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Note: many of the value judgements within this publication are based on the estimated typical prices printed. While every effort is made to ensure that these are correct at the time of going to press, they are subject to variation and fluctuation, and are clearly only applicable to the UK market. Readers should therefore bear in mind the current prices operating when interpreting value for money comments.

HOW TO USE THIS BOOK

Though *Video Choice* is one of our more complicated issues, regular readers of *Hi-Fi Choice* will find the overall format reasonably familiar. Because this is the first edition on the subject, the *Editorial Introduction* has been expanded into something of a 'novices guide' to the video jungle: video is new, so most of us are novices, so some personal reaction to enforced editorial exploration is worthwhile.

The *Consumer Introduction* is by Barry Fox (*aka* Adrian Hope) who has been in the van of video consumer journalism for a number of years. This concentrates upon the 'prime' use for domestic VCRs: recording broadcast signals; it examines what these consist of, how they were arrived at, and what a VCR does to them. The discussion on 'trick' effects like slow motion should be particularly illuminating to the interested layman who is curious to know how these machines work, and who doesn't want to swallow a dictionary of jargon to find out.

The *Technical Introduction* is divided into four sections. The bulk describes the tests we undertook on the VCRs and the reasons for doing them; some observations on the pitfalls for the unwary, and indications of the standards we would like to have seen achieved. A subsidiary section briefly describes the particular requirements of portable machines, in the areas where these differ from mains machines. Further sections examine and discuss the tests undertaken on Cameras and TV receivers. It was never our intention at this stage to attempt comprehensive assessments of these particular areas of the video market, but in both cases the tests have been quite revealing. Although some jargon is inevitable when describing our technical assessments, the persistent reader of reasonable intelligence should find much useful background that will help him choose wisely if setting out to buy such items.

The reviews themselves run concurrently, beginning with the VCRs (including the portables, as they would represent a very small group on their own), followed by the Cameras and then the TV receivers. In each group machines are arranged in alphabetical order according to the brand name. Amongst the VCRs we have only one duplication of a 'badge engineered' machine – there seemed little point in reviewing the various JVC equivalents of Fergusons (or *vice-versa*), Granada/Hitachi or Bush/Toshiba alternatives either. But we did manage to cover nearly all the basic machines available in the UK during Spring 1981 (save Panasonic), and those who encounter something unfamiliar (in a rental shop?) may well be able to identify an equivalent from the photographs.

Our attempts to examine the videocassettes themselves are then described. At this stage these are exploratory rather than exhaustive; for reasons explained therein and elsewhere, this is unavoidable at the present state of the art.

The *Conclusions, Best Buys and Recommendations* section mirrors the Technical Introduction in being divided into several sections. For reasons explained in the *Editorial Introduction*, we have decided not to pursue our normal policy of specifying Best Buys or Recommendations on this occasion: amongst the VCRs, the market is currently too complex and volatile for such simple classification, while our samples of Cameras and TVs are insufficiently large or representative. However we have included here summaries of the VCR reviews for those too lazy to read the reviews themselves. In addition the overall context of our findings in each case is described in some detail.

To complete the picture there is a section on *TV games* by Rick Maybury and an introduction to pre-recorded material (*Videograms*) by Cliff Wilson, followed by a comprehensive listing of available videograms. These two gentlemen are part of the editorial team of that redoubtable monthly magazine *Video Today*, and we have sponged further on their expertise to present the catalogue, as there is little point in trying to duplicate the efforts of those much more experienced in this field.

Finally, for easy reference at the back of the book, there is a *Glossary* which we hope will help with the jargon that has inevitably to be used in a publication of this nature.

EDITORIAL INTRODUCTION

This is the first time *Choice* has tackled *Video* as a topic. And those who expected this magazine to appear a month or three ago will realise that things have not gone with quite our customary precision. First of all I should like to apologise and give due thanks to the manufacturers, advertisers and PR companies who have borne our inefficiencies with patience and forebearance. There are plenty of possible reasons and excuses why we are late, and I am inclined to think that the cumulative effect was just too much. The official party line observes quite correctly that we experienced no end of difficulty in obtaining a comprehensive range of machines for testing, and had similar problems obtaining some of the more exotic test gear that we used; not unrelated however as was the fact that most of the people involved moved or nearly moved house during the project, which is not conducive to productivity. Nor is the editor entirely convinced that it is possible to produce five *Choice* issues within twelve months (rather than the four he has been accustomed to turn out); this certainly proved something of a strain, made worse because it was a 'first time' edition and required a completely new set of industry contacts.

To be frank I am not sure that I was really adequate to the task of editing the book, though now that it has all come together, I am really quite pleased with the result. Inevitably some things have worked better than others, but by and large I feel the book fills the need which we intended, offering a comprehensive guide for the intended video purchaser, and does so rather better than other attempts I have seen. The problem with a brand new project such as this is in deciding precisely what one should include or exclude, and at what depth one should cover the various aspects of the subject. Many such decisions are determined on practical grounds, and it is rarely possible to stick absolutely to the 'ideal' path. But we would be interested in any feedback regarding the content and overall balance, so any comment will be gratefully received, and may help make our next volume better.

This has probably been the first time that I have really envied *Which's* policy of purchasing the equipment that they test, because there has been a distinct shortage of VCRs in the UK for the past twelve months (the reasons for this will come later). Consequently the marketing and PR people themselves have been kept short of promotional models. Although some magazines can complete a VCR review in a week or so (or even a week-end), the fact that our schedule required several months, with all the user-panel work and the need to generate the testing standards in the first place, was something of a disincentive. In the end we missed out on Panasonic: so it goes; happily we caught most of the rest, though some missed some of the tests.

This shortage of product also presumably applies to the software, *ie* the pre-recorded cassettes known as *videograms*. These appear to have been going through something of a boom, despite prices that are reportedly significantly higher than in the US. Original plans to examine some, particularly on a technical basis, were abandoned after a mail shot to the producers requesting samples and catalogue received a desultory reply rate of less than 10%. In the end we settled for co-opting the services of one of the monthly magazines, *Video Today*, for a short resumé on recording quality, and a reference listing of available titles (as from June 1981). Even though they are from a 'rival' publishing house, I am happy to acknowledge that they do a very good job of a monthly magazine; happily it is aimed at a rather different market and fulfils a different purpose to our own.

Immersing myself in things video for the last year or so from a background of very little experience has provided certain perspectives which are probably quite relevant to the typical consumer. So I propose to extend this editorial somewhat longer than usual, to include some pertinent if personal observations

Modern TVs

For much of the project I have had access to the B&O and Philips receivers which we have tested, and I must admit I was very impressed by the improvement that these modern sets offer over my personal ageing model. Both feature sound circuits that are significantly better than average, and although this clearly reflects my personal hi-fi bias, as a result I am very unhappy going back to the old set. The Philips was particularly impressive in this respect; regretably I understand that it is to be discontinued. Happily this does not mean abandonment of the hi-fi intent, as there are plans to retain this feature and reduce its price disadvantage on a range of models to be introduced shortly. Respectable sound quality, even though neither stereo or real hi-fi, not only benefits music programmes; speech becomes much more intelligible when accompanied by a few high frequencies, and intelligibility is retained at a significantly lower volume level. A slight disadvantage which became apparent during the

tests was that it was rather harder to ignore the limitations in the sound quality coming from the VCRs themselves, but I have never considered that two wrongs are likely to make a right, and would rather hear what is going wrong than pretend that it isn't.

One of the newer features supplied with colour TVs are full infra-red remote controls, which I did find improved my enjoyment and use of the set. The second edge of this sword is that it makes it easier to turn the TV on, and harder to turn it off (because one invariably scans all available channels with a kind of desparation, before actually admitting that there is nothing remotely worth watching.) It is particularly useful to be able to change colour balance, brightness, volume etc to fine limits from the seated position, though I have not yet found a set which also offers remote contrast adjustment, and this could be useful when changing from a US made programme to a live studio broadcast, for example.

Remote control is an essential part of a Teletext equipped set, though the handset does start to get pretty complicated by this time. These page by page information services do have their uses, but frankly they are not the most accessible of media, and after a brief flirtation I confess I went happily back to a local evening newspaper. This largely because the information content of each TV page is not great, and unless one has a brain for memorising a string of key 3-figure numbers it is usually necessary to go to two, three or even more pages to find out what one wants. Page changing is at the whim of a frustratingly slow clocking system, and multiple pages likewise, so it can take quite a while to consult the oracle and see the facts. I also found it a nuisance that the service disappeared when regular TV channels closed down: for example, before retiring I sometimes want to check the latest weather forecast to decide whether to put the washing machine on (cheap rate electricity), but its usually back to the old fashioned radio for this purpose late at night.

VCRs

Video recorders like the TV itself are definitely a double edged sword. And anybody contemplating purchasing one would do well to indulge in a little self-analysis regarding their relationship with their relevision set, *ie* who runs who. Those who are strong-willed in their use of television and who do not let it run their life will be able to cope with the added time-stretch facility; the weak-willed who passively watch one channel 'till closedown will now be able to watch what they missed on the other channel until 3am. These are the extreme cases, and reality is likely to fall somewhere in between. But those who are prey to wasting time indiscriminately watching the box would do well to beware the VCR's capability of making this even more attractive.

However the ability to 'time-stretch' the half dozen or so programmes a week that I normally do make something of an effort to catch does have its attractions, particularly as the networks seem determined to schedule simultaneously programmes which appeal to a similar audience. This happens so often that it must be either deliberate bloody mindedness or the clever lobbying of VCR manufacturers which ensures, for example, that the BBC runs *Shoestring* against ITV's *The Professionals*, that ITV runs *Buck Rogers* against *Dr Who*, and *Kenny Everett* against *Top of the Pops*. Some degree of independence against this appalling misinterpretation of the meaning of competition when applied to pseudo-monopolies remains for me the most important and useful function of the VCR.

However it still raises the difficulty of actually finding time to play back the tapes one has recorded. Make no mistake, once something has actually been recorded, there's nearly always

something better or more urgent to do than watch the replay, and it can be surprisingly difficult to get round to watching the tapes. The act of recording may be made in the enthusiasm of the moment, knowing that one may not get another opportunity. There is no similar incentive to watch the replay which may be stored until *manana*. In fact I can recall an occasion when I taped something *in absentia*, and then held the tape unplayed for so long that I eventually saw the programme when the broadcast was repeated!

Ergonomics

There are grounds for severe ergonomic criticism of the timer design on nearly all the sophisticated models which we examined. And on more than one occasion I have simply bunged in the longest tape I could find, selected the channel I intended to watch in an hour or two's time, and then put the machine into record before going out. Single-programme timers are rather easier to handle, but I have found that the complex ones fully live up to the true (perjorative) meaning of the word sophisticated. In my opinion, a 'luxury' machine should offer two separate timer systems. A simple one for when one goes out for the evening, and which doesn't take ten minutes and the instruction book to set. And something more complex for those with the patience to do the programming, so that one doesn't lose the thread of Coronation Street during two weeks in Torremelinos. At present the capability to do the latter works against the simplicity of accomplishing the former.

'Tis true that most of the machines came with manuals that in theory made their more complex functions accessible, though even here attempts to explain things were not always successful. I never came to terms with the Grundig at all ergonomically, even though I found its performance probably the best of all. And the JVC *7700* had instructions guaranteed to fool the hasty, the paragraph relating to timer setting using the term pre-set indiscriminately as noun or verb some times! Even the Sony *C7*, which was in many ways a joy to use, perversely placed the channel selection buttons as far away from the timer as possible, so on more than one occasion I ended up with a recording from the right time slot but from the wrong channel. Although I believe others were less impressed than I, the Philips gave me the least trouble, perhaps because its operation was somewhat interactive, *ie* the machine instructed one what to do next.

Some machines provide a laminated instruction card to keep nearby, and this is useful. But I am frankly amazed that the current machines could be consistently ill-thought ergonomically; on the basis of their TV and hi-fi design, I await B&O's contribution with some interest. It should not be beyond the abilities of a good design team to produce a machine which is straightforward to tune, operate and programme the timer; which uses buttons large enough for human fingers, labelled legibly enough to read at arms length on a machine which is tucked away in a dimly lit corner of the room beside the TV set. The current fashion for tucking secondary functions behind little flaps offers a golden opportunity to use properly labelled and decent sized flaps, with room to print operating instructions on the inside of the doors. The common practice of using small lettering on a shiny background makes functions absurdly difficult to read: the lengths of cable supplied suggest that most manufacturers expect their machines to be placed in the same general area as the TV set, and this is hardly the place one wishes to use bright artificial lighting. Sensibly sized white lettering from a dark background, as in the Grundig, is much to be preferred.

Another gripe on the human engineering angle concerns a most irritating trend to provide machines with an automatic tuning system. Perhaps these might be of some use when trying to tune a dozen different stations, but have little relevance to the UK's three. Automatic tuning makes it comparatively tricky to match the VCR-tuned programme numbers with the sequence which one has already established and memorised for one's TV set. And if the sequences do not match, one is almost guaranteed to make recordings from the wrong channel by mistake. I suppose the reason for this trend is that it will be cheaper in the long term to provide the necessary electronic jiggery-pokery than the individual mechanical channel presets. But once again one is forced to adopt an irrational sequence of button pressing instead of the much more logical analogue scan; it reminds me of the nightmare of resetting the digital watch when changing from summer to winter time and *vice-versa*. Furthermore, with analogue tuning there is no need to re-tune if the power supply is removed for any length of time.

I have gone on at some length about the idiosyncracies and ergonomic blunders that plagued the tuner/timer sections of practically all the machines, which might perhaps be considered rather superfluous to the central task of recording and replaying programmes. Certainly the gadetry is more likely to be a challenge than a disincentive to the average hi-fi nut. But the

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whole point of video and TV is that it should and has in the past been accessible to a very wide range of people, from children right up to great-grandma. TV sets have been carefully engineered so as not to fill the nervous and technically illiterate with techno-fear. At the moment video recorders appear to be going the other way, so that one does not merely use them as a tool, but is obliged more or less to enter into an emotional relationship with them, cossetting their whims and peculiarities in the hopes that they will respond by recording what you wanted when you wanted it.

Luxury features

I feel much more kindly disposed towards the special operating facilities provided on the more expensive machines, such things as picture search and freeze frame. Once again these are too frequently controlled by fiddly and poorly labelled buttons on the machines themselves, though in practice these 'luxury' models are usually remote-controlled; the design and layout of the pads tends to be much better, giving rise to less complaint. Of the various trick-frame facilities, fast picture search is much the most useful, particularly on VHS format machines, where the wrapping pause between play and rewind can be most irritating when juggling to find the start of a section. The ability to skip commercial breaks is really nice (on 'non commercial' channels too, which spend far too much time advertising their own programmes). Slow motion, freeze frame and frame advance I found much less important, partly because the picture quality in most cases gets pretty ropey, and attempting to freeze a frame during movement nearly always gives significant judder. The double speed play with intelligible sound provided by the JVC *7700* is rather neat, enabling one to scan a boring sporting fixture in half the normal time!

