at 6.3kHz and 0.3 dB up at 125Hz. The pen charts show very acceptable overall frequency responses at −20dB recorded level and at the bias settings noted. The upper squarewave trace was taken with Dolby off and the lower one with it on along with MPX filtering. On both can be seen high-frequency 'rings' but the general waveshape is good, indicating quite reasonable bandwidth.

Fast spooling time for a C90 was 113 seconds, and wow and flutter was no more than 0·07%, which is good. Speed error was also small at +0·2%.

Headphone delivery was suitable for medium and high impedance 'phones. The mic circuits worked OK but the level control had to be more than half advanced for full tape modulation from the test microphone. Background hum or hiss was not troublesome in this mode, with my unloaded C-zero background hum and his could only be heard with the amplifier's volume control set fairly high, and with Dolby on and 70µs eq there was more lower frequency 'rumble' than actual hum.

Very acceptable recordings were made using Maxell MX. I was not unduly troubled by wandering stereo imagery, indicating good high-frequency stability, and at the correct recording levels there was barely any trace of LF or HF compression. Reproduction was 'clean' and frequency balance good, with a fair portrayal of low-level ambience.

MARANTZ SD-3020 £109

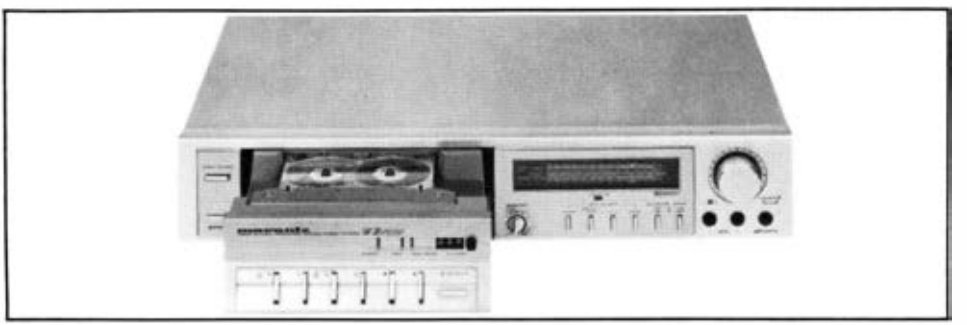
Like the BIC T1, this is another deck which can be switched from the standard 4.75cm/s cassette tape speed to the double speed of 9cm/s; but unlike the BIC, the Marantz has a metal position on its tape selector switching. In fact, there are four press-buttons which select simultaneously the bias and eq requirements for all four classes of cassette tape.

Tape transport control is by fairly deep throw mechanically-coupled press-keys. By operating either fast-spooling key while a tape is replaying it is possible to achieve an audible indication for cue or review. The machine is also equipped with a button curiously labelled 'compuskip'. When depressed, shown by a small light, and the deck is put into fast-spooling mode (either direction) while the play key is simultaneously depressed, the tape will spool in the appropriate direction until a pause is detected. The spooling then stops and the machine plays the tape from the pause onwards. This provides a measure of auto-programme identifcation, which was found to work on a number of commercially purchased pre-recorded music casssettes. The deck, though, is not equipped with a record mute button or switch.

The cassette carrier has a front window and a mirrored back showing through the cassette. Metering is by a 'bar graph' arrangement calibrated from −30 to + 6 dB, said to be a peak level display. Indicator lights show recording and Dolby modes, the latter being selected by a push-button aside those for tape selection. There is no separate MPX filter switch, the filter seeming to be active in Dolby mode. Recording level is handled by separate knobs for the left and right channels, and replay level is fixed at a suitable interfacing value. Rear 'phono' sockets are used for amplifier connection — no DIN option. A two-position rotary switch changes the tape speed, but fast-spooling speed is unchanged.

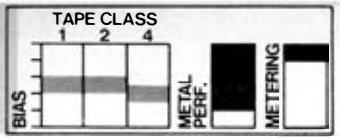
The appropriate mic channel is activated by the insertion of a jack plug, the corresponding line input then being disconnected. Since there are separate left and right recording level controls this makes it possible to record mic on one channel and line on the other at any required 'balancing' level.

The deck has a 'gold-tinted fascia and metal enclosure with matching finish. Corners of the fascia are pointed. Dimensions approximate 415 × 155 × 260 mm (W × H × D) and selling price £109.

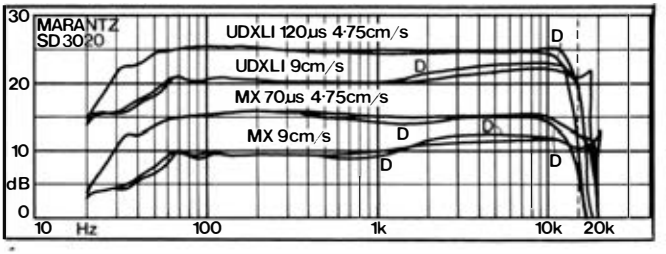


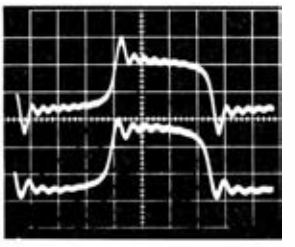
The verdict

Although this deck is attractively-priced, being one of the lowest-priced models of the group, I cannot enthuse over its metal performance and frequency responses at the higher speed. Overall S/N ratio was not all that exciting, either. Taking everything into account, I cannot give the deck any more than D for merit and 2 for value, bearing in mind the particularly low price.



merit D value 2





The findings

Tests were made at both speeds with UDXLI and MX metal. UDXLII was also tried and the response plotted on the Wayne Kerr RA200 to determine the Class II bias delivery of the deck. The pen-chart shows the responses at the two speeds. The best was with UDXLI at normal speed. I was impressed by the 'flat' overall response and the good Dolby integrity. At 9cm/s the frequency went higher but with a 'bulge' starting at 2kHz. MX plotted an undulating response at normal speed with more Dolby error than UDXLI, while at 9cm/s a curious characteristic 'kink' was revealed but, again, with the Dolby-off response going to a high-frequency — pretty well 20kHz. The responses with Dolby on would seem to be limited at HF by the MPX filtering. UDXLII penned a response similar to MX but to a lower HF.

The metering was scaled to +2dB at DL and was found to be virtually true peak with about 3dB under-reading on 20ms bursts. Replay signal/noise ratios were good, but I could only obtain 2.5dB improvement at 70µs; but the full 10dB with Dolby. At the higher speed the replay S/N improved by about 1·5dB. However, using the Scotch Master II test tape at 70µs eq and Dolby on the ratio was not much more than 61·5dB at normal speed with only about 0·5dB improvement at 9cm/s. Ripple content of the noise was not very high.

LF performance with UDXLI was not very good at 1·4% distortion and 3dB MOL. With MX it was even worse at 1·6% distortion and 2dB MOL. These results were essentially the same at both speeds. At the higher speed, though, the HF performance improved dramatically, with 120µs oxide then giving almost metal results, as the BIC T1.

Replay eq mid-spectrum at 120µs was very accurate, being 0/0/0 at 125/1k/6·3kHz. W&F was relatively poor at standard speed, being around 0·15% and the tape running 0·9% fast. Headphone delivery was adequate for medium/high impedance 'phones, though down across 8 ohms. The test mics interfaced without trouble, both input sensitivity and noise being satisfactory for domestic use. A C90 fast-spooled in 134 seconds. The squarewaves show the usual starting overshoot followed by 'rings', with Dolby better again (lower trace).

The deck performed as would be expected within its constraints. W&F was just about subjectively detectable on certain music (less noticeable at 9cm/s), and LF overloading could be induced by running at moderately high recording level. HF performance was good, though, especially at 9cm/s, but then the tape running time is cut by half. On the whole, at normal speed, UDXLI tape seemed to give the best auditioning. The deck, in my opinion, barely warrants the use of the more expensive metal; and there is not all that much advantage in running metal at 9cm/s — from the frequency response aspect, anyway.

MARANTZ SD-5010 £199

I can't say that I envy those chaps whose job it is to dream up new ideas for next year's models. They must be endowed with real lateral thinking for as the years go on the probability of coming up with an outstanding innovation that could be viably geared to the domestic market must surely diminish quite fast.

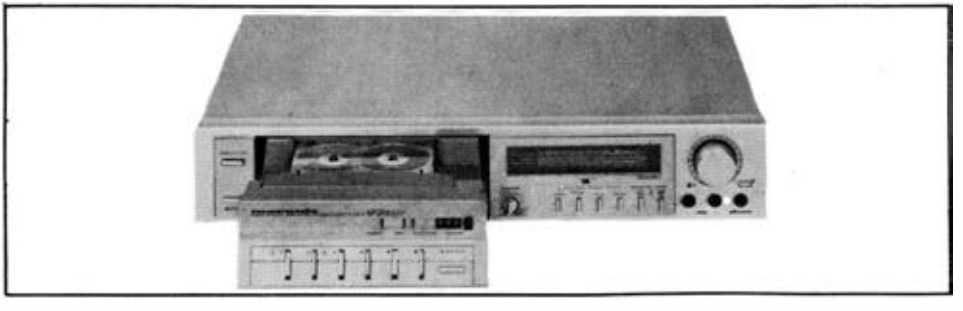
This year Marantz have undoubtedly succeeded on the cassette deck front with their SD5010, which looks even more like a radio tuner than cassette deck. When you first see it you wonder where the cassette goes but then, when energised and settled, you depress a button and watch with awe as the cassette department complete with logic control buttons slowly and quietly comes forward out of the fascia. You press the button again and equally as quietly and without apparent effort the assembly returns completely out of sight so that you end up with a perfectly flat fascia. The height of the deck is very minimal and at the right-hand side of the fascia you are presented with a horizontally disposed peak level metering display calibrated from −30 to + 6dB.

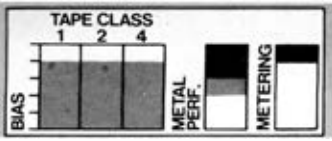
Each channel comprises twelve illuminated elements, each one having two parts, but the scale itself is not illuminated. Dolby level refers to about + 1dB and the elements after OdB are red-glowing — the others green-glowing. Bias and eq are set simultaneously for the four tape classes by four push-switches, and matching switches are used for Dolby and change from line input to mic. Amplifier interfacing is by rear 'phono' sockets (no sign of DIN), while front standard ¼-in. jack sockets accommodate left and right mics and headphones. Recording level is set by a fairly large two section knob at the right-hand side of the fascia, which could be mistaken for the tuning control of a radio tuner! Replay output is fixed, as also headphone volume.

The machine can be operated with the cassette department exposed, which saved me the frustration of having to wait for the relatively slow opening and closing during the tests which demanded many tape changes. The cassette is clipped in flat on the exposed platform so that the tape is clearly visible; but you will have to be careful not to let foreign bodies fall on to the platform or into the drive and head section. It is possible to open and close the cassette section while the machine is recording or replaying without adverse effect.

The bias on all tape classes can be adjusted over a ±15% range by a front control, and the instructions give suggestions on positioning for a number of different cassettes. The record and play buttons latch on when the deck is switched off, which makes it possible to set these for timed operation. When the deck is energised they automatically release. There are the usual operations, including record mute. Selection of record and Dolby are indicated by lights; a small light also shows when the power is on while a flashing light reveals that the tape is in motion (can be distracting, this) and steady in pause mode.

The deck is finished in an attractive 'gold-tinted hue, it being totally metal enclosed. It was classified as one of the best loooking decks that we have so far experienced. Dimensions approximate 416 × 80 × 320 mm (W × H × D) and the price £199.

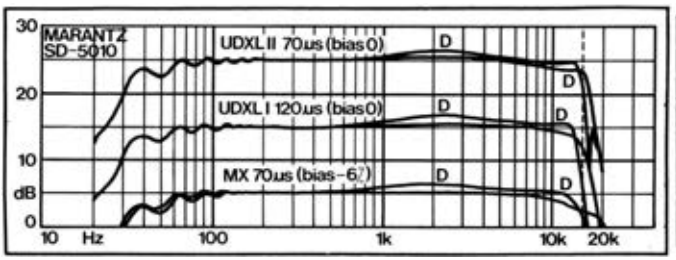


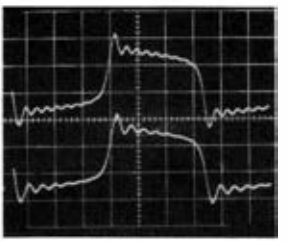


merit **B** value **3**

The verdict

Although failing to reach the heights of some models in a similar price range on lab performance the deck was nevertheless liked. It seemed a pity that the replay headroom was curtailed but I must stress that the test sample was a first UK model, so the result on this count may not be typical of later shop selling machines. The neatness of design and novel cassette loading must carry weight, but price is also a factor. Accordingly my verdict is B for overall merit and 3 for value.





The findings

We found that some of the fine bias settings failed exactly to correlate with the table in the instructions. UDXLI, for example, worked best at zero setting rather than at +6% indicated, as also UDXLII. MX, though, gave the best small-flux response at −6% as specified. The pen-chart shows that the results were variable, all the tapes selected showing some Dolby level error and LF undulations.

LF performance was best with UDXLI, where the distortion was 0.6% and the MOL 6·5dB. Metal was significantly poorer, the distortion with MX being 1·5% and the MOL 2dB. The recent Memorex Metal came out better with 1% distortion and 4·5dB MOL, but at a slightly higher bias setting than required by Maxell MX.

Replay channel headroom could be wider since by using a flux coupler to the head I could only measure +6dB output to the 1% distortion point. At +10dB output the distortion was 1.4% *via* the flux coupler and 1.5% with the input to line (souce monitoring). Mic headroom, though, was approaching 48dB, better than some.

Signal/noise ratios were OK, the overall ratio with Master II (70μs) and Dolby being 65dB, but the ripple content seemed to be a little higher than some, but not subjectively apparent. 120μs replay eq seemed to be reasonably well tailored, the output being 1.5dB down at 10kHz. W&F was commendably low, hovering around 0.07% (replay only), and the speed error −0.4%. It took 118 seconds to fast rewind a C90. The oscillogram shows a fairly typical square-wave performance (lower trace Dolby on). Headphone yield was only 51mV across 8 ohms.

Under audition the reproduction was steady, with a fairly stable stereo image and no W&F irritations. There was thought to be some lightness in upper-treble response with a little lack of music attack on percussion sounds, and low bass was thought to be a shade emphasised. Colouration mid-range was also detected, with traces of compression at highish recording levels of deep organ music using MX tape. However, on the whole the results were acceptable and sometimes preferable with high-energy Class I oxide than metal.

On the metering I should mention that there was 2 to 3 dB under-reading on 20ms bursts and although DL is indicated at +2dB my test tape gave a +1dB reading.

NAD 6140 £179

This front-loader has a smart finish of dark hue and is metal-enclosed. It is a two-head deck with logic tape transport operated by soft-touch buttons. Cassette holder is a full-view type and rear illumination facilitates tape observations. Metering is by two rows of LEDs, but each row only contains 8 active LEDs. There is a red-glowing one right at the end but this is alight all the time. Scaling is from −18 to +4 dB, and DL falls at 0dB.

Tape selection is by a three-position switch which sets bias and eq simultaneously for tape classes I; II and IV. There is no user-adjustable fine bias control. However, the deck is one of those equipped with Dolby HX as well as Dolby 'normal' (eg, Dolby B noise reduction). A three-position switch provides 'off', Dolby B and Dolby HX. A separate swich makes it possible to work with or without MPX filtering.

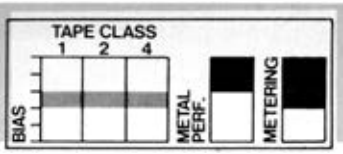
The three-digit mechanical tape counter can be linked to memory rewind by a press-button, indicator lights showing memory, Dolby NR and Dolby HX modes. There is another three-position switch for external timer starting in record or replay mode.

Recording level is adjusted by a friction-coupled dual-concentric knob, a smaller knob providing replay level control, which also controls the level of the headphone signal. Amplifier interfacing is by rear 'phono' sockets with a DIN socket as an option. Another socket will accept a wire-connected remote control unit (type RC-1). Each mic input becomes active and the corresponding line input inactive by insertion of the appropriate plug into a standard jack socket at the front. There is also a standard jack socket for headphones.

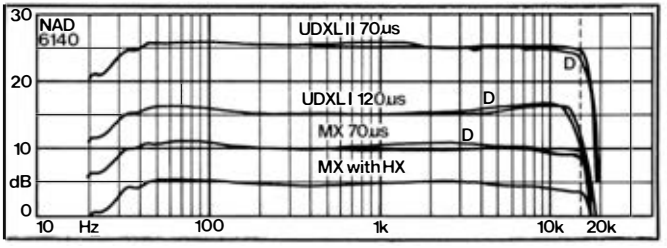
The deck uses a Sendust head and DC servo-motor. Dimensions approximate 420 × 110 × 240 mm (W × H × D) and price £179.

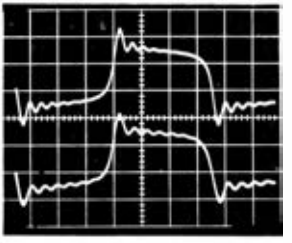
The verdict

Undoubtedly a nice little deck and one I felt which has potential. Unfortunately, the only moderate metal performance, although dispelled to some extent by the good small-flux frequency response, the rather noisy left and channel and the not too enthusiastic metering tended to reduce my award for merit. Nevertheless, the deck has quite a few plus points and does include Dolby HX so, excluding the noisy channel which I felt was a sample aberration, my award is B for merit and 3 for value.



merit **B** value **3**





The findings

I was impressed by the good small-flux frequency responses and Dolby integrity obtained from all the tapes used for the tests. In addition to the usual plots of UDXLI and MX, I again decided to plot UDXLII in this machine. To see the effect of Dolby HX on the overall response I plotted MX separately with this mode selected. The only difference between this and MX-with-Dolby-NR is about 1dB reduction in output at 15kHz, which is barely a worry. Mid-spectrum 120µs eq was also found pretty accurate with 0·5dB boost at 125Hz (as present in the overall responses) and 0·4dB drop at 6·3kHz.

LF performance with UDXLI was also good at 0·5% distortion and 6·5dB MOL, but with metal MX I was disappointed to obtain only 3·5dB MOL and 1·2% distortion.

Right channel signal/noise ratios were fine, measuring 58dB replay, 9dB Dolby improvement and 3dB 70µs improvement, leading to 65dB overall using Scotch Master II with 70µs eq and Dolby. Unfortunately, the left channel was noisier, the noise being 'spiky' and variable as though emanating from noisy electronics. Distortion in monitor mode was well down, though.

W&F was hovering around 0·09%, but the tape was running 0·7% slow. Headphone delivery was more suitable for high/medium impedance 'phones, the volume then being adequate.

The metering electronics were not exceptionally fast, the indication being some 6dB low on 20ms burst. The squarewaves show substantial overshoot followed by the usual 'rings' and there was barely any difference between the Dolby-plus-MPX-filter trace (lower) and that obtained (not shown) with Dolby HX engaged.

Under audition the greater noise in the left channel was audible, along with a slight trace of mains ripple, the subjective effect being an impairment of low-level ambience, at high setting of the amplifier's volume control. Apart from these aberrations the frequency response was considered to be 'smooth', tape/head intimacy quite fair and stereo imagery reasonably stable. No undue compression was detected at correct recording levels. However, it was thought that UDXLIS (or TDK SA-X when the programme contained an abundance of high amplitude treble peaks) gave almost as good results as the best of metals in the deck, especially with the application of Dolby HX, which certainly enhanced the HF headroom.

NAKAMICHI 480 £220

This is a two-head front-loader, the sample submitted for review sporting a 'silver' fascia. Although above price average for a two-head deck it carries a sort of 'professional' aura which tends to become even more apparent with detailed use. Two peak-responding meter movements reside behind a longish window at the top of the fascia, their black backing setting off the white print of the scaling which has the usefully wide range from −40 to +7 dB. Even illumination is provided by lights round the inside edges of the window, which also embraces a three-digit mechanical tape counter, linked to a memory rewind button, which shows through the black backing.

Replay signal is fixed at a convenient amplifier connecting level, and for recording level control there are separate sliders for the left and right channels. These sliders are good quality components and have an operating law which is not as compressed as some over the initial part of the range. It is thus easy to set recording levels quite accurately. There is no provision for microphones, it being Nakamichi's philosophy to use an external interface in the form of an optional three-input 'mixer', Model MX-100.

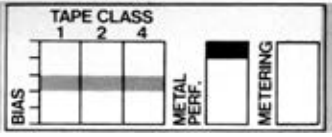
Tape transport modes are engaged by latching-type 'soft-touch' buttons in conjunction with a motor-driven cam and 'logic' control, which permit mode changes without passing through stop. Indicator lights signify the selection of record, play and pause. A dual-capstan tape drive arrangement is used which provides adequate tape tensioning over the heads to ensure good tape/head intimacy without reliance having to be placed on the tape pad in a cassette. In fact, the pad is lifted clear of the tape by the machine, which helps to reduce modulation noise. The transport system also employs resonance minimising artifices.

Although the Sendust record/play head has a very narrow gap (retaining a good upper-treble response), early saturation was not indicated. A strong erase field is provided by a dual-gap erase head.

Separate press-switches are used for bias and eq selection, there being one for 120μs/70μs eq and two more for bias, one of which changes between the requirements of Class I and II tapes and the other switching to the extra high bias required by Class IV metal tapes. It would be better for these switches to be marked in terms of tape classification rather than SX, EX and ZX, which are not generally understood. Three more matching press-switches activate Dolby, memory and MPX filtering.

Amplifier interfaces are by rear 'phono' sockets (no DIN), while a DIN-type socket caters for an optional extra remote control unit, Model RM100. Although there is no timer 'standby' switch, the deck will switch on for replay or record when the mains is switched on provided the appropriate transport buttons have been latched on beforehand. There is a Nakamichi timer for this function, Model DS200, available as on optional extra.

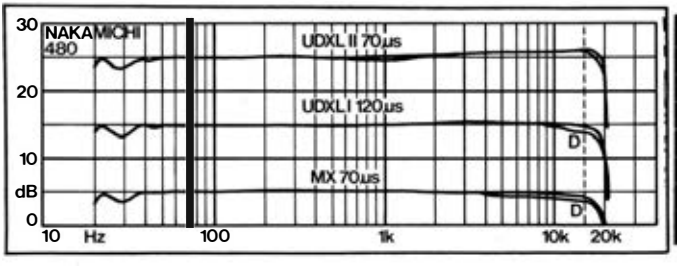
The deck is metal-enclosed in black, and although the sample was equipped with a 'silver' fascia the same model is also available with a matt-black front. Dimensions approximate 450 × 135 × 289 mm (W × H × D) and weight 6.4kg. The machine sells for around £220.

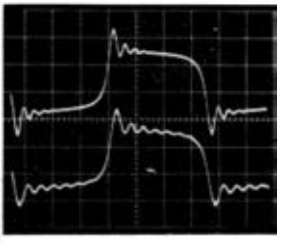


The verdict

I must admit to encountering difficulty in finding aspects of this deck reasonably to criticise! It is true that some of the decks in this book yielded a greater metal MOL, but not always with the same trueness of small-flux frequency response or up to such a high frequency. Some of the models you will find are better endowed at a lesser price. The latching tape transport buttons may not be to the liking of everyone; and then, of course, you have no mic facilities.

However, looking again at my lab results and the comments of auditioning I still feel that the plus factors outweigh the shortage of features and the higher price standing of this deck. Taking all things into account, not least the auditioning, my award must be A for merit and 1 for value.





The findings

I was impressed by the smoothness of the tape transport modes and the quiet motoring. The 'logic' control worked without flaw and exhibited the usual 'sorting out' delay following button pressing. Although it is not possible for the user to adjust the bias (apart from with the buttons already mentioned), it was found that the sample was closely biased to my (0) reference for all classes of tape.

The pen-chart shows some excellent responses with minimal Dolby error right from low bass to high treble using the three Class I, II and IV Maxell tapes. LF performance was marginally better with MX than UDXLI, the former giving 0·55% distortion and 6dB MOL and the latter 0·8% distortion and 4dB MOL. UDXLII had a higher distortion and lower MOL than UDXLI, which is usual. Electronic replay distortion at 10dB output was more than a magnitude lower than UDXLI at 0dB output.

The meters were scaled to read 0dB at DL and underead 20ms bursts by about 1 or 2 dB. Signal/noise ratios were very good at 59·5dB replay and 67dB overall with Scotch Master II (70µs) and Dolby. The usual 70µs and Dolby improvements were noted, and the mains ripple contribution very low. 120µs replay eq was accurately adjusted, with good match between channels, and W&F was down at 0·07% (replay only) with zero speed error. Metal erased to well below noise floor.

Headphone output was adequately high for low impedance 'phones, and a C90 cassette fast spooled in 76 seconds, which is swift. The oscillogram shows average sort of squarewaves, the lower trace with Dolby plus MPX filtering.

All listeners were impressed with the auditioning of the deck, especially with metal tape and top-grade programme material. It was often difficult to determine with conviction whether we were hearing the source or the recorded material! Stereo imagery was remarkably steady and low-level ambience nicely portrayed. An interesting feature is that any looseness in tape spooling is automatically taken up as soon as a cassette is inserted.

NEC AUK-9000E £180

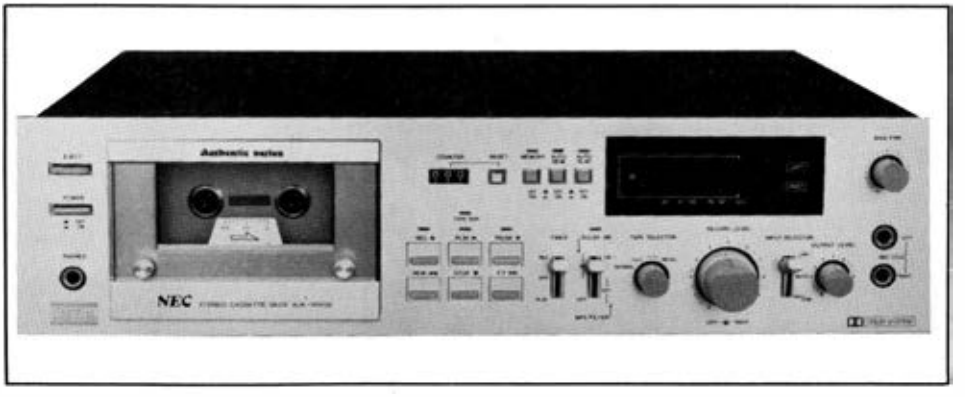
NEC stands for the Nippon Electric Company of Japan and this is the first opportunity I have had of examining this Company's wares. The deck is a front-loader using two motors and logic, solenoid-operated tape transport. The operating buttons are the low-pressure type, those for record, play and pause having light indicators. It is a two-head design enclosed in black-crackle-finished metal with 'brushed aluminium' fascia (the sales leaflet issued with the deck would indicate that there is also an all-black version).

Metering is true peak with auto peak hold of the fluorescent digital bar-graph type, there being 14 segments per channel. Scaling is from −20 to +8 dB and the segments above zero are red-glowing. A rear control makes it possible to adjust the brightness of display. DL occurs around +3dB which seems rather high for a peak-responding display.

Bias and eq are set together by a four-position rotary switch for all four tape classes. A separate control provides fine bias adjustment over a scale marked ±10. Dolby can be activated with or without MPX filtering, and the recording level is set by a largish friction-coupled dual-concentric knob. A separate smaller control knob adjusts the replay level as well as the headphone level. A 'tape run' indicator flashes on and off when the tape is moving, and a light also shows when Dolby is engaged.

The deck includes several 'auto' functions including memory rewind which works against tape counter zero, auto-rewind and auto-play. There is also a switch which allows the deck to be activated on record or play by an external timer (not supplied). Amplifier interfacing is by rear 'phono' sockets with the option of DIN socket interfacing, the changeover being affected by a front switch. In the 'DIN' position the front mic jacks are also brought into circuit. This input selector switch has a 'record mute' position which also disables the metering.

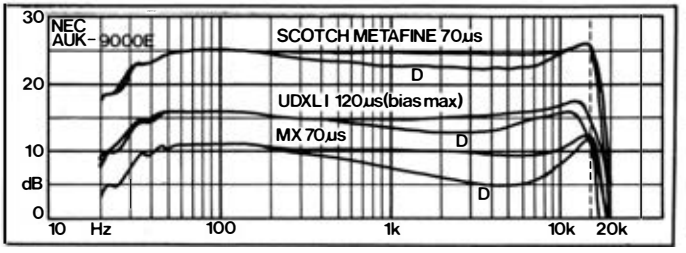
The deck is quite pleasant to the eye, but a little larger than some, having the approximate dimensions of 450 × 110 × 340 mm (W × H × D). Weight is around 8·6kg. The erase head is ferrite while the record/replay heads are laminated Sendust. Selling price is expected to be around £180.

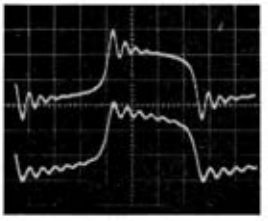


The verdict

For a two-head deck the price is getting towards the top of the scale, and taking this into account, the lab results and the listening impressions, along with the features offered my award relative to the test sample is D for merit and 3 for value. It is probable that other samples will give improved results, which could then be expected to bring the merit and value above group average.

merit D value 3





The findings

I couldn't help feeling that the deck was probably an early UK sample. The counter reset button was sticking in and the cassette carrier seemed to be less mechanically stable than it should be. The lab evaluation also gave the impression that the circuit electronics were not optimised to reap the deck's full potential.

For example, the pen-chart exposes quite serious Dolby integrity errors with all tapes plotted. No operating instructions were supplied nor were the factory setting-up tapes known to me. Anyway, since the deck features a fine bias control one would assume that it was the intention of the designers to make the deck as flexible as possible with respect to tape types.

Because of the particularly bad Dolby error with Maxell MX I decided to include an additional overall response with Scotch Metafine. Although the Dolby error was less with this, it was still quite apparent as you will see. Lab plots using UDXLII (Class II tape) were also made, and with this tape the error was less. Replay eq was also felt to be a trifle malaligned, the mid-spectrum result showing +1·2dB at 125Hz and −0·8dB at 6·3kHz.

The fine bias control appeared to have little or no influence on Class IV tapes. For UDXLI I was obliged to set the control to +10 to avoid excessive treble lift, while with UDXLII it was best set at −10.

I was also disappointed with the LF performance using UDXLI, the distortion measuring 0·9% and the MOL 3dB. Metal did better at 0·7% distortion and MOL 5·5dB, but the marking of metal tape performance had to be curtailed owing to the Dolby error. Distortion on the record monitor signal at +10dB output was acceptably low.

Signal/noise ratios were very good, being 57·5dB replay (with only a minor amount of mains ripple) and 66·5dB overall with Scotch Master II at 70µs and with Dolby. Almost the full 10dB of improvement with Dolby was measured and 4dB improvement with 70µs eq.

Wow and flutter was around the 0·1% mark and there was absolutely no speed error. A C90 rewound in 126 seconds. There was no under-reading on the meters with 20ms bursts, and the headphone delivery was high enough for most impedance 'phones. The squarewaves show a fair amount of 'ringing' and more starting overshoot without Dolby than with (lower trace).

Under audition the lower-treble depression with Dolby active could sometimes be detected, depending on the level of the reproduction, and some listeners preferred the result using metal tape with Dolby switched off. As the error between the two channels differed the stereo image had a tendency to wander around a bit. General noise level was low, though, and had it not been for the small-flux frequency response aberrations a higher mark for auditioning would have been assured. This is a pity for I felt that the deck had more potential than the sample conveyed.

The metering was favoured and the machine was easy to use and embodies features that could be of use to normal users.

ONKYO TA2060 £200

This three-head deck with off-tape monitoring is an up-market version of the two-head TA2040 yet the expected selling price is remarkably competitive. The sample received for this review was the first UK one, which appeared to have been well evaluated elsewhere before arriving at my lab. It is likely, therefore, that some of the criticisms may have been resolved by the time it gets into the shops.

It is a front-loader and is contained in a 'silver'-finished metal enclosure with 'brushed aluminium' fascia. Bias and eq are established by a three-position switch (no specific position for Class III FeCr tapes) and a fine bias control permits optimisation. This is aided by a two-tone oscillator which records suitable level 333Hz and 10kHz signals on the tape alternately and monitors them in realtime on the meters from the replay head. While this is happening the plan is to adjust the bias control until the deflection is the same at both frequencies. This is a simple process which appears to work well in practice. Onkyo call it 'Auto Accubias'.

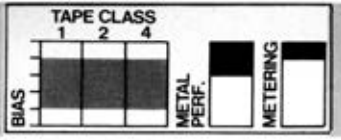
The deck incorporates Dolby B which can be used with or without MPX filtering and Dolby HX. There is also a switch for externally timed replay or record which has two extra positions for memory rewind and auto-play (eg, when zero on the tape counter is reached during rewind the fast spooling either stops or the transport goes automatically into play mode, depending on the position of the switch).

Tape transport is logic-controlled operated by elongated 'soft-touch' switches. There is also a press-in rotating control which makes it possible to introduce fade ins and outs on an already recorded tape. A small push-button switches between source and tape and another provides record mute while held depressed. A mini-knob adjusts line replay level and the headphone monitoring level simultaneously. Amplifier interfacing is to rear 'phono' sockets (no DIN option) and standard jack sockets are fitted at the front for headphones and left and right mics. A rear DIN-type socket accommodates a remote control.

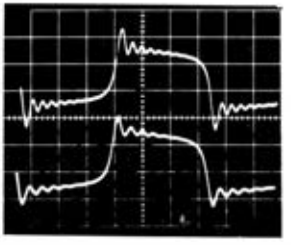
Indicator lights signify which tape transport switch has been depressed (with the exception of stop). There are also indicator lights for tape type and Dolby HX. Metering is by peak-responding movements calibrated from −20 to +7dB, with DL occurring around −1dB. Dimensions approximate 418 × 120 × 330 mm (W × H × D) and weight 6·5kg. Expected selling price is about £199.90.

The verdict

I must admit to being impressed by this deck at the expected selling price. Had it not been for the metal tape limitation and the one or two maladjustments (which will hopefully be cleared from later importations) I would have marked it even higher for merit. As it is I award B for merit and 2 for value.



merit **B** value **2**



The findings

I was greatly impressed by the very flat overall frequency responses and the only minimal lack of Dolby integrity as shown by the pen-chart, which applied also to UDXLII. You will see that the metal response is only about −1dB in error all the way from 20Hz to 20kHz. I should mention that these were plotted after bias optimisation which proves that the 'Auto Accubias' works, at least, to equalise tape sensitivity over the spectrum. 120µs replay eq was a trifle out of adjustment, being +0.5dB at 125Hz and −1·5dB at 6·3kHz.

Although I obtained very respectable LF performance figures with UDXLI (0·48% distortion and 6·5dB MOL ref. DL), the results were less happy with MX metal. At the established bias setting (for the MX overall response in the pen-chart) the distortion was 1% and the MOL 4dB. This could be improved by advancing the bias but at the expense of the 'flat' upper-treble response. Replay monitor mode distortion was low at 10dB over Dolby.

Signal/noise ratios were good, the Scotch Master II returning 65dB with Dolby. W&F, too, was low at 0·07% and speed was only 0·1% slow. Headphone delivery was suitable for 8-ohm 'phones as well as for higher impedance ones, of course.

Fast spooling time was very protracted at more than 180 seconds for a C90, but this was almost certainly caused by an incorrectly set torque adjustment within the machine. The squarewaves show the usual initial overshoot followed by 'rings', the upper trace with Dolby off and the lower with it on.

The meters were under-reading by less than 1dB on 20ms bursts so they can be classified as true peak-responding. The deck auditioned impressively, though a little more tape instability was noted than would have been expected, causing a wandering stereo image. Using metal tape Dolby HX appeared to have hardly any effect at normal recording levels. If the level was deliberately increased low-frequency compression was noted before high-frequency aberrations and in-band intermodulation. HX seemed to work better with UDXLI and very good recordings were made on this formulation with HX.

OPTONICA RT-7000 £159

This two-head front-loader is of attractive slimline styling. The height of the fascia is not much greater than the height of the cassette holder, the upper half of which is windowed. Rear illumination helps you to see what is happening to the tape through the cassette. This windowed part neatly lines up with an upper windowed section of the fascia proper, behind which lies the peak-responding fluorescent metering, the tape counter and the 'search system' indicators. The overall impression is more of a slim-line radio tuner than a cassette deck.

Tape transport is operated by a solenoid and soft-touch 'logic' buttons. Matching buttons are used for the 'search system', which Optonica call 'Auto Programme Search System' (APSS for short), for input switching (fron line 'phono' sockets to mic with DIN), Dolby selection, MPX filter switching, metering peakhold switch and timed record/replay switch. All these switches are fitted to the 'silvered' part of the fascia. The deck is metal enclosed of matching finish. Rear is a hardboard material.

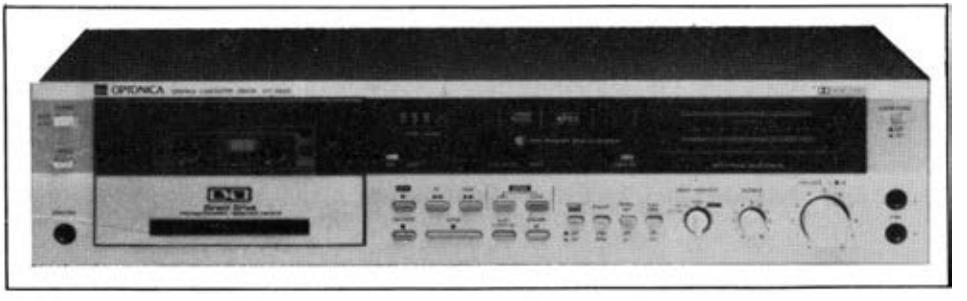
The APSS scans a recorded tape at spooling speed in either direction and when a deliberate pause is detected, or a gap in the recorded material, lasting for about 3 seconds the fast-spooling stops and the deck goes into normal play mode so that the recorded material following the gap is reproduced. Indicator symbols show that the APSS has been activated and the direction of scanning.

Recording level is adjusted by a small, friction-coupled dual-concentric knob, and there is a separate knob for replay level setting which also controls headphone volume. Amplifier interfacing is by rear 'phono' sockets, with DIN socket option brought into operation, with the front mic jacks, by a press-button. A four-position rotary switch selects the bias and eq for the four classes of cassette tape.

The fluorescent bar-graph metering is calibrated from −20 to +8dB, with DL at 0dB, and by depressing a button the final elements of the two channels are retained in display, being continuously updated by the signal peaks. Indicator lights signify play, record, pause and Dolby modes.

A button makes it possible for you to introduce your own deliberate pauses when recording so that the tape can then be used to operate the APSS. The button is depressed to mute the recording signal, and after about 4 seconds the deck goes into pause mode, which is retained until the play button is depressed to resume the recording.

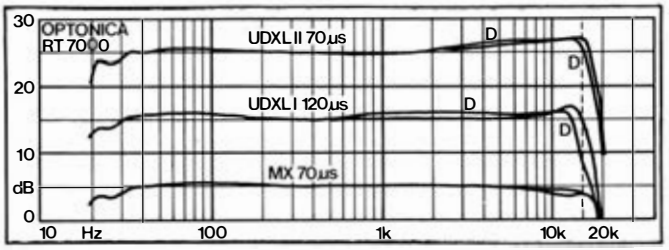
Dimensions approximate 430 × 95 × 320 mm (W × H × D) and weight 6kg. Expected selling price is around £159.

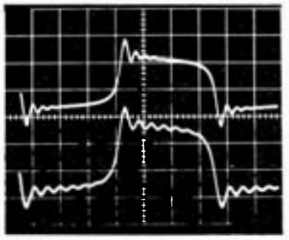


The verdict

This deck was favoured for its encouraging auditioning. One or two odd things were found during the lab scrutiny, as we have seen, but their impact on the sounding of the deck was minimal. Taking all things into account I am happy to award A for merit and 1 for value.

merit A value 1





The findings

The deck penned some fairly flat frequency responses with only moderate Dolby error with the test tapes used, as you will see from the pen-chart. In adition to the usual plots of 120µs oxide and metal tapes, I decided also to show a Class II tape plot (UDXLII) this time. The metal MX certainly gave a good account of itself, the −3dB point being pretty close to 18kHz. Extremely good Dolby integrity was also achieved with this tape. With the extended LF responses of all tapes, coupled with the freedom from LF undulations, I would classify the MX result as very good indeed for a two-head deck.

UDXLI shows a little HF peak (possibly recording pre-emphasis) around 14kHz, while UDXLII shows a more progressive rise to upper-treble and a higher HF response

Replay eq at 120µs mid-spectrum was good at LF, but had a little droop of 0·8dB at 6·3kHz.

Signal/noise ratios were good, replay being as high as 59dB (with only minimal ripple), and overall with Scotch Master II at 70µs eq and with Dolby 67·5dB — a top result!

LF performance with UDXLI was good at 0·5% distortion and 6·5dB MOL. Metal was not quite as good at 0.7% distortion and 5dB MOL W&F was quite reasonable at 0·09% with −0·4% speed error. Since the deck uses a separate spooling motor (direct-drive capstan motor) I was expecting a less protracted C90 fast-rewind time than the 140 seconds measured. I was also a little disappointed to find the monitor mode distortion higher than some at +10dB output. Although this could be limiting the MOLs (though they are certainly not bad as they stand), it would need a higher distortion at an output below +10dB significantly to affect the tape yield to my 3% distortion threshold.

Headphone delivery was adequate for medium/high impedance 'phones, while even across 8 ohms the signal was still 142mV (at DL) with the replay control at maximum.

The squarewaves show fewer 'rings' with Dolby off (upper trace) than on with this deck; but I have still yet to see a really good squarewave from a cassette deck!

The test mics interfaced without problems and both the sensitivity and S/N ratio were considered suitable for domestic applications.

Under audition encouraging comment was given by the listeners when the master-tape music was recorded on Maxell MX. The general opinion being that, despite the small metal MOL limitation, here is a deck which can do justice to the higher price of metal. Smoothness of response was good and the bass, although a little 'blurred' at times on heavy organ music, was thought full and firm. Low-level ambience was nicely portrayed, and it needed particularly high recording levels with metal to evoke HF compression symptoms.

PHILIPS N5431 £123

This is a rather bulky two-head deck with mechanical piano type keys for tape transport. It is one of the few decks of this class now in the market place without a metal tape position. It is a front-loader with a see-through window and tape remaining scaling. Metering is by two well illuminated quasi-peak dB movements scaled from −30 to +5, with Dolby level falling around 0dB. To help you know exactly where your real peaks are, Philips have included a solitary peak-responding LED set at +4dB.

Bias and eq are selected simultaneously by a press-switch, there being three of them for tape classes I, II and III. Similar switches operate Dolby noise reduction and MPX filtering separately. There is also a memory stop switch geared to tape counter zero.

Recording level is set by a large dual-concentric friction-coupled knob, while two small screwdriver presets at the rear allow for output level normalisation of the left and right channels separately. Amplifier interfacing is via rear 'phono' sockets with DIN socket option, but the deck does not provide source signal monitoring through the amplifier — only from the headphones.

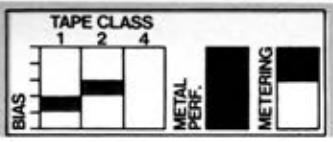
Standard ¼ in jack sockets at the front accept left and right mics and headphones. If you plug a single mic into the right socket, both left and right line inputs are disconnected and the mic signal can be recorded on both channels (mono mode). Plugged into the left socket only, the left line input is disconnected. With two mics plugged in you achieve normal stereo recording from the pair.

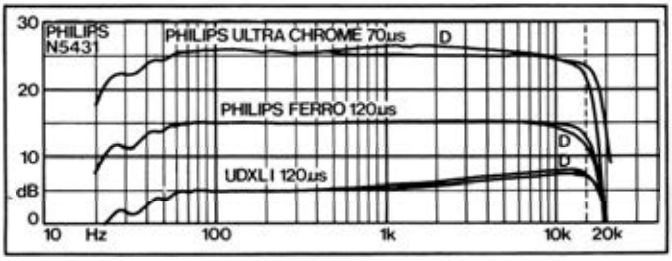
The back of the cassette holder is illuminated and small indicator lights show when Dolby and record are selected.

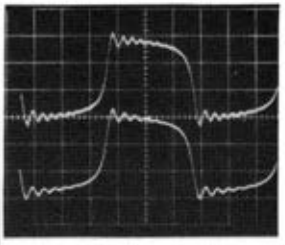
Dimensions approximate 450 × 150 × 350mm (w × H × D), and, although from the Black Tulip series, the fascia of the sample submitted for test was brushed-aluminium. Enclosure is grey-finished metal. The price, I was told, has been reduced from around £173 to about £123.

The verdict

I am sorry but I cannot be very enthusiastic over this non-metal deck. I was also annoyed at not being able to monitor the source signal from the 'phono' sockets. Careful control of the peak recording levels is essential to achieve the best sound quality. I would personally rather pay the extra for the N5748. My award is thus E for merit and 4 for value at the reduced price.







The findings

I had a little problem in finding suitable tapes for the machine. The plan was to use the latest Philips brews, but the high-energy Class I Ultra Ferro was under-biased by the deck, giving a significantly rising upper-treble response, while the latest Philips Ferro gave a poor LF MOL and highish distortion, though taming the upper-treble rise.

You will see from the pen-chart that the latest Philips Ultra Chrome gave a sanitary response, albeit with signs of Dolby non-integrity. I have also included the responses of Ferro and UDXLI, both of which suited the set Dolby levels of the deck. UDXLI also exhibited a rising treble, as you will see, but this tape did better on LF distortion and MOL.

Actually, the LF performance with most tapes was not good. Ferro produced the highest distortion and the least MOL. UDXLI was better but Ultra Chrome came out best in the deck.

I was also disappointed to find that the replay channel headroom was poor. The distortion tended to climb rapidly at increasing output above the 1% point. The deck seemed to be worse than the N5748 in this respect, which itself was not good on that parameter.

Line input headroom, though, was 44dB which would be adequate for most source inputs. Signal/noise ratios were also acceptable, but I was unable to attain the full Dolby Improvement, and the mains ripple on the noise was higher than from some decks. With the Scotch Master II (70µs) the ratio was 65.6dB with Dolby. 120µs replay eq was slightly out of adjustment, as also head azimuth. W&F was good, though, at no more than 0·08%, and speed error a mere 0·1% slow. Class II erase ratio was below noise. Headphone yield was 70mV (DL) across 8 ohms, corresponding to 0·6mW. A C90 fast-spooled in 120 seconds and the meter movements under-read 20ms bursts by about 3dB.

The oscillogram reveals quite fair (for a cassette deck!) squarewaves, the lower trace with Dolby and MPX filtering on. The meters, incidentally, were found to have a response rising with frequency.

After moderate recording levels (ensuring that the +4dB LED does not flash), the sonic results were better than might be expected from the lab findings; but harshness and stridence manifested by running at the higher recording levels that can be accommodated by other decks. Stereo imagery was not very stable and mid-range colouration was detected by some listeners.

PHILIPS N5581 £220

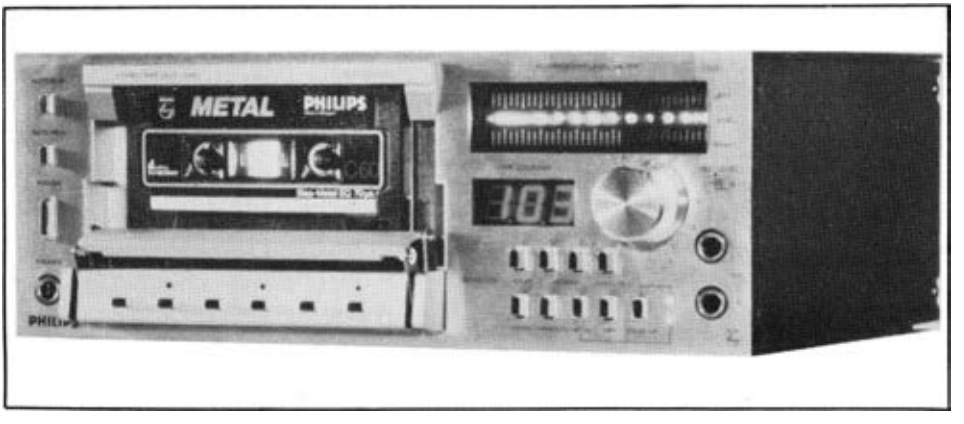
This is another miniaturised deck, the time from the Philips Black Tulip micro-system, which is available as a separate item and which could be integrated into virtually any hi-fi system, especially where space is at a premium. It is a two-head direct front-loader with logic tape transport control and digital electronic tape counting. The cassette is clipped into a fascia recess along the bottom of which is a protruding part which carries the soft-touch press-buttons and indicator lights for play, record and pause. A well-engineered hinge-over cover protects the vital parts when the deck is not being used. It swings out of sight underneath the press-button assembly when the deck is in operation but it is not very efficient in keeping out dust.

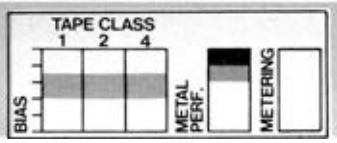
Competent engineering is in evidence, the machine being fully metal enclosed of essentially 'brushed aluminium' finish. Metering is by a peak-responding fluorescent display calibrated from −20 to +5 dB with +8dB when metal tape is selected. The fluorescent elements are very bright and clearly discernible, with a colour-change filter above 0dB. DL was found to correspond to 0dB, both channels closely matched.

A particular feature is the electronic tape counter with large, red-glowing digits, any two numbers on which can be entered into two separate memories. For example, if counter number 30 is entered in one of the memories the tape will stop at counter number 30 during fast rewind. It is also possible to link memorised counter numbers to autoplay and auto-rewind functions so that the tape will play from the first number to the second, then rewind back to the first number and play again, and so on. Other tricks are also possible such as autoplay and auto-rewind between the start of the cassette and counter number, between a counter number and end of the cassette and between the start and end of the cassette without memory assistance.

The memory functions are handled by small press-buttons as also are tape bias and eq selections, the latter two being selected simultaneously for tape classes I, II and IV. Dolby noise reduction with or without MPX filtering can also be selected by push-buttons, small lights showing the engagement of Dolby and metal tape. A friction-coupled dual-concentric knob is used for recording level control. Amplifier interfacing is by 'phono' sockets — no DIN socket option, which is a turn-up for Philips, though the deck is labelled as being made in Japan! Mic input is activated and the 'phono' input defeated by the insertion of a standard ¼in jack plug, each channel being independently operative in this respect. A standard jack socket is present for headphones, but there is no replay level control.

Dimensions approximate 260 × 100 × 210 mm (W × H × D), and the price was given as £220.

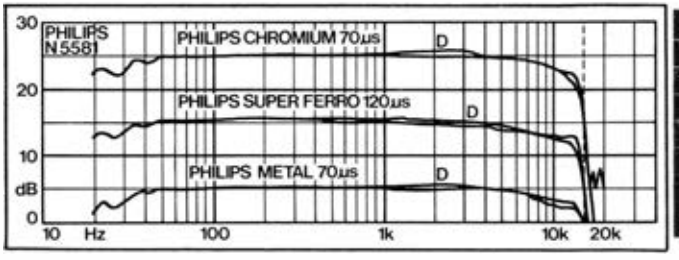


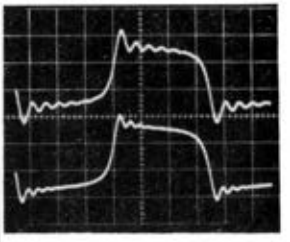


merit C value 3

The verdict

This is certainly another attractive mini-deck and one which is particularly well-engineered. I would have been happier with better upper-treble frequency responses, with a little more metal LF MOL and with less W&F and more speed accuracy. The auto-functions could prove useful. They are fairly versatile. Like most minis there is a price premium to pay. Over £200 for a two-head deck can seem a lot when compared with more conventional-sized decks of equal or, perhaps, slightly better performance. However, the auditioning and features have to be linked into the equation. I must admit to having a little difficulty in ranking this deck; but I feel it deserves a C for merit (I would have given it a 'B' had the frequency responses and W&F been better) and 3 for value.





The findings

Tape transport and the auto-functions performed without problems, but in order to zero the counter it was first necessary to place the deck in stop mode, which I found a trifle annoying for some applications. The cassette recess is brightly lit at the rear so the tape can be seen clearly through the cassette window. The deck was found to run a little warm, there being a small heat sink at the back.

It seemed only right with a Philips deck to use Philips tapes (not their latest ones) for the primary tests. The pen-chart shows that all three classes suffered from treble droop, though in all cases the Dolby integrity was good. 120µs replay eq was quite respectable mid-spectrum with a little boost at 125Hz. The upper-treble roll-off of the overall responses could be due to a little too much bias for the Philips tapes or HF eq maladjustment (or, perhaps, a bit of both).

LF performance with the Class I and IV tapes was also very reasonable, distortion being 0·7% and MOL 6·5dB with Class I and 0·8% and 5·5dB with Class IV (metal). Signal/noise ratios gave no cause for alarm but, although mains ripple components were not unduly high when measured in the lab, they could just about be heard under audition with the amplifier volume set high when the programme was at low level. However, the weighted ratio with Scotch Master II using 70µs eq and Dolby was up with the best at 65.5 dB. Distortion in monitor mode was satisfactory at + 10dB line output.

W&F was hovering around 0·12% (DIN) and the tape was running 1·1% fast. A C90 fast-spooled in 111 seconds. Headphone yield would be sufficient for low as well as medium and high impedance 'phones. Metering under-read 20ms bursts by about 1dB, so from the practical aspect it can be regarded as peak-responding. I thought the squarewave with Dolby plus MPX filtering (lower trace) was relatively good!

The test mic revealed adequate input sensitivity and a noise floor low enough not to detract from most domestic applications. I think that most people would be happy with the reproduction from this deck. Transient 'sparkle' was slightly less bright than some, and critical listening exposed mild colouration at low- and mid-range, but the bass itself was fairly firm and ambience accuracy fairly good. With the metering (used correctly) it was not easy to run into obtrusive tape compression. Metal was favoured over the oxide formulations for the best recording of the master-tape material.

PHILIPS N5748 £260

During the course of its existence the price of this well equipped Philips has been slashed quite dramatically. It is a three-head deck with logic control and of black fine-grain finish matching the other items of the Black Tulip series. It is substantially larger and more massive than most of the other decks and quite 'professional' looking. The cassette is loaded into a smoothly opening holder with a windowed front and scales showing the approximate playing time remaining on the tape. It is double-Dolby and provides source and off-tape monitoring selected by a lever switch. Similar switches all in a row along the bottom of the fasic operate both Dolby and DNL noise reduction, MPX/RF filtering, separate eq and bias for tape classes I, II and IV, and post-fade.

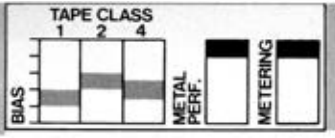
Recording level is adjusted by separate left and right channel sliders and the replay level can be normalised by screwdriver presets at the rear — one for each channel. A third slider sets the post-fade rate. The post-fade feature makes it possible to fade out the end of a recorded section cleanly after it has been made. The tape is wound to the approximate point were the fade is required and the recording then replayed and monitored. When the precise point is reached the post-fade switch is operated, and the recording then gradually fades out at the rate set by the slider. To avoid accidental erasure the switch needs to be unlocked by a sliding button before it can be operated.

Metering uses fast-responding movements calibrated from −30 to +3 dB and two peak-responding LEDs set at +4 and +7 dB. The scale backings are evenly illuminated and red illumination at the rear of the cassette holder helps you to see the running of the tape. While the tape is playing it is possible to spool in either direction by holding down the appropriate spooling button — normal replay resuming when the button is released. This is a sort of cue/review facility but minus sound monitoring.

There are standard ¼ in mic jack sockets at the front but no mic mixing. The mic circuit is engaged and the line input disconnected by insertion of the mic jack plug. Amplifier interfacing can be either 'phono' or DIN.

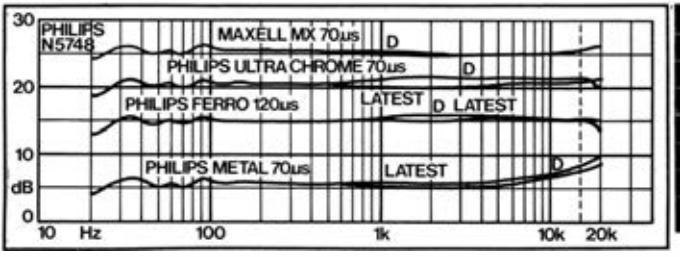
A big thing is made of headphone monitoring by way of a separate inbuilt amplifier, level and balance controls. The three-digit mechanical tape counter is related to a memory button, while another button provides auto-repeat. Each 'logic' button for the tape transport shows a small light when depressed.

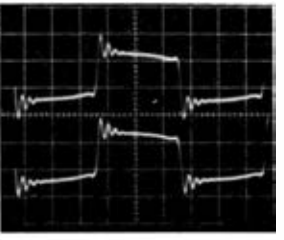
Dimensions approximate 428 × 150 × 300mm and the fascia is equipped with side slots for rack mounting. The deck is now selling for around £260, which is almost £200 below the original price.

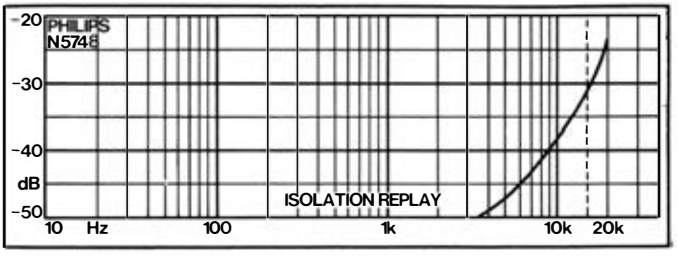


The verdict

We have seen that the machine is not totally blemish-free (what machine is?). I had to criticise replay and line overload margins and incorrect biasing for the latest high-energy Class I and IV tapes. Nevertheless, the machine carries some useful electronics for its reduced price and the auditioning was acceptable at the correct recording levels. Had there been better replay and line input headrooms and a higher Class I/IV bias, my award for merit would have been higher. As it is I still find the machine above average and give B for merit and 2 for value.







Graph to show how isolation between record and monitor channels decreases at HF.

This is the second sample of the N5748 which has passed through my lab, and checking with the results of the earlier one I was happy to note that a good few of the parameters were similar. I was unhappy, though, to find that the original replay clipping had not been improved; but as noted in an earlier review this must be considered in perspective. What it boils down to is that at about +8dB output the distortion in the replay channel is up to about 1%

Now, at +8dB output the tape distortion is grossly predominating, anyway, so a little second-harmonic of electronic distortion is not generally worrying — in fact it can be a blessing because it tends to disguise the third-harmonic from the tape! Obviously, running at abnormally high recording (and hence replay) levels, clipping distortion will be heard; but at normal recording levels my listeners were certainly not teeth-gritting.

LF performance via tape resulted in a very moderate Class IV distortion of 0·6% and MOL of 6·75dB with MX. Philips metal was similar. Class I tape gave 0·5% distortion and 6dB MOL (UDXLI). Philips latest Ultra Ferro was under biased in the deck, while the latest Ferro gave fairly high distortion and correspondingly low MOL. On the other hand, the latest Philips Ultra Chrome produced only 0·75% distortion and 6dB high MOL, which are certainly good for a Class II tape. Owing to the relatively high UDXLI, Ultra Chrome and metal MOLs, therefore, you can see that the off-tape yields were not being unduly inhibited by the moderate replay headroom.

The pen-chart shows that the very latest breed of Philips Metal was inadequately biased by the deck. The response was almost 5dB up at 20kHz! Maxell MX was better biased, as you will see. Ultra Chrome and Ferro were also well biased and, except for the Ultra Chrome, Dolby integrity was quite good across the board. The deck does not suit the latest Ultra Ferro of Philips nor the

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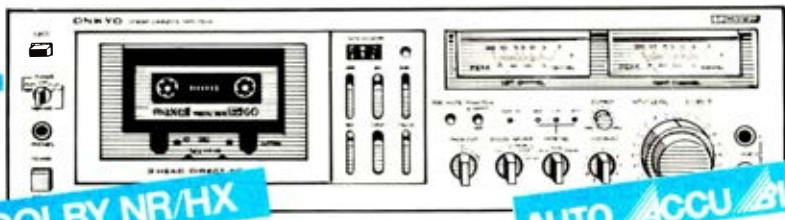

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The findings CONTINUED

UDXLI of Maxell since the upper-response with these tapes was rather like that of Philips Metal. Using these tapes (also Philips Metal) gave too shrill a treble. This is a pity, especially at Class I, because the Ultra Ferro is quite a good tape properly biased — under-biased, apart from the seriously rising upper-treble, the distortion is high and the MOL low. It would now pay Philips to rebias this deck to suit Ultra Ferro and Philips (latest) Metal.

Dealers selling the deck might be persuaded to undertake the rebiasing for you! Anyway, as the deck stands there are other suitable tapes you could use with it (see under Tape Biasing Requirements).

Signal/noise ratios were quite acceptable but Dolby failed to produce the theoretical improvement — not quite. With Master II (70μs) and Dolby the ratio was 65.5dB (with Dolby and DNL you can achieve 67dB). Hum content was low.

During the tests I came across another headroom which could be widened to advantage — line input. At 2·3V input the distortion was 1%. Mic headroom was okay, however, and the noise adequately low.

W&F was a mere 0·06% (replay only) and the tape running 0.5% slow. It took 115 seconds to fast-spool a C90. Metal erased to well below noise floor and the meters under-read 20ms bursts by 3 to 4 dB, so they are almost peak-responding , with rising HF sensitivity. The difference is made up by the two peak-responding LEDs. Replay eq was in balance (−1dB at 10kHz with my test tape). Headphone yield was so high that at full volume the amplifier could be run into clipping. I would hardly think you would run so high. Maximum output (at DL) was 3.8V across 600 ohms and 580mV across 8 ohms, corresponding to 24 and 42mW of power respectively.

The oscillogram shows fairly fast 'rings' but otherwise good wave shapes, indicating an extended HF response. If it had not been for the 'rings', in fact, the squarewaves would be about the best in the book: The lower one is with Dolby.

Very good auditioning obtained at the correct recording levels, but it must be admitted that harshness and stridence could be evoked by using too much level. I found it best not to flash above the +4dB LED. The best auditioning metal was Maxell MX and the best Class I oxide Philips Ferro despite the limited MOL. Good results were also obtained with Philips Ultra Chrome. A little unsteadiness of stereo scene was detected, but noise was low and ripple content inaudible.

PIONEER CT200 £90

This is a smart little slim-line deck of basic features and not very expensive to boot. It uses two heads and logic tape control by soft-touch buttons. Metering is by two illuminated blue-backed movements which, although calibrated in dB, are not very fast-responding, and there are no back-up peak-responding LEDs.

A three-position lever switch selects bias and eq simultaneously for tape classes I, II and IV (metal), while a similar two-position switch gives Dolby on and off.

The front-loading cassette holder springs open swiftly when the eject button is depressed, and through the windowed front can be seen the cassette, but there is no rear illumination to help you view the tape running through the cassette.

Amplifier interfacing is by two pairs of 'phono' plug-terminated leads coming out of the back (the usual sign of cost cutting), but there are three-standard ¼in jack sockets at the front for left and right mics and headphones. Input changeover from line to mic happens automatically when a mic jack plug is inserted.

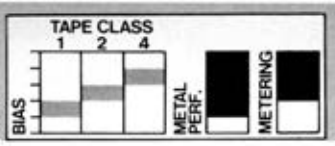
Tape counting is by the inevitable three-digit mechanical device with zero reset button, but there is no memory rewind facility. Recording level is set by a large dual-concentric, friction-coupled knob at the right of the fascia, but replay and headphone levels are fixed.

Fascia is brushed aluminium and the metering (with the tape counter) occupies an approximately centre position behind an oblong window with slightly protruding 'silver' surround. The deck is enclosed metal of black-crackle finish — the rear also of metal.

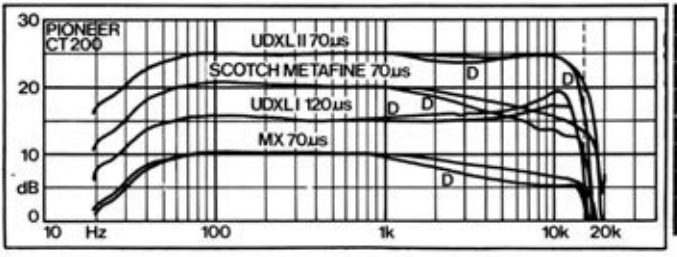
Dimensions approximate 420 × 99 × 333 mm (W × H × D) and weight 4·7kg. Selling price is expected to be around £90.

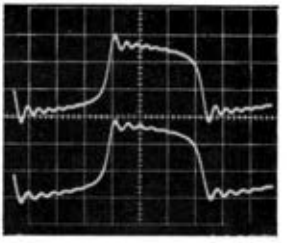
The verdict

Despite the relatively low price of this deck and going on the test sample I must admit to my disappointment over the results. I regret that I cannot award more than E for merit and, because of the relatively poor results, no more than 5 for value. One must have in mind the possibility of a sample aberration in this case, and it could be that a different sample would measure and audition better.



merit E value 5





The findings

I am sorry to report that the results failed to live up to the deck's appearance, especially with metal (Class IV) tape. It is possible, of course, that the test sample was somewhat out of adjustment internally or that it was bugged by a fault. Anyway, on metal the distortion was above 3% at DL and the MOL below 0dB. Replay headroom was acceptable, so it seemed that the trouble resided in the recording part.

Spectrographic distortion analysis revealed that the distortion was essentially 2nd-harmonic, and by using my flux-coupler I discovered that the distortion increased dramatically (at a given recording level) when the bias/eq switch was changed from Class I to Class IV. This suggested either that the bias/erase signal became badly distorted when it was stepped-up to Class IV or that the head was magnetically saturating on relatively low audio signal levels when it was also passing the metal bias current. It is not my brief, of course, to discover the precise whereabouts of faults for manufacturers, but the above should give them a good clue!

With Class I tape the distortion was a mere 0·5% and the MOL 5dB (with UDXLI), so no particular trouble with this sort of tape. Class II tape gave more distortion and a lower MOL than Class I, but this could well be a function of the tape itself.

The pen-chart shows a respectable UDXLII small-flux response but very poor metal responses with severe lack of Dolby integrity. UDXLI was better but with this tape the response tended to rise at HF and the Dolby non-integrity increase. I decided to try metal with both Maxell MX and the latest Scotch Metafine, but in both cases I had the impression that the tapes were being over-biased 110µs replay was a little out but not much.

I could find no problems with the signal/noise ratios which, although not to the pinnacle of some decks, was up to 65·5dB with Master II (70µs) and Dolby. Some ripple was present, but not subjectively irritating and owing to this the replay Dolby improvement (with CCIR/ARM weighting) was a little below 9dB.

W&F was hovering around 0·1% (replay) and the tape was running some 0·9% fast. Fast-spooling of a C90 took 131 seconds. The meters under-read 20ms bursts by 9dB and DL was scaled at +3dB. The meters have a range from −20 to +6 dB.

Headphone yield was very acceptable, there being 100mV across 8 ohms and 650mV across 600 ohms, both at Dolby level. The oscillogram shows minimal 'rings' on the squarewaves (lower with Dolby) owing, no doubt, to the restricted upper-treble frequency response and the apparently higher than required bias.

Under audition UDXLI gave the most balanced results. The low treble of metal could be heard. Stereo imagery was a little unsteady and bass a trifle boomy and distorted.

PIONEER CT 300 £110

This recent issue from the Pioneer stable is moderately-priced, sleek-looking and a fair performer as we shall see. It is a two-head front-loader and metal capable, of course. Metering is by a rectangular fluorescent display placed behind a window next to a large friction-coupled dual concentric knob which controls the recording level. Calibration is from −20 to +8 dB and the indications above 0dB are underlined so you can easily see when you are peaking to a high level. The display, including the calibrations, is bright-blue-glowing and, although failing to keep up with short-duration pulses, is faster than the average VU meter.

Tape transport is logic-controlled by light press-buttons and solenoid, and the windowed cassette holder opens silently and swiftly when the eject button is depressed. The rear is not illuminated so, as with other models like this, you need some front lighting to see what is happening to the tape. Dolby and tape selection use lever switches; the first a two-position which does not provide separate MPX filter switching and the second three-position for tape classes I, II and IV. This is another deck which is not equipped with a Class III tape position. Incidentally, bias and eq are set simultaneously.

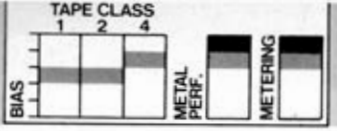
Standard ¼in front jacks accept left and right channel mics and headphones. Insertion of a mic jack engages the mic input and disconnects the corresponding channel line input, it thus being possible to record from line on one channel and from mic on the other. Replay output is at a fixed level and interfacing is by way of two pairs of phonoplug-terminated leads emerging from the rear, which undoubtedly help to keep down the cost of the machine. There is no DIN interfacing.

The three-digit tape counter is mounted behind the metering display window. No memory rewind switch or button is present. About the only extra is a 'standby' switch allowing externally timer-operated record or replay.

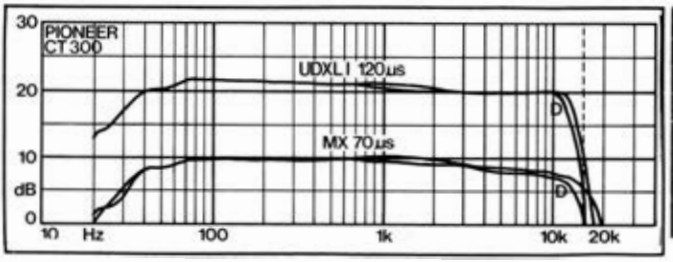
Fascia is 'brushed aluminium' and enclosure of black-crackle-finished metal. The deck is unobtrusive and smart-looking. Dimensions approximate 420 × 99 × 333 mm (W × H × D) and weight 4·7kg. Selling price is around £110.

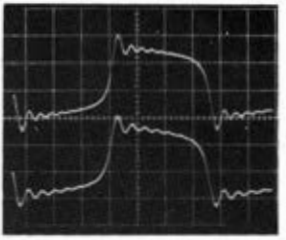
The verdict

The deck was mainly criticised for its metal frequency response (but some tapes were able to do better than the MX plotted) and slightly slow metering. Had these been slightly better and the W&F a trifle lower the deck would have received A/1 acclaim. Even so I still think it justifies a high mark, so my award is B for merit and 1 for value. It is a competitively-priced deck that would satisfy a wide range of users.



merit **B** value **1**





The findings

Tapes of my (0) bias reference were found essentially suitable for the machine, though the sample indicated that metal tapes veering more towards (+1) would help to combat the drooping upper treble revealed in the pen-chart. The other channel was less droopy, though. Dolby integrity was good with both tapes plotted, and similar results were experienced with UDXLII, the HF going slightly higher than UDXLI without the droop of MX. 120µs replay eq mid-spectrum was acceptable, there being just a little lift at 6·3kHz, and pre-recorded commercial cassettes came out quite well under audition.

LF performance with both Class I and Class IV tapes was very acceptable for the price of the deck. UDXLI returned 0·4% distortion and 6·5dB MOL and MX 0·6% distortion and 6dB MOL (in fact, with the latest Memorex metal tape I obtained 0·4% distortion and 7dB MOL). As is usual the LF performance of Class II tapes was less good, but these have the advantage of the 70µs noise improvement and slightly better upper-treble. Distortion on the source signal in monitor mode (while recording) was negligible at 0dB and around 0·1% at + 10dB.

I found no problems with the signal/noise ratios, replay being 59dB with the expected 70µs and Dolby reductions and overall with Master II (70µs) and Dolby active no worse than 66dB. Background hum was not obtrusive, either. W&F was hovering around 0·1% (replay only using test tape) and speed error −0·8%. Metal erased to below subjective noise floor. Line output interfaced with no trouble to the test amplifier but headphone yield was a bit down across 8 ohms. Test mics also worked OK.

Metering DL was scaled at +3dB, one channel being a shade more sensitive than the other. However, the display was not as fast as some, the 20ms bursts under-reading by 5dB.

It took 131 seconds to rewind a C90. Squarewave performance was less riddled with high amplitude 'rings' than some decks you will see (lower trace Dolby on).

Under audition the results sometimes belied the low cost of the deck. Using high quality direct-reel master tape sources some upper-frequency stridence was discerned, but in general the response was judged to be quite smooth with a little mid-range colouration and low bass below the quality of the source. The deck gave best overall results with metal, but the lower noise floor of certain Class II formulations was appreciated. Very slight W&F could sometimes be heard on piano music and the stereo imagery was below the established master-tape reference standard.

PIONEER CT-F850 £230

This substantial and relatively large deck incorporates a 'closed loop' dual-capstan, servo controlled tape transport system and a separate spooling motor. It is a three-head deck providing off-tape monitoring and the cassette is loaded directly into a fascia recess. When the machine is not in use a hinge-over cover protects the vital parts and minimises the ingress of dust.

Metering is by a digital fluorescent bar graph display which can be switched to VU or peak response. Level indications and calibration from −20 to +8 dB show up in bright blue light, with double indicating lines above 0dB. A rotary switch has positions for the four classes of cassette tape, bias and eq being set simultaneously, and the bias can be adjusted over a fair ± range relative to a centre control indentation. There is no provision for 'optimising' the bias except by listening to the change in replay quality while you are monitoring off-tape while recording (which can be quite effective).

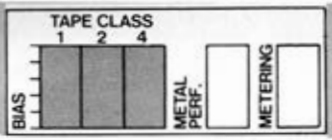
Recording level is set by a large friction-coupled dual-concentric knob, while a smaller two-section knob allows you to set and balance the replay level. This latter knob also adjusts the metering indication during replay, but confusion is avoided by an indentation, at which setting the metering reads 0dB at a tape flux level of 160nWb/m (about 2dB below DL). The metering thus reads +2dB with a DL test tape or +4dB with a DIN level tape.

All tape transport modes with the exception of 'stop' are indicated by small lights, and light indicators also show when metal tape and Dolby have been engaged. The rear of the cassette recess is diffusely illuminated which makes it possible to see the spooling disposition of the tape in the cassette.

Change between source and off-tape monitoring during recording is by a press-switch, while a similar switch zeroes the mechanical tape counter. There is no memory rewind button. Neither is there a separate switch for timer-controlled recording/replay, but the deck is so engineered that it goes straight into recording or replay mode, when suitably programmed by the transport buttons, when the mains is switched on, so timer-controlled operations are possible. This is because the transport buttons are the 'latching on' variety.

Amplifier interfacing is by 'phono' sockets (no DIN to be seen!) and the change from line to mic input is accomplished by insertion of the appropriate mic jack. There are no mic mixing facilities in the normal stereo sense.

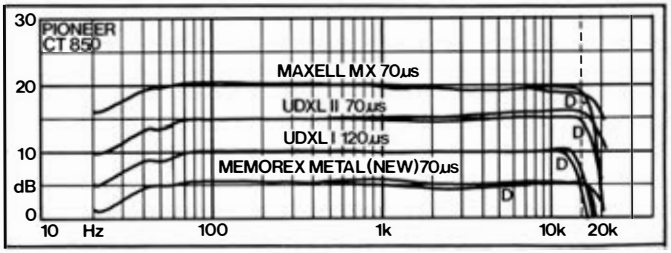
The deck is relatively large and 'solid' looking, having the approximate dimensions of 420 × 150 × 361 mm (W × H × D) and weight 9·5kg. The deck is said to sell for around £230.

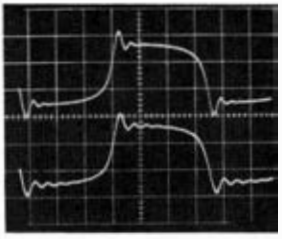


merit A value 1

The verdict

Despite the minor niggles and criticisms this deck was liked for both its lab and auditioning performance. I had to criticise head azimuth setting, record/replay isolation at 16kHz and speed error, two of which, at least, are not design aberrations. Change in metering indication with replay level setting is also of dubious merit in my mind. However, the plus points adequately outweighed the niggles, so I feel happy to award A for merit and 1 for value.





The findings

It was found that with the fine bias control at range centre the bias yield was then close to my (0) reference. Swings of almost (−2) and (+2) were possible by the control. The pen chart carries more tape responses than some of the other reviews for several reasons. At the time of testing I was in possession of the new Memorex metal tape and wished to see how this compared with Maxell MX in the deck; I also wanted to see how the biasing performed with other tapes.