Many of the machines have an automatic stop which is triggered by the beginning and/or the end of a recording. This is often useful, but can also be irritating, and as far as I could discover only the Grundig enabled one to pre-empt its operation. Emphasising the problems of sophistication, I put the Sony *C7* into record before retiring one night, knowing that it would turn itself off (after in fact auto-rewinding) after the tape ran out. The next day I found that the tape was electronically 'jammed' down the wrong end, because the idiot sensing mechanism in the machine had decided that post-transmission noise was really a continuous succession of record-starts. As soon as it started to rewind, the sensor switched the machine off; with no override switch, I was forced to tap the button repeatedly until I had 'rescued' the tape.

VCR flexibility

There are of course a number of other uses for a VCR besides time-stretching, though I haven't explored these in as much detail. Pre-recorded tapes are a flourishing business, and prices are slowly coming down (too slowly?) The quality seems about on par with recorded-off-air quality, and the range of choice is vast, embracing minority interest and uncensored material that is never likely to be broadcast. And although the cost of purchasing films outright is high, local rental schemes appear to be a great success.

Whether one gets into collecting a video library or archiving off-air tapes will depend entirely upon the individual concerned. I have already pointed out that there is little point in having recordings of things that there is never enough time to watch, and collecting tapes is not a cheap hobby. On the other hand there are few better baby-pacifiers than a good cartoon or a collection of *Muppet Shows*, while feature films can be a useful inducement to a babysitter (but of course you want to use the VCR to make a recording for you while you are out; it can't do two things at once; and it is so fiendishly complicated that you have the feeling if you try to do more than explain where the 'play' button is that you will miss your recording and find a precious film erased on your return; what you need is two VCRs!) And it is pretty obvious that an interesting collection of video tapes is likely to become as essential a part of batchelor existence as the legendary etchings, the record player of the sixties, and hi-fi of the seventies.

Film buffs and collectors appreciate films for

Sony Betastack

many different reasons, only some of which will be satisfied by TV and VCR replay. In the same way that TV can itself emasculate certain aspects of a great movie – notably in the sense of scale, but also in the fine detail, colour subtlety and sound quality – the VCR only makes matters worse. So although video will work admirably for archiving comedy, epics and spectaculars don't really make it, nor do 'artistic' films which glory in visual subtleties. To some extent this limitation of video may benefit from future engineering improvements, but it appears to be one of the main areas where the videodisc will score.

Whether or not the videodisc *will* score is the 64 million dollar question of 1981. We have made no effort to analyse or discuss discs because it would be premature until the systems are actually on sale in the European market. The success of discs will rest on whether or not there exists a market prepared to pay a highish price for a playback-only machine, which will enable mainstream movies and TV programmes to be bought at modest cost and replayed with better fidelity than can be achieved from a VCR. Manufacturer demonstrations have shown that the quality can be superb compared with VCRs, but the range of software available is likely to be more limited, at any rate in scope.

Little attention has been paid to the media role of the VCR. A moments reflection shows that it is probably the most accessible medium since the printed word, and that anyone with more than one VCR and a programme can in theory become a 'publisher' (or pirate). (And even in practice it is not difficult: an apocryphal tale concerns a rental shop manager who became suspicious of the number of service call-outs being made to a particular customer; upon investigation he found that the machine was being kept running 24 hours a day making copies for sale – not that dissimilar to the way the larger software houses operate.)

Cameras, and portables

Personally I am not particularly photographically inclined, so I wasn't easily inspired when I clutched my first video camera. I tried out the Sony *2000 via* the *C7* around the house and *environs* for a few days, and frankly must agree with our general review findings that cameras still have quite a long way to go before they will become widely accepted. At present the limitations on sensitivity and lag must restrict their appeal to the real enthusiast. However there is no aspect of home video that is improving quite as dramatically at the moment: the improvement between Sony's *2000* and *3000* models is one case in point; and the price of *saticon*-tubed models will tumble as production is geared up, so it will not be long before these become a really viable prospect. If there is one area where video can offer an equivalent to the exotic end of the hi-fi market it is in camera technology; curiously there has been little attempt to exploit this yet.

One of the most attractive new ideas in portables is Sharp's *VC2300*, which is available in Japan at about £500, and should be coming to the UK in PAL format around the end of 1981. This is really a mains machine with on-board tuner, timer, and batteries for occasional field work. Although not the lightest or most compact machine around, it looks eminently transportable (useful for the household with more than one TV), and probably reflects the needs of the 'holiday snap' user rather better than today's machines, at a more reasonable package price.

New formats for the future!

There is however a lot of work going into the development of new portable permutations. Sony, Panasonic and Hitachi have all announced special (and different) formats combining cameras with VCRs in hand-held portable units, clearly aimed at the 8mm cine market. The Hitachi version is expected to be marketed before too long, but Funai/Technicolour have stolen a march on all these and actually have a special format VCR available, weighing about half as much as current VHS portables, and using a separate Hitachi camera as part of the package.

The *rationale* behind these seems to be to save bulk and weight by using a smaller cassette and mechanism, recognising that three hours playing time is of little interest to portable users. Presumably the user then dub-edits onto normal mains formats. However our findings suggest that portables are barely adequate to this task using today's standard formats, so the prospects with mini-formats are not terribly bright at this stage.

One wonders whether the enthusiast might be better off using a domesticated U-matic type machine for portable (or at least transportable) work. Indeed on the couple of occasions that I have seen a row of TVs displaying comparisons between formats, I have been struck by the obvious superiority of the U-matics, which get quite close to broadcast standards. Now I know that such machines currently available are to professional standards, and are restricted to about one hour continuous running time. But if it were possible to produce a domestic machine

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with tuner/timer *et al*, perhaps running at more than one linear speed so that the user can trade quality for running time according to his needs, then this could be a VCR system with some pretensions to fidelity. If such a machine were available for around £1,000, I for one would be interested, and would be happy to sacrifice access to pre-recorded material in order to have reproduction quality that did not make me think 'ugh!' whenever I went from broadcast to tape. The parallels between reel-to-reel and cassette tape are obvious, and the possibilities in 'unit video' quite interesting.

The marketplace

The video market is a somewhat strange place at the moment, simply because things are happening so fast, resources of all kinds are stretched, and both manufacturers and marketing people are struggling to keep up. Despite economic recession, video seems to be in permanent boom: there is a definite shortage, particularly of the most popular VCRs, and the market currently seems to be growing at about 25% per annum, absorbing practically all the machinery manufacturers can supply. The situation has been further worsened by an unexpected increase in demand from the US, and the realisation that the UK has one of the fastest video growth rates in the world.

As a result of these and other factors, the customer may have comparatively little choice in the VCR he buys (and even less if renting). The rival bickering from proponents of different formats regarding their market share has less to do with any ideology of the customer having freedom of choice than in the manufacturer's abilities to meet demand. That VHS controls about 60% of the market may have less to do with customer preference than the fact that Thorn (who 'badge engineer' JVC machines) dominate the UK rental scene, while Granada rentals have done an OEM deal with Hitachi. Conversely Beta's claim to 60% of actual sales may have something to do with the fact that so many VHS machines are diverted to the rental market! In the end Hobson is as likely to dominate your selection as you or I.

A personal view

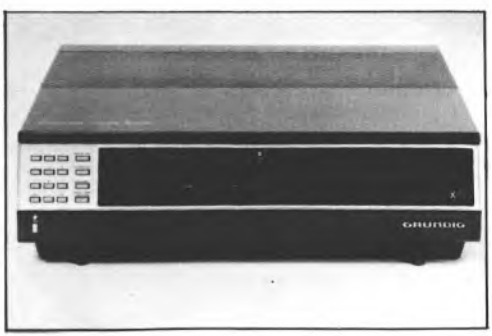
Without wishing to seem opinionated, I feel that I should crystallise some sort of personal reaction to the variety of products that have passed through my hands (most of them!) Oddly enough the new TVs have given me the greatest satisfaction, and in the toss-up between the Philips with its sound quality and the B&O with its picture quality, style and ergonomics, I shall have to hang on to the B&O (and use a modest hi-fi extension speaker). Now that the Germans are to have stereo TV (write to your MPs abusively), there will be a steady increase in good sounding receivers; at the 1981 trade shows Grundig and Tandberg (Lowe-Opta) were both showing interesting models.

I shall however resist buying a VCR for myself though the Sony *C7* is very tempting. If value for money was the prime criterion, I should be torn between the Hitachi *8000* and the Toshiba, but after seeing the new Grindig *Super* model recently, I was sorely tempted to place my order. I am also very attracted by the prospect of the Sharp mains/battery style machine mentioned above, and the new Sony *C5* looks like repeating the success of its big brother.

I don't think it actually matters that much which format one chooses, as they all have advantages and disadvantages. Perhaps one should try to choose the system that best suits one's particular requirements, remembering that changing formats is going to be more expensive than changing machines. VHS has a slight edge in the availability of pre-recorded material and the likelihood of borrowing tapes from friends; V2000 does seem to offer advantages in its ability to cope with future developments, while Beta sits neatly between the two.

In concluding this protracted editorial, I should like to express my especial thanks to the 'panel of users', who did much to make this project effective: Ian and 'Scilla Collington, Mike and Ann Scotney, Tony May and Clive Hewitt.

Paul Messenger



Grundig's new 'Super' model

The video revolution has finally arrived, albeit several years later than predicted by some enthusiastic observers. Nevertheless it has still taken plenty of people by surprise. Some areas of the hi-fi trade, for instance, are still talking about 'if video happens', while bewailing lost sales in audio. There is now a video cassette recorder in one out of every forty UK households with a colour television. If current trends continue there will be video tape or disc equipment in one in every four or five British homes by 1985.

This is all happening despite the current recession, partly because the great British public somehow always manages to find money for escapist luxuries, and partly because it is easy to rent video equipment in the UK. The cost of buying a new video cassette recorder can be anything from under £300 (for an obselete model) to over £700 for one of the most exotic new machines. The cost of rental is around £200 a year, but with the advantage of comparatively 'easy' payments. It is largely due to rental that Britain has proved to be one of the most buoyant video markets, not just in Europe but throughout the whole world including Japan and the USA. This helps explain why Thorn, with wide rental interests, holds 40% of the UK video market. It also helps explain the cold wind that is blowing through the hi-fi marketplace. Almost every video recorder bought or hired represents the loss of a hi-fi sale. Anyone who already has a working hi-fi system will be far more likely to branch out into video than replace their existing hi-fi with another improved or more modern system. Far sighted audio dealers have branched out into video, and most of the audio magazines have done likewise, or their publishers have launched a specialist video counterpart magazine. Hence this video edition of *Hi-Fi Choice*.

Incidentally any purists still clinging to the notion that a hi-fi publication is no place for video talk, should note well that the future of video and audio are inextricably linked. Video tape and disc technology has made domestic digital sound possible. Video recorders will in future offer stereo sound capability. Dolby or similar noise reduction is already being used to help compensate for the basic inadequacy of most video tape sound. Within a few years we shall be seeing the video equivalent of a music-centre; a videodisc player and video tape recorder combined together, probably also with a tv monitor.

Video cassette recorder basics

A video tape recorder can be thought of either as an audio tape recorder which captures colour tv signals in addition to sound signals, or as a television set with a tape deck instead of screen. Every domestic video cassette recorder on the market today is capable of receiving television pictures and sound transmitted over the air*, recording them onto tape and replaying the recording through the aerial socket of a conventional tv receiver. Every machine also has a built-in timer which allows unattended recording; the recorder switches itself on and off under timer control like an electric cooker.

Every domestic video cassette recorder has a built-in tuner so it can be used quite independently of a tv set; it can record programmes off-air while the tv set is switched off or while the tv set is tuned to another channel. In fact the owner of a video cassette recorder can tape programmes off air even if he or she does not own a tv set. It is only when the time comes to replay a recording that a tv set is needed to display the pictures. Professional, and most semi-professional, recorders need a special type of tv set to display their recordings. This is called a "monitor" and its circuits are designed to receive an input of 'raw' video signals rather than radio frequency signals as are fed from an aerial to the aerial socket of a domestic receiver. Monitor tv sets are more expensive than conventional domestic receivers and although some domestic video cassette recorders do have an output (and input) for 'raw' video signals most owners will use their recorders only in conjunction with a domestic tv set. This is possible because all domestic video cassette recorders have an inbuilt modulator which is really nothing more than a miniature tv transmitter. This converts the raw video signals coming off tape into radio frequency signals which the aerial socket of the domestic receiver 'sees' as if they were off-air signals arriving down the cable from a roof aerial. In the future 'unit video' along the lines of hi-fi separates is a likely possibility, in which case 'raw' video signals will be used for interconnection, reducing costs and improving quality.

It is easy to see why the prime use of a video cassette recorder is as a time-shift device. Off-air signals are picked up by the roof aerial and fed down to the video cassette recorder which is

**N.B. Some portable machines have their different functions split up into separate boxes, to improve portability, so the actual recorder section may be obtained without the tuner/timer, and with power supply options.*

recording either while the owner watches a tv set screening the same programme or a different programme, or while the owner is out or even on holiday. At any time in the future the recording tape is rewound and replayed just like an audio cassette recorder—except that colour tv pictures are displayed on the tv screen as well as sound from the loudspeaker.

Although the prime use of a cassette recorder is to tape tv programmes off-air in this fashion, it is almost always possible to connect a tv camera and microphone to the recorder. This enables the user to make 'instant' videotape movies. The tape is simply rewound and replayed; no laboratory processing is involved. As video tape can be erased and re-used this offers a potentially very convenient means of making home movies with synchronised sound. Colour cameras have until recently been awkwardly bulky and prohibitively expensive (around £1000), and it has been inconvenient to record anything other than a simple indoor sequence with a mains-powered cassette machine installed in the living-room. But colour cameras are getting cheaper all the time (around £400 now for some), and they are also getting smaller, lighter and better. Moreover most recorder manufacturers are now offering light battery-powered versions of their standard machine formats. And new formats with a mini-recorder built into a portable camera are on the way. Many people believe that Super 8 home movies will soon have had their day.

All this makes video recording sound very obvious and easy. For the user this is true but for the designer and manufacturer nothing could be further from the truth. It is no mean feat to record audio signals with sufficient fidelity for the reproduced sound to replicate the original. Witness, for instance, the number of different tape recorders which are available and which all still prompt some criticism from reviewers. Witness also the enthusiasm of many sound recording engineers for digital recording. It is many, many times more difficult to record colour tv picture signals than sound. One problem is the much wider bandwidth necessary and another is the extreme accuracy of timing required. Whereas inadequate bandwidth or wow and flutter on an audio recorder merely causes audible distress, on a video recorder they can cause complete disintegration of the reproduced picture. To understand why video recording presents such a considerable technological challenge it is necessary first to look briefly at how television works.