You will see that with all classes Dolby integrity was very acceptable. Low bass was about 3dB down at 25Hz while upper-treble depends on tape formulation. Metal, of course, scored maximum for treble and Memorex had about 1dB advantage over MX at 20kHz but the coating of Memorex was a little more 'fluffy' at HF than MX.

LF performance was very good with UDXLI and metal, the results being a mere 0·25% distortion and 7·5dB MOL for UDXLI, 0·6% distortion and 7·5dB MOL for MX and 0·45% distortion and (hold it!) 9dB MOL for Memorex metal. As is usual, Class II tapes did less well at LF, UDXLII, for example, giving 1% distortion and 4·5dB MOL. Distortion on the source monitoring signal at +10dB output was less than 0·03% and 0·3% *via* head flux coupler (eg, the latter taking head amplifier distortion into account) under the switched conditions of metal and Dolby.

Electronic replay noise was well below tape noise and with Master II (70µs) plus Dolby I measured 66·5dB (including bias noise). Mic headroom was higher than some decks at 49dB and noise was not obtrusive. W&F was well down (replay only) at 0·06% with +0·7% speed error (could be improved). Head azimuth error was noted by the test tape output being some 5dB down at 10kHz (120µs). Erase ratio was well below noise floor. Peak metering was fast with 1dB under-reading on 20ms bursts (10dB under-reading in VU mode). Headphone output was high at 8 ohms but, despite what the instructions say, medium/high impedance 'phones also interfaced with adequate volume. It took 116 seconds for a C90 to fast rewind.

I was impressed by the squarewave performance, especially without Dolby (upper trace), which is one of the best results achieved.

The deck auditioned particularly well. On the critical side the bass was a trifle 'fluffy' and a small degree of mid-frequency colouration was discerned; but I feel that many users would have difficulty in conclusively detecting differences between source and tape. Differences were heard using high quality direct-reel master tapes, but it was thought (when A/B-ing in real-time off-tape by using the source/tape button) that some of these could have been stemming from breakthrough from the recording to the replay channel since the measured isolation at the worst frequency of 16kHz by down to 20dB — at 10kHz it was 32dB and at 20kHz 24dB.

PYE SR3200 £87

This relatively inexpensive front-loader is from the Pye Hi-Fi Sound Project series. It is metal capable but employs mechanical press-keys for tape transport control rather than soft-touch buttons and logic control. The keys are not hard to push down, however, and they have quite a smooth feel about them.

The cassette holder has a see-through window at the front but no rear illumination, though a bright yellow patch at the back helps towards viewing the tape through the cassette windows. The holder opens fairly smoothly and quietly when the eject key is depressed.

Two separate control knobs are fitted for left and right recording level. Replay output level is fixed at a suitable amplifier interfacing value. A press-switch changes between line and microphone circuits. Left and right microphones are catered for by standard front jack sockets, while the line circuits have rear phono plug interfacing with DIN socket option. A standard jack socket at the front accommodates a headphone set but there is no way of adjusting the headphone monitoring level apart from adjusting the recording level.?

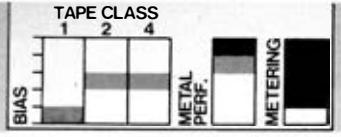
A three-position lever switch selects the bias and eq simultaneously for Class I, II and IV tapes, there being no position for Class III ***FeCr*** tapes. A matching two-position switch relates to Dolby on/off. A two-position slider switch at the back of the deck can be set to reduce radio interference. Little information is contained in the instructions about this switch, however, it merely being said that, in the event of LW and MW interference (eg. whistling on a recording made from these AM transmissions), suppression can be achieved by setting the switch to another position. This is not the usual type of MPX filter, then, which appears to be permanently active in the deck, but a filter for the suppression of bias beat tones when recording from LW or MW radio programmes.

Metering is by two well illuminated but rather small movements calibrated from −20 to +5 (dB or VU − take your pick!). Actually, as the meters are not peak-responding and Dolby level refers to about +3, the meters can be assumed to be VU-reading. There is a three-digit mechanical tape counter but no memory rewind button.

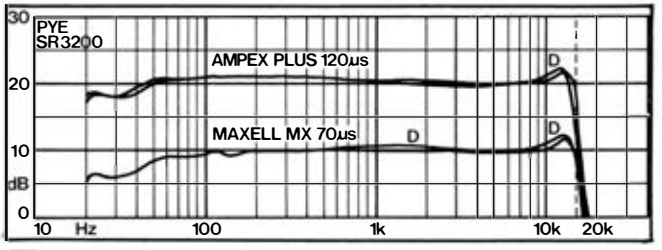
The deck has a smooth 'brushed aluminium' fascia and a metal enclosure of 'silver' finish. The rear is black plastic and the base hardboard. Dimensions approximate 420 × 125 × 220mm (W × H × D) and the price is around £87.

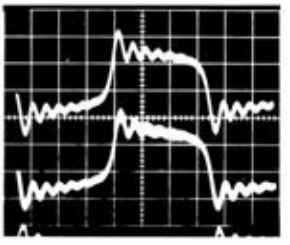
The verdict

The deck put up quite a creditable performances for its price. It was quite happy with metal tapes but fell down on metering, wow and flutter and speed accuracy. You will need to use the 'low bias' type of ***Fe*** tapes to avoid excessive 'brightness'. Taking account of the various technical results and auditioning, I would place it at C for merit and 2 for value.



merit C value 2





The findings

The first thing which became apparent was that the Class I bias delivery of the deck was below the bias demands of the latest high-energy ***Fe*** formulations. For example, using Maxell UDXLI and similar ***Fe*** tapes the small-flux frequency response would show a seriously rising upper treble. Experimenting with a number of tapes, using the excellent Wayne Kerr frequency response analyser, it was found that the deck gave the best frequency response with ***Fe*** tapes of my (−2) bias coding. A useful (−2) tape was the Ampex 'Plus', and this was used for all the ***Fe*** measurements, including the frequency response.

You will see from the upper curve on the penchart that even this low-bias formulation was responsible for a little peak around the 12kHz mark — though probably the deck was more to blame than the tape since the peak is also present on the frequency response of the metal tape, and was found to happen too with properly biased Class II tapes. Bias delivery of the deck in Class II and IV tape modes was close to my (0) reference in both cases. On the test tapes used you will see that Dolby integrity was good at −20dB recorded level.

Dolby level was shown on the meters as +3 left channel and +2·5 right channel (a slight imbalance), and the meters under-read my 20ms 1kHz bursts by as much as 12VU. Hum and noise was adequately low, the background being established essentially by intrinsic tape noise. With the Scotch Master II at 70µs and Dolby on. I obtained a signal/noise ratio of 64.5dB which is not much more than 1dB worse than some of the very low noise decks.

I was rather surprised by the low distortion and fairly high MOL provided by Ampex Plus in the deck. The distortion in fact, at 0.65% (Dolby on) was no higher than obtained with the metal MX. The MX tape, though, gave a 400Hz MOL as high as 7dB against the Ampex 5dB. Mid-spectrum reply eq was a little undulating at +1dB at 125Hz and +0.5dB at 6.3kHz. Wow and flutter was not too good at around 0.13% average DIN and the tape was running much too fast at +1.5%.

Headphone delivery was quite good even at 8 ohms, but higher impedance 'phones will sound louder. C90 fast spooling time was 104 seconds, which is not too protracted.

The squarewaves carry a fair amount of 'rings' with the usual initial overshoot, and as you will see there was barely any difference between Dolby on and off. The radio interference filter positions at the back made no difference at all.

I had no problems with interfacing my test microphones — hum and noise still being low. Quite good recordings were made with Maxell MX, but recording level had to be kept fairly low on the meters for the best results. A small amount of mid-spectrum colouration was detected, giving a kind of 'horn-like' effect on certain music, but this was not bad. Treble was very well portrayed and bass, too, was reasonably firm. There seemed to be no undue problems with tape stability, but there was some drift of stereo image. Comparing the hum/noise output with an unloaded C-zero against the Master II confirmed the lab findings that the noise is essentially that from the tape itself.

REALISTIC SCT24 £90

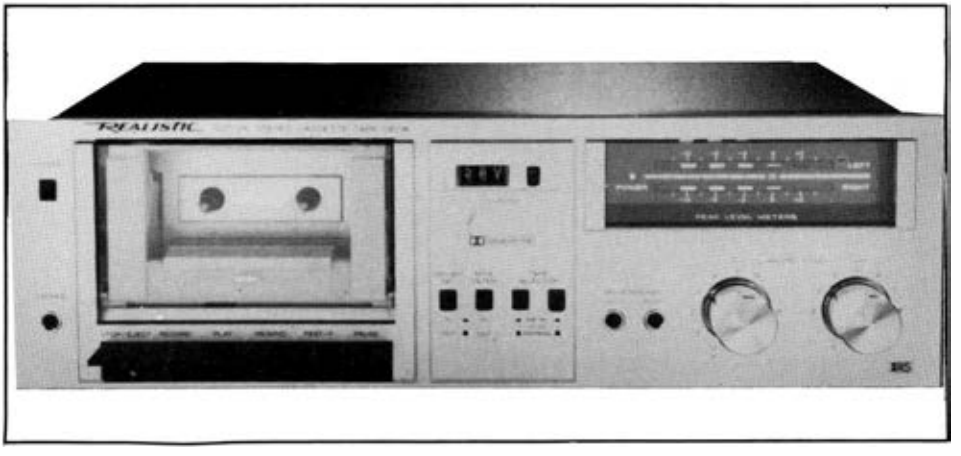
This two-head front-loader with mechanical-key-operated tape transport is sold by the wide-ranging Tandy network. Fascia is 'silvered' plastics material and enclosure and rear metal, the former of a crackled finish matching the fascia. The full-view cassette holder opens smoothly when the eject key is depressed but instead of rear illumination it uses a small mirrored surface. Metering is based on two rows each of five LEDs calibrated in steps from −13 to +3 dB, those at 0dB and above glowing red. Dolby level is set to 0dB.

Bias and eq for tape Classes I, II and IV are set simultaneously by a two-press switch combination. Similar press-switches are used for Dolby and MPX filtering. Two largish knobs control the recording level of the left and right channels separately, while at the rear is a small knob for adjusting the level of the replay signal. This, though, does not control the level of the headphone signal, which is fixed at a useful value.

One possible disadvantage is that a rear DIN socket only is present for amplifier interfacing. You could, of course, use a 'phono' adaptor but the DIN input sensitivity is very high so you would get input over-loading by feeding from an amplifier 'phono' interface unless an attenuator was also used. Input sensitivity at DIN is the same as at mic, around 200μV. In accordance with the DIN requirements there is no source monitoring signal from this socket when recording. Source monitoring, however, is available at the headphone jack socket, a facility which was exploited for some of the tests. Separate standard jack sockets are also present for left and right mics, with internal switching.

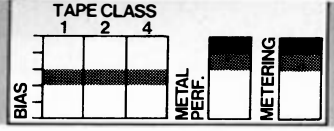
The deck does not boast a wide range of features but, in addition to those described, there is the usual three-digit mechanical tape counter without memory rewind. A small indicator light on the dark backing to the metering display shows when the deck is switched on.

Dimensions approximate 125 × 390 × 226 mm (H × W × D) and weigh a mere 3.5kg. Price was given by my local Tandy store as £89.95.

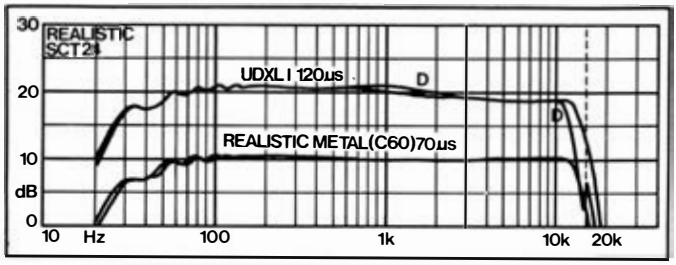


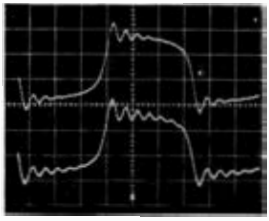
The verdict

It seems a pity that the deck was not equipped with 'phono' sockets. Metering range could also be increased to advantage and W&F was around the threshold of audibility. However, we have to take account of the price which, at less than £100, is in my opinion quite fair for what is offered. My award is thus B for merit and 2 for value.



merit B value 2





The findings

The deck was found attractive and easy to use, excepting the DIN-only interface which might cause a problem to some users. Although the metering was found to be true peak-responsive (no under-reading on 20ms bursts), its 'value' was somewhat reduced by the limited range.

As the deck came with a Realistic metal tape it was decided to use this for the metal tests despite the fact that it was a C60 and not C90. Tests were also made with Maxell MX to secure relative judgement. UDXLI and UDXLII were used for the Class I and II tests. The pen-chart shows a remarkably 'flat' metal response. UDXLI penned a less desirable response, but still not bad. UDXLII showed about 1dB lift between 4 and 5kHz which was aggravated with Dolby. Upper frequency response with all formulations was a little curtailed with respect to more expensive machines.

LF performance with UDXLI was outstanding with no more than 0·4% DL distortion and an MOL as high as 7·5dB. Metal failed to reach these heights, distortion being 1·2% and MOL 6dB — still pretty good, though, taking account also of the good frequency response. Distortion on the source signal monitored from the headphone socket was low at + 10dB output.

I could find nothing unduly wrong with the replay signal/noise ratios and the expected improvements were obtained with 70µs eq and Dolby. Overall ratio with the Scotch Master II and Dolby was 65dB, this being limited a little by the DIN input noise (level control half advanced) DIN and mic headroom was approachong 40dB. Replay eq at 120µs was not bad, the response being less than 1dB down at 6·3kHz with the test tape. Headphone delivery across 8 ohms was a little higher than from some decks, but a significantly higher output was available across higher impedances. Metal erased to below noise floor at 1kHz, and it took 142 seconds to rewind a C90.

W&F was on the high side at 0·15% and speed error was — 0·5%.

The squarewaves reveal significant 'ringing', the lower trace with Dolby and MPX filter active.

Under audition I must admit to being quite impressed by the results for a deck in this price range. There was some colouration, especially at low bass with recorded organ music; treble, too, was a trifle 'bright' and the W&F was close to the threshold of audibility, noticed on piano music. Stereo imagery was fairly stable although limited in forward projection, as with low-level ambience, but the net results were perfectly palatable. Metal tape revealed upper-treble improvement from high quality master-tape recordings, but barely any improvement at all over that obtained from top-grade 120µs oxide when the source was gramophone record or FM radio.

REALISTIC SCT 31 £269

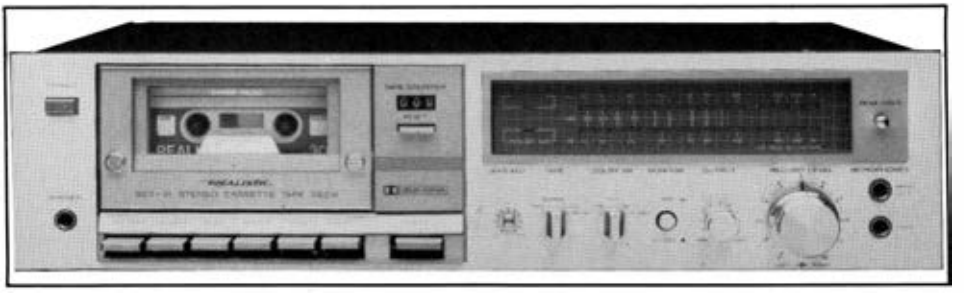
This is Tandy's three-head deck which is a front-loader, metal-ready (of course!) and equipped with an auto-peak-hold LED metering system. A front press-button allows you to change between the source and off-tape monitoring signal. The 'brushed aluminium' fascia is conveniently laid out with the metering 'bars' below a window at the top right-hand quadrant and the see-through cassette holder at the left-hand side, below which are the mechanical press keys for tape transport operation.

The metering panel is dark colour, marked in white lines forming squares. The LEDs themselves are fairly bright but the dB and percentage calibration numbers, not being illuminated, are not easy to read in low ambient light. For each channel there are 16 LEDs calibrated from −30 to + 10 dB, those above OdB red-glowing. The peaks hold for a few seconds before extinguishing, but by the press of a button it is possible to retain a peak reading.

A friction-coupled dual concentric knob adjusts recording level, and an adjustable surround makes it possible easily to establish any required setting of the control against an indentation. A smaller knob adjusts the replay signal level and the headphone volume. A four-position rotary switch selects bias and eq together for the four classes of cassette tape, while an adjacent mini-control provides a fair range of bias adjustment. A similar switch selects Dolby with or without MPX filtering. The fourth position is of no value to the UK user since it relates to the decoding of Dolby-encoded FM broadcasts as transmitted in the States. Setting presets for this reside at the back along with 'phono' and DIN amplifier interfaces. A switch makes it possible to set the DIN output to high or low level.

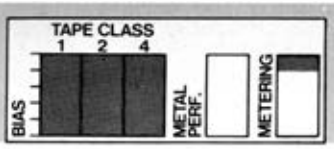
Standard ¼in jack sockets are present for left and right mics and headphones. Using the left mic socket the signal is applied simultaneously to the left and right channels.

The deck is enclosed in black crackle-finished metal and is quite a smart outfit as you might have observed in a Tandy shop window. Dimensions approximate 110 × 435 × 256 mm (H × W × D) and weight 4.6kg. My local Tandy store told me that the deck is selling at £269.95 but is sometimes offered at a substantial discount (as other items in the shop related to certain months). Prior to my enquiry about the price it was selling for £169.95.

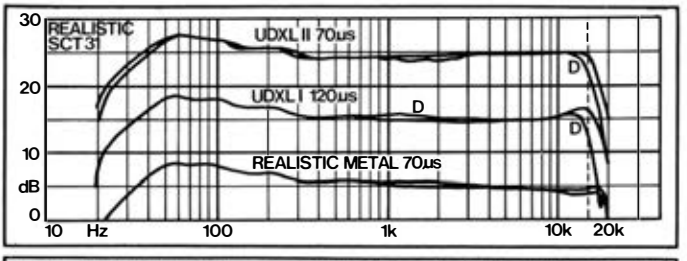


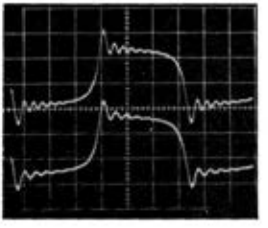
The verdict

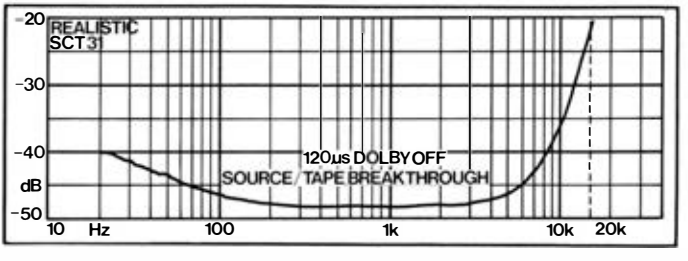
At the full selling price one might, perhaps, expect logic control and possibly one or two extra features such as memory rewind switching for record and replay by an external timer and maybe some method of optimising the biasing (like the Onkyo TA2060, for example, which is less costly). However, the deck put up a fair performance both in the lab and under audition and its LF performance was very good. Taking all things into account, therefore, my award is B for merit and 3 for value. Obviously, the value ranking would be much improved with £100 off the price, so if you are interested in the deck find out when your Tandy store has its 'bargain weeks' on decks!



merit **B** value **3**







The findings

As with the two-head machine, I checked the metal performance with Tandy's own Realistic metal tape. Maxell UDXLI and UDXLII were used for Class I and II tests. All tests were made with the fine bias control adjusted for the best overall frequency response at −20dB recorded level. With three-head decks there is always the temptation to plot frequency responses and make certain other measurements in the off-tape monitoring mode (that is, making the measurements from the replay head while the tape is being recorded). This can save time and reduce the complications, but it can also introduce errors if the coupling between the record/replay head sections is abnormally high.

I am sorry to say that this coupling was rather high, increasing swiftly and dramatically with increasing frequency as shown by the separate pen-chart.

The pen-chart of the responses shows that all tapes penned a 'boosted' LF response (which has nothing to do with bias setting). However, from about 300Hz upwards the responses flattened nicely, with metal going on almost to 20kHz (the specification says 30Hz-21kHz with metal ±3dB). Plotting in the off-tape monitor mode gave the impression of better extreme treble, accompanied by a 'peak' owing to the addition of the 'breakthrough' signal. The responses for UDXLI and UDXLII were also satisfactory (except the LF end) and Dolby integrity good with all the tapes.

LF performance of the deck with all tapes was astonishing! With the metal I measured around 0·35% distortion (Dolby on) and an MOL as high as 9·5dB, which is incredible. UDXLI was not far behind with 0·4% distrotion and 7·5dB MOL. Distortion on the source monitoring signal at +10dB output was not limiting the MOLs. The former are some of the best metal tape results I have ever achieved.

Signal/noise ratios were acceptable, replay being 57dB and with Master II overall with Dolby 65dB — not quite as high as some decks. W&F was low at 0.08% (+0.6% speed error) and metal-erased 1kHz tone was below noise floor. Replay eq at 120µs seemed a little in error, including a little bass lift.

The metering under-read 20ms bursts by about 2dB and the DL reference level occurred at −1dB.

The squarewaves reveal significant 'ringing' and a rather large overshoot without Dolby.

Under audition the deck would accommodate relatively large recording levels without noticeable compression. Stereo imagery was a little unsteady, possibly due to a little tape flutter. Subjective background noise was low with no apparent mains ripple. Complex classical music was pleasantly handled with fair rendering of low-level ambience. Some colouration was detected on massed strings.

ROTEL RD1010 £189

Finished in dark chocolate brown colour and metal encased, this three-head deck with off-tape monitoring is equipped with logic-controlled tape transport worked by soft-touch buttons, facilitating transport mode changes without passing through stop. Signal interfaces are phono sockets — no DIN.

Bias and eq are simultaneously switchable for Fe, Cr, FeCr and metal tapes, enhanced by a user-adjustable fine bias control. Noise reduction is Dolby and you have the choice of working with or without MPX 19kHz filtering. You can defeat record while the tape is rolling by the press of a button, and adjust replay level by a front control.

Recording level is adjustable by a two-section friction-coupled knob for the left and right channels but, although standard jacks are fitted for left and right mics, it is not possible to mic-mix in stereo (but see under Cassette Deck Features). The line input is disconnected and the mic imput activated when a mic jack is plugged in.

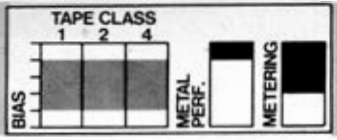
Headphone signal from a front jack is also adjustable by the replay level control. Cassette holder is see-through without rear illumination, and metering is by two lines each of 16 LEDs calibrated from −20 to +9 dB, with 0dB approximating Dolby level (200nWb/m magnetic flux).

A three-digit mechanical counter can be linked to memory rewind (you set counter to zero and on rewind tape stops at that point), and there are switches for auto-rewind, repeat-play and timed operations, the latter requiring an external timer. LED function indicators are present.

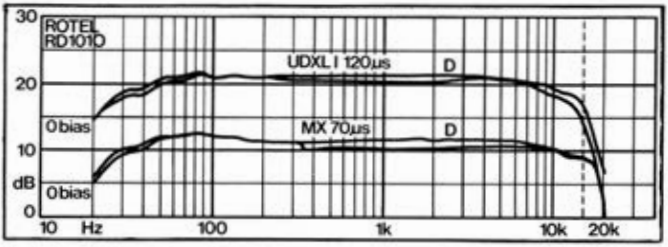
Dimensions approximate 430 × 115 × 294 mm (W × H × D) and weight 6.2kg. Price is around £189.

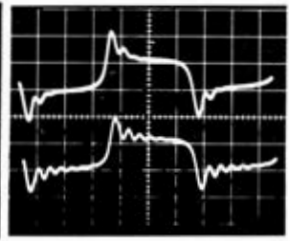
The verdict

A good effort towards design excellence, the one or two shortfalls might be later attended to as the deck reviewed was the first available. At correct recording levels subjective impressions were good. For a three-head, logic deck the price is competitive, and certainly a machine worthy of further thought. My verdict is B for merit and 2 for value.



merit **B** value **2**





The findings

Bias setting was close to my (0) reference but the fine bias control makes possible the use of tapes with bias demands from (−) to (+). Applicable to all tape types. The instructions carry a table of suggested settings for the various classes of tapes.

Metering calibration was accurate on one channel but down a dB on the other, and although it uses peak LEDs was not as fast responsive as I would have liked. There appeared to be some electronic delay giving a shortfall of almost 8dB on 20ms bursts. When recording material rich in 'peaky' transients try to avoid readings much above 0dB for the best results.

Replay noise was up a bit, but neither this nor hum was unduly apparent subjectively. Full noise reductions at 70µs eq and Dolby were not quite realised. With good Fe and metal tapes distortion was well down and MOLs correspondingly high — very good results, in fact. The overall frequency responses expose some treble droop, which could be a function of eq maladjustment (being looked at by the manufacturer). Replay only response was similar at treble; but mid-spectrum eq good. Dolby integrity at −20dB recorded level was not much in error on the test tapes.

The squarewaves show significant initial overshoot and the usual 'rings' with MPX filtering on. W&F performance quite fair and speed error 0·8% fast. Headphone output suitable for medium/high impedance 'phones, but low at 8 ohms. C90 fast spooling was about 113s.

SANSUI D300M £139

The sample sent for review was of all black finish, and very pleasant-looking it was, too. It is an attractively-priced deck sporting all the basic features plus what Sansui call AMPS, which stands for 'Audiomatic Music Programme Search'. It works in the usual manner where deliberate pauses between the recorded programme sections are detected during rewind. There are two positions on the corresponding switch, one which causes the deck to go into play mode when a pause is detected, and the other which puts the deck into standby instead. Unlike some of the more advanced 'searching' systems it is not possible to programme to which pause number along a length of tape it is required to replay back from. For the system to work the pause needs to last for at least 3 seconds.

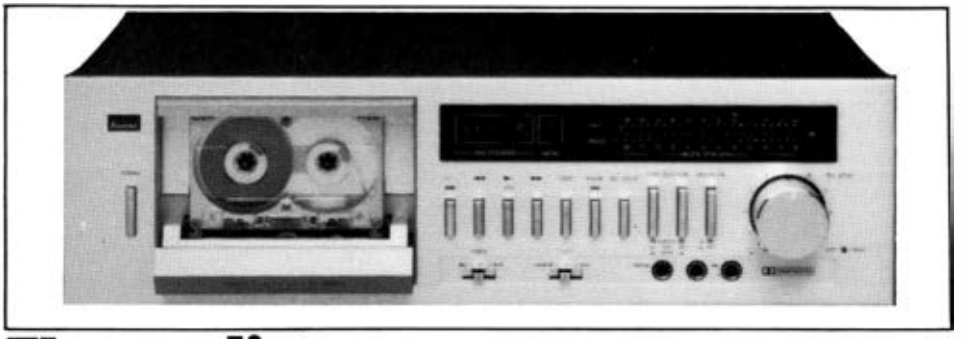
To facilitate introducing your own pauses along a tape, the deck includes a record mute button which activates an indicator light when depressed while also causing the red record indicator light to flash on and off at 1 second intervals.

Tape transport is controlled by elongated buttons and logic. Tape selection is by two matching buttons which need to be operated together to provide the bias and eq requirements for tape classes I, II and IV. Metering is by a 'digital' peak level display carrying two rows of brightly illuminated dots which show against a well illuminated graticule scale from −20 to +8dB. An indicator light shows when the deck is set for metal tape.

The cassette is directly loaded into a recess on the fascia and a hingeover cover at the bottom helps the keep the dust away from the vital parts. There is the usual three-digit mechanical tape counter with zero reset button. Dolby noise reduction is fitted but no separate switch for MPX filtering. A front switch allows the machine to be activated by an external timer for recording or replay.

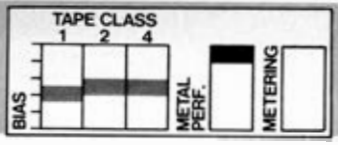
Recording level is adjusted by a friction-coupled dual-concentric knob. Rear 'phono' sockets are fitted for amplifier interfacing (no DIN interface) and the recording one is disconnected in favour of the mic when the mic jack is inserted into the appropriate front ¼-in. jack socket. There is also a standard headphone jack socket. Wire-connected remote control is catered for by a rear multi-pin socket. The deck runs from an electronically controlled DC motor.

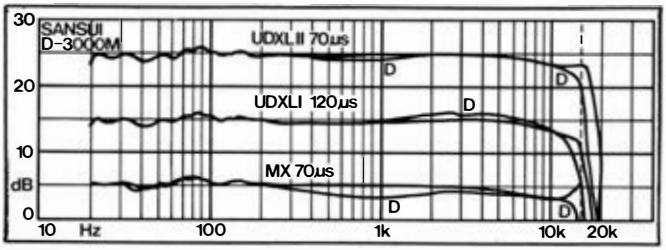
Dimensions approximate 430 × 132 × 238 mm (W × H × D) and weight 5.1kg. Selling price is around £139.

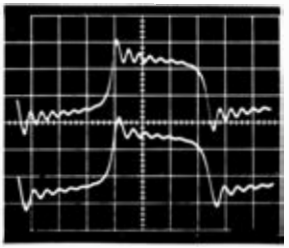


The verdict

At the price level this deck was liked. There are one or two shortfalls as you have seen, but taking everything into account, including auditioning, I was quite happy to award it A for merit and 2 for value. It is a deck that should not disappoint the keen listener with a limited budget.







The findings

I found the metering accurate and easy to use, aided by a little delay applied to the glowing dots. There was no under-reading at all on 20ms bursts. Quite acceptable overall frequency responses were obtained from the tapes used for testing. You will see from the pen-chart that there was some Dolby level error, but not too much. UDXLI tended to roll-off a trifle early while MX metal exhibited a small peak around 10kHz without Dolby. Of course, you will get different results with different tapes and I only wish we had the space, time and money to show the responses of all of them. Anyway, for this deck I decided to include an overall plot of UDXLII in addition to the plots normally shown. You will see that this goes a shade higher in frequency than UDXLI and suffers slightly less upper-treble droop. Small low-frequency undulations will be seen, but I was impressed by the extended low-frequency of the deck.

Mid-spectrum replay eq at 120μs was sanitary, it being 'flat' at 6·3kHz and 0·5dB down at 125Hz, the latter probably just catching one of the low-frequency depressions.

Signal/noise ratios failed to reach the high of some other models in this book, but the noise spectrum was not subjectively irritating. I measured a ratio close to 63dB with Scotch Master II at 70μs and with Dolby, which is not bad but 4.5dB worse than the lowest noise models. Some ripple content was detected in the lab and could just about be heard under audition at high replay level. Low-frequency performance was quite acceptable with both UDXLI and MX, the former giving 0·6% distortion and 5dB MOL and the latter 0·85% distortion and also 5dB MOL. Replay in monitor mode gave fairly low distortion at +10dB, which is higher than some but not too bad at this output.

W&F averaged around 0·1% and speed error 0·3% slow. Headphone yield was adequate for medium/high impedance 'phones but barely enough for low impedance ones. Mic interfacing was satisfactory with good sensitivity and low noise — also quite good quality. A C90 rewound in 115 seconds. The squarewaves show quite protracted 'rings', better tamed with Dolby (lower trace). Quality was smooth and 'open' with just a vague trace of compression. Recording music rich in HF metal was judged to be better than oxide, but we were surprised at the good results obtained with UDXLI from normal recording sources. W&F was not subjectively detectable.

SANSUI D-350M £189

This cassette deck is styled similarly to the less expensive D-300M but it carries more features, though is devoid of the 'music search' system. Instead it has a memory rewind function which works in conjunction with the three-digit mechanical tape counter, an 'auto' switch which provides repeat plays and auto-rewind followed by play when the tape comes to an end, and auto-peak-hold on the dual-bar metering display.

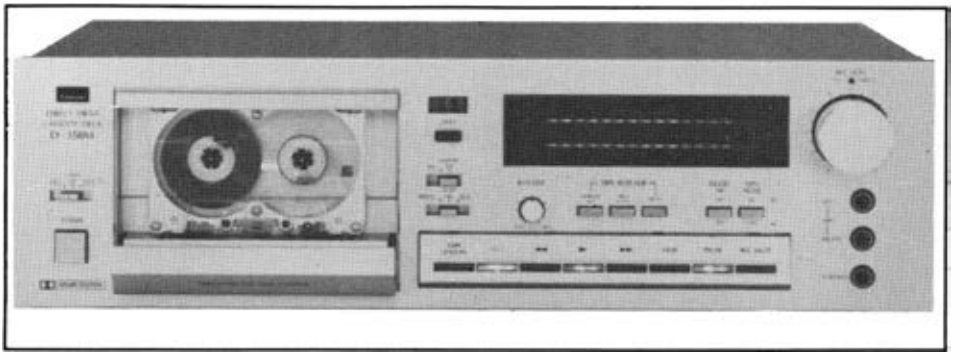
The deck also has a separate motor for spooling and illuminated soft-touch buttons for logic tape transport control. Record mute is included along with a button which winds the cassette on to the end of the lead-in tape and hence to the start of the coating when depressed. Another feature is a fine user-adjustable bias control which is said to provide a bias swing relative to 'normal' over ±20%, but there is no way of bias setting apart from experimentation and reference to an illustration in the instructions which lists some 28 different tapes, some of which I have not heard of.

Bias and eq are selected simultaneously by depressing one of three buttons for tape classes I, II and IV. Metering is calibrated from 'infinity' (first indication −10) to +8 dB but the graticule is not illuminated as that of the D-300M. The cassette is loaded straight into the front of the fascia as the less expensive model, the heads, etc. being protected from dust when the deck is idle by a hinge-over cover. The hinging of the cover seemed to be a little flimsy, that of the sample departing from its sockets.

Recording level is set by a friction-coupled dual-concentric knob. There is no replay level control. Amplifier interfacing is by rear 'phono' sockets (no DIN). Change to left or right channel mic is accomplished by insertion of the mic jack into the appropriate jack socket. A standard ¼-in. jack socket is also present for headphones.

Dolby noise reduction is activated by a press-button, while an adjacent button allows the introduction of MPX filtering if required.

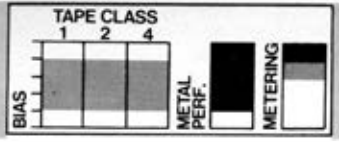
Dimensions approximate 430 × 128 × 282 mm (W × H × D) and weight 5·8kg. Selling price is around £189.



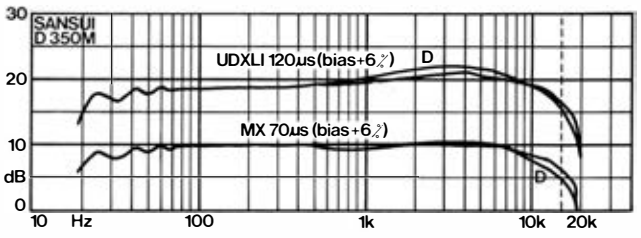
The verdict

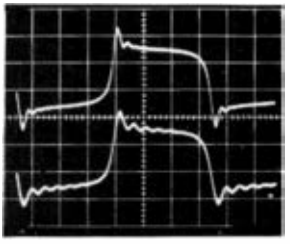
The deck was limiting metal tape potential in terms of low-frequency performance, though the HF attributes of metal were evident giving suitable recording signal. Most people, though, would find that a tape such as UDXLI (or high energy equivalent) or a good Class II formulation would give equally as good results on normal programme material as metal — possibly better in the LF.

Taking account of price, lab results and autitioning, along with the facilities offered, my award is D for merit and 3 for value.



merit **D** value **3**





The findings

It is not particularly easy to adjust the bias for the optimum results from any given tape type, and I found it impossible to achieve a perfectly balanced response with the test tapes. I had the impression that the eq of the sample was not accurately adjusted internally. The pen-chart reveals presence region lift, worsened by the action of Dolby, using UDXLI. This was not so bad with MX metal and Dolby integrity was better with this tape. UDXLII (not plotted) had a 1dB depression at 10kHz and was about 4dB into roll-off at 15kHz. With Dolby a mild 1dB lift occured at 4kHz. Curiously, the deck showed more low-frequency undulations than the cheaper one. Mid-spectrum 120μs replay eq read +1dB at 125Hz and −0·dB at 6·3kHz.

LF performance with any tape was not particularly encouraging, UDXLI giving 0·8% distortion and 3·5dB MOL and MX 1·7% distortion and 2·5dB MOL. Monitor distortion at +10dB output was low, though. W&F was also very acceptable at 0·06% average with no more than −0·2% speed error.

Headphone delivery was better than the D-300M but still barely enough for some 'phones. Metering was good with no under-reading on 20ms bursts, but readout definition is not too good. A C90 fast-spooled in 96 seconds. Squarewave without Dolby was good for a cassette deck (pity about the starting overshoot), but with Dolby plus MPX (lower trace) there were more 'rings'.

The test mic interfaced OK but a fair gain setting was required for full modulation. Noise was low and quality very reasonable. No amplifier interfacing difficulties were observed.

Under audition the reproduction was considered to be somewhat on the 'rough' side compared with the D-300M. Low-frequency compression could be incited at highish recording levels;but apart from these things the results would be considered acceptable by many users. Background noise was lower than from the D-300M and there was not a great deal of ripple. The Scotch Master II gave 65·5dB signal/noise ratio with 70μs and Dolby.

SHARP RT20 £90

This astonishing deck is equipped with what Sharp call a 'Computer-Controlled Multi-Display'. This is a fluorescent display which shows not only the ordinary metering but also a number of other things which are programmed by press-buttons and an inbuilt microprocessor. Five programming modes are possible which are 24-hour real time, alarm time, tape counter, time counter and remaining tape time counter.

The symbols and numbers of the display, which is located on the fascia behind a small window measuring about 95 × 45mm, glow a bright yellow and are thus clearly visible. The Dolby symbol also appears when the Dolby button is depressed. The metering parts of the display consist of two horizontal rows of 'dots' at the top and bottom, between which appear the time and counting digits — which is a little confusing.