How Television began

It was in the early 1920's that John Logie Baird, a Scottish inventor, devised the world's first working system of television. It is not the system being used today, and it was not even an original idea. Nevertheless it is worth a brief look. The basic idea behind Baird's system had been proposed by Polish-German inventor Paul Nipkow, in 1884. Nipkow patented the concept of using a spirally perforated disc to rotate in front of a scene to be televised. As the disc spins the spirally arranged perforations scan it in a continuously repetitive raster of lines. Baird put a light sensitive cell behind the wheel which produced an electric signal of strength dependent on the amount of light falling on its surface. So when the Baird scanning wheel spins, the perforations scan the scene to produce a flickering light on the cell which in turn produces a fluctuating electrical output. This is the transmitter or camera. The receiver has a similar wheel which rotates in synchronism with the transmitter wheel. But behind the receiver wheel there is a lamp instead of a light sensitive cell. This lamp is fed with an amplified replica of the output from the transmitter light cell. So the lamp produces fluctuating illumination. If a viewer looks through a lens at the spinning disc in the receiver a crude image is produced as the perforations scan the flickering lamp in a raster of lines. Baird first demonstrated his tv wheel system to electronic engineers in 1924, and put it on public display at Selfridges store in London in 1925. The next year he started broadcasting experimental tv programmes with a 250 watt transmitter in London, and on the 30th September 1929 the first fully-fledged and public television broadcast featured the late Gracie Fields.

Of course this is not how tv pictures are transmitted and received today. The mechanical system was doomed to failure, largely due to the problems of synchronizing the rotating wheels in the transmitter and receivers. Picture definition was also very limited. In 1936 the British Broadcasting Corporation, which had taken over the transmission of Baird pictures in August 1932, backed an all electronic system developed by EMI. In fact, for a few months the BBC transmitted the same programmes in two systems; EMI-Electronic and Baird-Mechanical! In February 1937 the inevitable happened and the BBC abandoned all mechanical transmission. Since then, with only the hiatus caused by World War II, British television (and television around the world)

has relied on an electronic scanning system based directly on the system which became the BBC standard in 1937.

How Television works: basics

The scene to be televised is "photographed" by a tv camera. This has a lens similar to that found in a conventional film camera and forms an image of reduced size on a light sensitive surface. This surface is of a material which varies in electrical characteristic depending on the amount of light which falls on its surface; it may for instance accumulate a charge or change its electrical resistance. The image of the scene formed on this surface thus creates a corresponding electrical pattern. If a beam of electrons is now fired from an electron gun at this surface, the electron beam will detect the charge or resistance pattern at the point where it strikes the surface image. If the beam is scanned backwards and forwards over the sensitive surface area in a raster of lines, like a human eye following the lines of a printed page, then a continuous electrical output signal is produced which varies with the charge pattern. As the charge pattern is governed by the image formed by the camera lens this output signal is an electrical replica or "analogue" of the scene being televised. In fact the output from such an all-electronic camera is directly comparable with the electrical output from Baird's mechanical camera.

Likewise an all-electronic tv receiver is in many ways comparable to the mechanical Baird receiver. The camera output, which is a continually varying electrical waveform, is transmitted, received, amplified and fed to the control circuits of the cathode ray tube which is at the heart of every domestic tv set.

The tv receiver cathode ray tube is rather like the camera tube except that its electron gun fires a beam of electrons at a flat front face or screen which is coated with light emitting material (phosphors). The electron beam in the receiver CRT is moved to scan the screen in a raster of lines which exactly matches that used for scanning in the camera tube. This is relatively easy to achieve because an electron beam can be diverted by a magnetic field. Electromagnets are clamped round both the camera and receiver tubes and fed with pulsed control signals which move the beam in the scanning raster of lines. In the receiver tube the electron gun is controlled in strength by the signals which originated from the tv camera. The stronger the beam the brighter the image produced on the screen.

Thus if the image formed by the camera lens on the camera tube is of bright white light then the electron gun in the receiver is driven hard to produce a bright white light on the screen. If the image seen by the camera is dark, then the receiver electron gun produces little or no light on the screen. If, as is most commonly the case, the image on the camera tube is of transitions between dark, light and intermediary shades of grey, then the electron gun continually varies the strength of the beam as it scans the receiver screen to produce transitions between light, dark and shade. Provided that scanning synchronism between the electron beam in the camera and the electron beam in the receiver is accurate, the receiver screen will display a pictorial replica of the image seen by the camera lens.

How Television works today

So far we have been thinking only about light, dark and shades of grey, *ie* black and white or monochrome pictures. To produce a colour picture the process must effectively be replicated three times over, using the fact that all known colours can be produced by varying combinations of the three primary colours (red, green and blue.) In the simplest type of colour camera (simple to describe of course. rather than simple to construct), three separate camera tubes are used, each designed to sense only red, green or blue light. The camera thus produces three output signals separately signifying the red, green and blue components of the picture. These outputs are coded together with black-and-white information so that they can be transmitted over a single wavelength, rather as the two channels of a stereo sound recording are cut in the single groove of a gramophone record.

In the receiver the three colour component signals are decoded again to control three separate electron guns in the receiver tube. These guns produce three separate electron beams which all fall together on the phosphor coating of a cathode ray tube screen. But the phosphors are of three types, which produce either red, green or blue light when struck by an electron beam.

Different colour tv tube designers adopt different methods of separating the three types of colour phosphors and the three beams. Essentially however the phosphors are arranged in discreet bunches or lines, and shielded by perforated masks or grids so that they can only be struck by their intended beam, *ie* the electron gun controlled by the red picture component signals

produces a beam which can strike only those phosphors which produce red light, and so on. In this way a full colour picture is built up on the receiver screen.

To record colour tv it is thus only necessary to record the coded complex of colour component signals which is transmitted to the receiver. Unfortunately the word "only" here is a gross understatement. To "paint" an accurate picture on the tv screen the electron beams must vary in brightness very rapidly. Thus the control signals for the beam must be of very high frequency. The colour television signals transmitted today contain frequencies up to 5 MHz or 5 million cycles a second. Compare this with an audio signal which need extend only up to 20 KHz or 20,000 cycles a second and you start to see the problems involved in colour video recording. There is also a need for exact synchronisation between the camera scanning and receiver scanning, and this is achieved by 'sync pulses' transmitted along with the beam control signals. If these sync pulses are not recorded and replayed with extreme accuracy the beam synchronization pattern in the receiver goes haywire and the pictures on the screen break up just as they do if you incorrectly set the horizontal line and vertical frame holds on a tv set.

International Incompatibilities

It is here opportune to look more closely at the line structure of a tv picture and the method used to code the colour information onto a single wavelength. Unfortunately there is no world standard for the picture line structure and colour coding technique. If there were, life would be much easier for system designers and the public alike.

The first electronic tv system used in the UK built up each tv picture from 405 lines and displayed 25 different pictures or "frames" a second. For reasons which will soon become clear, this 25 pictures or frames per second rate derived directly from the UK mains frequency (50 Hz), and although tv sets are no longer locked to mains frequency as they were in the early days, the 25 fps rate still remains in all Europe. It was recognised from the very earliest years of electronic television that the display of 25 pictures per second is far too slow to prevent noticeable flicker on the screen. (The cinema industry had learned this long before, and can only succeed in displaying 24 (or 16) pictures per second by deliberately introducing extra flicker from a multi-bladed shutter.) The 1930's television engineers devised a clever electronic equivalent to the multi-bladed shutter of a film projector. They built each tv picture frame from two half picture frames or 'fields' so that the 25 pictures per second rate becomes effectively 50 pictures per second. (This tied conveniently to the 50 cycle mains.) Early UK tv pictures were thus built up from two separate field scans, each of 202.5 widely spaced lines which optically interlace together to give a more tightly packed 405 line picture. Conventionally one field is referred to as the 'even' field and one as the 'odd' field. Although 405 line tv is now on its last legs in the UK and will soon disappear altogether, exactly the same interlaced 50-field-per-second approach is used for modern 625 line pictures in the UK, and in fact the interlaced field approach is used throughout the world. In the UK a 625 line picture is built up from alternate odd and even fields of 312.5 lines each. Most European countries also now transmit mainly 625 line pictures but in the USA and Japan all tv pictures are built up from two fields of 262.5 lines each, to make a total of 525 lines. Here then is a first and major stumbling block to world tv and video standardization: different countries use different line structures for their tv pictures.

But this is by no means the only obstacle. The USA and Japan not only use a different line structure, they also use a different picture or frame rate. Instead of 25 fps as in Europe, Japan, the US, and several other countries display 30 picture frames per second. This derives from their 60 cycles per second mains standard, and although the 525 line picture is often criticized for offering less definition (clearly you can get better resolution from a picture broken down into 625 lines than you can from one broken down into fewer and hence coarser lines), the 30 fps rate is now generally regarded as preferable to a 25 fps rate. With field interlace the 30 fps rate gives a field and flicker rate of 60 per second instead of the 50 per second in Europe. When a tv screen is showing a brightly lit sequence, eg a clear sky, it can often be seen to flicker in Europe. But in the US flicker is virtually eliminated, as few human eyes can detect a 60 cycle flicker even when the picture is bright and light. Ironically, although no tv system is tied to mains frequency any more, it is too late for anyone to change such a basic parameter as frame and field rate.

In addition to the line and field rate differences between countries, there is also a wide difference in the frequencies used to transmit signals into homes. Early UK transmissions were on the VHF

bands, packed in amongst FM radio broadcasts. But in the UK now all 625 line broadcasts are on the UHF bands. Elsewhere in the world a wide range of UHF and VHF frequencies are used; in some countries VHF and UHF are used for alternative programmes.

More subtle differences also exist between the methods used for separating the sound and picture signals in different countries. Essentially the sound signals and picture signals are separated on transmission by a small fixed frequency. Unfortunately this fixed frequency varies from country to country, and the UK is an odd man out in Europe in this respect. This is why tv equipment intended for the UK will usually not tune in properly to both sound and picture for Continental broadcasts, and *vice versa*, even where the country's tv standards appear to be the same as ours.

But even this is by no means the end of the tv incompatibility story. As mentioned above three colour signals are coded together for transmission along with basic black and white picture information. In simple terms the black and white picture information is transmitted as a 'luminance' (brightness) signal and the colour information as a 'chroma' (colour) signal. To transmit the chroma information as three separate colour signals (red, green and blue) would take up far too much frequency space in the already crowded airwaves. So a clever coding technique is used.

The basic idea of colour coding dates back to an invention made by a Frenchman, Georges Valensi of Paris in 1938. After the war, the Valensi patent was extended in legal life and proved very valuable, as it laid the groundwork for all modern colour tv transmission. Unfortunately different countries have used Valensi's groundwork in different ways. There are three basic colour coding techniques now in use throughout the world. The NTSC system is used in the USA and Japan, the SECAM system is used in France, the Middle East and the Russian bloc countries, and the PAL system is used in the UK and most of Europe. To cut a long story short, a PAL colour transmission can only produce colour pictures in a PAL receiver, a SECAM colour transmission can only produce colour pictures in a SECAM receiver, and an NTSC colour transmission can only produce colour pictures in an NTSC receiver. This incompatibility is of course in addition to all the other incompatibilities already mentioned, eg line and frame structure, transmission frequency and so on.

To make matters even worse there are modifications inside the basic formats. French SECAM, for instance, is not the same as Middle East and Eastern German SECAM! There may incidentally be some method in this apparent madness. By making their colour tv system different from virtually everything else in the world, the French have created an artificial barrier to imports. For many years it wasn't worth the while of foreign companies to produce limited quantities of special SECAM equipment for France, so the French tv industry has for many years been shielded from low cost competition from the Far East. The European tv industry has also been shielded from low cost competition by the patents granted to Telefunken of Germany on the PAL colour system. These patents which, along with the Valensi coding patent, were administered in the UK by EMI, have been cleverly used to limit the influx of large screen colour tv sets into Europe and the Far East. The Valensi patent is now long since dead and the PAL patents are dying out. This is causing considerable concern to European tv set manufacturers who are now losing a valuable legal restraint on competitive tv imports. It also helps explain the increasing competition now being seen in the domestic tv market places.

It should now be clear why it is decidedly risky to buy any tv reception equipment abroad for use in the UK, or to expect UK equipment to work in a foreign country. It is even more risky to assume that a videotape made in one country will play back satisfactorily in another. This is because there are a number of wholly different video recording systems now on the domestic market, and even apparently identical systems (*ie* with the same brand name such as *VHS* or *Beta*) may be quite different in different countries. To give just one example, the tape speeds of video cassette recorders sold for use in Japan and the USA are often quite different from the tape speeds used in apparently similar recorders sold for use in Europe. The rapid development of video technology over the last decade to meet consumer requirements explains the variety of different basic formats, and the wide range of different tv transmission systems in use around the world accounts for the differences and incompatibility between ostensibly identical recording formats in different countries.

Video recorder beginnings and development

At first sight there appears a simple solution to recording video signals onto tape; you simply run the tape very fast so that the high frequency wavelengths required are sufficiently stretched

out along the tape length to give them room to be recorded and replayed accurately. Although, by a full circle turn of technology, the high speed linear approach (usually called Longitudinal Video Recording or LVR) has been coming back into the news, early attempts at recording video with high linear tape speeds foundered. The speeds have to be so high, at least four metres a second even today, that a large spool of tape is soon used up. If a super-large and hence heavy spool is used, the machine becomes an unstable, and potentially dangerous, beast. Moreover it is very difficult to control high linear speeds with great accuracy, and any fluctuations in linear speeds will upset the regular flow of picture sync pulses and cause the reproduced pictures to break up. One of the two LVR systems so far proposed (from BASF) relies on a Time Base Corrector to iron out speed differences. A TBC is a digital store which accepts irregularly timed pulse trains and outputs a regular train. The other LVR system, proposed by Toshiba, probably also uses a TBC, although the company has so far been very secretive over such details. More of LVR later, however.

The real breakthrough in video recording came a quarter of a century ago when the American firm Ampex developed a VTR (Video Tape Recorder) which relied on a completely different principle of recording signals on tape. The Ampex machine, which was as large as a wardrobe and even then cost 75,000 dollars, replayed pictures with quality far inferior to that available from one of today's £500 domestic video cassette recorders. It was also capable only of producing black and white pictures. But it did work, and every professional, semi-professional and domestic machine in the world today is in one way or another a direct or indirect descendant of the original Ampex design.

Instead of running conventional narrow tape at a high linear speed, the Ampex machine used much wider tape (two inches in width) and ran it relatively slowly (15 inches per second). The key to the operation was that the recording and playback head was not fixed as in a conventional video recorder (or an LVR machine). In fact there wasn't just one head—there were four, and the four heads were mounted on a rapidly rotating drum which lay alongside the tape. This quadruplex or 'quad' head arrangement laid down a series of magnetic stripes across the width of the tape. This produced the magnetic equivalent of a very fast moving and very long tape length. Modern versions of the old Ampex machine are still in use today for professional broadcasting. They are of course colour capable, and offer quality indistinguishable from live television, but they still rely on the same quadruplex head technique, and they still use 2" tape running at 15ips.