Programming is not at all difficult as the various buttons are clearly identified. The alarm time can be switched to a high-pitched audible tone emitted by the deck (or the alarm sound can be switched off like an ordinary alarm clock). Reset buttons relate to the counter and time count functions, it also being possible to 'hold' time count. The tape remaining function needs first to be set to the length of the cassette being used, there being buttons for C46, C60 and C90.

The tape counter works in the normal way, it being possible to zero-reset while the tape is running as with mechanical counters, which can be useful. The time count merely counts up the seconds from zero reset while the tape is running, while the tape remaining count shows the time you have left per side of a C46, C60 or C90 cassette. Indicator lights are linked to the alarm and time count hold buttons. Another light (a red one) gives a 'tape end' warning by flashing on and off.

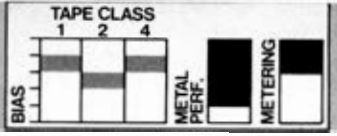
Except for the tape counter, none of the functions is essential for normal operation of the deck and can thus be regarded as extras (which you have to pay for) or even 'gimmicks' which may or may not be useful to you depending on how you personally value them.

Although a multiplicity of 'dots' form each metering line, there are only five active elements per line with minimal calibration from −13 to +3 dB.

The deck is indicated as being 'metal tape capable'. One push-switch selects bias and eq for Class I and II tapes, while a second switch provides the higher bias metal requirement with 70μs eq. A similar switch engages Dolby noise reduction.

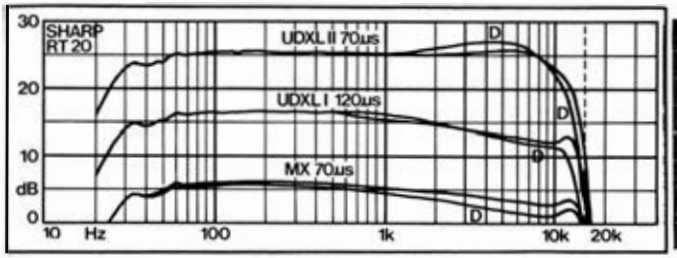
Tape transport modes are selected by mechanical 'piano keys' and recording level is set by two knobs for the left and right channels against fascia marks. Replay output is level fixed. Rear 'phono' sockets are used for amplifier interfacing, with DIN socket option selected by a rear switch (which also brings in the front mic jacks). A standard jack socket is available for a headphone set.

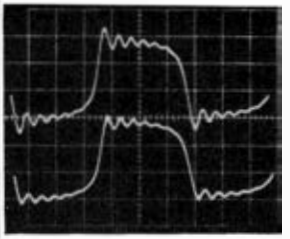
The deck is nicely presented with 'brushed aluminium' fascia and grey-finished metal enclosure. Dimensions approximate 390 × 125 × 226 mm (W × H × D) and weight 3·8kg. The deck is expected to sell for around £90.



The verdict

This was not an easy deck to rank as it was found difficult to determine a rational value for the computer-controlled functions. The main shortfall was the different results between the two channels. If both channels had been the same as the best one measured, a higher assessment would have been appropriate (but please take note that the imbalances measured on this first sample might well not exist on later machines). Excluding the fancy 'computer' bits and judging the machine purely as a cassette deck as found, then my award is D for merit and 2 for value. For those people finding usefulness in the 'alarm clock' and timing displays a slightly higher assessment would be appropriate.





The findings

I had no difficulty in programming the deck for its various 'timing' operations and all worked without error. However, the front on/off switch does not switch off the mains supply, it merely placing the deck in 'standby' mode so that the clock continues to work. If the power fails then the clock timing is defeated, indicated by flashing zeroes in the display when the power is restored.

Before proceeding I would like to make clear that the review sample was one of the first in the country and as it was requested in a hurry to meet my deadline Sharp Electronics were unable to check that it was working properly.

Although the LF performance with top-flight Class I and II formulations was highly commendable, metal gave discouraging results on the left channel, but the right channel was very much better. UDXLI gave 0·35% distortion and MOL as high as 7·5dB; UDXLII 0·6% distortion and 6dB MOL, which is very good for this tape; and metal 3% distortion and 0dB MOL on the left channel but only 1·2% distortion and an MOL up to 5·5dB on the right channel.

Tests with my head coupler showed that the recording headroom in metal mode was relatively poor on the left channel compared with the right.

The pen-chart refers to the left channel and shows that both UDXLI and MX penned small-flux responses with drooping treble indicating, perhaps, a too high bias yield, which could have accounted for the remarkably good LF MOL of UDXLI. Treble droop of UDXLII was not quite as bad but the response shows a 'bulge' around 5kHz. Dolby error was present with all the test tapes, but apart from low-bass boost 120μs replay eq was quite fair.

Metering was swift with no under-reading on 20ms bursts but the primary shortfall here was the limited calibration range. DL was close to OdB on both channels. I could find no problems with the signal/noise ratios, good results being obtained in all modes. W&F, though, was on the high side and close to subjective threshold at 0·15% (replay only) with +1% speed error. Metal erased to below noise floor and a C90 fast rewound in 140 seconds. Headphone delivery was moderate across 8 ohms. The squarewaves show the usual 'rings' but of fairly restrained amplitude, especially with Dolby active (lower).

The test mics interfaced OK, as also the deck to the testing amplifier, but the mic headroom was a trifle lower than I have measured.

Recording to 'normal' metal levels gave the vague impression of 'tightness' and lack of spaciousness, but treble results were fair and background noise low. Stereo imagery was not very defined (possibly resulting from the channel imbalances), and colouration was detected by some listeners with certain types of music.

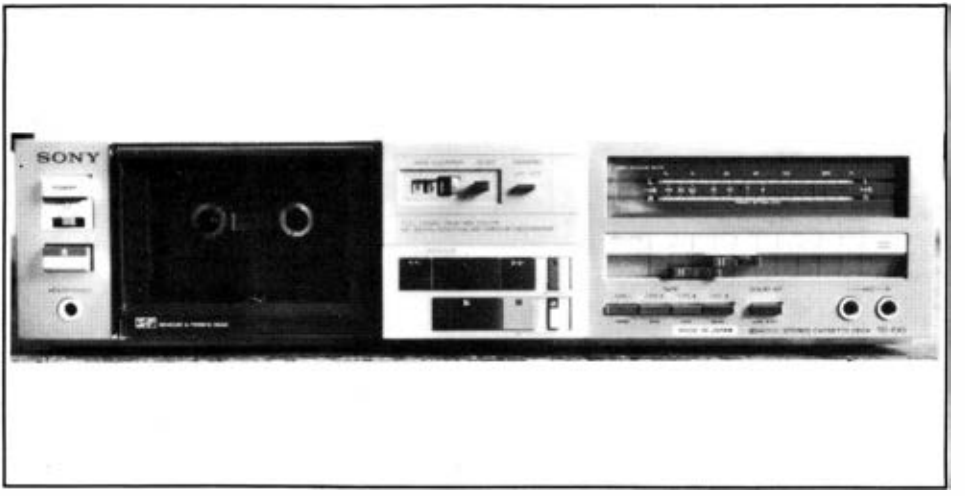
SONY TC-FX5 £140

This Sony is better equipped than the TC-K33 and its tape transport is logic controlled with soft-touch buttons. It also uses two motors and its metering is equipped with auto-peak-hold. There is the addition of a memory button geared to tape counter zero which will either halt a fast rewind or place the deck into replay automatically when counter zero is reached, the latter provided the play button is depressed with the fast rewind button. I find these things useful myself.

Since the logic buttons are the non-latching type, a separate switch is fitted to allow a time replay or recording to happen from an external timing clock. Metering is peak responsive using 15 LEDs per channel calibrated from −30 to +8 dB, the first LED at 'infinity' and always alight. Colour change occurs after 0dB. Dolby level is scaled at 0dB though the Dolby symbol on the scale is slightly below this. The higher level LEDs are held for a short period before being updated by subsequent signal.

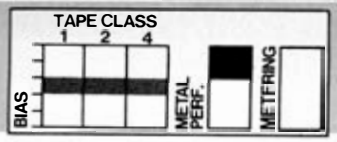
Tape selection is by four press-buttons labelled in tape classes as well as type, and Dolby is similarly switched. Recording level is set by two adjacent sliders along a 'calibrated' runner. There is no replay level control. Amplifier interfacing is by rear 'phono' sockets (no DIN) and a socket is at hand to connect a remote control unit (type RM50 or RM80). Indicator lights on the buttons tell when you have engaged pause, record mute or play. The metering scale is softly illuminated.

The cassette holder opens smoothly and is rear illuminated, being the windowed type. The deck is pleasantly presented with a 'satin' aluminium fascia and 'silver'-finished metal enclosure. Dimensions approximate 430 × 105 × 275mm (W × H × D) and weight 5·3kg. Price is around £140.

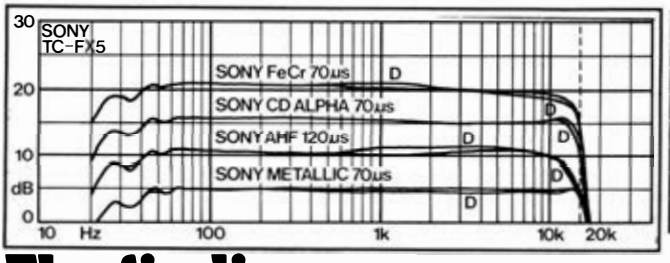


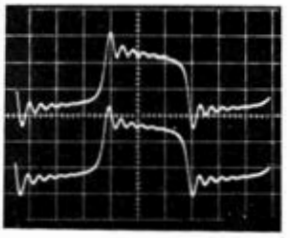
The verdict

I think the extra price is warranted for the 'logic' and the 'memory' function, and scaled on this basis my award is similar to that for the TC-K33, being B for merit and 1 for value. Pity metal LF was not better to have given the deck full acclaim!



merit B value 1





The findings

Again I elected to use Sony tapes for the primary tests, and as you will see from the pen-chart remarkably 'flat' small-flux frequency responses were obtained from most of them with very good Dolby integrity. The metal response was truly excellent though rolling-off swiftly just before 15kHz. 120µs replay frequency response was very flat mid-spectrum with a touch of boost at the bass end, using my test tape.

LF performance was, again, best with the Class I tapes, AHF returning 0·4% distortion and 6·5dB MOL (UDXLI gave the same distortion but 7dB MOL). Metal was less enthusiastic, the distortion being up to 0·9% and the MOL down to 4·5dB (both with Sony Metallic and Maxell MX).

Curiously, the signal/noise ratios were not quite as good as from the TC-K33, replay only being 56·5dB and overall with Master II (70µs) and Dolby 64·5dB. Ripple content was not high. Mic headroom was typically 40dB — okay for domestic use, perhaps, and no interfacing problems were detected.

W & F was hovering around 0·07% (below subjective threshold) and the tape was running about 0·3% slow. It took 109 seconds to fast spool a C90 but we were all aware of a rather loud whine when the deck was fast spooling. Headphone delivery was strong, there being a good 180mV across 8 ohms, corresponding to something like 4mW of power.

Metering was true peak-responsive, showing no under-reading of 20ms bursts, and squarewave performance was pretty typical of most decks as revealed by the oscillogram (bottom trace with Dolby).

Results were not too dissimilar from the less expensive TC-K33 in the listening room. The metering was well favoured but there were mixed views about the slider recording level controls. It is possible to adjust the two together by reason of matching finger 'cutouts', but they were a bit wobbly.

Music with abundant low-bass was better handled by high-energy Class I tapes but metal, again, scored with music rich in treble energy and overtones — though it needs very good quality programme material to hear all that much difference!

SONY TC-K33 £95

This popularly-priced Sony is without the features of its more expensive counterparts, but is metal capable and a two-head front-loader with Dolby noise reduction and a single tape selector switch with positions for tape classes I, II, III and IV — clearly indicated.

LED-type metering uses eleven active elements per channel calibrated from −30 to +8 dB, with the starting element labelled 'infinity' and always glowing. The calibration is printed in black along the metering edging.

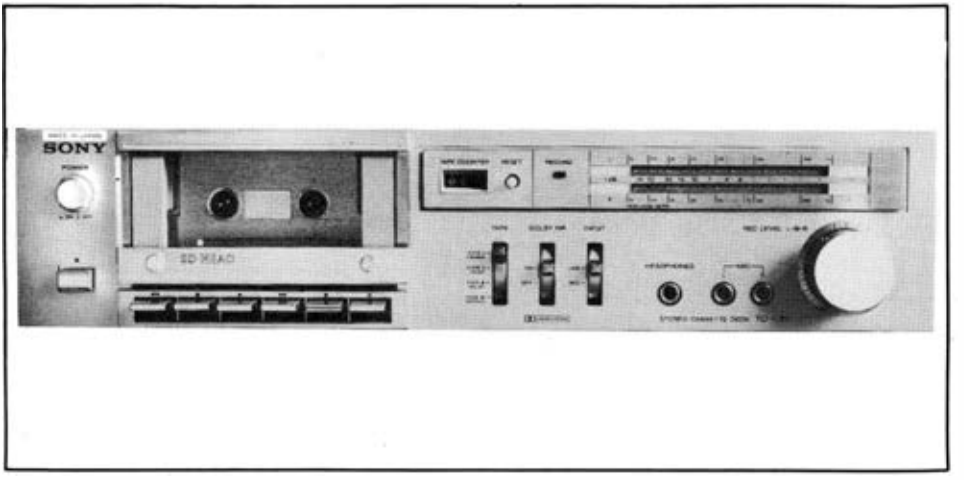
Fascia is 'brushed aluminium' and enclosure 'silver'-finished metal. A large dual-concentric friction-coupled knob sets recording level but replay level is fixed. Lever switches are used for tape selection, Dolby and input change from line to the front mic jacks.

Amplifier interfacing is by 'phono' plug-terminated leads emerging from the rear (no DIN). The mic jacks and that for headphones are standard ¼in. There is the usual three-digit mechanical tape counter but no memory rewind switch.

Tape transport is operated by mechanical piano keys which need a fair pressure to push down, but like the majority of decks with 'latching' keys it is possible to set for replay or record with the power off, the mode then working when the power is switched on — by an external timer, for example. When the power is removed the key(s) unlatch. It is essentially those decks with logic tape transport control which require a separate timer switch for replay and record.

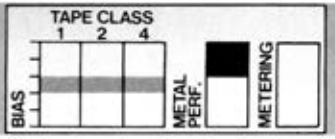
Cassette holder is of the see-through variety but has no rear illumination — instead a 'silvered' backing helps you to see the tape in the cassette.

Dimensions approximate 430 × 105 × 290mm (W × H × D) and weight 4.5kg. The price is said to be around £95.

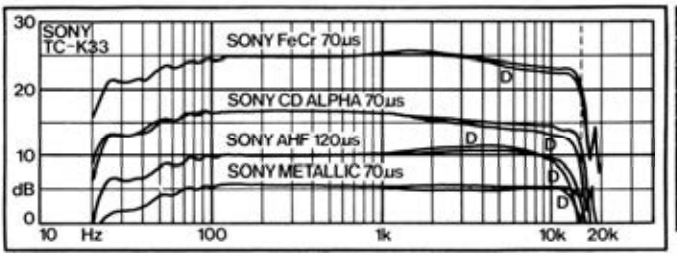


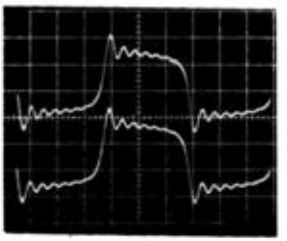
The verdict

Although by no means a 'perfect' deck, at the price I must confess to being quite impressed with both the lab and listening results. It is a pity that the LF performance of metal was not a bit better and the W & F a trifle lower. Anyway, despite these things my award is B for merit and 1 for value. It is a deck that would suit many people.



merit **B** value **1**





The findings

It seemed logical to use Sony tapes with a Sony cassette, the pen-chart showing the small-flux Dolby off and on plots using tape classes I, II, III and IV. You will see that Dolby integrity (at −20dB recorded level) was quite fair to good with all formulations. Sony Metallic penned a remarkably 'flat' response with barely any Dolby error.

LF performance with AHF was very acceptable, distortion being no more than 0.4% and MOL up to 6·5dB. Metal fared less well, with 0.9% distortion and only 4.5dB MOL (results with both Sony Metallic and Maxell MX). Monitor mode distortion was extremely low.

I was also happy with the signal/noise ratios, there being little doubt that the ratio given by the majority of decks is essentially a function of the tape and not the electronics. I measured 66dB with Master II (70µs) with Dolby on.

W & F was a little on the high side at 0·13%. Speed error was −0·6% and the deck fast-spooled a C90 in 120 seconds flat. Metal erased to well below noise floor. Metering was truly peak-responding with no under-reading at all of 20ms bursts. The LEDs are red above 0dB and Dolby reference lies at that level. Headphone yield was low, being more suitable for medium/high impedance 'phones than low impedance models.

The oscillogram shows the usual starting overshoot and subsequent 'rings', the lower trace with Dolby active.

The machine performed adequately in the listening room. The metering was good and was liked and, bearing in mind the price of the machine, the auditioning was quite sanitary to boot. Some upper-treble stridence was detected and the bass was not quite as 'solid' as from some more expensive creations, but I feel that many people would be perfectly satisfied. Piano music, though, tended to reveal the W & F to the ears of the more critical listeners. Organ music seemed to be better rendered on UDXLI and Sony AHF than metal, but the metal tapes performed better with music rich in upper-frequency energy and overtones.

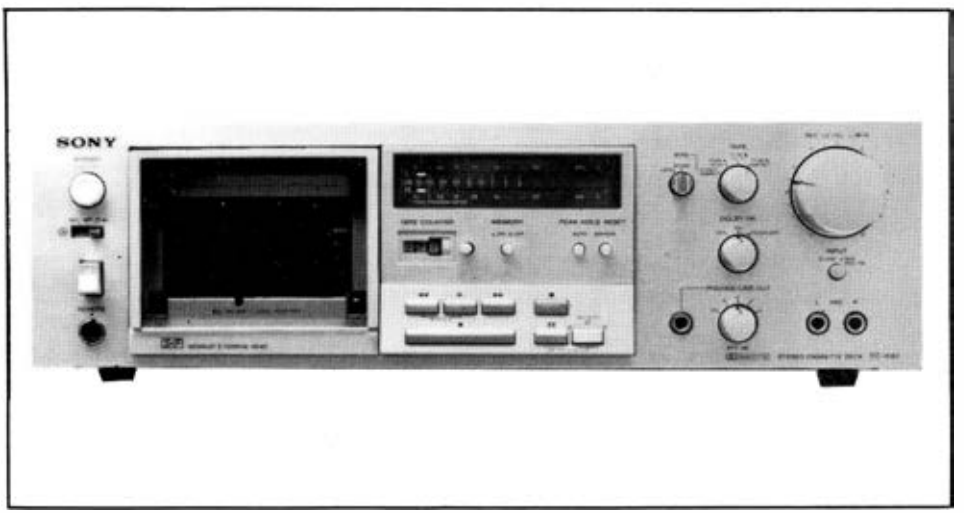
SONY TC-K61 £155

This two-head front-loader is equipped with logic tape transport control worked by soft-touch buttons. Fascia is 'brushed aluminium' and the enclosure metal with a matching finish. Cassette holder is the full-view type and it opens smoothly with useful damping. Metering is peak-responding of the 'bar graph' configuration calibrated from −40 to +8dB. No fewer than 32 LEDs are used, and the display can be switched to auto-peak hold.

Bias and eq are selected by a four position switch and all classes are catered for (including Fe Cr Class III). In addition, a separate switch provides two levels of bias for Class I tapes, labelled 'low' and 'normal'.

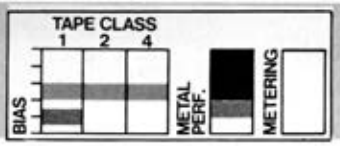
A linear torque motor is used for the capstan and a separate motor for spooling. Recording level is established by a large friction-coupled dual-concentric knob. There are front jack sockets (standard ¼-in.) for left and right mics and headphones. A front switch (rather than jack-operated switches) provides the changeover from rear 'phono' line inputs to the mic inputs and to a rear DIN socket option.

A three-position switch selects Dolby noise reduction with or without MPX filtering, and replay level (including 'phones level) is adjustable by a five-position rotary switch with attenuation settings of 0, 3, 6, 12 and 24 dB. Another switch provides for timed record and replay. A front socket caters for a wired remote control unit, Model RM-50, which is an optional extra. A three-digit mechanical tape counter can be zeroed and switched for memory rewind. The deck uses a Sendust and ferrite head. Dimensions approximate 430 × 130 × 295 mm (W × H × D) and the selling price is around £155.

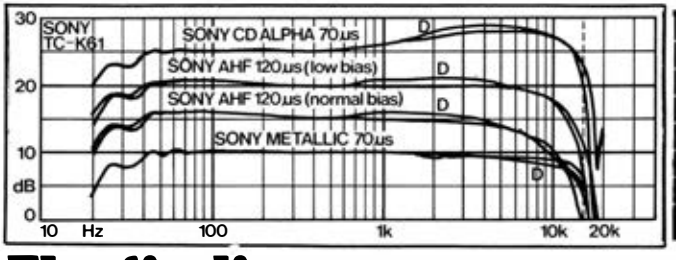


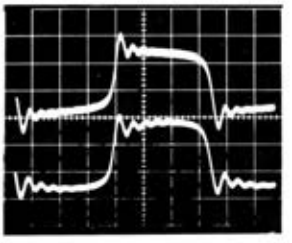
The verdict

The deck has some good points and the metering was particularly well favoured, there being hardly any under-reading on 20ms bursts. It fell short mainly on metal performance, internal adjustments, balance and frequency responses. I felt that the model has potential, but I would have favoured a greater difference between the 'low' and 'normal' Class I bias settings. However, taking account of all these factors, lab performance, auditioning and price my award is C for merit and 3 for value.



merit C value 3





The findings

In the lab it was discovered that one channel was better adjusted than the other. The left channel was somewhat in eq error and the Dolby reference level was not quite right. You will see that the pen-chart carries four Dolby off/on frequency responses. As I was not particularly happy with the AHF response with 'normal' bias I ran another plot in the 'low' bias position. This improved the upper-treble a little, but rather early treble roll-off was still apparent. Sony Metallic plotted a better response, but still with some upper-treble droop. The CD Alpha penned a rather curious response with a ledge at the lower frequencies followed by a gradual rise in response. Dolby integrity was not bad, however, throughout.

The other channel penned different responses, and I couldn't help feeling that the deck's potential wasn't fully realised owing to internal maladjustment. For example, while the LF performance of UDXLI and AHF was quite good with 0·4% distortion and around 6dB MOL, that of Maxell MX and Sony Metallic was relatively poor with 3% distortion and about 3dB MOL.

Signal/noise ratios gave no cause for alarm, electronic replay being 57·5dB, and using Scotch Master II 66dB with 70µs eq and Dolby. Ripple content was well suppressed under correct operating conditions. W&F was low at 0·06% and the tape was running no more than about 0·3% slow. Distortion from monitor output at + 10dB was very low, so no trouble here.

A decent headphone output was measured and there was sufficient yield to drive low impedance 'phones as well as high impedance ones, of course. A C90 rewound in 111 seconds. Had it not been for the starting overshoot and the quickly damped 'rings', the deck would have had a very respectable squarewave performance (lower trace, as usual, with Dolby and MPX filtering on).

No problems were experienced with mic interfacing and the gain here seemed reasonable with only minimal noise introduction. Under audition better high-level low-frequency reproduction was achieved with UDXLI and AHF rather than with any metal formulation. Metal, though, showed its advantage at high-frequency with suitably potent programme material. On the whole metal would hardly be warranted owing to its higher price with the deck as it stood. It is possible, of course, that other samples may fare with greater metal impact than the test sample supplied.

A little background hum could be detected at high volume levels using big speakers, but noise was not much higher than the general run of the lower noise models of the group. Stereo imagery was regarded as satisfactory with fair head/tape intimacy.

TANDBERG TCD420A £299

Here is a deck which differs significantly in appearance from most of the others in this book. It strongly reflects the Tandberg characteristics which many users over the years have come to respect. Althoug essentially a 'top-loader' for flat standing, it comes complete with feet for vertical mounting. In fact, a variety of operating positions are possible, including wall mounting. It is very pleasantly finished in a dark 'black', including the controls, press-keys and meter scale surrounds.

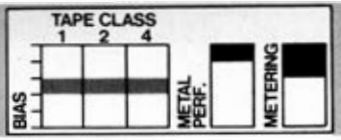
Two pairs of slider controls are used for left and right recording level and left and right replay level, the latter also adjusting the headphone signal level. Resetting marks and numbers are printed in red on the control panel. The meters are scaled in dB from −24 to +6, with DL falling close to −3dB. Tape transport is operated by a solenoid and servo press-keys which are easy to work, and an unusual aspect is that it is necessary to engage pause mode before the record key can be depressed.

It is a two-head machine which has separate switch operations for bias and eq, a three-position switch for the former and two press-buttons for the latter. Although the machine is baised when leaving the factory for UDXLI, UDXLII and Fuji Metal or TDK MA-R, the bias can be reset to suit virtually any brand as there are pairs (for the left and right channels) of preset adjustments for tape classes I, II and IV accessible on the control panel. The deck was tested as received with UDXLI, UDXLII and Fuji Metal. There is no specific Class I bias but the instructions suggest using Class I bias and 120μs eq for recording FeCr tape and 70μs eq for replay.

Amplifier interfacing is by rear 'phono' sockets (with DIN socket option), while standard jack sockets are present on the control panel for headphones and left and right mics. Normal stereo mic mixing is not possible, but the line input is disconnected and the mic circuit activated by plugging in the mic jack, the two channels operating independently.

There are three motors which lead to astonishingly swift fast-spooling and quick mode changes. Dual capstans are used for tape transport. The deck also features Tandberg's own dynamic record pre-emphasis system (called 'Dyneq') and 'Actilinear' recording circuit. The first is a neat arrangement whereby the circuit automatically reduces the degree of recording pre-emphasis when large amplitude high-frequency components are detected.

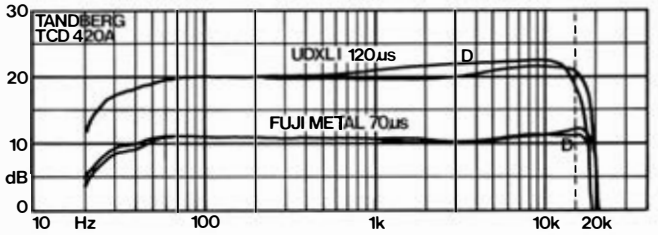
Dimensions approximate 465 × 100 × 225 mm (W × H × D) and weight 6·7kg. The price of the deck has been reduced, it now selling for around £299.

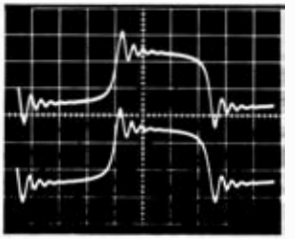


merit 1 value 2

The verdict

Even at the reduced price the deck is still relatively expensive and is less well endowed than some. Nevertheless, and despite some of the foregoing technical criticisms, I still feel that it warrants a high mark for merit, especially in view of its good three-motor mechanics, servo control and subjective impact. I accordingly award it A for merit and 2 for value.





The findings

As received the deck was biased to my (0) reference for all tape classes. Accurate rebiasing for different tapes cannot be done without test instruments — a job best left to a qualified audio engineer. The pen-chart indicates that UDXLI could have done with eq correction or a shade more bias fully to flatten the treble end but UDXLII, class II tape, was better. Dolby reference level, too, for this tape could have been better. The Fuji Metal response was more encouraging, showing very good Dolby integrity and a well extended upper-frequency response. In 120µs mode replay eq was a shade out at 125Hz and 6.3 kHz. Signal/noise ratios were satisfactory, but with Dolby and 70µs eq the Scotch Master II just failed to make the 65dB mark. Background hum was very low, though.

LF performance with UDXLI was good with 0·5% distortion and 7dB MOL ref.DL. With the Fuji Metal, though, it was not quite as good, distortion at 0.65% and MOL 6dB. Distortion on the monitor signal was low at +10dB output — good, but I have measured lower. At 0·12%, I thought the W&F a trifle high for a deck in this price range, but the tape was only 0·2% fast. Headphone output was 140mV at DL across 8 ohms (output maximum), so you will be able to use almost any 'phones with the deck. A C90 fast-spooled in the remarkably short time of 52 seconds.

The squarewaves show a fair amount of starting overshoot and greater amplitude 'rings' than some decks (Dolby on lower trace).

Owing to the high speed spooling it was difficult to return precisely to a given tape counter number, several to and fro operations being required to acquire the required point on the tape. I must admit to sometimes forgetting to release pause to get the tape rolling in record mode! But I was particulary impressed by the 'smooth' action of the tape transport keys, it being possible to alternate between rewind, wind and play as quickly as you can press the keys without tape snatching, cassette protest or other nasties.

With metal tape the performance was truly outstanding and it was difficult sometimes to determine whether we were hearing the high quality signal from the reel-to-reel tape or that signal after it had been recorded on the cassette tape. Background noise was fairly low, low-level ambience nicely portrayed and stereo imagery well defined. There was hardly any electronic colouration at all. I concluded that these very good subjective results were in no small measure encouraged by Tandberg's excellent electronic and mechanical design, especially in terms of the active record pre-emphasis and the 'Actilinear' way the recording signals are coupled to the head. I should also mention that, despite the higher than average W&F measured in the lab, we were not troubled subjectively by wow or flutter in the listening room. Meter deflection rose with treble and under-read 20ms bursts by about 8dB.

TEAC CX350 £110

This desk is some £160 less expensive than the up-market TEAC A770. It is a two-head deck (no off-tape monitoring) and is less well equipped. Tape transport is operated by mechanical press-keys and metering is by VU movements. Metal tape is catered for and, as on the A770, two three-position lever switches are used for separate bias and eq selection, with positions for Class I, II and IV formulations. There is no specific setting for dual-layer ferrochrome tapes, but the instructions state that such tapes can be used with 'normal' bias and 70μs eq (which also applies to the A770).

Recording level is established by a single dual-concentric, friction-coupled knob for the left and right channels, and changeover from line to mic is by a press-switch, another one changing back to line again. Microphone mixing is not catered for. A smaller knob adjusts the replay level from the line outputs and simultaneously the signal level at the headphone socket, which is a jack at the front aside the two jacks for mics — all standard ¼ in.

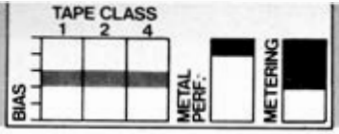
Noise reduction is by Dolby B but no separate MPX filter switch. The deck carries a recording mute button and a lever switch for memory rewind, working in conjunction with a three-digit mechanical tape counter. Amplifier interfacing is from rear phono sockets, and like so many decks nowadays there is no DIN socket, which is no hardship to me! The VU meters are respectably large and illuminated, the Dolby reference level (200nWb/m) being at the usual +3VU position.

The cassette holder is of the see-through type and operates smoothly and quickly without too much noise. Rear illumination makes it possible to see the tape through the cassette windows. Transport keys are piano type of moderate throw. Fascia is brushed aluminium and the housing grey-painted metal, the general appearance, in fact, being similar to the A770.

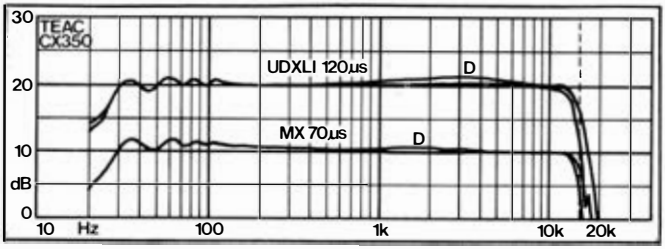
Dimensions approximate 410 × 142 × 300 mm (W × H × D) and weight 6kg. The machine falls in the £110 price bracket.

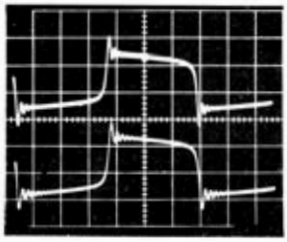
The verdict

At just over £100 this machine has a good bit going for it. It is well made and substantial looking. The metering would be improved by peak LEDs. Wow and flutter was well down (0·07%) but the tape of the sample was running about 0·9% fast. Taking due account of the metering you can get good results, and the deck was happy with metal tapes. My judgement is B for merit and 1 for value.



merit **B** value **1**





The findings

It was a change using a deck with mechanical keys rather than soft-touch buttons which typify logic control. The keys were not all that stiff, though, but did have a trace of starting stickiness. As with the A770, the controls worked smoothly and felt 'expensive'.

Bias delivery on all the classes of tape catered for by the deck was close to my (0) reference, so the deck would be suitable for all tape classes carrying this bias reference in the cassette reviews.

The meters were accurately scaled to +3VU at DL and the two matched accurately. Like most VU meters, however, they were under-reading by about 12VU on 20ms pulses. I felt it sad that the designers elected not to complement them with peak-responding LEDs.

Signal/noise ratios were on par with the A770, but the ratio was 0·5dB worse than that of the A770 using the Scotch Master II cassette. With Dolby active using this tape I obtained a ratio as high as 64.5dB (weighted with 70μs, of course), which is good.

Distortion with both Class I and IV tapes was marginally greater than that from the A770, and the MOLs were correspondingly lower. Nevertheless, with Maxell MX I obtained an LF MOL as high as 7·5dB, which is very good for a two-head deck.

I found less eq error on this deck than on the A770, and the overall frequency responses were flatter as you will see from the pen chart. Comparing the graphs of the two machines shows that the CX350 curtails the metal response to around 14 to 15 kHz, while the A770 goes on to 20kHz without Dolby. Dolby integrity of the CX350 was also much better than that of the A770, as you will observe.

There was sufficient output from the headphone socket to drive low impedance 'phones, but higher impedance ones sounded louder. A C90 cassette took about 151 seconds to fast spool. The squarewaves were remarkably similar to those obtained from the A770 — upper trace with Dolby off and the lower one with it on. Again, there is not much difference between the two.

Peaking on wide dynamic range music to just under OVU using Maxell MX (metal) tape produced very acceptable recordings with good dynamic range. Slight upper-frequency compression was detected using Class I tapes, but this could be cleared by reducing the recording level slightly without too much impairment to the dynamic range. Frequency balance was good, but stereo imagery a little wandery. Low-level ambience was nicely rendered, as also piano and organ music. The latter, with cathedral ambience, came over well. It was thought that this deck had an even better low-frequency performance than the A770.

Virtually all the background noise as heard was proved to be from the tape rather than the deck electronics and head.

TEAC A770 £270

This up-market deck employs three heads (giving off-tape monitoring), two motors for capstan and spooling and peak-responding meter movements. It is logic controlled and a front-loader whose lightweight cassette holder opens swiftly but quietly on depression of the eject button. A large window at the front of the holder lets you see how the tape is running, aided by rear illumination. Fascia is nicely finished brushed aluminium, and the enclosure grey-painted metal.

Separate three-position switches select bias and eq, and similar level switches operate source/tape changeover and memory functions. Small press-buttons are used for Dolby and line/mic switching. Mic mixing is not possible. The inevitable friction-coupled dual-concentric knob sets the recording level while also allowing channel balancing. A smaller knob adjusts the level of the replay or monitoring signal from the line and headphone outputs. Standard jack sockets are used for 'phones and left and right microphones. Amplifier interfacing is by rear phono sockets (no DIN socket), and you can plug in to a rear socket an optional remote control unit Model RC90.

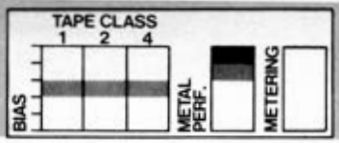
Meter movements are desirably large and softly illuminated, being calibrated from −20 to +5 dB, The 0dB mark corresponding to 200nWb/m (DL), which seems perfectly logical to me. There is also a switch for external timer operation.

Tape counter is an electronic three-digit red display which seconds for programming what TEAC call 'Computamatic Program System' (CPS) — the names they think up for this function! It is a programme locating artifice which, like many others of its kind, works by detecting deliberate pauses between recorded sections on the tape. By pressing a button aside the display the programme number (1 to 19) is selected, this then showing instead of the counter number. It is then possible to fast-spool in either direction such that that numbered pause is detected, the deck then going automatically into replay mode and playing the following recorded material.

For proper operation the pauses must be no noisier than −45dB and must span at least 3 seconds. A 400 Hz signal prior to the pause should neither have exceeded −30dB for at least 20 seconds. The deck incorporates a record muting button for introducing your own pauses. When depressed and released a red light flashes at 1s intervals, and after four flashes the deck enters pause mode. The muting continues if the button is held down.

Another interesting auto operation is called 'Block Repeat'. This makes it possible automatically to replay indefinitely any previously selected part of the tape. The mute button is also handy for erasing unwanted material during the recording of a programme, while overdubbing is facilitated by being able to select record mode during replay without having to stop the tape.

Dimensions approximate 432 × 126 × 302 mm (W × H × D) and weight 7kg. Price is around £270.

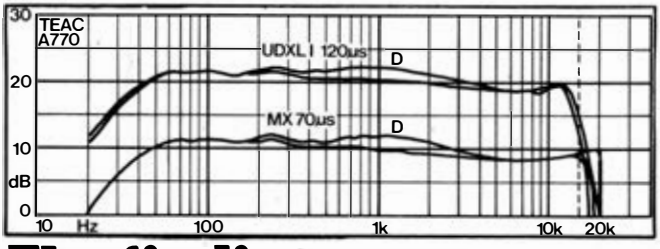


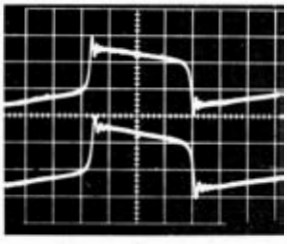
merit **B** value **3**

The verdict

This is another deck which was particularly favoured. It would have received a higher merit rating had the frequency responses been less undulating, Dolby integrity better and wow and flutter lower. It was also necessary to down-rank the metal tape performance due to the first mentioned. The value takes account of the relatively high price in conjunction with the features offered, the main ones being the CPS and three-head off-tape monitoring, which you may nor may not consider worth the extra price for your own applications. The machine is well made.

I thus award the deck B for merit and 3 for value.