All domestic, and semi-professional machines (and now some professional broadcast machines) adopt a modified approach. This stems from development work carried out by Ampex in the USA and a number of Japanese firms, notably Toshiba. The modified approach is called "helical scan". Two, rather than four, recording heads are mounted on a rapidly rotating drum, and this is arranged obliquely, rather than transversely, to the tape. The tape is narrower than that used in an Ampex quadruplex machine: half an inch wide for domestic machines, three-quarter inch wide for semi-professional machines and one inch wide for the highest quality helical scan equipment. (One firm, Akai, has even sold quarter inch helical scan machines.) The tape moves relatively slowly; in modern domestic machines it moves at only around one inch per second, which is even slower than an audio cassette.

Because the rotating head drum is obliquely angled to the tape, the magnetic stripes which the two spinning heads lay down are helical, like the threads of a screw. Hence the term 'helical scan'. A major advantage of the helical scan approach is that it readily enables 'freeze' or 'still-frame' display. Each of the two heads record one field of each tv frame or picture. Thus when the tape is stationary and the head drum continues spinning, the two heads continually replay the odd and even fields of a tv frame. The tv screen thus displays a continuously repetitive sequence of two tv fields which interlace to build up a freeze-frame or still-picture. The facility to display freeze-frame easily is one reason why the head drum rotational speed is always made a multiple of the picture or frame rate on a helical scan machine. In Europe the video heads of a helical scan recorder rotate at 1500 rpm, or 25 times per second, to match the 25 pictures per second frame rate. In a helical scan machine intended for the USA or Japan the video head drum rotates at 1800 rpm, or 30 times a second, to match the 30 pictures per second frame rate used in those countries. This then is yet another basic incompatibility between superficially similar video machines intended for different countries. We shall return to freeze-frame display, and trick-play in general, later.

In the 1960's some helical scan machines were available at a reasonably low price (under £1,000) and were used mainly for industry and education. They relied on open reels of tape

(usually ½ inch wide but as mentioned above sometimes ¼ inch), and superficially resembled an open reel audio tape recorder. But the tape path is much more complicated in a video recorder because the tape must be threaded in a close wrap around the head-drum, and past several guide and tensioning rollers. Although this is no particular hardship to an intelligent user, it is a fiddly task especially when you are in a hurry—and there is always the risk of damaging the video heads. These are very fragile, and expensive to replace.

In recent decades Kodak has launched a self-threading Super 8 film cartridge to replace the Standard 8 film roll which required awkward manual threading, and Philips has given us a compact self-threading audio cassette. Following this train of consumerism, videotape engineers around the world set themselves a goal: a video cassette recorder which threaded itself completely automatically, so that the user need never touch any of the fragile machine parts or the tape (which itself is easily damaged by finger contact).

In the early 70's Sony of Japan offered the *U-Matic* video cassette format and Philips of Eindhoven launched the *VCR N1500*. The *U-Matic* used, and indeed still uses, a tape speed of 3¾ inches (9.5cms) per second and three-quarter inch wide tape. The Philips *VCR N1500* machine used narrower tape (½ inch wide) but a higher tape speed of 5½ inches (14.3cms) per second. Both formats therefore consumed a similar *area* of tape. Both also offered a maximum playing time of one hour per cassette.

The Sony *U-Matic* was always aimed only at the industrial and educational market, and has rightly become a virtual standard in these areas. On the other hand the Philips machine was aimed at the industrial, educational and domestic markets, and fell between all stools. It was neither good nor tough enough to become an industrial standard, and it was only a stepping stone to today's domestic video recorders. The one hour maximum playing time per cassette was inadequate for taping feature films off-air, and the cost of that one hour cassette was between £20 and £25. Only the most well-heeled enthusiast could afford such indulgence. Nevertheless the machine was a remarkable technical breakthrough. It set the whole domestic video ball rolling. The sadness is that Philips soon lost its lead in the domestic video market and has not yet won it back.

The Philips *VCR N1500* machine had three features which were available only as expensive optional extras for the *U-Matic*, but which are now standard in virtually every video cassette recorder in the shops today. Every *N1500* had a built-in tuner, a built-in modulator and a built-in timer. As previously explained, the tuner enables a video machine to record television programmes 'off air', whether or not it is used in conjunction with a tv receiver and whether or not an associated tv receiver is tuned into the same station. The modulator enables the recorder to replay direct into the aerial socket of a conventional tv receiver, and the timer enables it to be set to switch on and off at pre-set times. In those early Philips machines, the timer was of fairly primitive mechanical type and was not accurate. This, coupled with the British tv companies' infuriating habit of not sticking to pre-announced schedules, often meant that a Philips video recorder would miss the end of a one hour programme because the tape had run out.

The original Philips *N1500* machines cost only around £500, which was remarkable for the time. And when they were good they could produce very good pictures and sound. Unfortunately they gained a poor reputation for reliability, and this was largely the result of a puzzling design decision by Philips. Although the company had pinned their faith on a flat or 'co-planar' audio cassette, they used a two-tier video cassette. The Philips format video cassette has the two tape spools mounted one on top of the other rather than side-by-side and the tape runs in a skew path between them. Each cassette contains several dozen separate component parts, and the whole is, frankly, a brute to mass-produce. Furthermore, the tape has always had a tendency to stick and jam. The *U-Matic* system, incidentally, uses a larger but flat cassette with co-planar tape spools, and this has surely contributed to its reputation for reliability.

It soon became clear to video designers around the world, especially in Japan, that reliability was a key factor in domestic video, and that the one hour maximum playing time had to be improved on for domestic users. This time constraint represented no real problem with a *U-Matic*, because in industrial and educational use there is seldom a need for more than one hour's continuous programme. But for domestic time shifting a minimum of two hours per cassette is essential. It was also clear that if the long awaited video revolution was ever to happen, Mr and Mrs Average would have to be able to tape their two hours or more of tv off-air at considerably less cost than the £20 or £25 per hour feeding-cost for the Philips *N1500*.

There is one obvious way in which to kill these

two birds with one stone, and that is to reduce the linear tape speed so that it passes the rotating heads more slowly. But this is technically a very tall order. If the tape speed is reduced by half, to double the playing time and halve the feeding cost, the helical stripes across the tape will bunch one into the next. At first this seemed an insuperable problem. The *N1500* and *U-Matic* both had clearly defined guard bands between each helical stripe across the tape. If these guard bands were reduced in width, or sacrificed altogether, there was unacceptable cross-talk between adjacent track stripes, and the pictures on screen were badly degraded. The solution, now adopted by every domestic video manufacturer, borrows from a twenty year old idea of Professor Okamura of Japan. This is the so-called "slant azimuth" principle.

According to the slant azimuth approach, the two heads on the video drum are slightly angled in opposite directions so that each lays down a track which can only match in azimuth the head which has recorded it. Let's call the two heads on the drum the A and B heads. The A head records the A field of each tv frame and the B head records the B field of the same frame. But because the azimuth of the A head is different from the azimuth of the B head, the A head can only read the A field tracks across the tape and the B head can only read the B field tracks. This parallels the situation in an audio cassette recorder where there is a loss of high frequencies if the playback head azimuth does not match the azimuth of the record head. (To be strictly accurate, some clever phase shifting circuitry is necessary in a video recorder to ensure that the A and B field heads ignore low as well as high frequencies from the other fields.) Once the slant azimuth technique had been worked up to a practical system, there was no longer any need to provide guardbands between the video tracks across the tape. It doesn't even matter if adjacent tracks slightly overlap each other. The A field simply ignores any B field information that overlaps into the A field track. Once guard bands had been banished, the door was open for low speed recording, with long playing time and low feeding costs.

The current formats

To cut what is really a very long and very complicated historical story short, various Japanese companies announced various low speed recording formats. Of these only two prevailed; the JVC-developed *VHS* format and the Sony-developed *Beta* format. News first broke of these in 1976 but they did not appear on the British market until a couple of years later. In the meantime Philips had launched a low speed version of the *N1500*. This was called the *VCR LP* (Video Cassette Recorder Long Player) and code named the *N1700* series. The Philips *N1700* machines were launched on the UK market in the Winter of 1977 and have now been phased out in favour of a new and wholly different Philips format, the *V2000*. The *N1700* machines ran tape at less than half the speed of the original *N1500* machines, but used the same cassette and thus offered over two hours from a one-hour cassette. In a curious move, Grundig, supposedly a Philips ally, modified the Philips *VCRLP* format still further by offering *SVR* (Super Video Recorder). This was a machine which took the same cassette but ran the tape even slower to offer even longer playing time and lower feeding cost. In fact, to add to the confusion, although the Grundig machine *looked* as if it would take normal standard Philips video cassettes it actually needed batch-selected cassettes which had a special lug built in to trigger a sensor in the *SVR* machine. It isn't surprising that the *SVR* machine format started to disappear almost as soon as it was launched, and Grundig is now partner with Philips in the new *V2000* format.

'Trick-frame'

There is considerable confusion in the video market-place over how still-frame, slow motion and fast motion replay (commonly all called 'trick-play') are achieved. This confusion was brought to a head when Sony launched the *C7* machine in London early in 1980. According to the show-biz presenter employed to display the *C7* to the UK press and trade, this was the first domestic video machine to offer 'genuine slow motion', because it displays every frame rather than selected frames. Of course if a video system only displays selected frames in slow motion, *ie* skips some altogether, it can miss that vital frame in which a cricket ball hits the batsman's pad, a football glances off the hand of a player, and so on. It may also conceal the crucial point of a conjurer's trick. (The conjuring world is in fact more than a little alarmed at the prospect of domestic viewers analysing their televised tricks in slow motion). After the presentation, engineers with a close knowledge of *VHS* promptly confirmed that it was rubbish to suggest that the *VHS* system only displays selected frames in the slow motion mode. This can be confirmed by photographing a digital clock with a *VHS* machine and video camera, and then replaying the pictures in slow motion. The seconds display on the clock

changes every 25 frames or pictures displayed. As European television relies on a 25 frames per second standard this confirms that the *VHS* 'slo-mo' is indeed displaying every single frame of information. But try the same trick with the Sony *C7* and you are immediately faced with a fascinating mystery—as if by magic it displays twice as many pictures!

To understand how this apparently impossible situation arises, is to understand the whole business of video 'trick-play'. As previously explained, a television picture in Europe is built up from 625 lines, and to avoid the very noticeable flicker which would arise if the 625 line picture were changed only 25 times a second, each picture is interlaced from two fields, each of 312.5 lines. As also explained these are conventionally referred to as the A and B fields.

When the BBC or ITV are transmitting pictures derived from a film, using tele-cine equipment, fields A and B of each picture or tv frame are the same. This is because the film is running through the tele-cine at 25 frames per second, and each film frame is scanned twice to produce two identical fields. (Incidentally cinema film is shot at 24 frames per second but run at the slightly faster speed for tele-cine. This is why films last a slightly shorter time on television than in the cinema. It is also why someone with very acute musical hearing may notice a slight pitch increase in any music on the film soundtrack.) However, when pictures are transmitted or recorded from a television camera each field (A, B) of each frame will be slightly different because they are separated in time.

We have already seen that when a television signal is fed to a video recorder the A field is recorded on the tape by one head on the drum (called the A head) and the B field is recorded by the second head on the drum (called the B head). According to the slant azimuth technique, which angles the two video heads differently to prevent crosstalk, the A head can only read the A field tracks and the B head can only read the B field tracks. At first sight there appears to be no problem in replaying a still picture from video tape. You simply stop the tape so that the A head continually scans an A field track and the B head continually scans an adjacent B field track. In practice however, simple geometry proves otherwise. The angle of the tracks which the heads record across the tape effectively varies with the speed at which the tape is running past the rotating heads. So the angle of the tracks laid across the tape will only exactly match the scanning angle of the heads when the tape is being replayed at exactly the same speed as during recording.

When the tape is stationary there is a quite considerable angular discrepancy between the rotating heads and the oblique tape tracks. Unless special measures are adopted the rotating heads can only read part of their intended track. Where the head mis-tracks, *ie* leaves its intended track and starts trying to read an adjacent track, only random noise is generated because (due to slant azimuth recording) head A can only read an A track and so on. If the tape is stopped on a simple recorder, without provision for still-frame or trick-play, there will be serious mis-tracking, and a 'noise bar' or horizontal line of confusion will appear across the middle of the picture. (On some early video machines you could artificially produce still frame by holding the start button half pressed). On some machines that offer still-frame reproduction, the noise bar problem is partially solved by servo circuitry in the tape drive; this automatically inches the tape past the heads until the mis-tracking is confined to the edge of the tape. The noise bar then appears on the top or bottom of the picture. But this is not a wholly successful approach, because the noise bar can be seen to roll up and down the picture and never truly disappears. For this reason JVC developed a very clever approach which is now being used on an increasing number of *VHS* machines.

On early *VHS* machines each of the two video heads on the drum were 49 microns wide. On the new improved slo-mo machines the A head is 60 microns wide and the B head is 80 microns wide. During recording this doesn't matter because the too-wide track recorded by the A head is trimmed down to size as it is over-recorded by the B head and the too-wide track recorded by the B head is then trimmed down to size by over-recording from the A head and so on. So standard width tracks are recorded on the tape even though the heads are of non-standard size. During normal replay there is also no problem because (due to slant azimuth) the A head can only read the A tracks and the B head can only read the B tracks. Each head simply ignores what it sees of the next door tracks because they are of the wrong type. (To be strictly accurate, some phase-shift circuits are needed to ensure full cancellation of crosstalk, but this is not of significance in the present context.)

When the *VHS* machine is set in the still frame mode, the extra-width heads come into their own. The A head, which is wider than the A field track, is automatically aligned with the A field track on

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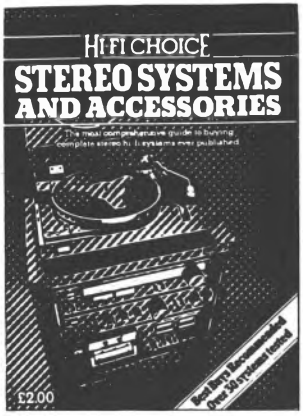

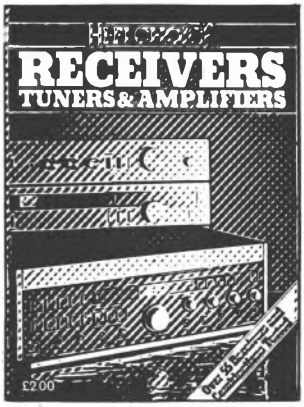

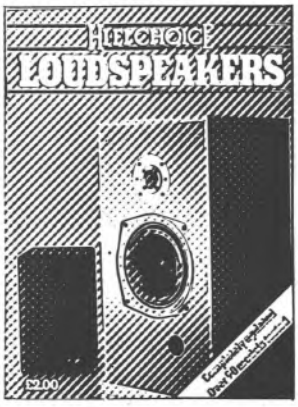

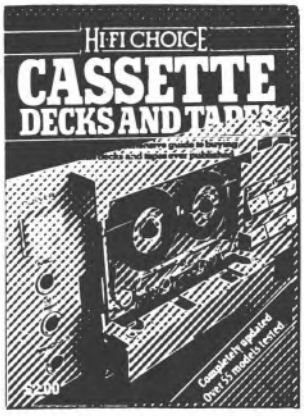

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the stationary tape to read it as accurately as possible. It overlaps a little of the B track to either side but duly ignores what it overlaps because of slant azimuth. Because the A head has been aligned with the A field as accurately as possible, the B head is now out of line with the B field. But because it is much wider, almost double the normal width in fact, it is still able to read the misaligned B track with only a little loss at the edges. Again of course it overlaps the neighbouring tracks but again it duly ignores them. The result on screen is a fully interlaced still picture made up from the A and B fields, with only a slight degradation of quality at the top and bottom and a noise bar out of sight at the extreme top or bottom. In the slow motion mode the *VHS* machine steps from frame to frame under servo control in a very precise manner. Because it steps from frame to frame, 25 frames a second are displayed.

The Sony *C7* does *not* adopt a similar approach. Instead of moving in discrete steps, the *Beta* tape crawls continuously past the rotating video heads so that they are continually scanning different pairs of tracks. The *Beta* system, like *VHS*, relies on slant azimuth, so the A head can only read an A track and the B head can only read a B track. Thus as the tape slowly moves past the heads for slow motion display they read an ever-changing combination of field pairs, *ie* first track A and track B from a first time frame, then track B from the same frame and track A from the next frame, then the same A track but the B track from the next frame and so on. This produces a continually changing series of still frames with a noise bar which continually rolls across the picture. When the *Beta* machine is switched into still-frame, the tape is inched into a position where mis-tracking is confined to an area as near the tape edge as possible. The noise bar is thus at the top or bottom of the picture. The tape then remains stationary until the still frame switch is released.

Because the Sony *C7* moves in slo-mo from field to field rather than from frame to frame (as in *VHS*) it appears to display twice as many still pictures as a *VHS* machine with stepped slo-mo. It is a moot point whether this difference is an advantage or not. But certainly the noise bars are much more noticeable on the crawling *C7* slo-mo than they are on the stepped slo-mo offered by *VHS*. So if there is any benefit from crawling from field to field, rather than stepping from frame to frame, it is offset by the noise bar interference.

Why then does Sony not adopt a similar solution to noise? The company argues that although the slant azimuth recording technique eliminates the cross-talk which is inevitably created by use of the double-size head for normal play at high frequencies, there is still cross-talk in the lower frequencies where colour information is carried. This is eliminated by filtering and signal averaging techniques, but could cause some loss of vertical definition in colour rendition. The Sony philosophy is that picture quality for normal speed replay should not be sacrificed for improved quality in still picture or slow motion replay, because normal speed replay is for most people by far the most important use of a video cassette recorder.

Doubtless this is why Sony is already introducing in Japan a new generation of machines which offer improved still-frame display. These adapt a technique used in broadcast television technology. An extra video A head is mounted on the drum, alongside the normal B head. So in the still frame mode the A field is scanned twice per frame and the displayed still picture is actually made up of two identical fields even though they are interlaced in the normal manner. (Because the A head cannot be in exactly the correct position on the drum—which is occupied by the B head—a delay line electronically compensates for the slight error in position.) Conjurers can thus look forward to a reprieve, if the split-second give-away to their trick is caught only by the B field on a future generation *Beta* machine which shows only A fields in the still-frame mode!

Fast search

Normally when a video recorder is put into the fast forward or fast re-wind mode, no pictures appear on the screen. Two years ago in Japan, however, Sony demonstrated a Betamax machine which produced pictures on the screen even with the tape running at high speed. Although the pictures were inevitably of disjointed form and degraded by horizontal bars of snowy noise, they were recognisable. This feature made it possible for the user to scan through a video tape recording looking for a particular sequence, rather like flipping through the pages of a book. Initially Sony claimed that the VHS format, with its different tape-loading path, couldn't offer what they christened 'fast picture search' or 'cue and review'. But inevitably, bearing in mind the rivalry between the Beta and VHS camps, it was not long before VHS machines started to offer a similar facility (albeit under the slightly different name of 'shuttle search'). Now most top-priced video recorders of either format offer a similar facility. For the VHS machines the tape is simply kept wrapped round the drum while it is

wound at high speed, instead of being unthreaded back into the cassette as it is for normal fast wind or rewind.

Fast picture search can be a *very* valuable feature, because it can be an infuriating business to search through a long tape for the beginning and end of a programme by the hitherto routine fashion of continually switching between fast wind and play and so on.

The V2000 format has the potential to offer extremely clear pictures in fast search, and the review of the Grundig 'plus' model in this book would appear to bear this out.

Several machines of all formats offer another aid to fast searching through pre-recorded material. An inaudible cue tone is automatically recorded on the tape every time the machine stops and starts recording. Sensor circuitry in the recorder can then stop the machine from fast wind every time a cue tone is reached. If for instance a tape with several different programmes is re-wound, the recorder can be set automatically to stop at the beginning of each fresh sequence. Some machines offer cue tone searching in addition to fast search with picture; others offer it as an alternative.

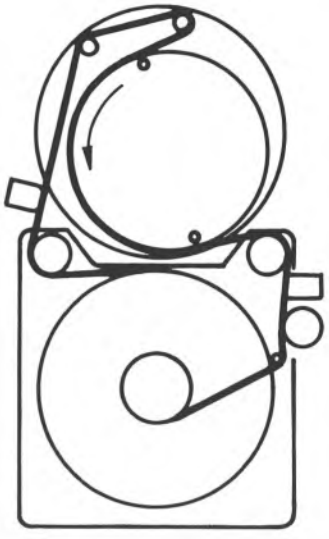

Fig 1. 'C' loading wrap.

The major systems – vital statistics

Philips *N1700* uses the original Philips video cassette with the two tape spools stacked one on top of the other (*ie co-axial*), and casette size is 146x127x41mm. Tape width is ½ inch, speed is 6.56cm per second and maximum playing time per cassette 3 hours (or more usually 2½ hours). Track width is 85 microns, video drum diameter 105mm, and writing speed 8.1 metres per second. By way of reference the original *N1500* format used the same cassette, but ran the tape at 14.29cms per second to give a maximum of one hour playing time. The *N1500* track width was 130 microns.

The VHS format cassette has the two spools side by side (*ie co-planar*), and measures 188x104x25mm. The tape width is ½ inch, VHS running speed is 2.34cms per second, and maximum playing time is normally three hours, but four hour cassettes (with more, thinner tape inside) are now becoming available. Track width is 49 microns, the video drum diameter is 62mm and the writing speed 4.85 metres per second.

Beta format uses another co-planar cassette, this time 155x95x25mm, and again tape width is ½ inch. Tape speed is 1.87cms per second, to give a (current) maximum playing time of 3 hours 15 minutes, but a four hour cassette should be possible. Track width is 33 microns, video drum diameter 74.5mm, and writing speed 5.8 metres per second.

V2000 uses a co-planar cassette, superficially very similar to the VHS cassette, of size 183x260x110mm. The tape is again ½ inch wide, but only half the tape width (*ie* ¼ inch) is used on each pass. The cassette is then flipped over and the second half of the tape used on the return run, in a manner comparable to the use of a compact audio cassette. Tape speed is 2.44cms per second with a maximum playing time per cassette of 8 hours (4 hours in each direction). Track width is 22.6 microns, the video drum diameter is 65mm, and the writing speed is 5.08 metres per second. Space is set aside in the centre of the tape for two auxiliary tracks, one for each "pass" of the tape. These tracks, which can for instance be used to record cue pulses for audio-visual synchronisation, are not yet used by any machine on the market.

Tape loading wrap

Both the Philips *1500* and *N1700* series machines used the same tape loading path as shown in Figure 1. For obvious reasons, this is commonly called C-loading or U-loading. As its name implies this was the path adopted by the

U-Matic format. Beta format machines also use U-loading as shown in Figure 2. VHS however adopts a path called M-loading as shown in Figure 3. The Beta faction claim that U-loading puts less tension on the tape because it passes through fewer tight curves. This, they say, reduces wear, and makes it easier for a Beta machine to keep the tape wrapped round the video head drum at all times, *ie* during normal playing, fast rewind, fast forward wind, or fast search. The VHS camp refute this, and argue that there is less wear on the tape and video heads if it is unwrapped from the drum for fast forward and re-wind. For fast search with picture a VHS machine must of course leave the tape wrapped round the drum. Curiously the V2000 format does not specify U- or M-loading. Grundig uses a U-loading wrap, similar to that adopted by Beta, while Philips on the other hand uses an M-wrap, similar to VHS.

The issue of head and tape wear is still unresolved; despite all the claims and counter-claims, no-one has yet offered up any real evidence to suggest that the Beta U-wrap wears the tape and/or heads faster than the VHS M-wrap. There has however been some evidence to support another claim, namely that it is easier to make a small, compact portable with M-wrap because the U-wrap mechanism takes up more space. The real proof on this point may however come when Philips and Grundig, whose V2000s each use the same size head drum but adopt M- and U-wrap respectively, start to show their portable units.

One thing, however, is beyond dispute. The VHS format policy of unwrapping the tape from the head drum for normal fast forward and rewind does limit the speed with which such a machine can be switched between fast wind and record or replay mode. The few seconds it takes to wrap and unwrap can be very irritating, especially where the user is searching through a long tape for a specific point in the recording. Fast search is thus an even more valuable feature on a VHS machine than on a Beta recorder.

The V2000 format here offers a choice. The tape can either be wound fast through the machine while still wrapped round the drum, or (by a different user control selection) it can be wound at higher speed after unwrapping from the drum. This option was built into the format in readiness for the provision of fast search on second generation V2000 machines.

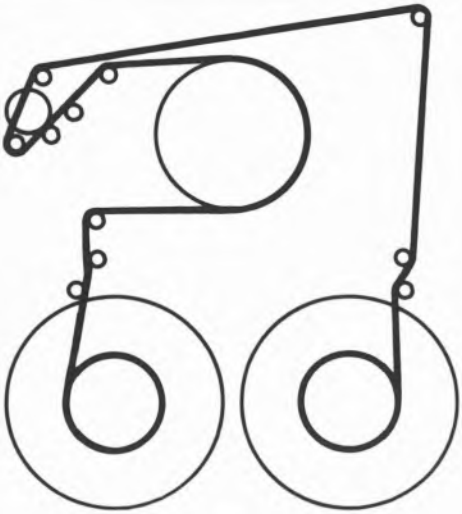

Fig 2. 'U' loading wrap.

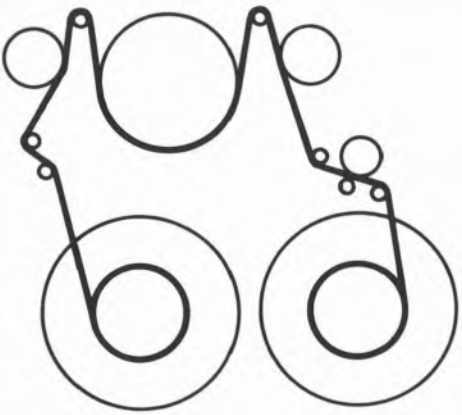

Fig 3. 'M' loading wrap.

Reproduction Quality

It is only now, nearly ten years after the very first Philips machines were demonstrated, that a few people are starting to question the *quality* of the pictures and sound available from a video

cassette recorder. Until recently the promise of three hours of colour tv pictures and sound from a cassette no larger than a paperback book (and costing no more than a hardback) has been a guarantee of satisfaction. But gradually a few people are starting to notice that the pictures on screen and accompanying sound are not really as good as those available from an off-air broadcast. The visual differences become even more noticeable if the tv screen is large (over 20ins), and the viewing distance is close. And even despite the low-budget circuitry and 'tinny' loudspeakers of most domestic tv sets, it's still possible to distinguish a loss of audio quality when programmes are recorded and replayed from a domestic video recorder.

Once inadequacies of picture and sound start to be noticed, they will become a selling point, just as the more subtle nuances of sound reproduction became a selling point in hi-fi. As this happens, the questions will be asked: why are some recorders better than others? It's much easier to explain the variations in audio performance than video performance. So we'll take these first.

Audio quality

Although all existing domestic video cassette machines record the video information by laying helical stripes across the tape from rapidly rotating heads, the sound signals are recorded in linear fashion. The tape simply runs past a stationary sound head just as it does in an ordinary audio tape recorder. It is well established that the performance of an audio recorder depends largely on tape speed and tape width. As the tracks become narrower the level of unwanted background noise effectively rises; this is why a stereo recording made on cassette tape (of one seventh inch width) is much more prone to background hiss than a recording made at a higher speed on open reel tape, which is ¼ inch wide. The use of Dolby and other noise reduction systems, and the availability of ever improving tape, has enabled audio cassette performance to be compared with open reel tape performance, but the medium is still very intolerant: if too much signal is put on tape it overloads and the reproduced sound is distorted; any build up of dirt or oxide on the audio heads will also degrade performance. For optimum results the tape type must be matched to the magnetic and electronic characteristics of the recorder.

Now compare an audio cassette with a video cassette. For the Beta and VHS systems the sound track laid alongside the area occupied by the helical video tracks is just 1mm in width; for V2000 it's only 0.65mm. At 1.5mm a stereo pair of tracks on an audio cassette is much wider. What's more, none of the modern domestic video cassettes run at anything like the speed of an audio cassette. The lowest speed is Beta (1.87cm per second), while VHS and V2000 run at similar speeds (2.34cm/s and 2.44cm/s respectively). Thus even the fastest domestic video tape speed is still only around half the audio cassette speed of 4.75cms per second. The use of Dolby noise reduction by some VHS machines, and proprietory noise reduction systems by Beta and V2000 may help keep background hiss down to reasonable levels, but it can do nothing for overall quality.

The tape used in a videocassette has a coating of much higher coercivity than an audio cassette. (A chrome 'high bias' audio cassette has a coercivity of around 450 oersted, but a video cassette has a coercivity of over 600 oersted.) This is essential for recording the very high frequencies needed to reproduce colour video, and as a happy by-product it offers a reasonable opportunity to record high audio frequencies with reasonable fidelity, despite the slow linear tape speeds used. The often inadequate bass response of a video recorder is often attributed to the thin tape used, especially in a cassette which offers three or four hours playing time. But in fact the coating on a video tape is similar in thickness at around 4 microns to that used for an audio cassette. (Incidentally video tape often has a slightly thicker base film; 10 microns or more for video and around 10 microns or less for audio). Inadequate bass response is more likely to be the result of economies in the video recorder audio circuits, tailored to the often poor audio performance of a domestic tv set. It is also advisable to roll-off audio frequencies below 100Hz for a video recording to prevent (or at least reduce) the irritating effect of 50Hz frame or field buzz breaking through from the picture circuits into the sound circuits.

Although some formats and machines can be expected to offer marginal benefits over their competitors, thanks to imaginative pre- and de-emphasis techniques, it would be a contradiction of well established laws of physics if any of the current domestic formats offered true hi-fi. The situation can only be radically improved if a new generation of video recorders is developed which encode the sound in digital code and interleave it with the picture signals. Otherwise there is not much more that can be done with the audio performance of domestic video cassettes.