The findings

The deck was found easy to use, the logic worked without flaw and the motors were quiet. The peak-responding meter movements were liked but a little more decay delay would have been preferred. As I have indicated in the story on metering at the beginning of the book VU metering does have the advantage of widening the effective dynamic range of a recording but at the expense of possible severe over-recording on real music peaks. Distortion resulting from brief (short-duration) overload is far less detracting than when the overload (and hence the distortion) occurs over a longer period, but when the 0dB point of a peak-responding meter is sealed to correspond to DL (200nWb/m) this is to some extent catered for, since a VU meter generally deflects to +3VU at the same flux level. I found it possible to obtain very good recordings with suitable tape when the meters were peaking to around +3dB on wide dynamic range music, without background noise being obtrusive.

Deck signal/noise ratios were such that without Dolby I still obtained the expected ratio using Scotch Master II in 70µs mode Distortion from both Class I and IV tapes was very low and the MOL correspondingly high. In fact, I obtained LF MOLs as high as +8dB to 3% 3rd-harmonic distortion. Mid-range eq was a little undulating, it being +0.5dB at 125Hz and −1dB at 6.3kHz ref. 1kHz using my test tape. This is also reflected into the overall frequency responses, as you will see, and Dolby integrity could have been better at −20dB recorded level.

Wow and flutter on the test sample was slightly higher than I would have expected but the speed error was very small. Headphone delivery was suitable for low impedance 'phones. Excluding the initial 'rings' and overshoot, the squarewaves are quite acceptable for a cassette deck, and as you will see there was hardly any difference between Dolby off (upper trace) and on. Fast spooling of a C90 was accomplished in 135 seconds, which is a little protracted for a two-motor machine.

My test microphones (Audio Technica ATM10's) interfaced well and background noise was very low. As an aside I used this machine for recording the booms of Concorde for later spectral and sound pressure analyses. Sadly, we suffer these severe sound pressure disturbances at my sleepy (during winter!) little abode of Brixham on clear nights, and sometimes I have fear of the instruments in my lab.

General background noise using the unloaded C-zero was low and consisted mostly of 'rumble' at high setting of the amplifier's volume control.

TECHNICS RS-M51 £160

This interesting two-head front-loader is equipped with a black-backed and windowed panel at the top right-hand quadrant of the 'brushed aluminium' fascia which displays peak-responding fluorescent metering and an inclined row of LEDs against a scale which indicate the setting of the digital recording level control. Instead of the usual recording level control there is a two-way rocker button for manual level setting and a larger illuminated rectangular button for automatic level setting.

The two halves of the rocker button are marked down and up. When pressure is retained on the down half the recording level falls automatically to zero, while a single press causes the level to drop by one of the digital steps. The same things happen when the up half is depressed but this time, of course, the recording level rises to maximum. There are 16 LEDS in the inclined row which switch sequentially as the level button is operated, the glowing one thus indicating the established recording level against the scale which is marked from zero to 15. All the LEDs except the zero (yellow) one are red-glowing.

When the deck lies in record mode and is receiving the signal to be recorded the recording level can be set automatically to suit that signal (approximately) by depressing the larger button which normally shows a green light. When depressed the green light extinguishes and a flashing red one shows while at the same time the middle level LED also flashes on and off. During this time (about seven seconds) the peaks of the signal are sampled by the electronics and the recording level is set to correspond. When the process is finished the red flashing light goes out and the steady green light comes on again, the set level then being revealed by the LED scale.

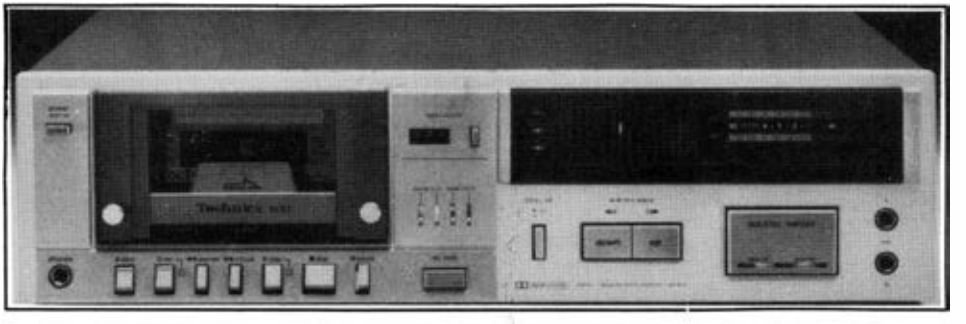
The fluorescent metering is peak-responding and is calibrated from −20 to +8dB, with Dolby level at around +3dB. A useful feature is that the peaks of the signal are retained by the metering for a few seconds before changing to their new values.

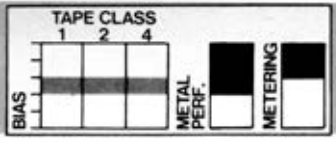
Bias and eq for the four tape classes are established simultaneously by a rear switch whose setting is shown by front lights. In the 'auto' position of the switch the change between Fe and Cr occurs by virtue of the sensing cutouts in the cassettes. There is no fine bias control.

Tape transport is by 'logic' and press-buttons and only one button needs to be depressed to engage record mode. A record mute button is fitted which when pressed also switches out the metering. While in play mode it is possible to operate fast-spooling in either direction to achieve cue or review, audible through the speakers.

Standard jack sockets are present for 'phones and left and right mics but mic mixing is not possible. Rear 'phono' sockets give amplifier interfacing (no DIN) and both channels are disconnected from 'phono' when either mic jack is inserted. A rear socket is available for remote control and the replay level (including 'phones) can be set by a rear control.

Enclosure is greay-finished metal and the cassette holder a full-view type with back illumination. Dimensions approximate 430 × 119 × 270 mm (W × H × D) and the price £160.

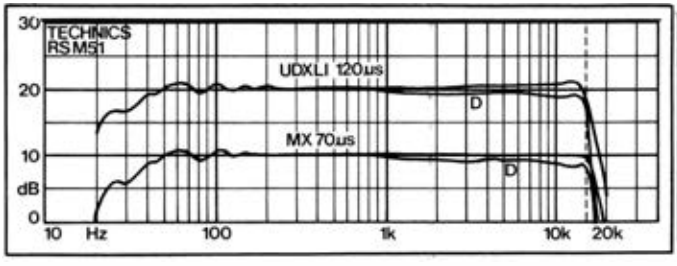


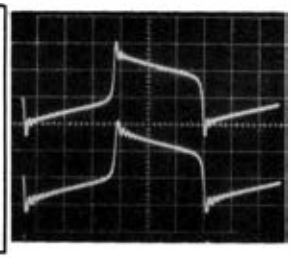


merit C value 2

The verdict

The deck is certainly interesting and different but I couldn't help thinking that you might be paying over the odds for the digital level setting system. It's a novelty but not, I think, of particular operating value. Metal performance could be improved, so my verdict as it stands is C for merit and 2 for value.





The findings

Bias yield of the deck was close to my (0) reference for all tape classes, and as shown by the pen-chart flat non-Dolby responses were obtained from the test tapes up to 15kHz, also with UDXLII. Bass tended to roll-off a little early accompanied by LF 'ripples'. Some Dolby level error can also be seen. Mid-spectrum 120µs replay eq was satisfactory. Metering was true peak-responding with hardly any under-reading on 20ms bursts. I found no undue problems with signal/noise ratios and hum level was low.

LF performance with UDXLI was also good at 0·5% distortion and 5·5dB MOL. Metal tape did less well in the deck, however, the distortion on the particular tape used being 1·6% and the MOL barely 3dB. It was also noticed that the monitor replay distortion was a little on the high side at + 10dB and was affected by the setting of the level control. W&F was low and tape speed was a mere 0·1% slow. A good headphone output is available even across 8 ohms and fast spooling time was around 126 seconds for a C90. The squarewaves show the usual initial overshoot and 'rings' (lower trace Dolby on), but please note that this was taken at 300Hz in an endeavour to access the LF phase characteristics.

Under audition the digital level control system worked OK, but we could never seem to strike the right level by using the auto button. It is impossible to derive the correct level during a seven second period, particular with classical music. Pop music gave better accuracy, but it is not difficult to step the level up or down by the rocker button. The transport buttons differ from the general logic control, being stiffer and with 'locking' action.

Although metal tape auditioned favourably, especially when the music contained an abundance of upper-treble, the general feeling was that high-energy 120µs oxides did better in the deck. A weather eye needs to be kept on recording levels but the metering calibration is not very well defined. Noise was low but a certain degree of mid-spectrum colouration was detected from all tapes.

TENSAI TFL-815 £129

This Japanese made deck is a reasonably-priced direct front-loader with metal tape position and peak-responding metering using ten elements per channel and calibrated from −20 to +6 dB, with Dolby level at +3dB. Tape transport control is by 'soft-touch' buttons and 'logic', indicator lights showing when play, record, pause and metal have been selected. The latter indicator lies at the side of the metering display, along with a red LED which glows when the power is switched on, showing 'standby' mode.

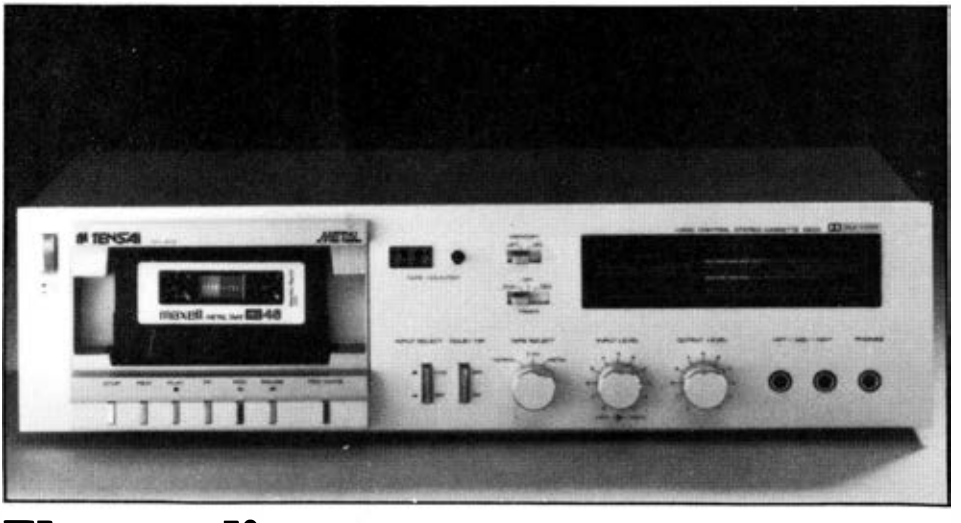
The metering scale is black and not illuminated and the LED elements themselves are duller glowing than some (less distracting!) and change from green to red above OdB. The cassette is clipped into a recess on the fascia (left-hand side) but is not rear illuminated — a bright coloured patch helping you to see the tape through the cassette windows.

Bias and eq are selected simultaneously for tape classes I, II and IV by a rotary switch knob. Similar knobs are used for recording *and* replay level control, the former friction-coupled dual concentric for channel balancing.

A rewind memory switch is geared to tape counter zero, while another switch gives external timer switch-on for replay and record. Elongated push-switches are fitted for Dolby and line-to-mic/DIN changeover. Amplifier interfaces are 'phono' sockets with DIN option, and standard ¼-in. jack sockets are present at the front for left and right mics and headphones.

A rather flimsy dark-tinted transparent cover can be hinged up over the heads and vital parts when the deck is not in use, but it is not very good at keeping out dust!

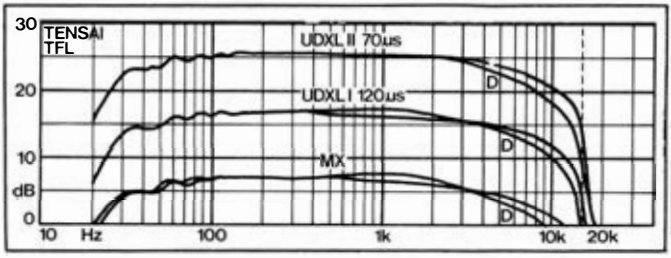
Fascia is brushed aluminium and enclosure grey-finished metal. Dimensions approximate 430 × 109 × 250 mm (W × H × D) and weight 6·5kg. Price is around £129.

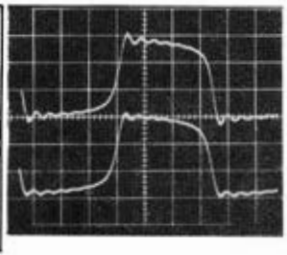


The verdict

My impression was that this deck has a good potential at its price level, especially with its good logic tape transport control. Unfortunately, one or two curios were exposed in the lab, and if the line input-to-source monitoring headroom could be widened and the upper-treble of the small-flux frequency response brought out of the doldrums it would attract a greater award. However, as the sample stands my verdict is E for merit and 3 for value.

merit **E** value **3**





The findings

The deck would appear to be biased to the Japanese 'standard', corresponding to my (O) reference, but I found that the upper-treble of all tapes tended to roll-off fairly swiftly, as can be seen from the pen-chart. Tests were made with a number of different tapes but the general trend remained, which I thought a pity as the deck showed up quite brightly on other measurements. Checking the 120μs replay only response gave the impression that the eq and possibly record pre-emphasis could be improved, so these findings could well represent maladjustment of the test sample.

Bearing in mind the relatively low price of the deck I was perfectly happy with the LF performance from Class I and IV tapes. UDXLI gave an MOL as high as 7dB with 0.6% distortion and MX metal 6dB and 0·8% distortion. Replay channel distortion from head to output was also very low at +10dB output, but with the input to line (instead of head ***via*** a flux-coupler) the distortion was up to 1% at +8dB output — a curio which undoubtedly lies somewhere in the record input circuits and worth investigation by the designer. On the other hand mic headroom was acceptable at around 47dB.

Although not as low as some, the signal/noise ratios were quite reasonable, with 70μs and Dolby giving almost the full theoretical improvements. Overall with Master II (70μs) and Dolby the ratio was close to 64dB.

W&F was hovering around 0·1% (replay only) and speed error a mere — 0·3%. A C90 fast-spooled in the small time of 76 seconds. Headphone yield was nice and high (maximum replay level), and even across 8 ohms (at DL) I measured 250mV. There was no under-reading on the meters using 20ms bursts, and scale accuracy was good. The oscillogram shows some remarkably good squarewaves, with minimal 'ring' amplitude, especially with Dolby (lower trace), which could possibly have some bearing on the upper-treble roll-off characteristics measured. You can't have it both ways it seems!

Under audition overtones and harmonics of string instruments were somewhat muted, but not as bad as might be expected from the pen-chart. Mid-range colouration was also detected but bass was very reasonable, as also low-level ambience. Organ music, in fact, came across quite well with no early compression symptoms. W&F was not apparent but stereo imagery was a little wobbly. The metering allowed a good control to be kept on recording levels and I was not worried about the relatively dim LEDs of the display.

TOSHIBA PC-X22 £140

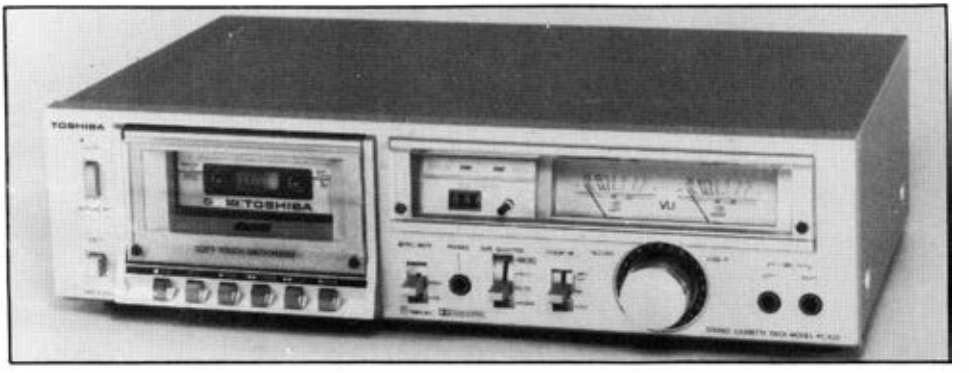
This is a two-head deck with the usual type of front-loading cassette holder which hinges down when the eject button is depressed. Fascia and metal enclosure are finished in 'silver' but instead of there being 'phono' sockets at the rear for amplifier interfacing two pairs of leads terminated with 'phono' plugs emerge from the back. However, they should be long enough to connect to a nearby amplifier. This is one method, of course, of reducing cost, but not one that I personally commend. The rear panel is of hardboard, which also seems to be a cost-cutting artifice. There is no DIN socket.

The front is nicely presented, though, and press-buttons are used for tape transport control, linked to a 'logic' circuit, but instead of a solenoid the deck incorporates a motor for the controlling functions. Most of the other operations are handled by a type of 'lever' switch. A four-position one selects simultaneously the bias and eq for the four tape classes, but there is no fine bias control nor switch for changing the bias level of ***Fe*** type tapes. A three-position switch provides for Dolby with or without MPX filtering, while a hold-down switch gives record mute.

The usual three-digit mechanical tape counter is present but it cannot be linked to memory rewind. Tape wind and rewind buttons can be operated while the deck is in play mode. When the appropriate button is held down the tape can be speeded up, normal speed resuming when the button is released. Toshiba call this 'cue' and 'review', though my sample failed to give an audio output when the tape was fast spooling by this action in the play mode. Of course, when the deck lies in the 'off' position the normal fast-spooling occurs when either button is depressed and released.

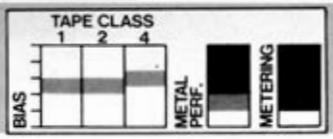
Metering is by VU movements, clearly scaled from −20 to +5 VU and illuminated, but they are not complemented by peak-responding LEDs, and the response of the meters is slow. Recording level is established by the usual dual-concentric, friction-coupled control knob (with resetting numbers on the fascia). There is no replay level control. Standard jack sockets are fitted at the front for headphones and left and right mics. The appropriate line circuit is disconnected and the mic input activated when a jack plug is inserted. Normal stereo mixing is not possible.

Dimensions approximate 420 × 120 × 268 mm (W × H × D) and weight 4·6kg. The deck sells for around £140.

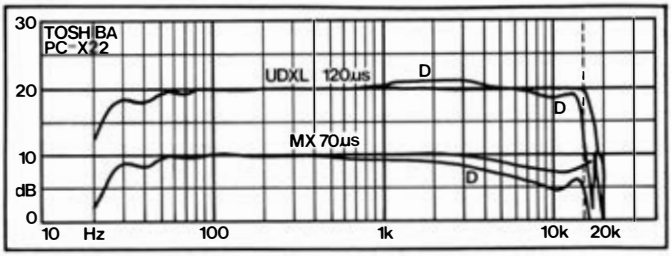


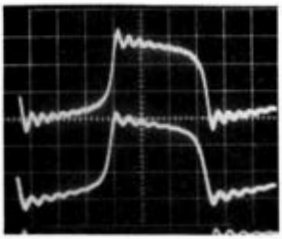
The verdict

This deck failed to reach the heights of some of the others on several counts, and it is not a deck that can be expected (as supplied) to do full justice to metal. I can only award it D for merit and 3 for value.



merit **D** value **3**





The findings

Bias delivery of the deck would appear to approximate my (0) reference on all tape classes with the possible exception of Class IV (metal) where, as you will see from the overall frequency response in the pen-chart, a very nasty 'dip' occurred around 10kHz from Maxell MX. This is really sad for Maxell MX is a very good and popular metal tape. I would say that this is more of an eq error at 70µs than over-biasing in metal mode, but some improvement can be achieved by going slightly towards (+1) bias reference (TDK MA showed an improvement). You will also see that the error was exacerbated with Dolby active. 70µs oxide (UDXLII) gave a better upper HF than UDXLI.

Without Dolby UDXLI gave a remarkably flat overall response, but again you will see error when Dolby was engaged. The 120µs replay eq was very acceptable mid-spectrum with only 0.5dB boost at 125Hz. Toshiba should look again at their quality control making sure than the 70µs eq and Dolby levels with reference to the more popular tapes are set correctly.

Signal/noise ratios were good and using the Scotch Master II at 70µs and with Dolby I was approaching 66dB. Ripple content was not high. LF performance with UDXLI was reasonable at 0.5% distortion (DL) and 5dB MOL, but metal was relatively poor at 0·9% distortion and 4dB MOL. I was also unhappy to measure 1·4% replay distortion at + 10dB (ref DL) output.

Wow and flutter at 0·12% was highish and the tape was running 1% slow. Rewind time was 130 seconds for a C90 and the meters under-read 20ms bursts by 12dB. The oscillogram shows the usual 'ringing' squarewaves with barely any change between Dolby 'off' and 'on with MPX filtering'.

Under audition overall results were preferred with high-energy Class I tape, such as UDXLI. Class II results were relatively 'poor' and there was barely any improvement using expensive metal. Pre-recorded 120µs oxides (Class I) tapes played fairly well but the slow speed of the tape could be heard. For best results the meters had to be kept around — 2VU on strong music peaks.

TRIO KX-600 £159

This interesting looking two-head deck is a direct front-loader. There is no moving cassette holder or eject button, the cassette being clipped between upper and lower members on the fascia. The lower member runs along almost the whole width of the fascia and carries light-touch press-switches for operating the logic tape transport, along with press-switches for tape selection, Dolby noise reduction and record mute, and standard ¼in jack sockets for left and right mics and headphones. To protect the heads, capstan and pinch-roller when the deck lies idle, and to keep out the dust, the machine comes complete with a detachable transparent cover.

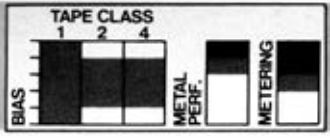
Between the cassette loading point and a large dual-concentric, friction-coupled recording level knob at the right-hand side of the fascia lies a rectangular window displaying two well-illuminated VU meters and three peak-responding LEDs set to flash at 0, +3 and +6 dB. The meters are black-backed and the numbers and calibration marks show up well in coloured light. Scaling is from −20VU to +5, with Dolby level at +3. The scale is red above 0VU.

There are four tape selector switches, each operating bias and eq together, for tape classes I, II, III and IV. It is also possible to adjust the bias over a limited range for each tape class by a front control scaled ±5 whose centre 'zero' position is 'click' identified. The instruction manual carries a list of tapes with suggested approximate bias settings.

There is the usual three-digit mechanical tape counter but no memory rewind switch. Indicator lights show for record, pause and Dolby. The pause button also seconds as 'timer standby' so that the deck can be switched on by an external timer for record or replay. While recording the head signal can be disengaged temporarily by holding down a button, but the recording level meters continue working.

Amplifier interfacing is via 'phono' plug-terminated flying leads coming from the rear (no DIN), and by plugging in a mic jack the corresponding channel line input is disconnected. Fascia is 'brushed aluminium' and enclosure grey-finished metal.

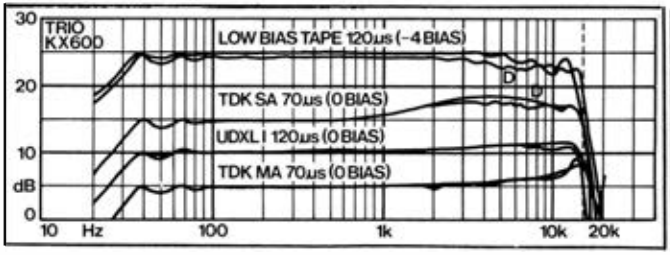
Dimensions approximate 440 × 133 × 285mm (W × H × D) and weight 5·9kg. Selling price is expected to be around £159.

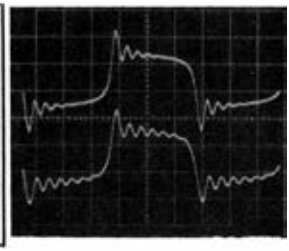


merit C value 2

The verdict

This was considered to be a nice-looking deck but a *little* on the large size compared with some. It was easy to operate and no 'logic' problems were met. For accurate recording levels it was found best to place reliance on the LEDs rather than the VU meters. I have made one or two criticisms, but in general the deck was favoured, and I accordingly award C for merit and 2 for value.





The findings

The instructions indicate that UDXLI, TDK SA and TDK MA are the setting-up reference tapes, and these were used for some of the primary tests. The pen-chart shows the frequency response of these tapes with the bias control at centre 'zero'. It will be seen that UDXLI gave the 'flattest' response with very good Dolby integrity. The MA (metal) exhibited substantial upper-treble boost but without loss of Dolby integrity, but SA produced a significant 'bulge' in the presence region with some Dolby error. The response at the top of the chart was taken with a 'low bias' Class I tape and with the bias turned down to −4 position. The −5 position would have been better, but the treble undulations indicate poor head/tape intimacy.

LF performance with UDXLI was very good with the distortion being little more than 0·5% and the MOL up to 6·5dB. Distortion of MA was 1·2% and MOL 3·5dB. Best metal was the latest Memorex at 0.8% distortion and 5dB MOL, SA gave an LF performance similar to that of MA, but the top end of the latter was better. Replay channel distortion was a magnitude or more lower than from tape at +10dB output — so no replay headroom problem.

Replay signal/noise ratio was 57dB and overall with Master II (70µs) and Dolby 65·5dB. Mains ripple content was a little higher than from some decks, but not subjectively annoying. The VU meters under-read 20ms bursts by 10dB, but this war partly compensated by the peak-responding LEDs, which flashed at the true peak level. Dolby level was scaled at +3VU. Replay eq at 120µs mid-spectrum was fairly accurately adjusted, but the treble was falling at 6·3kHz and meter fluctuations were noticed.

W & F was hovering around 0.08% (replay only) and the tape was running 1·2% fast. A C90 fast-spooled in 124 seconds. Headphone yield (at DL) was only 55 mV across 8 ohms but up to 350mV across 600 ohms. The oscillogram shows significant starting over-shoots and multiple squarewave 'rings', the lower trace with Dolby active.

The test amplifier and mics interfaced without problems, and the mic headroom was just over 40dB, which is fairly typical. Mic noise was not obtrusive.

Under critical audition mild mid-range colouration was discerned, but the reproduction was desirably 'open' and lacking compression at correct recording levels. Bass was fairly 'solid' and low-level ambience reasonable, but some wavering of the stereo image was detected on certain, high quality programme material. Although metal tape performed well at the treble end, it needed high quality source material to notice the difference against top-flight Class I oxide. Pre-recorded cassettes were thought to be a trifle weak on music attack and very critical ears were aware of the slightly fast-running tape; but W & F was not a problem.

YAMAHA K350 £125

This is another two-head front-loader where the cassette is loaded straight into a fascia recess. The backing is not illuminated but a red patch helps you to see the tape through the cassette window. A hinged cover protects the heads, etc. and helps to keep out dust when the machine is not being used.

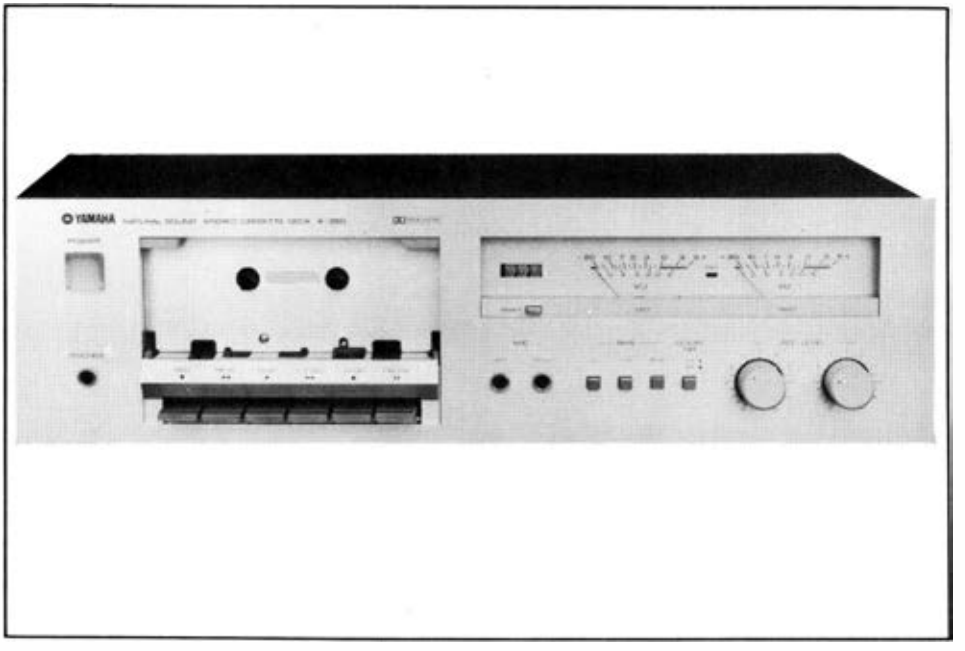
Tape transport modes are selected by fairly deep-throw mechanical press-keys which are well engineered and not too hard to depress. It is possible to change modes without the need to go by way of stop. The deck is fairly 'basic', it having fewer features than some of the others, and the metering is by two VU movements which are not very fast responding and devoid of complementary peak-responding LEDs.

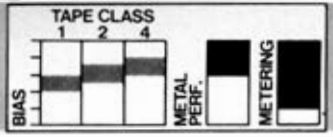
Bias and eq for tape classes I, II and IV are selected simultaneously by press-buttons, while a fourth button activates Dolby noise reduction. It is not possible independently to switch MPX filtering and neither is there any means of adjusting the bias externally.

Recording level is adjusted by two knobs, having fascia resetting marks and numbers, one each for the left and right channels. Replay output is non-adjustable but set to a suitable amplifier interfacing value. Line in and out terminations are by way of two pairs of leads emerging from the back connected to 'phono' plugs. There is no DIN interfacing. The fascia, though, is equipped with three ¼in jack sockets for headphones and left and right mics. Mic input is activated by insertion of the appropriate plug, which also disconnects the corresponding line input.

The flat, smooth satin aluminium finish typifies the Yamaha look, and softly illuminated meter movements are located behind a window which is flush with the fascia, along with a three-digit mechanical tape counter. An indicator between the two movements lights in the record mode, and the press-switch for mains is also illuminated.

The deck is metal-enclosed of black-crackle finish and the dimensions approximate 435 × 132 × 267 mm (W × H × D). Selling price lies in the region of £125.

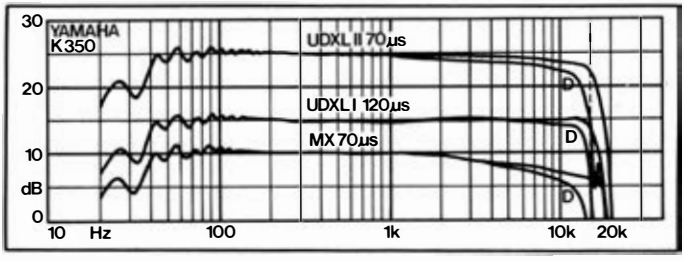




merit C value 2

The verdict

Although this deck is without the frills of some of its competitors it was considered mechanically sound and well made. It could do with one or two improvements to enhance its 'competitiveness', and I found it necessary to limit the merit score for the slow metering and LF response undulations. Metal rank would have been higher had it not been for the drooping upper-treble. Taking all things into account, therefore, my award is C for merit and 2 for value.



The findings

The deck was tried with a large number of tapes and although Class I formulations of my (0) bias reference (such as Maxell UDXLI) gave the flattest and best HF response, the metal position of the sample favoured tapes veering more towards (+1), which applied to a smaller extent to Class II formulations. The pen-chart shows that while UDXLI gave a sensibly 'flat' response up to 15kHz, MX metal was on the droop from about 2kHz upwards, a trend which was also reflected in a smaller way by UDXLII (I think it appropriate here to mention that during the writing of this book I noticed that some of the very recent C90 Maxell MX issues seemed to have a lower coercivity than the earlier C46 samples that I have tested.)

The pen-chart further shows quite substantial LF undulations with all tapes, and the least Dolby integrity with UDXLII and MX. One of the best Class II responses was achieved with Maxell XLIIS.

Signal/noise ratios were very good, replay (electronics) being as high as 59·3dB, with the usual 70µs and Dolby improvements, and overall with Master II (70µs) plus Dolby 67dB.

LF performance with UDXLI was 0·55% distortion and 6dB MOL, with MX it was 1% distortion and 5·5dB MOL. Mid-spectrum 120µs eq was fairly accurately adjusted, and the distortion on the source monitoring signal was well below overall tape distortion. Metal erased to below noise floor.

W&F was commendably low and speed error small, a C90 fast rewound in 96 seconds. Headphone yield was adequate for the medium/high impedance test 'phones, and no trouble was experienced with mic interfacing, overload threshold being around 42dB.

The VU movements under-read 20ms bursts by as much as 10dB, and because there are no peak-responding LEDs particular care would need to be taken when recording high quality, wide dynamic range music to avoid peak compression (eg avoid over enthusiastic peak meter readings!). Squarewave performance was a shade better than 'average', especially with Dolby active (lower trace).

During audition the deck evoked encouraging comment, especially with metal tape. Critical comment included 'smooth' rendering but slightly weak and 'spongy' bass, low noise with barely a trace of background mains ripple and 'clean' upper treble. Some mid-spectrum colouration was detected using high quality music and the 'openness' of the reproduction improved by lowering the recording level. Stereo imagery was good and low-level ambience fair.

BAR GRAPHS

These have been deliberately designed with wide scales to emphasise small differences and, regardless of parameter, the longer the bars the better the results. They do, of course, refer only to the solitary samples submitted for test. To evaluate things like sample spreads, quality control, internal adjustment accuracy and so forth one would need to measure a fair number of decks of the same model to secure averages and standard deviations. It is important to remember that these things are applicable to any review in any magazine, book or consumer's guide, for I know of no 'popular' review text of this nature which takes account of the measurements of a sufficient number of items of exactly the same model to yield this sort of 'spread' information, especially in multi group reviews. I could, of course, be wrong over this and would welcome any feedback if I am!

In some cases the deck reviews stress that the samples tested are the first UK models. In these cases it is possible that the machines have not been totally optimised in adjustment or that on the bulk production will take into account technical factors that will improve the results.

Moveover, where there could possibly have been a sub-standard factor in the sample this is also mentioned in the text.

The bar graphs cover five primary parameters of signal/noise ratio overall, replay signal/noise ratio, 400Hz distortion, 400Hz MOL and W&F.

S/N Ratio Overall

This was measured with Scotch Master II tape with the eq at 70μs, Class II bias and Dolby (or other noise reduction) engaged. The OdB point corresponds to Dolby level and before the measurements were made the tape was passed through the deck in record mode (line input) with the input terminated and with the recording level control half advanced. The overall S/N ratio thus includes recording amplifier noise (but this is generally only small at line input with the level control half advanced and well below intrinsic tape noise), bias noise and deck erase noise. If the distortion on the bias/erase signal in highish in even-harmonic content (and this can happen more in metal mode where the bias level needs to be substantially increased) then the overall ratio can suffer slightly, which is one reason why a given deck may show a relatively high replay ratio (without tape — see below) yet, relatively, fail to show such a correspondingly high overall ratio. I should also mention that care was taken to ensure that the results were not being influenced by stray hum fields which might otherwise reduce the ratio by a dB or more.

Replay S/N Ratio

Again 0dB corresponds to Dolby level, but this time instead of using a tape a cassette without tape was used (after first ensuring that the C-zero was equipped with a good hum shield and the measurement made with 120μs eq with the deck in replay mode. The results indicate the noise in the replay channel and that emanating from the head loaded to the input of the replay amplifier.

With Dolby noise reduction and 70μs eq engaged one could expect a maximum improvement in CCIR/ARM-weighted noise floor amounting to some 14dB over the values given in the bar graph, depending on the mains ripple content.

To take an example, the Aiwa L450 shows a replay ratio of 59dB with 120μs eq and without Dolby. With Dolby and 70μs eq active the ratio could go up to about 73dB. For the same deck the overall ratio with Dolby and 70μs eq using Scotch Master II is 66dB. The difference between the 73dB and the 66dB is a function of the tape noise proper, in this example the electronics noise barely having any effect at all on the overall S/N ratio (also please refer to the opening articles in this book dealing with S/N ratios)

It should be noted that CCIR/ARM weighting was used for the measurement of both the overall and replay S/N ratios.

DISTORTION 400Hz

This bar graph shows the total harmonic distortion recorded at 400Hz and Dolby level. Where possible a common metal tape formulation was used for all the decks (see information under Distortion in the opening parts of this book). Deviations from this practice are given in the reviews and, of course, with non-metal decks an oxide formulation had to be used. The measurements were made with Dolby on which, in essence, reduced the noise power bandwidth of the measurement so that a greater definition was given to the actual distortion harmonics. Without Dolby the distortion, from particularly low distortion decks, would have been higher owing to the addition of more noise.

The general trend is that decks with a low distortion yield provide a higher LF MOL (see below) than those with a higher distortion with a specified tape formulation. However, there are times where this does not follow, such as when the MOL is limited by inadequate replay headroom or sometimes when the head in recording mode (or recording head in a three-head deck) goes into saturation in metal mode as the drive is advanced beyond Dolby level. In these cases the Dolby level distortion may be acceptably low yet the MOL not as high as would thereby be expected.

MOL 400Hz

This was again measured with Dolby (or other noise reduction) active so as to take into account the high-level distortion in the noise reduction circuits themselves. OdB corresponds to Dolby level so the bar graph shows the outputs as so many dB above Dolby level for 3% total harmonic distortion. The tape used for these tests was the same as that used for the distortion tests.

WOW AND FLUTTER

These measurements were made in replay mode using the excellent TDK AC-341 W&F test tape. It seemed to my mind only logical to adopt this technique than attempting unpredictable overall W&F measurements which would be influenced so much by the production cassettes themselves! Intrinsic W&F of the TDK test tape is low, thereby exposing essentially the deck shortfalls in this respect.

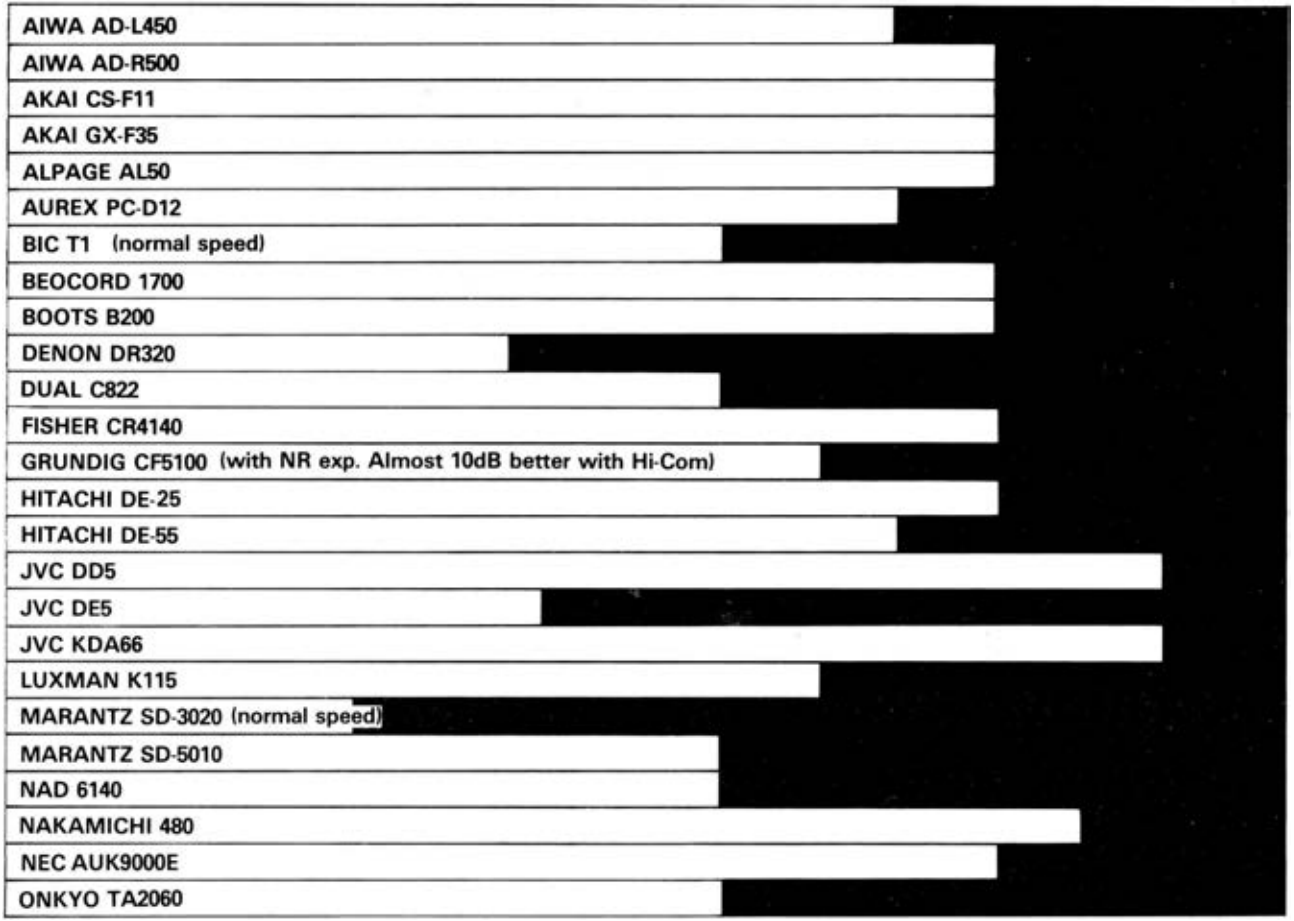
The measurements were weighted according to DIN peak and taken at the same 'average' swing of the test instrument for all decks. Under ideal conditions the overall W&F would be approximately 41% higher (eg, 1.4 times) than the replay only W&F; but in practice the results are often even higher than this, depending on the W&F contributed by the cassette containing the tape for the recording and then replay of the *circa* 3kHz test signal. This is one reason why in some reviews you may see considerably higher W&F percentages than shown by the bar graph.

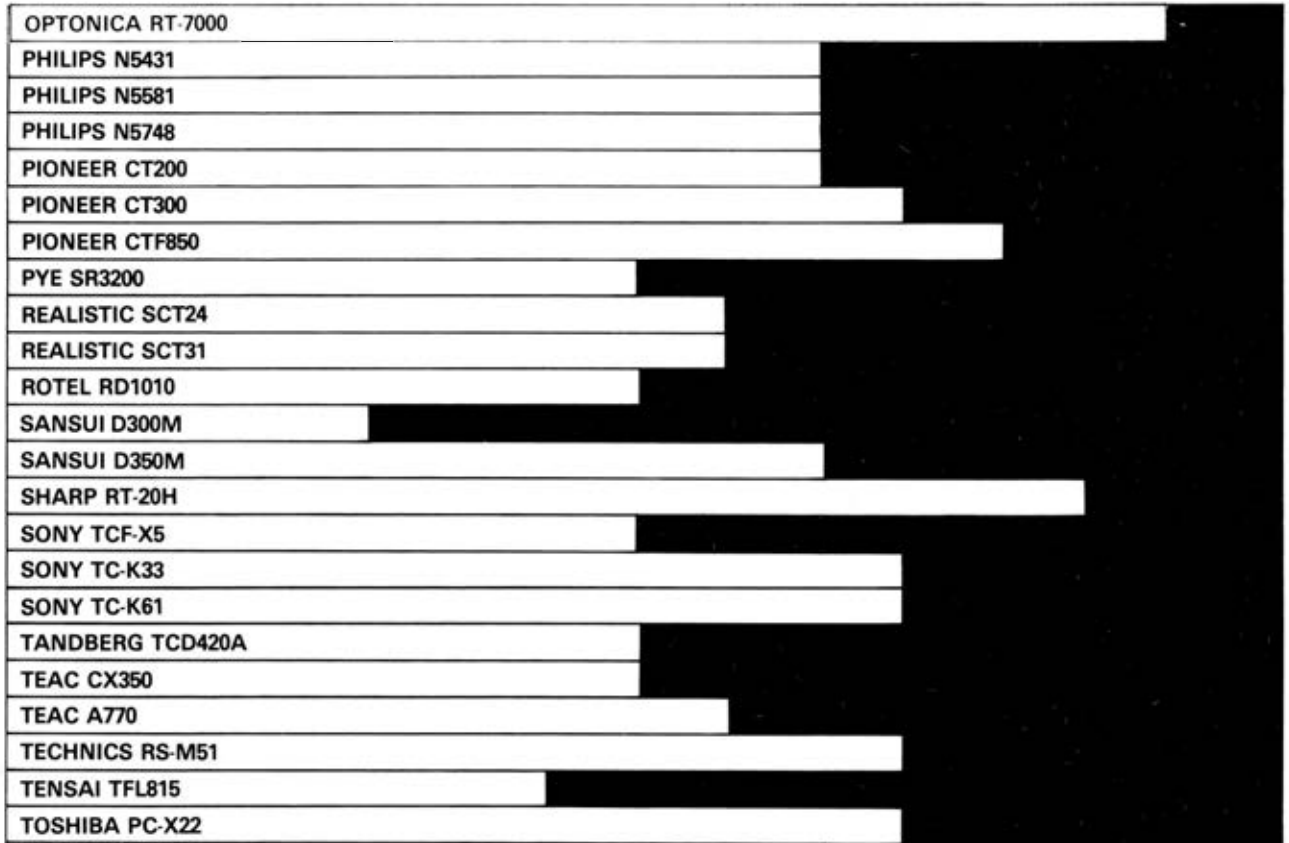
The type of weighting used will also affect the results. In some manufacturers specifications the weighted root-mean-sqare (WRMS) is given which gives a better result than the DIN weighting!

OTHER PARAMETERS

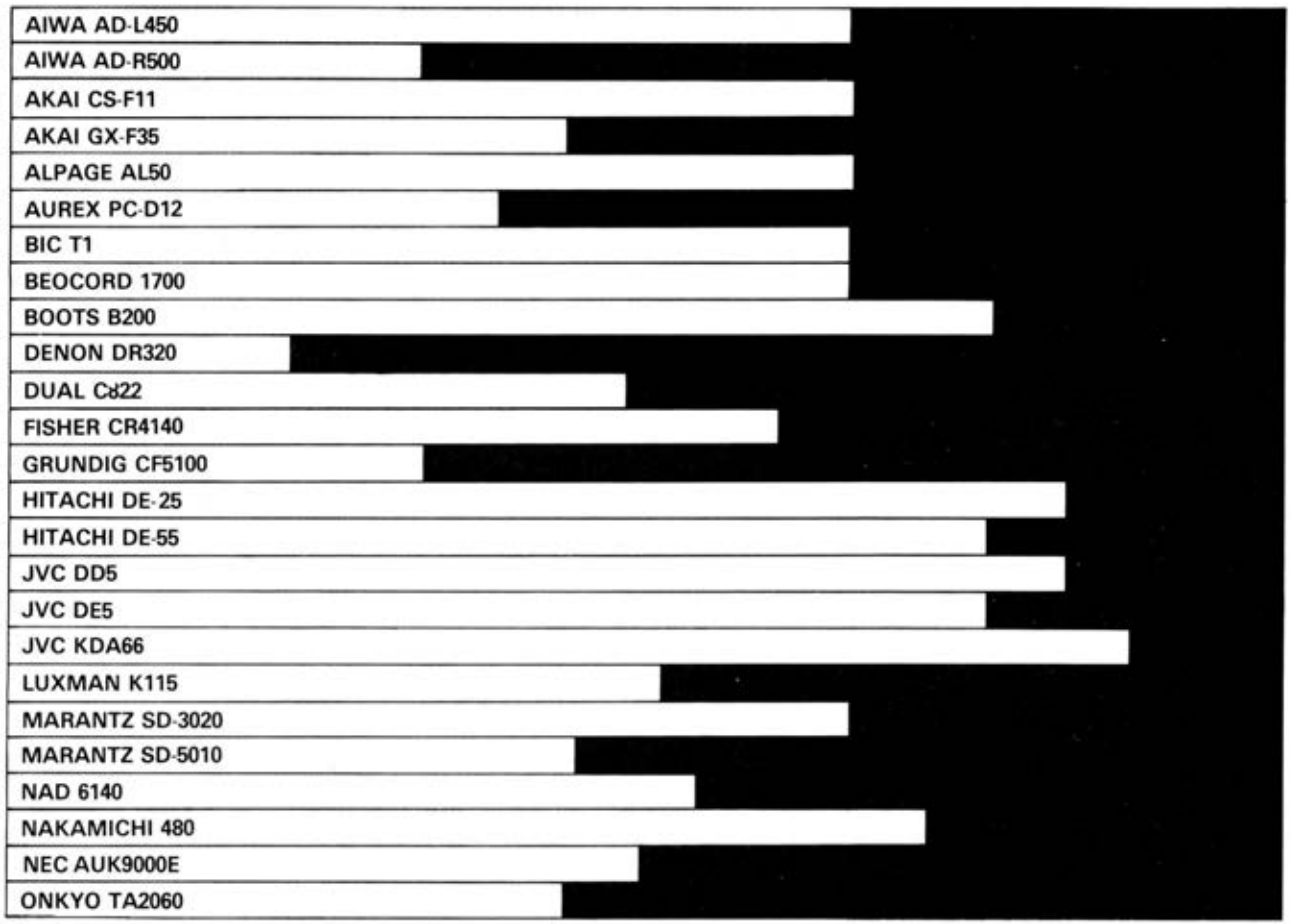
You will find the results of some of the hosts of other measurements to which we subjected each deck in the reviews. As I have already mentioned in the earlier parts of this book the HF performance is greatly influenced by the performance of the tape itself in this respect, so I could see little point in tabulating the 3rd-order intermodulation products resulting from twin-tone HF signals. A good clue to HF performance is given by the squarewaves, by the small-flux frequency responses and by the auditioning impressions. It is not always appreciated that the HF compression performance of a deck/tape partnership is very much related to the small-flux frequency response.

SIGNAL-TO-NOISE RATIO

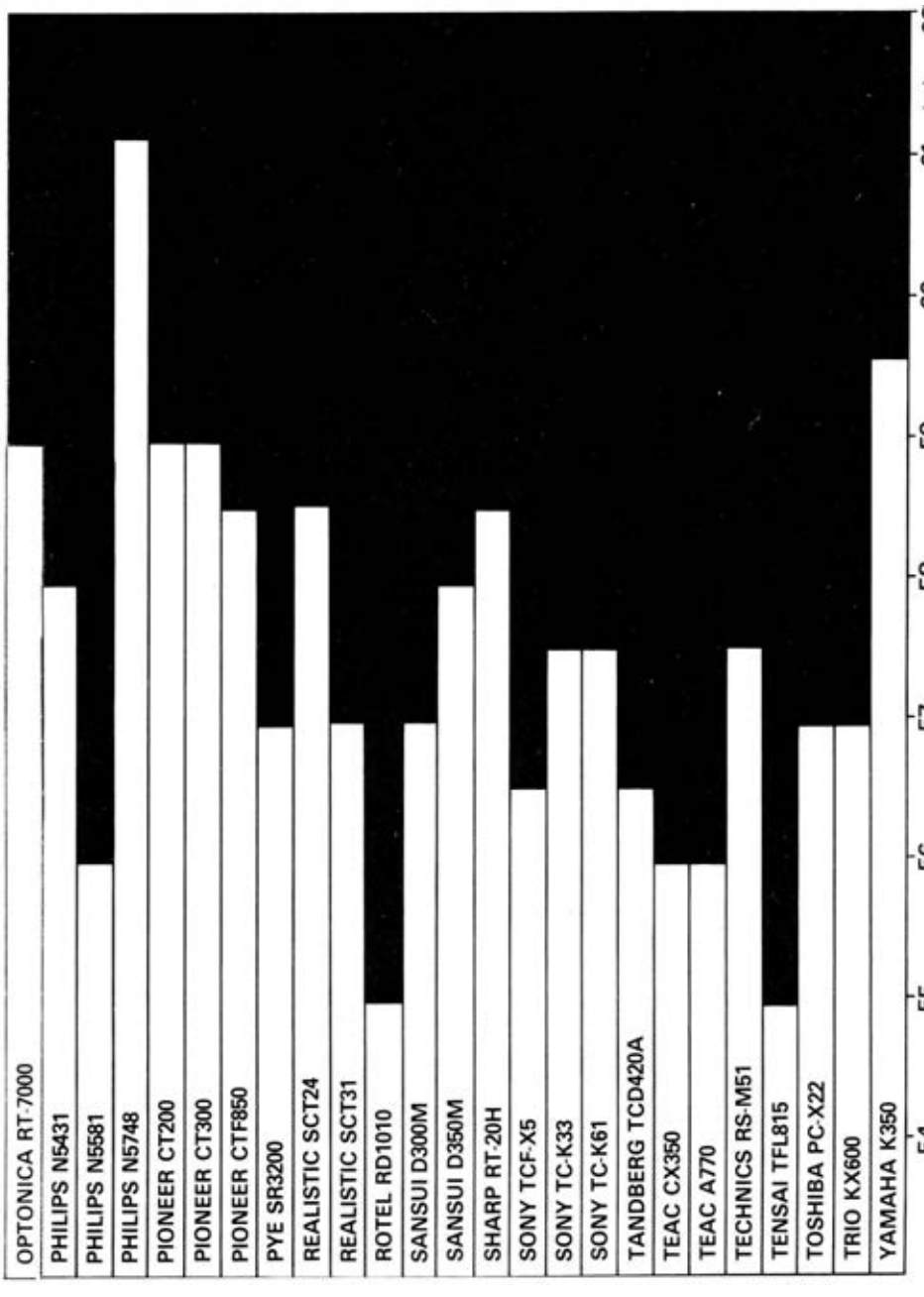




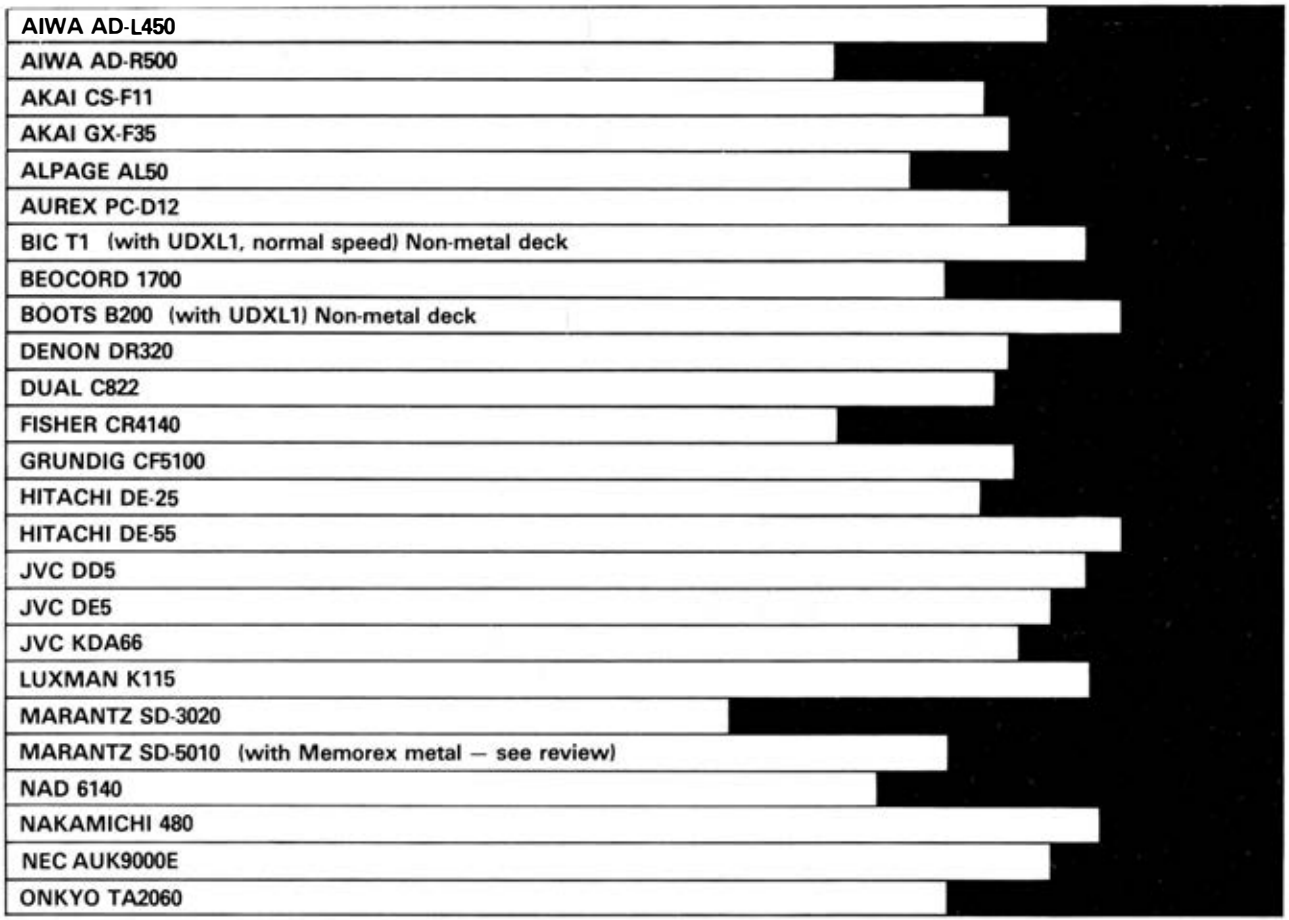
DOLBY ON, 70μs EQ
SCOTCH MASTER II

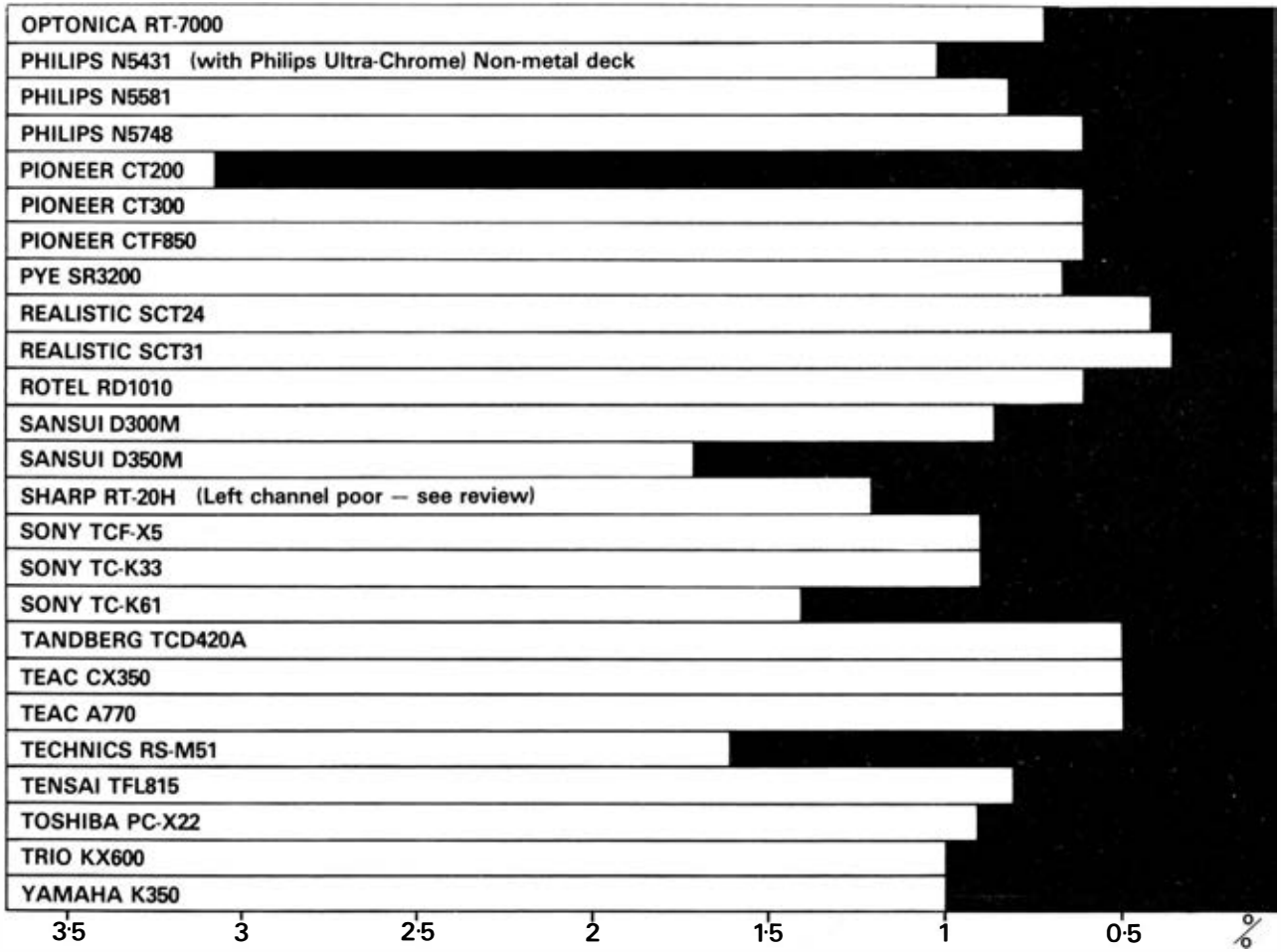

AIWA AD-L450
AIWA AD-R500
AKAI CS-F11
AKAI GX-F35
ALPAGE AL50
AUREX PC-D12
BIC T1
BEOCORD 1700
BOOTS B200
DENON DR320
DUAL C822
FISHER CR4140
GRUNDIG CF5100
HITACHI DE-25
HITACHI DE-55
JVC DD5
JVC DE5
JVC KDA66
LUXMAN K115
MARANTZ SD-3020
MARANTZ SD-5010
NAD 6140
NAKAMICHI 480
NEC AUK9000E
ONKYO TA2060

DOLBY OFF 120 µs EQ



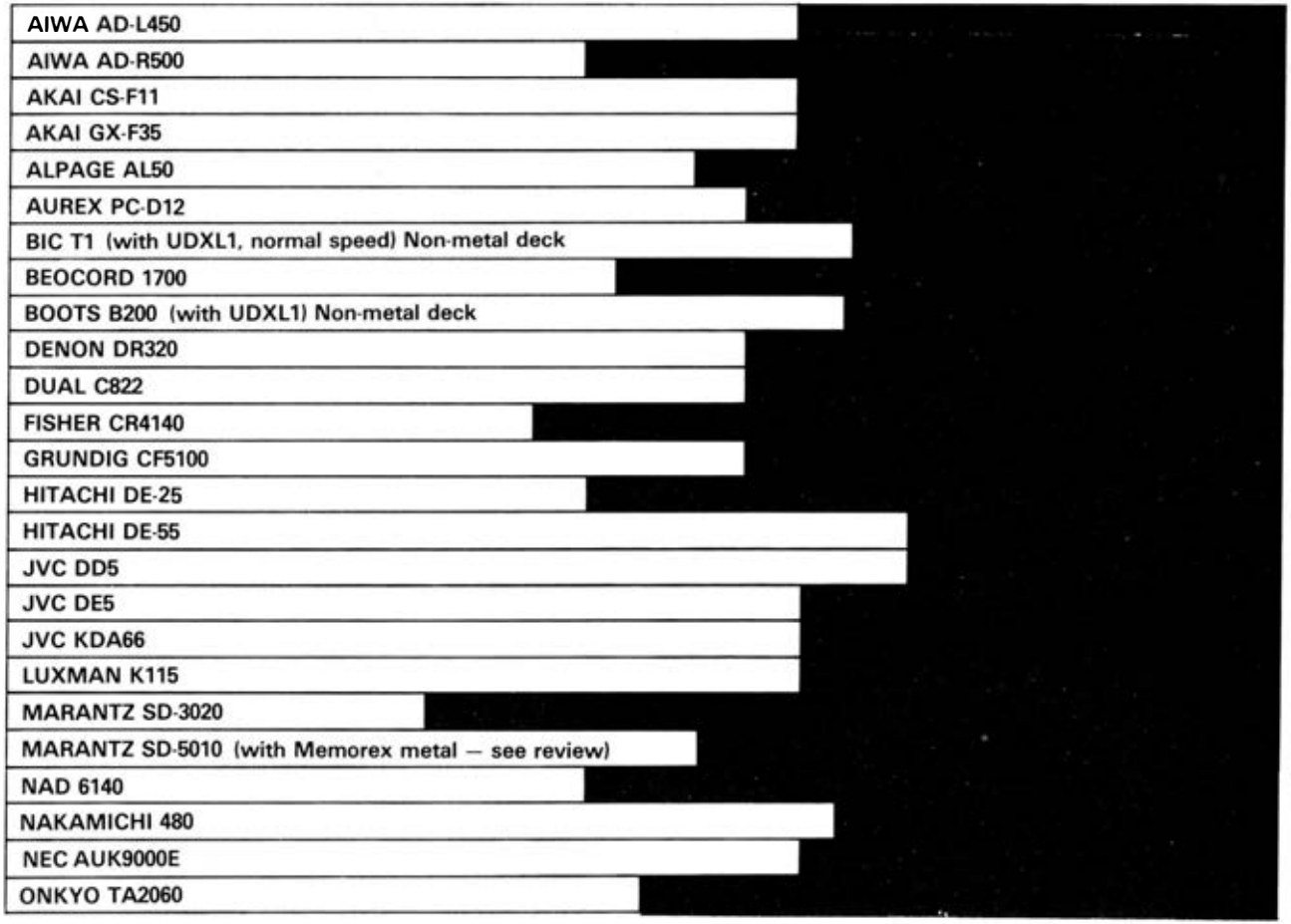
DISTORTION ON METAL



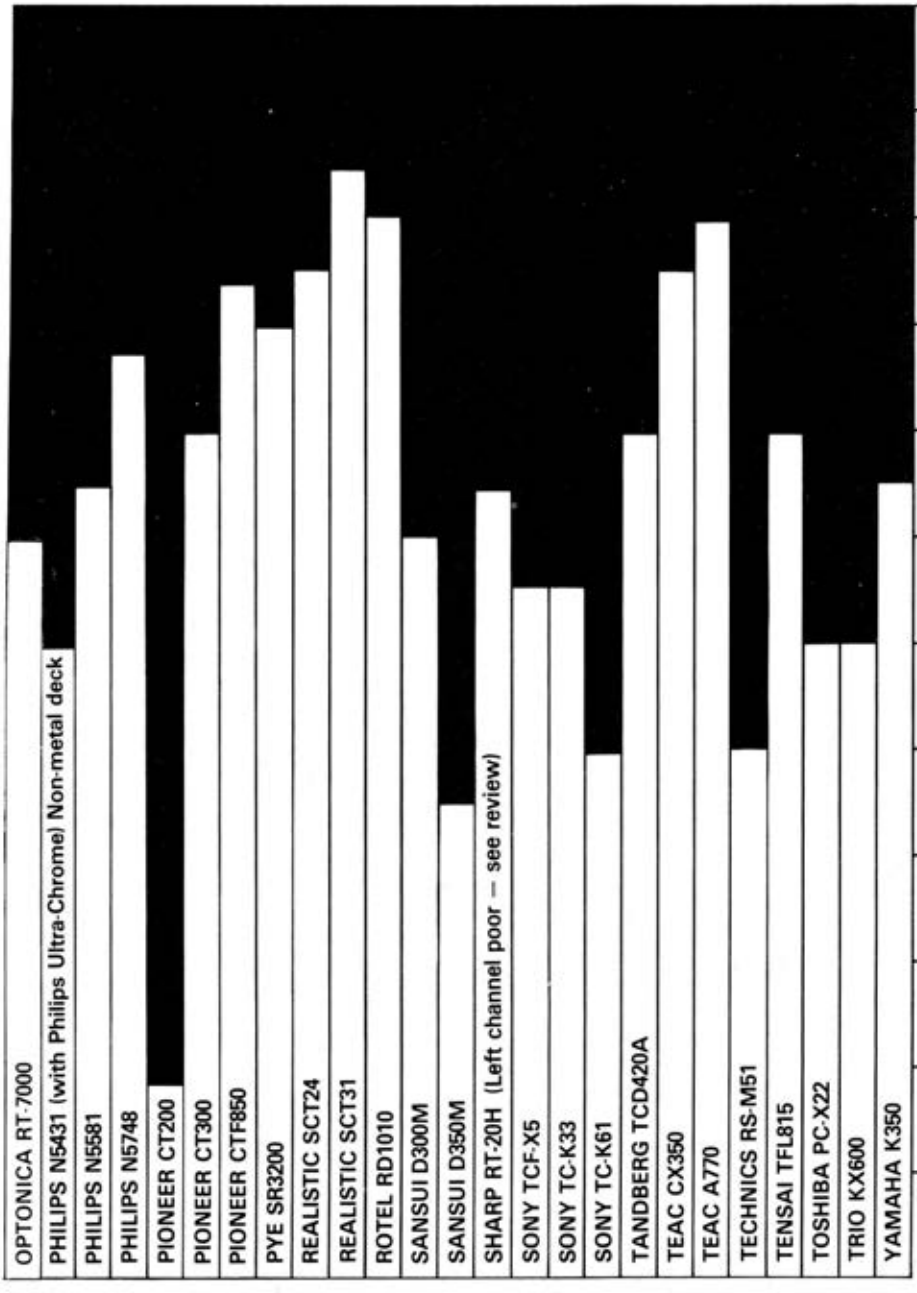


DOLBY ON, 400 Hz

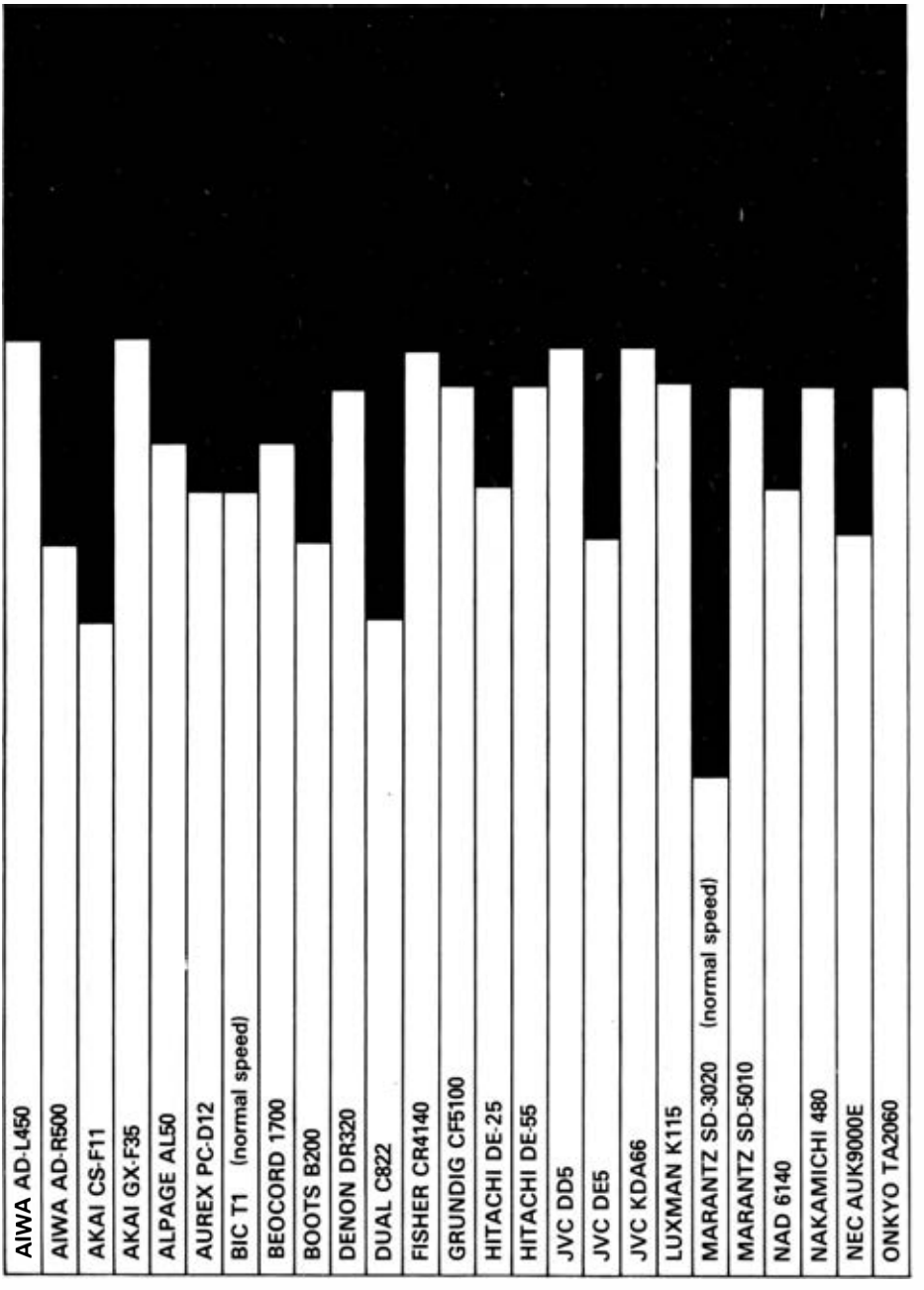
MAXIMUM OUTPUT LEVEL

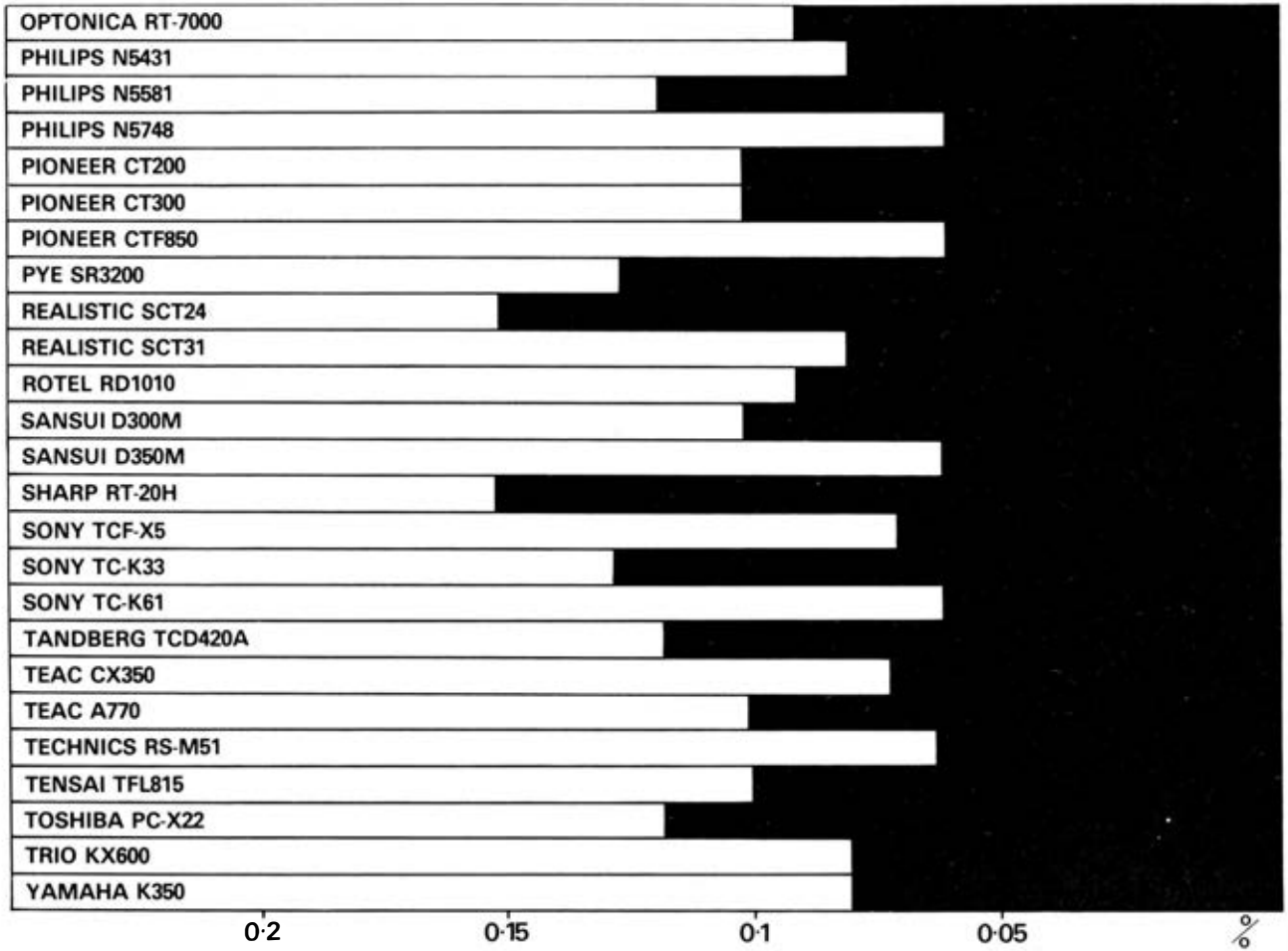


DOLBY ON, 400 Hz



WOW & FLUTTER


AIWA AD-L450
AIWA AD-R500
AKAI CS-F11
AKAI GX-F35
ALPAGE AL50
AUREX PC-D12
BIC T1 (normal speed)
BEOCORD 1700
BOOTS B200
DENON DR320
DUAL C822
FISHER CR4140
GRUNDIG CF5100
HITACHI DE-25
HITACHI DE-55
JVC DD5
JVC DE5
JVC KDA66
LUXMAN K115
MARANTZ SD-3020 (normal speed)
MARANTZ SD-5010
NAD 6140
NAKAMICHI 480
NEC AUK9000E
ONKYO TA2060


OPTONICA RT-7000
PHILIPS N5431
PHILIPS N5581
PHILIPS N5748
PIONEER CT200
PIONEER CT300
PIONEER CTF850
PYE SR3200
REALISTIC SCT24
REALISTIC SCT31
ROTEL RD1010
SANSUI D300M
SANSUI D350M
SHARP RT-20H
SONY TCF-X5
SONY TC-K33
SONY TC-K61
TANDBERG TCD420A
TEAC CX350
TEAC A770
TECHNICS RS-M51
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TRIO KX600
YAMAHA K350
0·2
0·15
0·1
0·05
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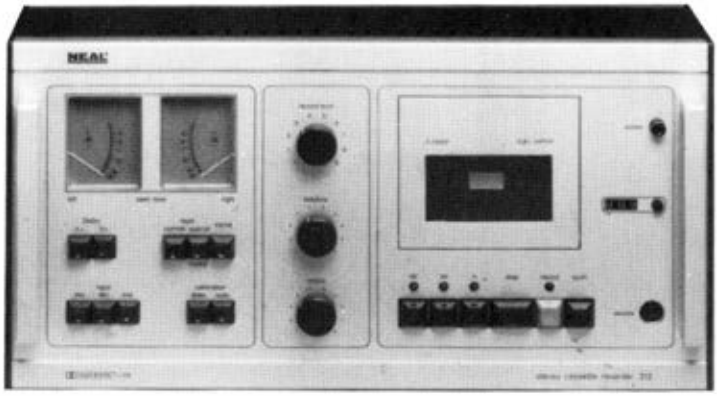

With their model 302, NEAL-FERROGRAPH launched the first British designed and manufactured cassette recorder. Over the last few years, NEAL-FERROGRAPH have been quietly building for themselves an enviable reputation for reliability in industrial applications. The new model, the 312HX, which is manufactured entirely in their factory in South Shields, incorporates the same basic deck as the original 302, but with improved logic controls. The most important feature is the incorporation of Dolby B + HX. Dolby headroom extension, abbreviated to HX actually increases the amount of information that can be recorded on to the tape, rather than further compress it as all other recent invention in this field seek to do.