CONSUMER INTRODUCTION

In many respects we are now doomed to audio quality which is inadequate by domestic hi-fi standards. And things will become even worse if either the VHS or Beta systems halve the tape speed to double the available playing time per cassette (as has happened in the US and Japan).

Anyone with an audio ear and intending to purchase a video cassette recorder should try and hear its sound replayed at reasonably high level through a tv set with respectable sound performance (*eg* one of the Philips 'hi-fi' sets). Listen for excessive background hiss, buzzes caused by breakthrough of the video signals on the sound circuit, and distortion through overload. If any of these problems is noticeable from the outset, they will become more and more irritating during prolonged domestic use.

Picture quality

Believe it or not no one is yet agreed on how to measure the picture quality performance of a video cassette recorder. As a result manufacturers, and reviewers, must either adopt measurement techniques evolved for broadcast use or invent their own. Broadcast techniques are largely unsatisfactory because they are intended mainly to check the quality of signals being carried between transmitters, and will fail to reveal inadequacies which are peculiar to domestic video recorders. To take just one example, a broadcast tv signal conveys the colour or "chroma" information on a carrier wave which is of higher frequency than the signals which carry the black-and-white or "luma" information. For both broadcast and domestic recording the luma is in FM, but for domestic video recording, where the bandwidth is not wide enough to carry the colour above the luminance, the colour carrier is reduced in frequency and recorded in AM under the luma. (Hence the term 'colour-under' as applied to all domestic colour recording.) Broadcast signal measurement tests inevitably overlook some of the problems which can occur with colour-under recording. For example, any phase jittter in this frequency band, caused perhaps by tape transport irregularities, will distort the colour signal. In European countries where the PAL system is used, these distortions will emerge as variations in amplitude, *ie* changes of colour strength, rather than the changes of hue which will be caused by similar distortion of an American format NTSC colour signal.

Rapid changes of colour strength will show up on the screen as mottling (high frequency noise) or as streaking (low frequency colour noise affecting several whole lines of the picture). Clearly a test measurement intended for broadcast equipment, which carries the chroma signal at high frequency, cannot possibly quantify such by-products of colour-under recording. As the effect of colour noise is very noticeable on screen this is obviously an important inadequacy of the test technique. But, in Catch 22 fashion, if non-standard techniques are used to measure individual products, the results can be equally valueless because there is no point of reference with other products.

As a result manufacturers can quite legally quote all manner of exotic figures to impress the trade, press and public, even though the pictures on screen are far worse than one would expect from the figures quoted. So for this comparative survey of a wide range of equipment, completely new tests have been developed in an effort to correlate subjective viewing impressions with measurements by instruments.

Chroma or colour noise is of course only one contributory factor to a general subjective impression that the reproduced pictures are poor. A picture replayed on a video cassette recorder can also look worse than a picture received off-air for some or all the following reasons. The colour may be smudged, the picture may be polluted by white snowy noise, and there may be overall lack of definition, *ie* the image appears soft as if out of focus. Particularly annoying, but often not immediately noticeable, is a shimmering fuzz on sharp-edged shapes in the picture, allied with loss of detail on wide open areas.

Colour smudging is caused by imbalance of the circuits which handle the luminance (black and white) and the chroma (colour) information. If the luma and chroma signals take different times to pass through their different routes, they will arrive on the screen out of step. The result is a colour ghost image alongside the more prominent main image. This becomes more noticeable on a large screen set.

White noise or random snow over the whole screen, like the off-air picture produced by a tv set with a poor aerial, indicates inadequate signal coming off the tape. Random white blips, dashes or holes in the picture are a sign of drop out, that is to say brief local deficiences in the tape coating which briefly cause the signal to disappear altogether. Video recorders include circuitry which compensates for brief drop outs by continually storing and replaying the last line of the picture when the next line is spoiled by a drop out. But only the smallest gaps can be compensated, so large drop outs will still appear

as on-screen blips. Efforts are also made to disguise random snow noise by 'coring' or correlation techniques. The manufacturers are generally reticent over the actual circuits used, but coring techniques work – as the word suggests – by filtering off low level, high frequency noise from those areas of the picture where it is most noticeable, *ie* the wide open spaces, and leaving the useful 'core' of the picture. But coring also filters off fine detail, and cannot work on the transient type of signals which define sharp vertical edges. This is why sharp vertical edges in domestic video pictures often appear to shimmer; they are showing up the noise which has been filtered off from wide areas of the picture, but which remains on the transients. Correlation techniques compare one picture line with the next and boost similar information, while reducing random noise which is by definition dissimilar. This is similar to the technique used to clean up video pictures transmitted from space probes. The penalty is some lost vertical definition; the correlation circuit will be confused when the picture content changes radically from one line to the next, *eg* where there is a sharp horizontal edge in the picture.

There is good reason to believe that some of the manufacturers are measuring signal-to-noise ratios in areas which have been cored. As a result their figures are deceptively good, and uncored noise at the picture edges may be as much as 10dB worse. Also the impressive signal-to-noise figures tell nothing about the undesirable side-effect of coring, namely the loss of fine detail along with the noise in wide areas of the picture. This explains why a recorder with excellent s/n figures can produce pictures which are decidedly unpleasant to watch over a prolonged period of viewing. Objects adopt an irritating shimmer round their edges, hair and skin look like plastic, and a field of grass resembles a green wash of paint. For this reason a different approach to noise measurement has been adopted for this survey. This is intended to distinguish between the noise in cored and uncored parts of the picture.

All domestic video systems suffer from inadequate bandwidth. Whereas a broadcast signal has a bandwidth of over 5MHz, domestic video systems must make do with around 3MHz. As already mentioned the luma signals are recorded in FM and there is a physical upper limit to the frequencies which may be recorded. The limit for any system depends primarily on the writing speed, or the relative speed which the video heads travel with respect to the tape. Although adoption of a high writing speed means that higher frequencies can in theory be recorded, there are, as will later be explained, very real practical problems in relying on a high writing speed. For example if the tape is inadequate self-erasure of the high frequency FM signals may occur and even result in *less* video bandwidth than is obtainable from a lower writing speed. Either way, high frequency response, or more accurately lack of it, becomes especially noticeable on those same sharp vertical edges in the picture that show up noise when coring techniques are used. Sharp edge transients need a very wide bandwidth to reproduce accurately, and the inadequate bandwidth of a domestic video cassette recorder tends to distort the transients and so soften the picture edges. (The analogy with audio recording will be immediately apparent to any hi-fi buff.)

To compensate for this, domestic video cassette recorders use 'enhancement' circuits to try and restore the transient shape artificially. Essentially a 'gate' is used which changes state suddenly, like a switch, halfway through a distorted transient. This creates artificial sharpening. Without such enhancement the pictures from a domestic video cassette recorder would look unacceptably soft; but with too much enhancement they tend to look too artificial. Moreover the edge on the 'soft' side of the gating point still looks soft and mushy.

The clarity of a picture, or lack of it, is thus due to a complex of inter-related factors, each contributing a part to the overall subjective impression. Our measurements are intended to quantify the effect of these factors, separately and objectively. Over recent years, improvements in tape and recorder design have improved signal-to-noise ratio and frequency response. These in turn have improved picture quality.

Because V2000 adopts a high writing speed and uses the least amount of tape of all systems (only half the half inch tape width at 2.44cms per second) it places by far the heaviest demands on tape and machine technology. Early V2000 machines produced very poor pictures largely because the tape available was not up to the demands placed on it by the machine electronics. There was just not enough signal information, especially at high frequency, coming off the tape to provide clear, clean, noise free pictures. But latest batches of tapes and machines are offering far more encouraging results.

Writing speed

As already outlined, the theoretical key to successful video recording is a high writing speed, that is to say a high relative speed between the video heads and the tape. But there are problems in practice. When the tape is running fast past a stationary head, as in the old unsuccessful attempts at video recording and the newer re-discoveries of Linear Video Recording, the situation is very straightforward. The faster the tape runs past the head, the higher the speed at which the video signals are 'written' onto the tape. But where the tape moves slowly, past a rotating helical scan head drum, the situation is less simple.

The speed of rotation of the head drum is fixed, dependent on the country in which the video recorder is to be used. In the UK, where 50 separate fields, making 25 fully interlaced frames, are needed per second, the drum speed must be 1500 rpm if the heads are to produce a fully interlaced freeze frame picture when the tape stops. The two rotating heads then scan a pair of video tracks. Each track contains one field, so each of the rotating heads scans one track field to produce a fully interlaced freeze frame picture. For the USA, where there are 60 fields, and 30 interlaced frames, per second, the head rotational speed has to be 1800 rpm.

The linear speed of the tape in a modern domestic video recorder is virtually irrelevant to writing speed. The tape is moving so slowly, compared to the drum speed, that it contributes little or nothing to writing speed. (In fact in some machines the tape is moving in such a direction relative to the drum rotation that its speed of travel subtracts from the head speed, and thus marginally reduces the writing speed.) There is only one really significant variable – head drum diameter.

The bigger the video drum the further the heads have to travel for each revolution. As the speed of drum revolution is fixed, this means that the heads are effectively travelling faster on a big drum than on a small drum. To provide contact between the tape and each head over a full half revolution of the drum, the heads must trace a long oblique path across the tape width, rather than a short path from edge to edge. For V2000, which is recording on the equivalent of ¼ inch tape, the heads must follow a very long oblique path.

At first sight it seems obvious to make the drum diameter as large as possible and the helical tracks as long as possible. The writing speed will then be high, the high frequency response better, and the pictures clearer. Unfortunately there are problems.

The most obvious is that the use of a large diameter drum makes it difficult to build a compact portable recorder compatible with the system format. Moreover when long tracks are laid across the tape they will have to be narrow in width – unless of course the linear tape speed is increased. Obviously any increase in linear tape speed is unacceptable because the system then becomes less economical on tape, more expensive to run, and cannot offer the current expected norm of at least three hours per cassette.

Although the use of slant azimuth recording techniques enables the video tracks to be narrow and packed close together without cross-talk between adjacent tracks, the use of narrow, closely packed tracks puts another severe strain on the system. The more narrow the tracks, the more difficult it is for the video heads to trace them accurately. Even if a machine can successfully replay its own recordings, it may find difficulty in replaying recordings made on another machine with microscopically small mechanical differences. High writing speed thus requires a high degree of mechanical precision in the recorder tape transport.

There is also a problem over tape quality. As we have seen in a high writing speed system, especially where the tape width is narrow as in V2000, the heads are reading very narrow tracks. If the tape is of low coercivity (in simple terms the coating is not densely packed with individual magnetic particles) the narrow tracks will be unable to cope with the high frequency FM signals being laid down by the heads. The recorded signals will then self-erase. Moreover, if the tape suffers from dropouts, that is to say tiny holes in the coating, these will take out whole track sections and be revealed on the screen as white blips where the head briefly encounters a complete absence of any magnetic signal. Thus a system which opts for a high writing speed can produce clear pictures, thanks to the potentially wide bandwidth, but only if the tape is of high quality; and it may be more prone to visible drop out effects. A system which opts for low writing speed will offer less bandwidth and less clear pictures, but it should be less prone to drop-out and more tolerant of inconsistencies in the tape.

All the current domestic video recorders push the boundaries of magnetic recording technology to unprecedented limits, requiring tapes of very high coercivity (600 to 700 oersted). And even this is barely adequate. In the future, higher

coercivity tapes (such as pure metal tapes with a coercivity of 1,000 oersted or over) should become available for video, and it will then be possible to improve the performance of existing video formats – or introduce new formats of improved quality – by using the higher coercivity to extend the bandwidth and so achieve clearer pictures. Although this will require a modification of the record circuitry in existing formats, this could be switched automatically by notches or lugs provided on the video cassette housing.

Significantly, the V2000 format, which many people believe was originally intended for use only with metal tape, already has provision in the format specification for circuitry which self-adjusts to the type of tape used, by registering the presence or absence of coded holes in the cassette housing.

Until metal video tape becomes routinely available in bulk, at a reasonable price and with reliable quality, designers must content themselves with using either ferric tape (modified with cobalt to increase the coercivity) or chromium dioxide tape. Although the video companies are secretive over the tapes used, it seems that VHS tapes from Japan are all of the ferric-cobalt type. But at least some Sony Beta tapes have been chrome. BASF uses chrome for both VHS and Beta. V2000 tapes have so far all been chrome; even those produced by 3M who have normally preferred to use ferric-cobalt for video tape. This all ties in with the relative demands placed on tape by VHS, Beta and V2000.

As the previous comparison of systems shows, the V2000 system opts for the high writing speed of 5.08 metres per second. And because the tracks are laid across only half the ½ inch tape width, they are extremely narrow, just 22.6 microns in width. The Beta system relies on an even higher writing speed, 5.8 metres per second, but because the tracks can extend across the full half inch width of the tape, they are slightly wider than V2000 at 33 microns. The VHS system uses the slowest writing speed, 4.85 metres per second, and the full tape width, so it has the widest tracks at 49 microns. It is clear therefore that V2000 and Beta put a higher demand on the tape than VHS, and offer potentially better picture quality. But it is also clear that this potential is only achieved if the tape is up to scratch. Comparison of early and later Beta tapes suggest that at least some of the excellent quality now obtainable from a Sony C7 is due to the ever-improving quality of Beta tape. Likewise inadequacies of early V2000 tape was partly to blame for its extremely inadequate pictures in the early days. At least some of the continual improvement in V2000 pictures is the result of the continual improvement being made in tape for the format. VHS continues to offer pictures of quality which is consistent but not as good as the quality potentially obtainable from Beta and V2000.

The video format user must pay his money and take his choice in this respect. Rather like a Wimpy hamburger, VHS produces consistent but less than perfect quality pictures. Beta pictures were initially very poor but have been continually improving. V2000 pictures were initially atrocious but are also now improving. Our objective measurements are intended to quantify the extent of improvement and establish the current relationship between different formats and different machines within the formats.

As previously explained, the wide track format adopted by VHS makes it easier for manufacturers to ensure compatibility between machines, *ie* ensure that a tape recorded on one VHS machine will always replay perfectly on another. In theory there should be more problem of compatibility between Beta machines, due to the narrow tracks. But in practice, and due largely to design of the Beta tape transport, no compatibility problems have been reported. V2000 faces the toughest challenge. With such narrow tracks compatibility would normally be a frightful headache, even between tapes made on the same machine over a period of years. This problem was recognised by Philips early on in the development of the format, and an elegant electronic solution has been adopted.

Dynamic Track Following

The very long and narrow track form adopted for V2000 necessitates very accurate guidance of the video heads as they record, and replay, the helical tracks across the tape. If the heads are not accurately aligned they will either stray off the tracks altogether, causing a noise bar on the picture, or stray partly off the tracks, causing lack of signal and a noisy, snowy picture. Although it might be possible in the laboratory to produce a conventional recorder which tracks 22.6 micron paths with the necessary precision, in the field it would be out of the question. Production tolerances in a factory, temperature changes in the user's home, and tape stretch, would all conspire to make V2000 a 'hit and miss' system. With this in mind the V2000 designers have built into the format an unconventional technique called Dynamic Track Following (DTF). Essentially this continually monitors the position

of the video heads and aligns them with the tracks.