The other main feature of this model is that, by careful design, NEAL-FERROGRAPH, have produced a cassette recorder that is expected to last in excess of ten years, in normal use. A full range of spares will be kept available for this period. The owner of a NEAL-FERROGRAPH product is thus free from worry about the planned obsolescence that hangs as a cloud over so many other products on the market today.

LONDON SOUND is the UK NATIONAL RETAIL DISTRIBUTOR and MIKE SOLOMONS will be available at the number below for all queries. Please write or telephone for leaflets on the NEAL 302 and 312HX, and for the mame of your nearest authorised dealer.

LONDON SOUND
266 Field End Road, Eastcote, Ruislip, Middx.
HA4 9NH
Tel: 01-868 9222

The following Table lists the primary features of the decks which can thus be used as a quick comparative reference. However, I must stress that although extreme care was taken in compiling this it is not meant to be exhaustive and readers are advised to refer to the reviews themselves to obtain more detail.

In some cases it has not been possible to isolate each and every feature as more than a single function (or slightly different function) may be provided by a particular key or switch. Moreover, there are machines which are shown as not possessing an external-timer switch yet which can be set for replay or record by external mains switching. Although in some cases an indication has not been given for Class III (FeCr) tape, it may still be possible to use this class of tape, though some experimentation with the bias and eq switch positions may be required for the best subjective results.

In some cases 'peak meters' may not be true peak-responding , but the effective speed of response is given in the text. A 'peak' meter movement is usually calibrated in dB while an 'average-responding' movement is calibrated in VU. Even LED or fluorescent metering may not be true peak-responsive. The degree of under-reading on fast signal bursts is given in the reviews. With respect to 'cue and review', some machines provide for fast-spooling in either direction while the play mode is engaged sometimes with and sometimes without an audible indication from the speakers.

Peak hold may be automatic or switchable — see the reviews for details. Remote control refers in essence to a rear socket to which can be connected an optional extra remote control unit. This unit is not normally supplied with the machine.

'Logic transport control' refers in general to transport systems which rely on a solenoid or motor (torque) rather than on mechanical linkages from press-keys. It should also be noted that although a deck may not be equipped with an MPX filter switch, such filtering is usually introduced when Dolby is selected. In some cases the filtering is active regardless of whether Dolby is switched on or not.

Some of the automatic functions on decks so equipped may be more elaborate than the Table is able to indicate. Please refer to the reviews for more detail.

The coding used in the Table follows.

A: Adjustable by replay level control
B: Remote control ***socket.***
C: Normal and double speed deck.
D: Autowind.
E: Repeat.
F: Auto-switching from cassette cutout 'coding'.
G: Single knob with balance control.
H: Auto-reverse.
I: Low and normal bias switching for Class I tapes.
J: Switchable to peak or VU response.
K: Special slider with balance control.
L: Press-buttons.
M: Plug(s) on rear emanating flying lead(s).
N: High-Com noise reduction.
O: Quasi-'logic'.
P: Timer operation possible.
Q: Single knob with balance knob.
R: Called Computer 'memory' by Hitachi.
S: Auto peak hold.
T: SANRS and/or ANRS.
U: Dolby with Dolby HX.
V: With dimmer switch.
W: Also pre-fade.
X: Stop and play.
Y: With LED.
Z: DNL (Philips type of noise reduction)

CASSETTE DECK FEATURES

	AIWA AD-L450	AIWA AD-R500	AKAI CS-F11	AKAI GX-F35	ALPAGE AL-50	AUREX PC-D12	BIC T1	BEOCORD 1700	BOOTS B200	DENON DR320	DUAL C822	FISHER CR-4140	GRUNDIG CF-5100	HITATCHI D-E25	HITACHI D-E55	JVC DD-5	JVC DE-5	JVC KD-A66	LUXMAN K115	MARANTZ SD 3020	MARANTZ SD5010
Fe tape switching	●	F	●	●	●	●	●	F	●	●	●	●	●	●	●	●	●	●	●	●	●
Cr tape switching	●	F	●	●	●	●	●	F	●	●	●	●	●	●	●	●	●	●	●	●	●
FeCr tape switching						●			●	●	●		●		●			●		●	●
Metal tape switching	●	●	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●	●
Fine bias control	●			I					●										●		●
Opt bias setting indication																					
Separate bias/eq switches							●		●											●	
Dolby level setting																					
VU meters without peak LEDs											●										
VU meters with peak LEDs		●								●		●						●			
Peak meters							●									●					
LED or fluorescent metering	●		●	J	●	●		●	J				●	●	●	S	●		●	●	●
Peak hold																					
Mechanical transport keys							●	●	●		●		L							●	
Logic transport control	●	●	●		●	●				●		●		Q	●	●	●	●	●		●
Cue/review				●					●	●							●			●	
Ganged recording level knobs	●	G	●	●		●	●		●	●			●		Q	●	●	●	●		●
Sep. L&R rec. level knobs					●						●	●		●						●	
Recording level sliders								K													
Replay level control				●					●	●			●		●	●		●			
Mic controls for mixing																					
Headphone level control				A						A		A				A		A	A		
Post fade control																					
Remote control		B	B	B	B	B				B					B	B		B			
Phono sockets	●	●	●	●	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●
DIN socket line	●	●	●	●	●			●			●	●	M	●	●	●			●		
DIN socket mic								●					●								
DIN socket headphones																					
Jack sockets for mic	●	●	●	●	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●
Jack socket for phones	●	●	●	●	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●
Dolby noise reduction	●	●	●	●	●	●	●	●	●	●	●	●		●	●				●	●	●
Other noise reduction													N			T	T	T			
Three-head deck										●											
Off-tape monitoring										●											
Source monitoring	●	●	●	●	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●
Tape counter	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Memory rewind				●		●		●							R				●		
Tape advance																					
Auto-repeat/rewind	DE	H		●	●	●									●	●		●			
Auto programme locate				●													●			●	
Auto bias/eq/level setting																		●			
External timer switch	●	●	●	●		●				●		●		P	●	●	●	●			●
Rec. time remaining indication																					
Record mute				●	●	●			●	●		●		●	●	●	●		●		
MPX filter switch			●	●	●	●					●								●		
Others							C													C	

NAD 6140
NAKAMICHI 480
NEC AUK-9000E
ONKYO TA-2060
OPTONICA RT7000
PHILIPS N5431
PHILIPS N5581
PHILIPS N5748
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NAD: NAD Sales, Unit 3, Colonial Way, Watford, Herts. Tel: 0293 39954.
NAKAMICHI: Natural Sound Systems, 10 Byron Road, Wealdstone, Harrow, Middlesex HA3 7TL. Tel: 01-863 8622.
NEC: Cap Ten Industries, 54 Jermyn Street, London, SW1
ONKYO: Audiotrend Ltd, Bridle Path, Watford, Herts. WD2 4BZ. Tel: Watford 33011.
OPTONICA: see Sharp.
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TRIO: Harman (UK) Ltd. see Teac.
YAMAHA: Natural Sound Systems. See Nakamichi.

While the Class I, II and III samples tested were all C90s, only one or two of the Class IV samples were of that length. At the time of writing some manufacturers had not got round to issuing C90 metals. I thus had to make do with C60s and, in some cases, with lesser length tapes. As I have already noted tape thickness can influence the magnetic properties, a factor which should be borne in mind when comparing the metal results.

Owing to the generally higher remanence of top-flight 120μs oxides these tapes make a good choice when the programme material contains an abundance of low and middle bass energy and where you are not bothered so much about extreme treble. Some 70μs oxides have a generally lower remanence and are thus down at bass and middle treble with respect to the very good 120μs oxides. On the other hand, their higher coercivity provides more output at upper-treble, so your choice may be in this area when the music you record is rich in strong high-frequency tones.

When your deck is capable of fully exploiting the metal tapes, then the Class IV formulations give you the best both at LF and HF, without the MF shortfall exhibited by some 70μs oxides, especially ferrochromes. Most latter-day decks from Japan require tapes with my bias reference of (0), so you can look for these, remembering the things I have already brought out in the introduction to this section. Even though your metal deck may not reap the full LF potential of metal tapes, you will, nevertheless, obtain a greater HF headroom by using this class of tape in comparison with any of the oxides; but metal is more expensive.

Metal sometimes is to be intrinsically noisier than Class II and III formulations, so what you gain on the swings you may lose on the roundabouts. The dynamic range is the difference between the maximum output at any frequency and the noise floor. Remember that Dolby cuts the integrated noise floor by 10dB, which is a lot; but also remember that if you use Dolby with a tape that differs from the Dolby setting up sensitivity you will suffer frequency response aberration. Once you have done with experimenting with different tapes you could have your deck 'optimised' on bias and Dolby for the very best results with that tape, and then stick with it; but find a reputable dealer with knowledgeable technicians to do this for you.

Remember, too, what I have said about recording levels. Even a relatively inexpensive tape, when correctly biased, can give very acceptable results when not over-recorded. This applies particularly when used with machines equipped with auto-setting bias. When the tape has been so 'optimised' it is really surprising how well even a modest tape can measure and audition in the same deck. Inexpensive 120μs oxides often require a bias level below my (0) reference for the best overall balance, as you will have seen. Just because these tapes need a lower bias this is no single reason why they should be dismissed out of hand. If you can bias your deck down to their requirements you will often be surprised by the results.

On the other hand, there are cheap tapes which should be avoided. I have examined some 120μs oxides in C90 format that you can see through quite clearly, meaning that there is hardly any coating thickness on them. These perform remarkably badly at LF and MF, though may be better at HF. Conversely, I have examined similar oxides with fair LF and MF but with abysmal HF, even at very low bias.

Cheap tapes, too, tend to shed oxide and 'short' the heads prematurely, calling for frequent head cleaning.

I am not keen on Class III cassettes personally, but there are people who seem to like them. The average music that you are likely to record contains quite a lot of 'energy' around the middle frequencies which, sadly, corresponds to the shortfall area of the ferrochromes!

In conclusion I should mention that none of the cassettes included in the reviews are of the type criticised in the last three paragraphs.

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	C60	UFO I	96p	
	C90	UFO I	£1.28	
	C120	UFO I	£1.64	
	C60	UFO I-S	£1.04	
	C90	UFO I-S	£1.44	
	C120	UFO I-S	£1.76	
	C60	UCD	£1.25	
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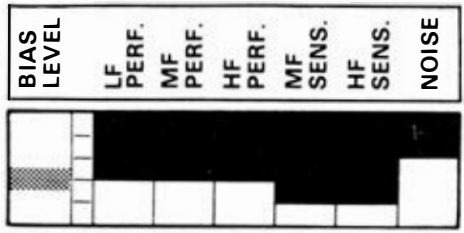
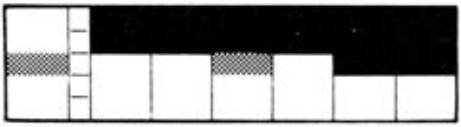


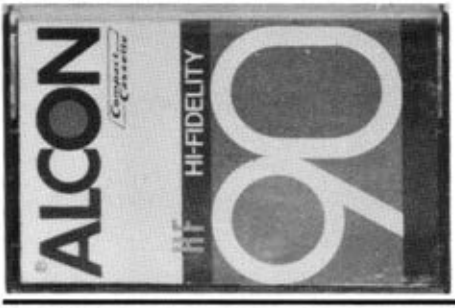
AGFA FERROCOLOUR

A fairly inexpensive tape for non-exacting applications. Suitable for inexpensive decks. It is not a hi-fi tape and would tend towards over-biasing by the expensive category of deck from Japan, leading to poor HF and droopy treble. Cassette runs fairly quietly and I have found no undue W&F problems. In common with other Agfa cassettes, an extra 6 minutes on top of the total normal playing time are provided: eg. C90 + 6. Coating variable.

AGFA SUPER FERRO DYNAMIC I

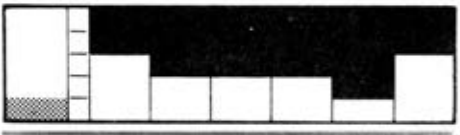
Although a 'high bias' 12(μ oxide, 'optimum' bias was found to be as small shade below my reference. It would, however, be suitable for the average hi-fi deck and fairly high dynamic range music. Coating stability of samples was slightly variable but not detectable under audition. Also with + 6 minutes playing time.





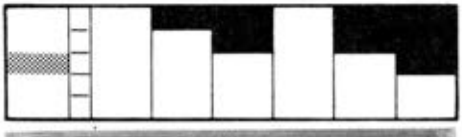
ALCON HF

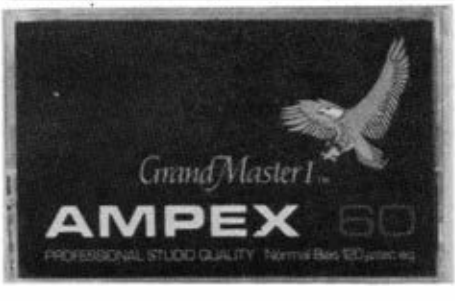
This 120μs oxide is one of a range going under the Alcon label. Others include LN (Class I) and CR (Class II). The tapes have been included in my Tape Check articles over the years, the HF being the best of the Class I formulations, which has a bias demand close to the (0) reference. At this bias the frequency response is fairly flat, though showing a little upper-middle lift, and the LF performance reasonable. HF performance is good up to about 12kHz, thereafter it falling quickly. Noise floor was a little below 120μs average, and the coating on one sample was poor, causing fluctuating output and noise. Cassettes were a little noisy.



AMPEX 371 PLUS

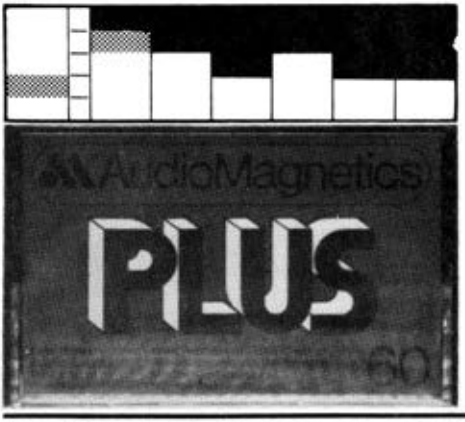
This is a low-bias 120μs oxide which would be suitable essentially for low-fi applications. Unless the deck has user-adjustable bias, treble performance would be poor; but fair results are possible at 'optimum' bias. Cassettes run quietly and no jamming has been experienced.





AMPEX GRAND MASTER I

This is a relatively new formulation. I have found that the LF output is high and the DL distortion corresponding low. Bias requirement was very slightly less than the reference, but the tape would be very close to 'optimum' bias in the majority of recent decks. Although suitable for wide dynamic range music, particularly at LF and MF, over zealous meter peaks should be avoided when recording music of excessive HF energy content.



AUDIO MAGNETICS PLUS

Significant variations between samples have been noted, the best tested showing surprisingly high values, especially at LF, for the price. Although a 'low bias' 120μs oxide, it would not be excessively over-biased by a contemporary deck, but would give best at HF in the earlier species or in machines equipped with user-adjustable bias. Not particularly recommended for music of high HF energy, but fair for organ music and that containing strong bass, provided a weather eye is kept on recording level. Coating of samples not too brilliant and a few drop-outs noted.

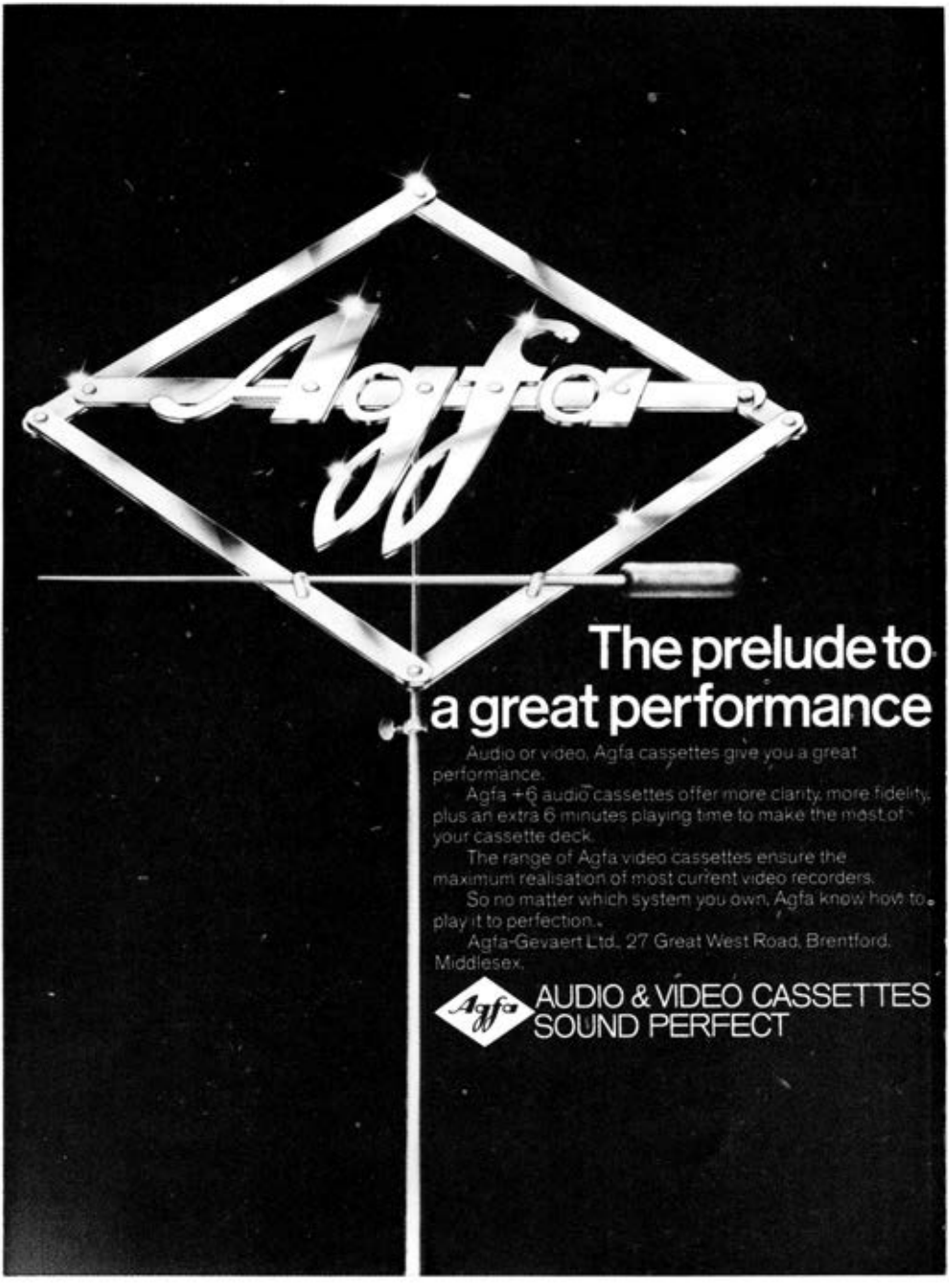
AUDIO MAGNETICS XHEI

Recent samples of this tape have indicated that its bias requirement was a trifle above my reference. This would mean in the 'average' deck a slight lift of upper-treble, which would not be bad. However, wide variations between samples have been noted, the results based on 'averages'. I also noted coating variations, but the latest samples are better in this respect than earlier ones. I regard it on 'average' as a very fair hi-fi tape, though the best of the samples would rank even higher than this. Cassettes are rather noisy and some jamming has been experienced.

BASF LH

Although a relatively inexpensive 120μs oxide, bias requirement is a shade above that of similar quality formulations. In the average Japanese deck it would tend to show a droopy treble, but would suit European decks better and possibly show treble-emphasis in cheap decks. Spooling was a little on the noisy side, but not bad. Coating of samples tested was fair.

Note: Ferro Super LH is a lowish-bias version focused on the DIN bias requirement, thereby being even more suitable for European decks so biased. Parameters slightly exceed those of LH (Mid-Bias).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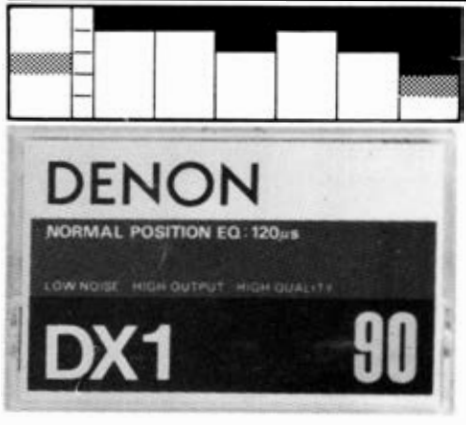
BASF FERRO SUPER LHI

This new-formulation tape comes in a green pack. Samples that I have tested have all exhibited encouraging results. If anything, bias requirement is a shade above my reference, so it is a tape which would be suitable for Japanese decks, showing a mild treble lift which would not be bad. It is a tape suitable for hi-fi applications and high dynamic range music. Spooling was quiet and coating good.

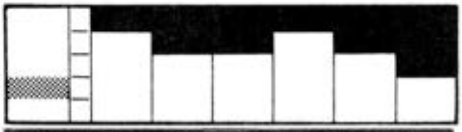
CONTEK UHE

This is possibly the best 120μs oxide under this label. Bias requirement was a little below my reference, so the tape would be more suitable for European decks rather than high-biased Oriental machines. It would be suitable for medium quality recordings, failing to reach the heights of some competing brands. Spooling was a little noisy and coating variable.



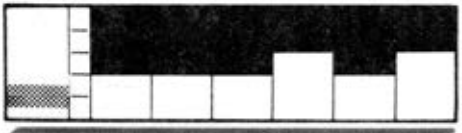
DENON DX I

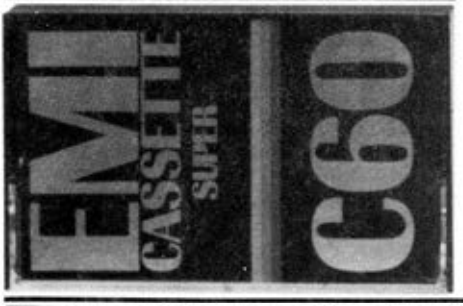
I found that my samples biased to my reference tape, but on some Japanese decks there may be slightly falling treble output. I was pleased with the LF performance and MF sensitivity, but noise floor was a little higher than some similar categories. Cassette was not unduly noisy and coating quite steady. A tape suitable for quality recording below the absolute in fi.



DENON DX3

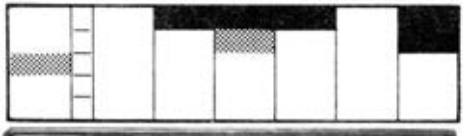
From the biasing point of view this tape does not follow-on from the DX1. In fact, my samples worked better on a trifle lower bias than the DX1, its sensitivity at 'optimum' bias was better, though. LF performance was about the same, and it is difficult to see how this tape scores over DX1. In fact, working in Japanese decks the DX1 could prove marginally the better tape all round. In general, though, I would give it about the same subjective ranking as DX1. For a 120μs oxide I thought the print-through ratio was rather towards the low side of average, though barely likely to be irritating.





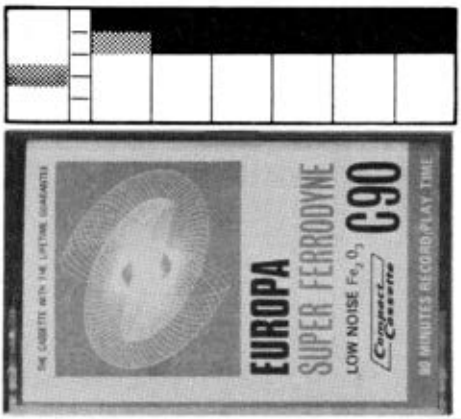
EMI SUPER

This is a 'low' (normal) bias 120μs oxide which is geared more towards the DIN biasing slot. In Japanese decks it shows, on average, a droop of about 2.5dB at 8kHz. Performance is similar to other tapes in this bias region, but at LF my samples did not shine very brightly. More suitable for European decks and, possibly, inexpensive music centres. It is not a true hi-fi tape. Cassettes of samples were noisy and tended to squeak a little! Coating appeared to be quite fair.



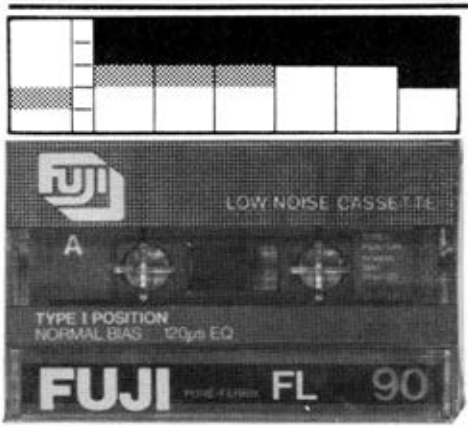
EMI XT

This is a far better tape than the Super, and with its relatively high MOLs and low noise floor has good dynamic range potential, so would be suitable for hi-fi recordings. Bias requirement is geared towards the Japanese deck, meaning that treble lift could be expected in European decks and 'kitchen' machines. Coatings of samples were fair/good and cassettes reasonably quiet.



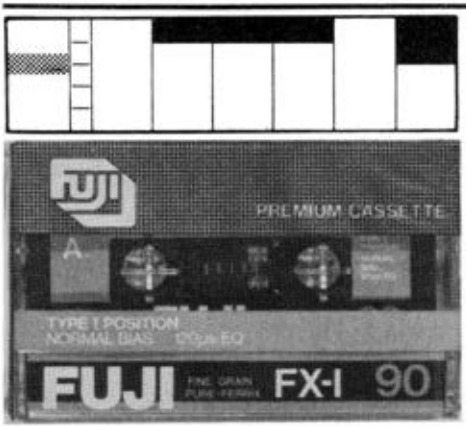
EUROPA SUPER FERRODYNE

Despite the brand name, this tape favours the Japanese deck more than the European species. Bias requirement was close to my reference. It has some fair points as you will see, but the cassettes were on the noisy side and coating variable, especially at HF. Suitable for 'average' music requirements, but not the ultimate in hi-fi.



FUJI FL

While below the Japanese bias requirement, the slot for this tape appears to be a little above DIN. Thus in European decks a little treble lift may be experienced, while in Japanese ones the treble may issue a shade weak. Parameters measured were on all-round fair/good, and coating and cassette performance good. The tape could be used for quality music recording provided an eye is kept on recording levels.
Latest samples appear to be formulated for a slightly higher bias.



FUJI FX-1

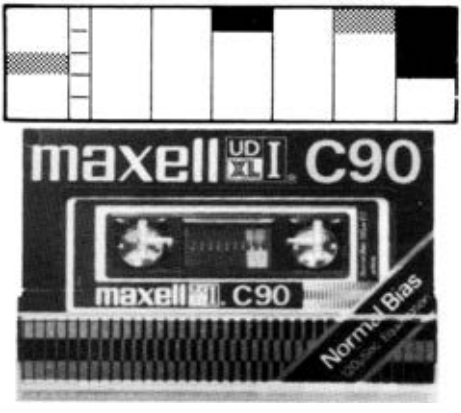
My recent samples were formulated closer to the Japanese bias reference and they were found to be a little above my reference. Cassettes operated smoothly and quietly, and coating was good and steady at HF. A tape which I can recommend for serious recording at 120μs eq, having good dynamic range potential.

MAXELL UD

Bias requirement to my datums was found not too different from UL, but the sensitivity and other parameters were better, the tape being more expensive than UL. Coating and cassette mechanics slightly better than UL also. A good all-round tape at a reasonable price, being suitable for hi-fi results.

MAXELL UL

My latest samples revealed a bias demand close to the Japanese reference, though at lower sensitivity than the UD (see above). However, the tape will also function in lower-biased decks with treble emphasis. I place it as a good lower-level tape which would suit a good few decks. Coating was very good and cassette quiet.



MAXELL UDXLI

I class this as one of the best performing 12 μ oxides (pity the noise cannot be lowered a little). It is capable of hi-fi results in decks biased to the Japanese reference and then can yield astonishingly high LF and MF MOLs. Tape coating is very good and the cassettes are very quiet.

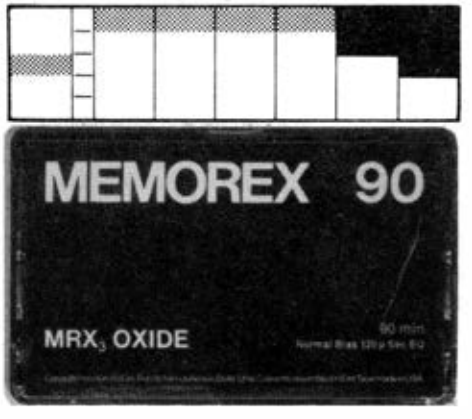
MAXELL XLIS

This is a new formulation which can be regarded as a 'super' version of UDXLI. I found that the 'optimum' bias was a little higher than my reference or UDXLI, but on a number of decks set to my reference bias I have measured astonishingly high LF MOLs. Small-flux frequency response shows a little upper-treble lift which can be tamed, if possible, by increasing bias, but at the expense of HF performance. Cassette mechanics and coating similar to UDXLI, but noise floor slightly higher. An excellent formulation.

MEMOREX MRXI

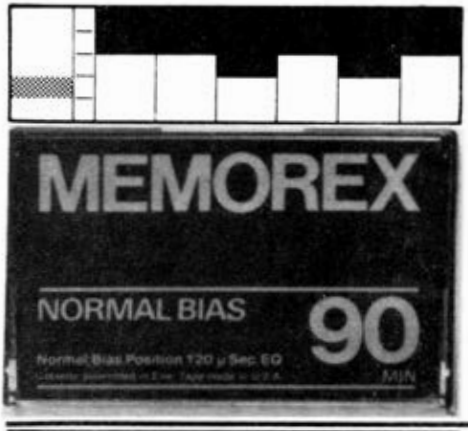
This formulation is destined to replace the old MRX_3. The pre-production samples which were sent to me for testing were on par with competing Class I's at LF but had the advantage of better HF performance at the (0) bias reference. However, for the best LF the bias can be advanced to virtually (+1) without the upper-treble drooping. The results were certainly better than those of the old MRX_3

Noise floor (CCIR/ARM) was almost 1dB lower than some equivalents. Coating of the samples was good and cassette mechanics quiet. There was not sufficient time to evaluate print-through. A tape with promise which looks like a keen competitor for equivalent brews.



MEMOREX MRX3

This tape was found to bias quite close to my reference, but it can be worked at a lower bias without the LF distortion rising too much, which gives improved HF performance and less of a roll-off at the top of the small-flux frequency response In Japanese-biased machines, therefore, the HF performance could be below the tape's optimum. It can, nevertheless, be regarded as a hi-fi formulation. Coating was a trifle variable at HF on some samples, but cassette was quiet and mechanics good.



MEMOREX NORMAL BIAS

Although having a coercivity of 350 oersted, this tape is formulated to suit a wide range of decks, including the basic portables and mid-fi machines. At the (0) bias reference it exhibited a little upper-treble roll-off, so would be more suitable for decks biased slightly below the reference. Working at the (-1) test bias the LF performance was quite sanitary and improved dramatically with increased bias but at the expense of HF. Noise was a shade lower than some of the higher remanence formulations. Coating was a little variable but cassette mechanics satisfactory. A useful tape if you can turn down your Class I bias or for a low-bias deck.

OSAWA LH

At my reference bias this tape suffered HF droop and relatively poor HF performance, so for balanced response would be more suitable for low-biased decks and those with user-adjustable bias. It would probably be all right in some European decks, but was not judged to be a particularly brilliant tape for hi-fi music recording. Cassettes fast-spooled quietly and the coating at HF of my samples fluctuated a little.

Note: I was also sent LN samples, but these required even less bias than LH for a balanced response.

PHILIPS FERRO

This is a relatively low-bias formulation which is more suitable with European-biased decks than Japanese-biased ones. It would also be suitable for low price machines and would respond quite fairly in decks with adjustable Fe bias. It cannot be classified as a hi-fi tape, though. Cassette was a little noisy but the coating fair/good.

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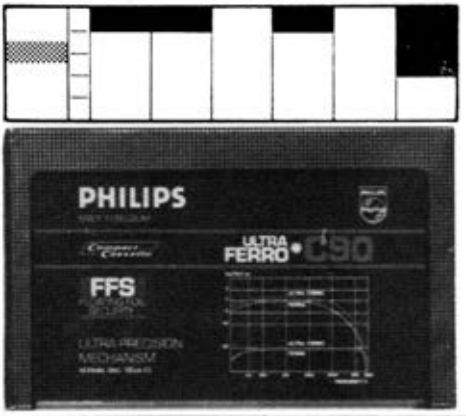
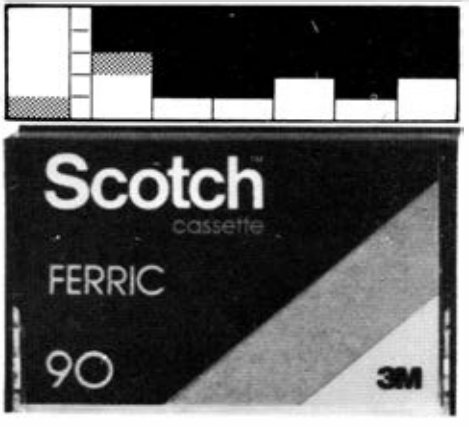


PHILIPS ULTRA FERRO

Comparative tests of my samples of this formulation with the earlier Superferro I, which it is destined to replace, indicated that there were differences. Ultra Ferro was found to accommodate a greater bias than Superferro I for a given HF performance, but the latter was slightly better at LF. There was not much difference between the two on noise, but the Ultra Ferro was judged to be better balanced and more compatible with decks of Japanese biasing than my samples of Superferro I. There has also been a change in mechanics, the cassettes now having larger windows and quieter fast spooling with more accurate azimuth. Coating was good

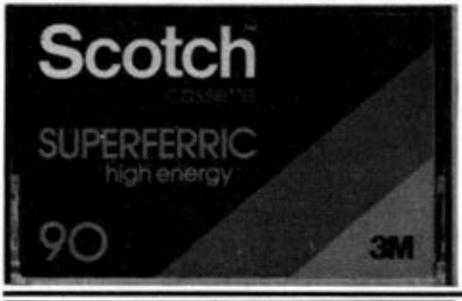
PYRAL SUPERFERRITE

Although the biasing of this tape was a little below my reference it does seem to suit a fairly wide range of decks. The tape, though, has failed to keep abreast of the prevailing competition, but price might be a factor of judgement, and it still has some good points. It does make good hi-fi recordings in a suitably-biased deck, but general availability has diminished. Cassettes run very quietly and mechanics are good, but coating can be a trifle variable at HF.



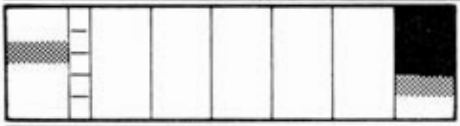
SCOTCH FERRIC

This is a curious tape which requires a very low bias for a viable HF performance. It is seriously over-biased in Japanese decks, yet still appears not to be correctly biased in European ones. It is suitable only for use in cheap machines where HF dynamic range is not important. It is not a hi-fi tape. The manufacturers state that this tape is suitable for low/medium priced portable recorders.



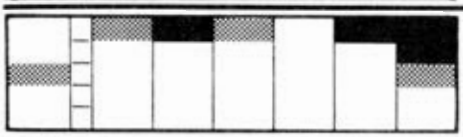
SCOTCH SUPERFERRIC

This is better than Ferric but requires a slightly lower than 'normal' Class I bias for the best HF performance. It runs at a higher bias than the Ferric, but still tends to suffer at HF in Japanese-biased decks. Coating is quite respectable, though, and cassette mechanics not found a problem. The manufacturers state that this tape is intended for better cassette recorders and music centres.