It is already common practice in professional machines, to mount each video head on a tiny piezo-electrical crystal, rather like that found in a cheap gramophone cartridge or microphone. A piezo crystal produces electric currents when mechanically stressed, and conversely it changesshape when fed with an electric current. So by mounting the video heads on piezo crystals, it is possible to change their position under electronic control. Professional machines use the piezo principle only for replay. Philips went one stage further and adapted it to function both during record and replay.

During recording the video heads bury an extra reference signal inside the picture waveform. So when the tape is replayed, the video heads pick up the reference signal as well as the ordinary picture signals. By arranging for adjacent tracks to have different reference signals it is possible to sense immediately when the replay heads start to stray out of line with their intended tracks. When following the intended track they pick up only the intended signal; but if a video head moves out of alignment with the intended track, it starts to pick up another signal from the track alongside. The more signal sensed, the worse the head error. The sensed signal is used to produce a servo control current which flexes the piezo crystals to move the head until the tell-tale error signal disappears. All this happens continuously, and very rapidly. The result is accurate alignment of the heads with the tracks, *ie* they follow the track 'dynamically'.

To keep the heads in alignment during the *record* mode the V2000 machine repeatedly switches briefly into the playback mode to check the strength of reference signals recorded in the preceding track. If this switching provides a tell-tale of misalignment the servo control circuit adjusts the head position by a microscopically small amount. Again all this happens very quickly, and the brief switch from record to replay happens at a carefully chosen moment so that it is not visible when the recording is viewed on a domestic tv screen.

Although DTF was originally devised to make the V2000 system work reliably in the *normal* record and replay mode, it also opens the door to very clear, noise free, pictures in still frame, slow motion and fast motion. As already explained, in these modes there is normally bound to be mistracking because the heads cannot make the same angle with the helical tracks on replay as they did during recording. When the linear tape speed is interferred with. The DTF circuit senses this misalignment and continually corrects it. The only limit to correction is the speed and distance of head movement. So far it seems that the system can cope with speeds of up to seven times normal replay speed, and still correct tracking to produce noise free pictures. Already Grundig has a machine on the market which offers noise-free replay at three-times normal speed, and it is only a question of time before further V2000 machines become available which offer noise free pictures in fast search mode up to seven times normal speed. It is uncertain whether the piezo response will ever be fast enough to offer noise free pictures at still faster search rates.

Headcleaning

Over the last decade, owners of audio cassette recorders have been brainwashed on the need to clean their recording and playback heads. A build-up of magnetic oxide, shed from the tape coating during normal use, clogs the head gaps and prevents smooth contact between the tape and head surfaces. This can cause a dramatic fall off in high frequency (treble) response. A little knuckle grease, with a cotton bud or plastic probe, can work wonders for reproduced sound quality. The only taboo is the use of any metal object, because this can scratch the delicately polished head surface.

Audio enthusiasts who turn to video must unlearn this brainwash teaching. The rotating drum of a video recorder houses two video heads, each with working dimensions comparable to the width of a human hair. They are so fragile that any physical contact with any cleaning tool, be it of plastic, cotton bud or metal, is virtually guaranteed to cause irreparable damage. Just touching a video head with your finger can ruin it. Even a drop of moisture on the tape can destroy a head. So can a splice in the tape. This is because the heads are rotating at 1500 rpm – or up to 20 mph – and literally fracture on impact with even the smallest obstacle. Although there are various kits and gadgets on the market which are designed to clean the internal working parts of a video recorder (more on the controversy which surround this later), the user should *never ever* try to clean the tiny heads on the drum by physical contact with any kind of probe.

Head wear

Unfortunately even the most careful user, with the most foolproof recorder, will eventually need new heads. Most video cassette recorders in-

corporate a thermostatically controlled heater which prevents the formation of any dew drops on the tape. But there is always the possibility of a foreign body finding a way into the recorder mechanics. More important still is that all video heads have a finite life. After several thousand hours of use they simply wear out. Picture quality gets progressively worse until one day the machine just refuses to record, because the working parts of the head have fallen apart. This is a perfectly normal situation. Tape is an abrasive medium and the very fine structure of the heads is bound to become worn as they rotate at high speed, like a mini-grinding wheel. No one really knows how long a set of video heads will last. It depends on humidity, the type of tape used, and whether you live in a clean or dusty environment. Also video head technology is continually improving, as is tape technology. So modern heads last longer and modern tape is less abrasive. What all this uncertainty means in practice is that a set of video heads can last anything from 1,000 working hours to 4 or 5,000 working hours.

One thing however is certain. It is an expensive business to replace video heads. This is partly because the heads themselves are a remarkable example of high precision technology of microscopic size. It's also because on most video recorders it takes an engineer around an hour to replace the heads and make the checks on circuit alignment which are necessary to optimize performance after a head-change. So it can cost anything up to £100 to have the heads of a video recorder replaced. The exact charge depends on the type of machine, the skill of the technician, and the greed or goodwill of the firm carrying out the repairs. For instance a set of video heads for a JVC VHS machine currently costs around £50 retail. It should take a competent engineer no longer than an hour of bench time to do the job but this still puts the price at around £70, including VAT.

This prompts two pieces of advice. First, and obviously, don't be tempted to get your fingers or any cleaning tool anywhere near the video head drum. Secondly, and perhaps less obviously, don't be tempted to use your video machine unnecessarily. Every hour of use, either for recording or replay, is an hour off the life of the heads.

If you think you're hard done by, when presented with the bill for a new set of video heads, count your lucky stars that we have progressed so far from the original days of domestic video. In 1974 and 1975, when the original Philips N1500 one-hour format VCR first came onto the market, the expected life of a set of video heads was only around 500 hours. So anyone using their proud new purchase for a couple of hours a day could expect to need a new set of video heads in well have expected to need a new set of video heads in well under a year!

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This is the first book in the *Hi-Fi Choice* series to present assessments of television pictures as well as sound reproduction, and in so doing prompts the question whether the term 'high fidelity' could be applied to the visual side of consumer electronics. What does a 'high-fidelity' audio system achieve? It would be fair to say that the most advanced systems available today are capable of producing sounds which are as dramatic and subtle as many which occur 'live'. Although the concept of 'the closest approach to the original sound' may be rather academic in these days of multitrack recording, the fact is that the ear may be fooled quite easily into believing that a recorded version of human speech, for instance, is the real thing.

With video, however, the inherent shortcomings of the reproduction process are stark and inescapable. No-one could even momentarily be persuaded that what they were seeing on television was 'real'. First, the image is two-dimensional, while everything we see has depth. Secondly, even if there were no shortcomings anywhere else in the process, the image is of necessity divided into only 575 active lines of picture content, which sets a finite limit to the possible vertical resolution of the picture. (Readers who are accustomed to thinking of 625 line television may wonder where the other 50 lines have gone; they are blanked off to allow time for synchronising signals and teletext information.)

The limiting factor affecting the horizontal resolution of the picture is the bandwidth of the link between the camera and the picture tube. The greater the bandwidth, the faster the television signal can change value and so the greater the amount of detail which can be presented across a line of the picture. In UK broadcast television, the transmitted bandwidth is never more than 5.5MHz, which means that the maximum resolution in the horizontal direction cannot exceed more than 500 lines, and in practice is somewhat less than this.

Tube limitations

Other factors affecting the fidelity of colour television which are perhaps less inevitable, but nonetheless prescribe the current state of the art, have to do with the picture display tube in the receiver. The picture is traced out by three electron beams, which are simultaneously deflected up and down and from side to side by the current in the scanning coils on the neck of the tube. These are then sorted out by a slotted mask immediately behind the screen, so that the electrons from the red gun hit only red phosphor dots, the green the green, and the blue the blue.

Two limiting factors must now be considered. The ability of a colour tube to reproduce the colours of nature is determined by the colours emitted from the glowing phosphors on the face of the tube. A picture cannot ever be a deeper or a richer red than the colour emitted by the red phosphors with the other two phosphors quiescent. Although this is not a serious drawback, it is apparent to discriminating eyes where a direct comparison between live and televised scenes is possible, and particularly affects the red end of the spectrum.

A similar colour limitation occurs with low-grade cameras, whose ability to reproduce rich and vibrant reds is often poor, especially if the lighting is less than ideal. This limitation is connected with the spectral sensitivity of the camera tubes used, and although it is not a factor for which we have yet devised a measurement technique, it may be worth looking out for when choosing a colour camera.

The other limitation associated with the picture display tube arises from the difficulty of ensuring that the focus of the electron beams is maintained as a sharp point over the whole area of the screen. In most domestic-quality display tubes, the focus of the scanning spots is poorer at the corners of the screen than it is in the centre, because the path taken by the electron beam is longer. This drawback is most apparent when the material being viewed is itself particularly sharp, such as the output from an internal teletext/viewdata decoder.

Broadcast Quality Standards

Both the BBC and the IBA keep a very close watch on the quality of the picture and sound transmitted to the public, and there is an elaborate logging system in use at monitoring stations to record any shortcomings noted by the engineers in charge of quality assessment. No fewer than 87 different vision defects can be identified, together with 37 possible faults on sound, and their presence, together with the degree of picture or sound impairment, is carefully recorded.

It is extremely unusual for members of the public to complain about the technical standard of the programmes transmitted. Those complaints which do arrive are more frequently to do with the sound rather than the picture: 'sibilance' – a distorted, 'splashy' noise of the 's' sounds of speech – is the most common complaint.

What is objectionable

It would seem that a technical impairment resulting in a loss of information is much less objectionable than one which introduces extra visible or audible information which is clearly out of place. The first kind of impairment might be loss of resolution in the picture, or high frequencies in the sound, due to the use of poor quality or historical film material. A general 'dulling' or 'blurring of the edges' on sound or picture is likely to pass without adverse comment, particularly if the impairment is uniform throughout the programme.

The other form of impairment is one which is rare in UK television. Sibilance is a clear example of a short, sharp disturbance to the sound channel. A similar effect on the picture gives intermittent lines, streaks or bars, or picture roll, which would be extremely difficult to ignore.

From the experience of the broadcasters, it would appear that in assessing video pictures we should give more weight to any defects which introduce extra information which is clearly not part of the original signal than to those which miss out minor details. But before we go on to discuss the tests on the video equipment from a technical point of view, let us look in more depth at domestic receivers, and at the signals at the input and output of a video recorder: what they are like, and what actually happens to them.

Domestic Receivers

The domestic television receiver has until recently been a legendary inflation-beater. Throughout almost its entire lifetime, the price of a monochrome receiver of average screen size has been somewhere under £100, and the price of a typical colour set has only recently exceeded the £300 price tag attached to the first colour sets launched around 1967. And for quite a long period UK manufacturers have shown themselves to be capable of producing receivers with an adequate if mundane performance: good enough to keep the punters happy, and sufficiently unreliable to keep rental companies and service engineers comfortably in business.

The technical performance of most home-produced receivers could fairly be described as adequate, though hardly startling, and it would be fair to say that for most people the prospect of paying over the odds in order to see Crossroads or Coronation Street with more clarity was not a major consideration when they selected a receiver. It was left to foreign manufacturers such as Bang and Olufsen to tackle the up-market fringe, while the most the UK could come up with was a 26 inch set in a Queen Anne cabinet, being very much a case of mutton dressed as lamb.

Recent technical innovations have resulted in a more uniform and generally higher standard of reproduction. Receivers of the late sixties and early seventies produced a picture which had a distinct character peculiar to the manufacturer in question; an experienced eye could usually tell a GEC from a Philips, a Pye from a Thorn, simply by looking at a testcard displayed on the screen. Early sets were also cumbersome, difficult to set up accurately, and even more difficult to maintain at a high level of performance. This was due to the large number of preset adjustments inside the receiver: there were fifteen or twenty controls setting the convergence (maladjustment of which produces gaily coloured fringes round the edges of objects, reminiscent of the morning after the night before); another twelve or so coils in the IF amplifier were prone to drift, resulting in smeared picture, buzz on sound, or wiggly patterning on coloured areas; and yet more controls set the colour to something approaching a neutral balance.

This nightmare of internal adjustment provided plenty of opportunity for the twiddler to get it all wrong, and the overall picture quality, already at the mercy of fate, was also subject to the manufacturer's whims about what constituted a video output stage. Valves gave way to transistors, which improved reliability and performance, but the improved performance of modern television receivers owes most to two developments which occurred during the seventies – the self-converging picture tube and the surface acoustic-wave (SAW) filter. A third factor leading to more uniformity and better overall performance was the ubiquitous integrated circuit: by virtually forcing manufacturers to use the same circuit around the little black package, any scope for individuality (and error) was considerably reduced.

The self-converging picture tube came in three manifestations. From the word go Sony receivers used the *trinitron* tube, which had very little in the way of convergence adjustments, and produced a very superior picture on the small-screen format. Then RCA with the *PIL* (Precision-in-line) tube and Mullard (using the similar *20AX* system) provided almost simultaneously the opportunity for manufacturers to dispense with the expensive, power-consuming and unreliable panel of convergence adjustment controls which had previously been a necessary evil. It is now rare to see misconvergence on a receiver at normal viewing distances, and the number of adjustments avail-

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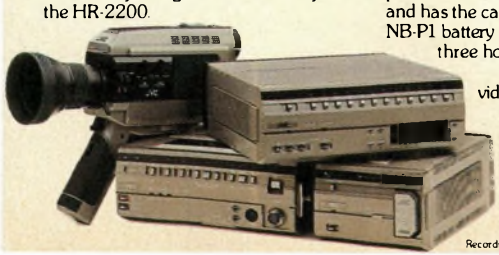
The TU-22 Tuner/adapter. This 4 in 1 unit acts as a TV tuner, timer for unattended recording, AC power adapter and battery charger. It stacks neatly on the HR-2200.



The TU-22 can recharge the HR-2200's battery pack in only 90 minutes.

The AA-P22 AC Power Adapter. This dual purpose unit for those not requiring the off-air recording facility, powers the HR-2200 from an AC outlet and has the capacity to recharge two NB-P1 battery packs in series in only three hours.

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able internally for the purpose of setting convergence has dropped from fifteen or so to one or maybe two at the most.

Finally, the other panel in the receiver section of the set, packed with coils to sort out the picture from the sound and the colour from the picture, has been simplified by the SAW filter. This replaces almost all the coils and adjustments with a single package, the characteristics of which are established at the manufacturing stage and need no further tinkering.

It will be apparent from this potted history of the television receiver that a modern receiver produces a picture of higher quality, and does so more consistently than its predecessors. It bears a price tag which has fallen dramatically in real terms over the past decade, and in this energy-conscious era it also consumes less energy in both manufacture and use: a power consumption of not much more than 100W is to be expected nowadays, while early models required three times this figure.