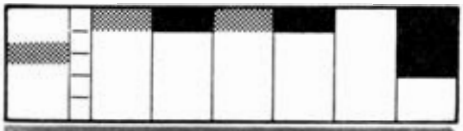
SCOTCH MASTER I

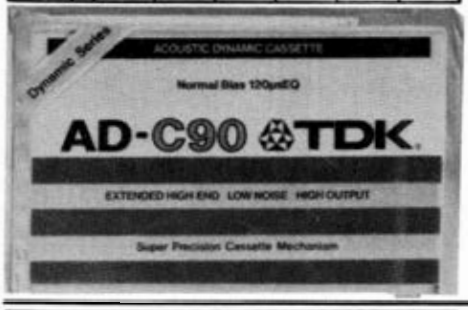
This is an entirely different category Scotch product and a good tape to boot. At my reference bias it came out well, though optimum bias was found a slight shade above this reference. In the average Japanese deck a very mild treble lift may be noted, but this is not bad and could be desirable. Coating was a little variable at HF, but cassettes run very quietly. It is a good value tape.



SONY AHF

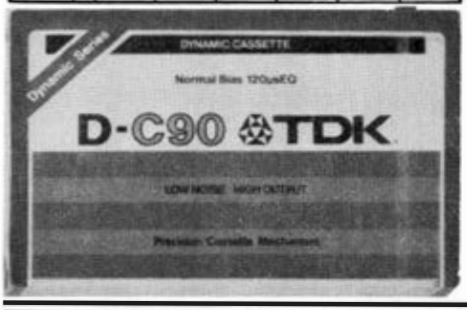
This is one of Sony's 'new' collection and always seems to yield above average overall performance in its class. Bias was close to my reference, making it suitable for most Japanese decks (note: BHF and CHF are other, lower-bias formulations in the series), but sometimes at the expense of extreme upper-treble. Cassettes run very quietly and coating was good.





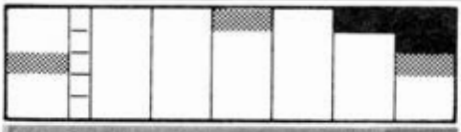
TDK AD

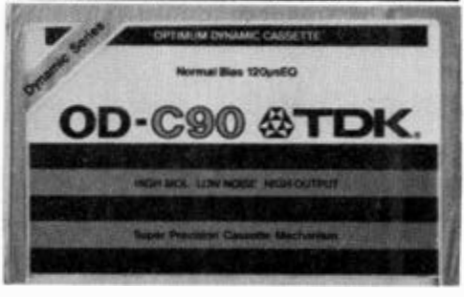
My samples required slightly more bias than my reference to tame an upper-treble rise, which might well be exhibited with the tape in Japanese decks. In some cases this could be desirable, especially when heads are wearing! Coating and cassette mechanics similar to D.



TDK D

This fairly low price 120 μs oxide has a generally good performance in its class, but variations have been noted between batches. The latest issues are proclaimed as originating from Japan yet assembled in Korea. LF performance is not much affected by bias over a reasonable range. Sensitivity is lower than high-bias species, but coating was good and cassette mechanics very good, running with very little noise.





TDK OD

This is a more expensive tape than AD and works closer to the Japanese reference bias. It is also a more sensitive tape at MF than AD and has a slightly lower noise floor, on average. It can certainly be classified as a hi-fi tape and competes well with other up-market formulations, being close in price to Maxell UDXLI. Cassette mechanics good, as also coating.

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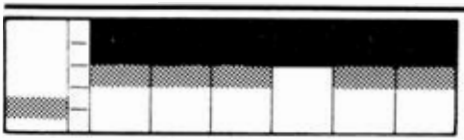
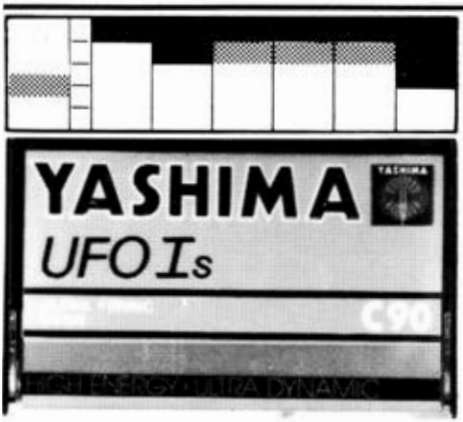
WINFIELD ALPHA SUPER

I regard this formulation the best of the named Woolworths tapes at the time of writing. Bias requirement was close to my reference (but a lower performance version is available going under Alpha Plus), and at this bias the LF performance was very acceptable of the purchased samples tested, with particularly healthy HF end. Cassettes were a trifle noisy in fast spooling and 'buzzed' a bit, but coating held steady on the samples.



YASHIMA UFO+

Introduced as a low-bias tape, this relatively inexpensive '2(μ xide would be overbiased by the average Japanese deck, leading to the HF shortfall. With correct bias overall performance quite fair, though. Suitable for budget decks and portables. Coating of samples variable at HF. Slight fast-spooling cassette noise noted.



YASHIMA UFOIS

Biasing requirement of this formulation was closer to my reference and would thus suit Japanese decks better; also decks with user-adjustable or auto-setting bias. Good LF results obtained at the test bias, the formulation indicating dynamic range promise for the recording of music which would not fully justify more expensive 12' μs oxides or the higher cost of Class II, III or IV formulations. Coating a little variable, especially at HF, and fast-spooling on the noisy side; but no W&F problems noted. (Note: the suffix 'S' indicates that the tape is of the higher-bias formulation. New formula UFO1S has slightly higher bias demand and better overall performance.

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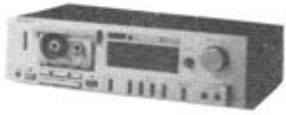
B3  TEAC A770	C2  TRIO KX-600	D3  SANSUI D350M

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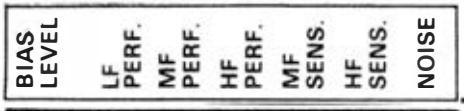
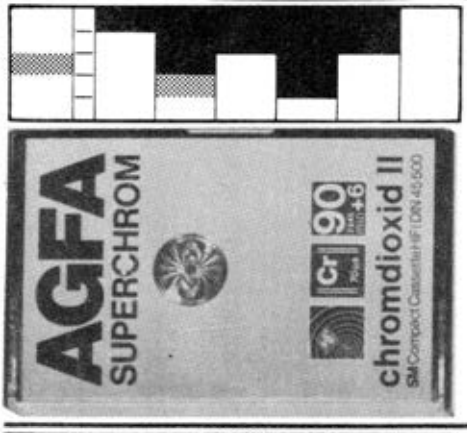
70μs EQUALISATION CHROME BIAS

An advantage of 70μs tapes over 120μs ones is the reduction in replay noise resulting from the effectively lesser treble boost of the lower time-constant. Another is the possibly improved HF resulting from the higher coercivity, but the higher bias and 70μs time-constant tend to play against this. Cassettes in this class were tested with 70μs eq and appropriate bias, the datum 'reference' being established by a 70μs tape.

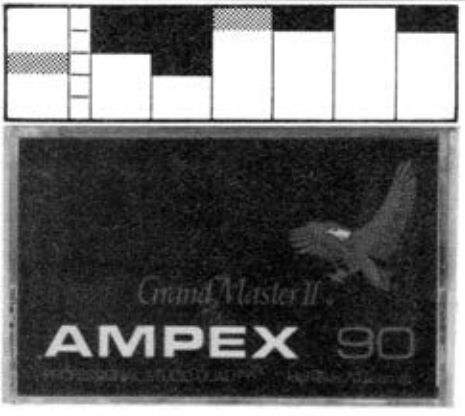




AGFA SUPERCHROM

This tape could not be biased accurately. At the reference bias the LF was well up with respect to MF and lower HF, while if the bias was turned down the LF collapsed quickly. Tests were thus made at the reference bias, results being very good LF but poorer MF, these also showing on the small-flux frequency response. Cassette was a shade noisy but coating reasonable.

Note: there is also an Agfa Stereochrom but of lesser overall performance.



AMPEX GRAND MASTER II

Bias requirement was close to my reference but at this setting the LF output was down a bit. An increase in bias improved matters but took the edge off the treble. MF MOL was below that of good 120μs oxides, but MF sensitivity suffered less and noise floor was low. Coating was good but cassette a little noisy. Could be a useful 70μs oxide in a suitable machine.

Note: there is also an Ampex 20:20+ Cr but of lesser overall performance.

AUDIO MAGNETICS XHEII

This tape was nicely biased at my reference and LF performance is not affected much over a moderate bias range, so would be suitable for a wide range of decks in Cr mode. Although dipping a bit, MF performance held up reasonably well. Coating was variable, especially at HF and transparent cassette a little noisy.

BASF CHROMDIOXID II

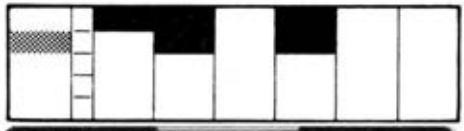
This new Mark II BASF Cr formulation was found to bias for balanced LF/HF sensitivities close to my (0) reference, its LF performance then being better than Chromdioxid Super. At the reference bias the LF MOL was about 2dB better and the distortion lower. Further LF improvement was possible by increasing the bias but at the expense of HF performance. Noise floor was very low but not too different from the 'Super' (Mark I) in the test deck. MF performance was better than some earlier Cr tapes and the HF end held up well. Coating seemed satisfactory and the cassette was not too noisy when fast spooling. I judge this as one of the better Cr formulations

BASF CHROMDIOXID SUPER

Another chrome which biased a little above (0) and would thus be suitable for many machines in Cr mode. LF performance was reasonable but MF MOL revealed quite a dip, though MF sensitivity not bad. Very good HF performance and sensitivity, along with low noise floor are attributes of the tape. Print-through ratio is poor, so cool storage is essential. Coating was good but cassette a little noisy when fast spooling.

Note: A less expensive non-super Cr also available but at reduced performance.

CLASS 2 TAPES

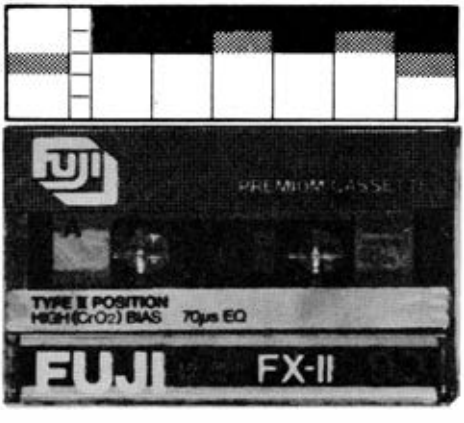


BASF CHROMDIOXID SUPER II

This is another new BASF formulation on which I could undertake preliminary tests. It has a similar noise floor to Chromdioxid II (without the 'super' suffix). At the test bias there was not a great deal of difference between the LF performances of the two, but it is possible to turn on a little more bias with the 'Super' which improves the LF yield without unduly impairing the HF performance. Used with the (0) bias reference the tape showed a rising treble. Sensitivities seemed slightly lower than the non-Super formulation and MF performance was not so good. The tape undoubtedly possesses a good dynamic range potential.

DENON DX7

For the best LF performance this brew required biasing close to my reference, but then the HF was down. For balanced LF/HF the LF performance was poor. Sensitivities were below those of some other Class II formulations, as also MF performance. Although noise was good, other Class II tapes can do better. Coating was not too good, especially at HF, but cassette noise was low. Not a strong competitor, but very recent samples showed improvement.



FUJI FX-II

This biased close to my reference but bias change had a fairly small effect on LF output However, on some decks the HF will show a slowly falling response with respect to LF. I was pleased with the coating of my samples and cassettes were quiet; but on an overall basis the results of early samples were not particularly outstanding, but recent ones were better with very acceptable HF MOL.

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CLASS 2 TAPES

MAXELL UDXL II

This biased exactly to my reference, but for improved LF performance a shade higher bias can be tolerated with a slight reduction in HF performance. Although this was one of the better Class II formulations, I would still recommend UDXLI when that slightly extra HF response might not be important. I can rarely get UDXLII to yield the same LF and MF performance as the latest UDXLI. Coatings were very good and cassettes low in mechanical noise with no W&F abberrations.

MAXELL XLIIS

This formulation appears to have a higher coercivity than UDXLII and is thus capable of a better upper-treble yield. Unfortunately, my tests have indicated that the tape is slightly under-biased in the average deck in Cr mode, which impairs the LF performance. Turning up the bias (if you can) gives more LF but at the expense of HF. The average deck in Cr mode will show a treble lift with the tape, but this need not be bad. Overall a commendable tape whose coating and cassette mechanics are comparable to UDXLII.

MEMOREX CHROMIUM DIOXIDE II

To retain a 'flat' treble bias demand was a shade below my reference, but at this the LF results were not very good. Tests were thus made at my reference. An attribute of the tape is its low noise floor, thereby in this way providing an increased dynamic range potential. Coating was a little 'fluttery' at HF, but cassette mechanics were good with low noise and W&F.

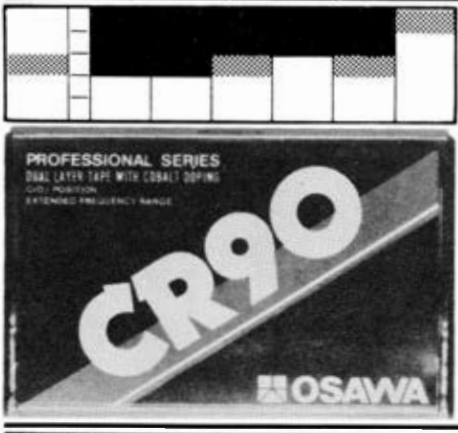
CLASS 2 TAPES

BIAS LEVEL | LF PERF. | MF PERF. | HF PERF. | MF SENS. | HF SENS. | NOISE

MEMOREX HIGH BIAS II

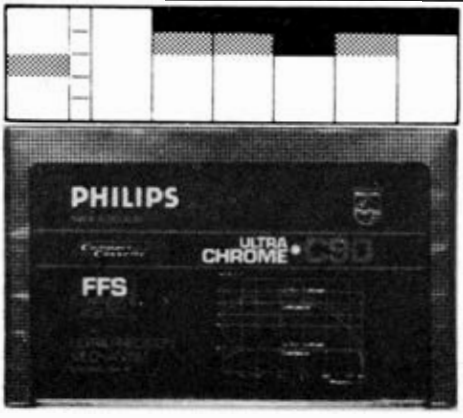
The original High Bias formulation has now been updated and its name changed to High Bias II to conform with the new range of Class I, II and IV tapes under the Memorex label. Like the earlier High Bias, it remains a high coercivity tape and consequently exhibits an outstanding HF performance in a suitable deck.

When biased by a deck to my (0) reference the upper-treble tends to rise. This can be combated, if required, by advancing the bias a little with the bonus of improved LF performance. However, there are people who prefer a degree of treble lift and improved HF headroom which, of course, results when the tape is used in a deck nominally biased to the Japanese 'standard'



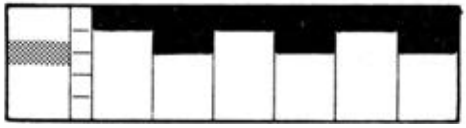
OSAWA CR

Despite its type name (CR), this would appear to be a cobalt-doped oxide which, in common with other Osawa cassette tapes (excluding the 120μs LN and MX metal), is of a dual-layer structure. Bias demand was close to my reference to retain a healthy upper-treble response. LF performance was not too good, either; but noise was very good. I cannot class it as an outstanding 70μs oxide.



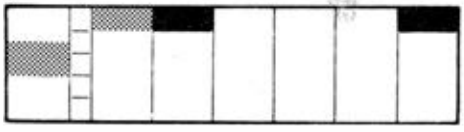
PHILIPS ULTRA CHROME

This is Philips' latest Class II tape, it being a Crolyn II formulation of particularly high remanence (1,900 Gauss). Using the reference bias, which is a good choice for the tape, the LF performance was most encouraging, though the noise floor was not quite as low as exhibited by some other Mark II *Cr* formulations. HF performance was tantamount to a coercivity of just below 500 *Oe,* coating was fair to quite good and cassette mechanics very good. There was insufficient time to glean data on print-through performance, but it looks promising from the manufacturer's spec, though not as good as metal and the Class I formulations.



TDK SA

For a balanced LF/HF sensitivity our samples of this tape called for a trifle in advance of my reference bias, but it can be expected to work happily in decks of average Cr bias. At the test bias the LF performance was good but, relative to top 120μs oxides, the MF MOL dip was still apparent. Noise floor was not particularly low for a 70μs species at this replay eq. Cassettes were fairly quiet but coating was a trifle 'fluffy' at HF.



TDK SAX

What 'S' has done for UDXLII, X' has done for SA. However, I found that my samples of SAX were less dependent on bias turn-up for respectable LF than UDXLIIS. At my reference bias the upper-treble lifted more than SA, resulting in a very good HF performance, which I think is perfectly acceptable. A little more bias will tame this, of course, and also further up LF performance. I liked the very good HF myself in 'average' Cr bias operation, and this extends to frequencies above 10/11kHz. A very encouraging formulation in my opinion which has been desirably balanced magnetically. Cassettes and coating similar to SA.

YASHIMA UCD

This Mark II Cr formulation has the attributes of a very low noise floor and the ability of holding on to its good LF performance even when the bias falls to the Cr 'low'. It was found to bias adequately at my reference and under this condition yielded very acceptable LF and HF, but with the usual 'Cr MOL dip' at MF. Coating was a little 'fluffy' at HF, but not detectable subjectively, and cassettes a little noisy on fast-spooling. A useful Class II formulation.

YASHIMA UFO II

This also biased OK at my reference and the LF performance is relatively independent of small bias change. It should thus suit most hi-fi decks from the bias aspect. LF MOL was below that of UDC but there was less relative MF dip, and HF quite reasonable. Noise floor was not as low as UDC. Coating a little variable at HF and cassettes a trifle noisy, but no undue W&F.

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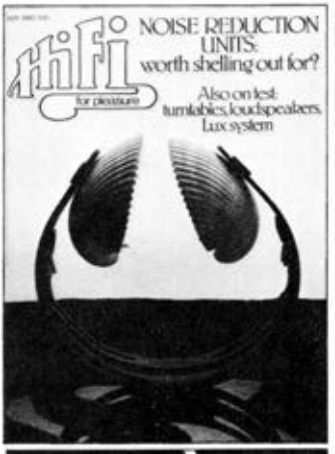

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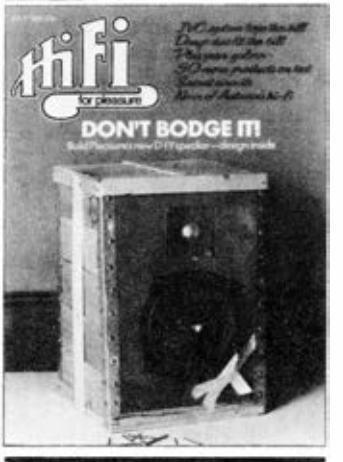

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CASSETTE TAPES

CLASS 3 FERRI-CHROME FORMULATIONS

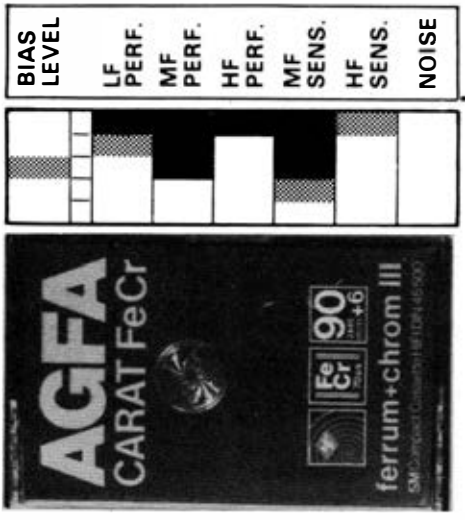
As readers of my Tape Check articles in Hi Fi for Pleasure will be aware, there are far fewer FeCr tapes available than Fe or Cr types. Also from these articles it will have been noticed that FeCr brews all tend to suffer to varying degrees from MF MOL shortfall and reduced MF sensitivity. I have already referred to this in the introduction to this Cassette Tape section.

FeCr brands are undoubtedly difficult to bias for a sane LF/MF/HF performance balance at 70μs eq, which is the time-constant provided by the majority of cassette decks when the tape switch lies in the FeCr position. Where the deck is equipped with separate bias and eq switches and/or with user-adjustable bias it is sometimes possible to achieve improved performance balance from the tapes by, for example, using 120μs eq (but then the noise advantage of 70μs is lost) and adjusting the bias for the most acceptable (to you!) reproduction.

Anyway, since there are people around who do favour FeCr formulations I felt it only right to include some of the important ones in this book. The tests were made with 70μs eq and with a reference bias which gave the best results from Sony FeCr, which is one of the better FeCr formulations, in my opinion.

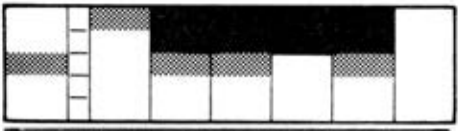
The bias indications in the cassette reviews show how the tapes were biased for the tests and hence, what I regard, as their 'optimum' bias demands relative to the reference tape, denoted (0).

However, while the deck reviews reveal suitable tapes in terms of their bias category for Fe, Cr and metal formulations, I have always avoided this mode of 'selection' for FeCr for the reasons already given. If you are prone to FeCr usage I would recommend some degree of 'experimentation' — not only of tape types, but also in terms of bias and eq if your deck so permits. The tape reviews may assist you in the latter respects; and, it is hoped, the former!



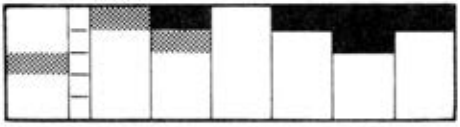
AGFA CARAT FeCr

This tape was less sensitive than the reference but was found to 'peak up' with 120μs eq and a bias a little below the Cr average. As this may be difficult to achieve in some decks the tests were done at my reference. Small-flux frequency response resolved with a 3dB dip around 1kHz so the relative treble lift (peaking at 15kHz in some decks) could generate too much 'sharpness for your liking, depending on head wear and whether you are using the MPX filter. Relative bass lift could be less detracting. Noise floor was very low, cassettes a little noisy when fast-spooling and coating good.



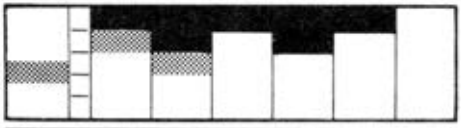
BASF FERROCHROM 111

This required a trace less bias than the reference and was regarded as one of the better ferrochromes. A slightly better HF response was achieved with 120μs eq at the 110% FeCr bias, depending on deck; but a fair small-flux response, at least should obtain at 70μs giving you the bonus of improved noise. Coating was OK and cassettes a trace noisy when fast-spooling, but W&F not bad.



DENON DX5

This biased close to the reference and had a characteristic similar to the BASF but with less upper-treble lift in some decks. However, in European decks (notably Philips) I obtained very acceptable small-flux responses. You will need to experiment, and with some ferrochromes recording at 120μs and replaying at 70μs (to get advantage of the lower noise) can help matters. Cassettes spooled fairly quietly and coating good.



OSAWA FC

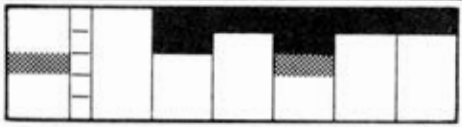
This was another hybrid Class III tape which was found to be a problem to bias for an acceptable overall balance. At my reference bias the treble was fairly flat and LF sensitivity was good. Noise floor was also low. I must admit to not having much practical experience with Osawa cassettes, the samples not having been in my possession very long before concluding this section of the book. I had the impression from the tests that I did make that it is no worse than most other Class III hybrids, and would be worth trying if you are keen on this sort of tape. The upper layer is cobalt-doped. Cassette mechanics were good and the coating fairly stable.

PHILIPS FERROCHROMIUM

This is an interesting tape, the samples from recent batches. In European decks it performed remarkably well for an FeCr, and noise was extremely low. It biased to my reference and not much improvement could be obtained by deviating from this. It still showed the dip at MF MOL but MF sensitivity was good, the small-flux frequency response being 'flat'. Coating was OK and cassette noise minimal; no undue W&F.

SCOTCH MASTER III

This was found to be a particularly sensitive ferrochrome which, again, biased fairly well at my reference (that is, as well as can be expected — not outstanding!). Looking back through Tape Checks past I have found that the tape has come out very well on quite a high proportion of decks, so would be a ferrochrome worth looking at. You will still be bugged with MF MOL dip and shortfall in MF sensitivity. Noise floor is not as low as some, either; but it has some plus points! Cassettes run very quietly but coating on samples a little variable at HF.



SONY FeCr

This was used for the bias reference. Magnetic parameters were fairly well balanced except at MF. I obtained some very good LF MOLs, though, and noise floor was low. Chrome formulations were, on the whole, better at extreme HF. Coating was steady and cassette noise low.

CASSETTE TAPES

CLASS 4 — 70μs EQUALISATION METAL BIAS

These are the metal particle variety which run with 70μs eq. When they first started coming on the market the results were, frankly, below what I had been conditioned to expect, especially at LF. This was confirmed by a wide range of measurements undertaken by my lab. Coatings were poor/bad and LF MOLs nowhere near what had been optimistically forecast. Print-through ratio was generally OK. Results were also influenced by shortfalls of the so-called 'metal capable' decks themselves, which were then arriving on the market. There were exceptions, of course, but on the whole first impressions were not highly encouraging.

To some extent the deck problem is still with us. Some machines work better with metal than others. You will see in the deck reviews that I have given a separate rating for metal performance. A big thing about metal is its very good HF performance. This gives a useful treble and upper-treble headroom and thus reduces serious compression at high signal levels, which can otherwise bring into the sensitive hearing range hosts of very obtrusive non-musical, intermodulation products, especially when the deck has 'slow' metering.

Upper-treble headroom, although highly desirable, is less 'valuable' when the LF and HF headrooms are limited by the tapes and the decks. It is my view that the performance of metal tapes and corresponding decks should, at least, come up to the standards of top-flight 120μs oxides at LF and MF.

Not all the music you record, though, is so rich in high-level treble, harmonic and overtone components as to render the extra HF headroom of metal really viable. It is already limited on many gramophone records and FM radio programmes, anyway. In my opinion the expensive metal brews only become really viable when the music for recording is of a particularly high studio quality. This means that for many applications, even if you have a metal capable deck, you will still be able to use up-market 120μs oxides and obtain good results provided you keep a keen eye on recording levels. Over-recording is a prime reducer of sound quality as I have emphasised at the start of this book.

Happily, recent batches of metal were found to be better than earlier ones. The improved treble results from particularly high coercivities, but the different formulations do tend to vary a little on this parameter. To achieve the best at LF the metals need to be biased adequately. Insufficent bias can reduce LF MOLs quite dramatically, while further improving the HF performance. Coercivity which, as already intimated, corresponds to the magnetic field required to reduce to zero the magnetisation of a fully saturated tape, and is commonly expressed in Oersteds. Values approximate 300-350 for Fe, 500-600 Cr and Cr types and 900-1,000+ metal. These values also give a measure of the biasing required by the tapes.

LF performance is dependent on the rententivity which is the maximum remanent magnetisation that the tape can accommodate, and is commonly expressed in Gauss. Values approximate up to about 1,700 Fe, 1,400-1,600 Cr and Cr-types and 3,000-3,500 metal. You can understand, therefore, why it is that metal has a far better HF performance than Fe or Cr; also why Fe is capable of greater LF output than Cr; and also in theory, at least, why metal should provide greater LF output than the oxides.

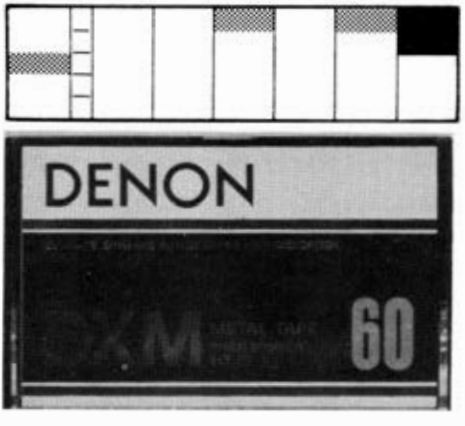
My reference bias level was established from the 'average' of a number of decks in metal mode, and the bias entries in the metal tape reviews tell of tape deviations from that reference, notated (0) as for the other tapes. As similar tests were also made on the review decks themselves you will also be able to establish a bias link between the review decks and tapes, as already explained, but metal tapes hold closer to the reference bias than 120μs oxides.

AUDIO MAGNETICS XHE METAL

First samples of this tape were not encouraging, a criticism which could have been directed against first samples of other make metals. Biasing required to be lower than that provided by the average deck in metal mode to defeat early upper-treble roll-off, but LF MOL was not then so good. It is likely that subsequent samples will resolve better. Coating fair and cassette spooled a little noisily.

BASF METAL IV

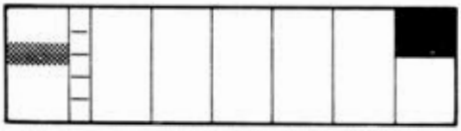
Latest samples of this brew were good but coercivity seemed below some of the higher bias formulations. Metals in general are not particularly low noise intrinsically, but the BASF samples seemed to do a little better on this score than some. Cassette spooled a little noisily; coating fair. On some decks the treble may 'droop' a little but would be better if you can turn down the bias.



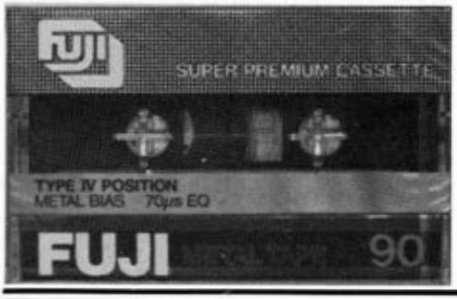
DENON DXM

Latest samples of this formulation came out well at my reference bias, but the coercivity of my samples veered below that of Maxell MX, though remanence was approximately the same. Good LF and MF MOLs were thus secured. Frequency response was essentially flat in a correctly equalised deck, with a mild trace of rising upper-treble. Coating was good and fast-spooling quiet. I regard this as one of the better metals at the time of writing.

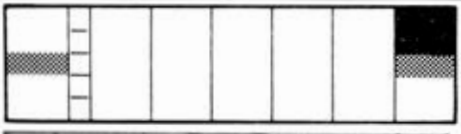
CLASS 4 TAPES



FUJI METAL

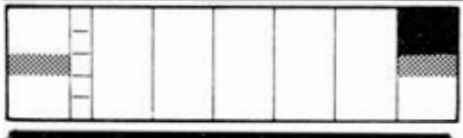


Very latest samples of this formulation also came out well. For the very best LF MOL biasing required to be a trifle above my reference; but the tape could be expected to work well in the average, good metal deck. Small-flux response was 'flat' and extended, but coating at upper treble a shade 'fluffy' on some samples. This would not be heard. Cassette fast-spooled quietly.



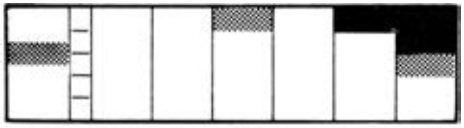
MAXELL MX

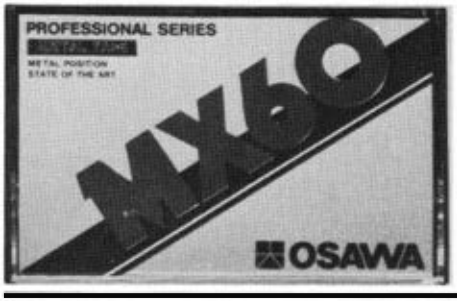
This is the tape which has the habit of coming out top in my Tape Check articles. I think it is one of the best, if not the best, of the metals when properly biased. The test results speak for themselves. Coating was good and cassette mechanics particularly good. Very recent C90 samples have exhibited a bias demand slightly lower than that indicated for maintenance of upper treble.



MEMOREX METAL IV

This formulation is from the very latest range of Memorex tapes. Although actual selling samples were not available at the time of writing I managed to acquire a couple of pre-production samples for measurement, and I must admit to being impressed with the findings. Coercivity was just right for the (0) bias reference, resulting in a very flat frequency response in the test machine. LF performance was not too dissimilar from other top-grade metals and HF performance was excellent. Noise, though, seemed to be a trifle higher than some metals, but the sensitivity at all frequencies was well up in level. Coating was variable but the cassette fast-spooled quietly, the tape being presented in a newly designed C-zero and library case. A tape which looks like holding its own with the best of metals.



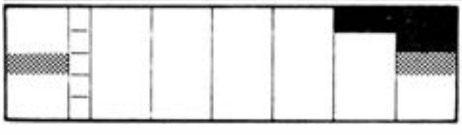


OSAWA MX

This Class IV metal brew was quite respectable, but the samples sent were C60s. I obtained a good LF performance at my reference bias with hardly any MF dip, but for the best HF I was obliged to use a little less than the reference bias. I cannot claim that it matched the really top metal performers, but it is a good tape with good cassette mechanics and a stable coating. HF improves with lower than indicated bias.

PHILIPS METAL

This is another tape which has undergone stages of improvement. Coercivity seems lower than most other metals, with the possible exclusion of early XHE metal. If you have a non-metal deck with adjustable bias this tape could be experimented with if you are that way inclined. Operate in Cr mode and advance bias fully. Snag is that the erase field may not be strong enough to eliminate all traces of a previous recording. You would then need to bulk erase. Small-flux treble will be down a little in metal decks of average bias. Although variable, coating was distinctly better than that of earlier samples. Noise floor was also low (possibly resulting from the lower remanence). Cassettes a little noisy but no undue W&F. Very recent samples seem higher coercivity.



REALISTIC SUPERTAPE METAL

Realistic tapes are sold by the vast network of Tandy stores. As this tape was sent with the Realistic cassette decks I thought it appropriate to include it in this section, especially in view of the excellent LF performance it gave.

Indeed my tests (admittedly on a single C60 sample) indicated that the tape was very close in performance to other good metals, though coating may have been a little more variable. Cassette of the sample was quite respectable with well-mounted rollers and graphite-coated slip pads. LF performance was well up with the top performers at the bias reference, as were most of the other parameters tested.

ELLIS MARKETING

Hi there,

The other day Carol and I were in the garden and she pointed to some snowdrops, the first signs of Spring at the end of January! The winters are certainly getting shorter There is something very special about spring, its a time to clean up your hi fi and we are certainly prepared for that We carry a vast range of the latest cleaning accessories and would you believe, an electronic stylus cleaner which not only cleans but polishes the stylus tip This unique gadget is marketed by Audio Technica and sells for under £10 00 Certainly a breakthrough although I feel sorry for the manufacturers of women's make up whose brush sales have no doubt fallen!

The new year has certainly started for us in a big way despite the so called economic gloom as our sales have increased and the only problem I foresee might be a snortage of certain products, Video in particular While on the subject of video let me mention films We carry a comprehensive range from children s to adult viewing and they range in price from under £20 00 to under £50 00 to buy We also rent films from as little as £5 00

The sales of cassette decks seems to be on the increase while prices in general of tapes including Metal having come down, encourages more people to record their own material, especially in view of the rise in the cost of records One of my favourite range has to be the Nakamichi whose slick styling and performance is hard to beat The problem in the past has been the rather high prices but for the month of March we shall be offering them at very special prices from as low as £200 00 which I'm sure you'll agree is a bargain for a superb piece of technology

Our reputation as remote control hi fi specialists seems to be spreading far and wide, but for those who find the Dual Remote System a little too high in price we have the Technic System 80 or the Hitachi Triple Cube now in stock again

Both the Ariston playdecks the RD80 and the RD110 are selling extremely well and our offer for February for a home trial certainly has convinced our customers about our feelings on Ariston

Nothing more to add except my thanks to a bunch of guys who started out as customers, became friends, and now help out in the shops on Saturdays and now for the 'honours'. Eddie, the tea maker, Phil, the cassette deck whiz, Malcolm the Quad artist, Errol, the general all-rounder, Garry the coffee drinker, Yanni, the helper and last, but not least, Ray, the wine bringer

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CAPITALS PLEASE CD1

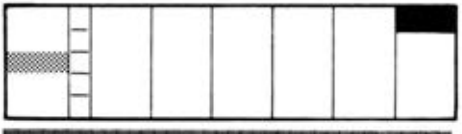
CLASS 4 TAPES

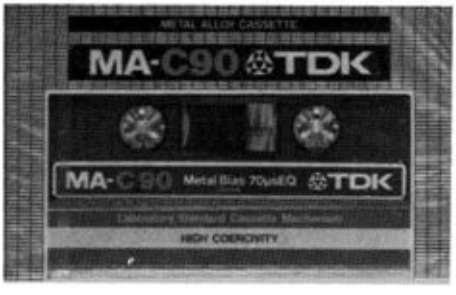
SCOTCH METAFINE

This tape, too, has passed through stages of improvement, the latest issues being better but not, in my opinion, up to the quality of the top metal competition. The tape does have a very low noise floor for metals, being on par with some of the Class II and III formulations in this respect. It tended towards over-biasing at my reference, which in the average metal deck could lead to droopy treble and not so good HF performance. Coating of the latest samples was quite fair, but fast-spooling was a bit noisy.

SONY METALLIC

This biased at my reference without trouble, the coercivity of my samples seemingly being on the high side. On the average metal deck, therefore, you should obtain a fairly 'flat' response with, perhaps, a touch of upper-treble lift. LF and MF MOLs were quite fair at the test bias level, with about average noise. Cassettes were judged good and coating revealed trace of upper-treble fluctuation.





TDK MA

The latest MA (received about the time of this writing) came out very well. Far better than earlier samples. Coercivity was judged to be around that of Sony. As also remanence. The tape would bias okay in the average metal deck, but with the possibility of slight upper-treble lift, which might be desirable. Noise floor was low, but not as low as Metafine, and LF and MF MOLs okay. Coating was around metal average, as also cassette performance.

There is also type MA-R with a much more sophisticated cassette; but the tape in my samples had a lower coercivity than MA, calling for a lower working bias. The results refer to MA.

cassettes digest

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