The principle of operation is of course the same; the basic job of the set is to display a signal which is presented to it in the form of a radio-frequency carrier modulated with a standard television signal. Some sets have the facility for the television signal to be introduced directly without any radio frequencies being involved, but all video recorders have the facility to mimic a broadcast station by producing an RF (Radio Frequency) signal. Let us now look at what else they get up to.

Video recorders – the signals involved

Fig. 1 shows, in a highly simplified form, what happens inside a video recorder when it is recording a programme off-air. The 'beginning' of this particular saga may be taken as the "RF INPUT" socket on the left-hand side of the diagram. To this is connected the aerial which would otherwise be plugged into the back of the television receiver.

Clearly, having disconnected the aerial from the receiver, it will be necessary to make sure that the receiver is still capable of picking up the programmes to which it has already been tuned. It would be a considerable nuisance to have to fiddle around with aerial plugs whenever one wanted to change from watching a tape to a broadcast or vice versa. So an RF amplifier, capable of slightly boosting all the signals from the aerial, is used to drive both the tuner inside the recorder and the RF output socket, from which is taken a lead to the aerial socket of the TV receiver.

This means that with power applied to the recorder, the receiver is presented with all the signals present on the incoming aerial lead, with usually a slight measure of amplification. It is interesting to note that some home users reported that the picture they received watching normal broadcast programmes *via* the recorder's RF amplifier was usually slightly better than it had been direct. This is more a reflection on the performance of their receiving system (*ie* aerial) than on any attribute of the recorder, showing that some benefit could be gained from having extra signal at the input to the set.

The incoming signals are presented to the tuner inside the recorder, which is programmed manually or automatically to receive any broadcast service. The tuner provides a video signal, which contains both colour and black-and-white information, and an audio signal, which is recorded on the tape in a conventional (linear)

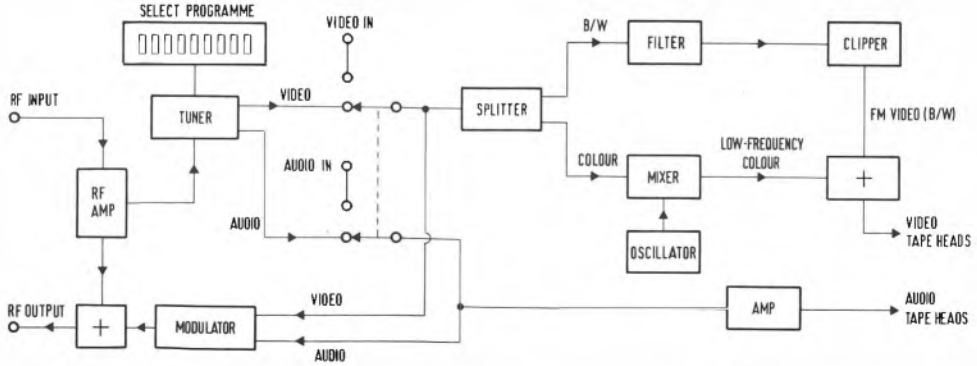


Fig 1. Rudimentary block diagram of VCR recording off-air.

fashion. In most machines these signals are fed back to a modulator while the machine is recording. This modulator converts the signals back into their original RF form, but on a different frequency which can be tuned by all receivers but which is not used for broadcast services.

It is therefore possible while recording a programme to watch the said programme on two different frequencies by selecting either the incoming frequency itself in the usual way, or by tuning to the output from the modulator inside the recorder. Again this facility for comparing the signal direct and after it has been through the mill of being demodulated and then remodulated again evoked comments from the user panel from time to time. However, the degradation of picture and sound quality introduced by this process was in almost all instances very minor compared with the shortcomings of the record/playback process; when particularly adverse comment arose (in the case of one early sample), it was clear that the tuner inside the machine was in fact faulty.

At the point where the video and audio signals have been recovered from the tuner there is a switch which can be used to substitute 'home-grown' video and audio signals from a camera, microphone or other remote peripherals. In the course of our tests we generally applied our input signals at this point. It could be argued that since most of the machines would spend most of their time recording off-air signals it would have been more appropriate to test the whole system from aerial socket to RF outlet. However, doing this would inevitably introduce extra distortions and anomalies, as we ourselves would have to use one modulation (on the way in) and one demodulation (on the way out) in order to carry out measurements from ordinary baseband video/audio sources and test equipment. Again, quantitatively the distortions omitted by by-passing the RF sections of the recorder were felt to be insignificant compared to those introduced by the process of taping and playing back the signal, and this was confirmed by a sample of measurements taken at the outset on a number of machines.

The video signal next passes to a filter, whose job is to sort out the colour information from the black-and-white. In the PAL colour system, colour information is concentrated around a central frequency of 4.43MHz, and the amount of colour energy which extends below 3MHz or so is negligible. It is possible therefore to generate a monochrome signal by passing the video information through a low-pass filter with a cut-off frequency somewhere around 3MHz. This will, as explained earlier, remove some of the fine horizontal detail from the picture, but it is not possible to record this in any case, so no extra degradation is introduced by this filtering.

Conversely, the colour information is filtered out by the use of a bandpass filter centred on 4.43MHz. This information is then changed in frequency, by mixing it with an oscillator running just above 5MHz, to somewhere around 600kHz, whereupon it is recorded onto the tape. Because it has been converted to a lower frequency than that used for the black-and-white information, this technique is known as 'colour-under' recording. This process restricts the bandwidth of the colour signal from its normal broadcast value of just over 1MHz to rather less than 500kHz, the effect of which is to make the coloured areas of the picture less well-defined than previously. We did not attempt to make a comparative evaluation of this on the various machines, except where user comments arose. They are reflected

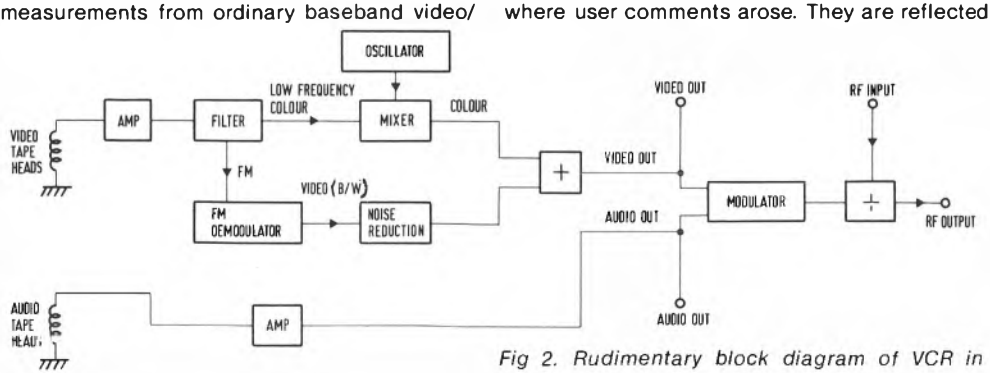


Fig 2. Rudimentary block diagram of VCR in replay mode.

in the text of the reviews where appropriate.

Back to the black-and-white information. This now occupies a frequency range from a few tens of hertz up to around 3MHz, but this cannot be recorded directly onto the tape because the number of octaves involved is too great. So it is changed to an FM signal, where the frequency of the signal recorded on the tape is varied according to the brightness of the scene at any particular instant. The frequencies involved are in the range 4–6MHz, and the total bandwidth of the resulting signal is such that it can be recorded onto tape and played back without encroaching onto the colour information down below 1.1MHz, and without exceeding the maximum possible recording frequency of the system.

Readers familiar with the other popular use of frequency modulation, for stereo radio, will be aware that pre-emphasis is used in transmission, and corresponding de-emphasis on reception, with the aim of improving the overall signal-to-noise ratio. And so it is with video. The higher video frequencies are boosted before the signal is applied to the tape, with an appropriate cut on playback. This does introduce a problem, however. A sharp transient, subjected to pre-emphasis, will overshoot its original level (*Fig. 3*). Should the magnitude of this overshoot result in the transient exceeding the permissible frequency deviation, the signal will either be incapable of being recorded onto tape (if it is too high a frequency) or crash into the part of the frequency domain reserved for the colour signal (if it is too low). Neither of these things must be allowed to happen, so the pre-emphasised signal is subjected to clipping (*Fig. 3(c)*) to prevent excessive frequency excursions.

Of course, clipping a signal results in distortion. But subjectively the impairment introduced by this artifice is merely to soften hard edges in a manner which is not subjectively objectionable, although it does of course represent a loss of fidelity.

Playback

On playback the essential processes go into reverse. The low-frequency colour signal is mixed up to its original frequency of 4.43MHz by the same heterodyne process applied on record. The sound is replayed in entirely conventional linear fashion.

The black-and-white signal has a slightly more complicated path to follow. After having been demodulated from FM back to a normal video signal, it goes through a process of de-emphasis and noise reduction. Typically, the video signal-to-noise ratio achieved from tape replay is of the order of 33dB. This would produce unacceptably grainy pictures if it were presented to the receiver untreated, and so a technique known as *noise coring* is frequently used to improve the output signal-to-noise ratio.

What happens in essence (*Fig. 4*) is that the video signal is passed through a high-pass filter, so that only information at high video frequencies is available at the output. This information also contains most of the noise on the video signal, as well as energy corresponding to sharp edges (apart from those which are virtually horizontal). This filtered signal is then applied to a 'clipper' circuit, which 'clips' whenever a sharp transient appears on the picture. Most of what passes through the clipper unimpeded is noise. The output from the clipper is then added to the original signal in anti phase, to cancel out some of the noise.

Off-tape signals treated in this manner look much less noisy than the raw output. However,

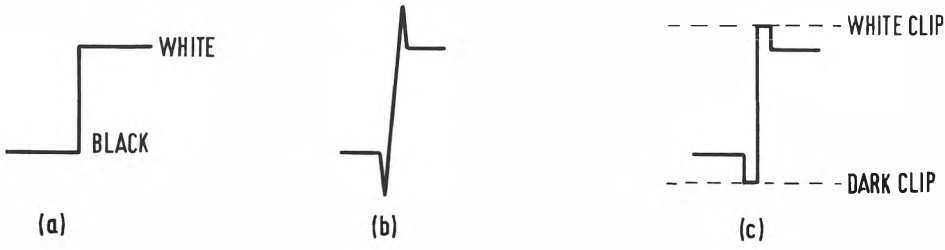
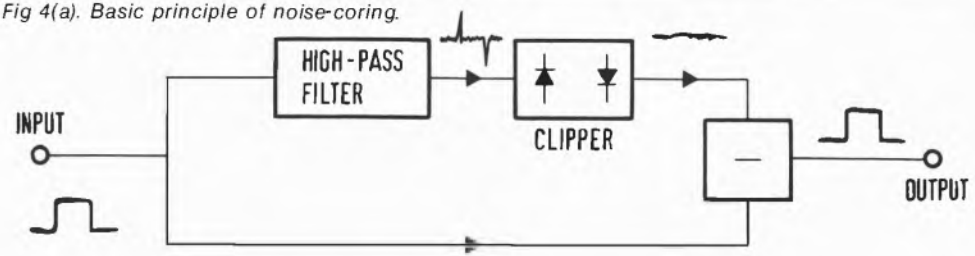


Fig 3. Transient signal: (a) original; (b) after pre-emphasis; (c) after pre-emphasis and clipping.

Fig 4(a). Basic principle of noise-coring.



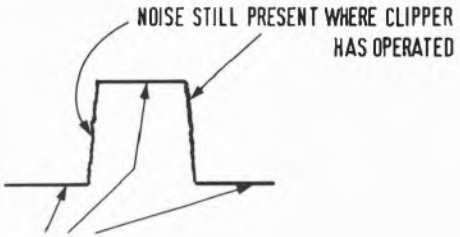


Fig 4(b). A closer look at the output.

two side-effects arise from this sort of treatment. First, when the clipper operates on transient information, the noise reduction no longer works. This means that the outlines of images on the screen are much noisier than large, relatively uniform areas of picture. Secondly, subtle detail, corresponding to low-amplitude high-frequency information, passes through the high-pass filter and is not affected by the clipper. The cancellation process therefore eliminates it from the output along with the noise.

The effect of this second shortcoming is to make large, relatively uniform images, particularly faces, look rather bland and featureless, except for bold outlines. The effect is considerably compounded if the process is repeated (*ie* if a video cassette is played back and recorded onto another video cassette machine and then played back, thus passing the signal through two stages of noise-coring). The effect tends ultimately to reduce pictures to cartoonery.

Sound Quality

The sound on a video cassette recorder is taped in exactly the same way as on a normal audio cassette machine, by a stationary head against which the tape passes at its linear speed. Sometimes it has the benefit of Dolby noise reduction, sometimes not. The results obtained are without exception firmly low-fi. The worst frequency response is about ±3dB from 100Hz to 6 or 7kHz, with around 0.3% wow and flutter, and a signal-to-noise ratio frequently no better than around 40dB.

On material such as elderly feature films this grade of performance is unlikely to be notably worse than the incoming signal. On more recent productions, however, the limited frequency response may be apparent to viewers with reasonably wide-range loudspeakers on their receivers. The signal-to-noise ratio is usually adequate for the heavily compressed TV sound, although again replay on a high-quality receiver, particularly at a higher-than-usual listening level, may also reveal this shortcoming. The wow-and-flutter figures, though scarcely hi-fi, are only likely to attract adverse reaction on material such as choral singing or piano music. The spoken word is likely to sound quite acceptable with this level of wow and flutter, though readers should note the user comments recorded in the individual reviews.

And so to the tests themselves, which were the results of much trial and tribulation, mostly the former.

Reference Points

Some care was taken over establishing correct reference points for both the video and audio noise measurements. The video input was exactly 2V p-p unterminated with a 75ohm source impedance, ensuring the standard level of 1V p-p into the usual 75ohm load.

With audio, it was necessary to establish a reference level by means of the tuner. The television sound broadcasts of the BBC and the IBA have a peak deviation of 50kHz on the sound carrier. This corresponds to PPM 6 on the peak programme meters used to monitor sound level on the control desks. If we used this level of modulation on our RF test signal, however, we

would not be representing the typical amount of modulation encountered in mormal practice, which is nearer PPM 4. This corresponds to 8dB below 100% modulation, and is typical of the level of programme material.

So an RF carrier with AF modulation at 1kHz was introduced into the UHF tuner of the machine under test. The amount of modulation was 8dB below 100%, and the output from the machine (on E-to-E if possible) was noted. A 1kHz tone was then introduced into the line audio input of the machine, and adjusted in level until the same reading was present on the output meter. In doing this we have then established a reference point for the audio tests, and all measurements are taken with levels referenced to this datum.

Audio frequency response

Initially we thought that making frequency response measurements at this sort of recording level would show the machines up in a very unfavourable light, since the normal measuring level for cassette recorders is of the order of 10dB lower relative to normal programme levels. In practice it didn't – we made a number of comparisons between frequency sweeps at this recording level and ones recorded 20dB lower, and in no case was the discrepancy between the two more than 2dB at any frequency in the 'working range' of the machine.

We conclude from all this that any frequency distortion conclusions drawn from our continuous tone measurements may be taken as closely representative of the distortion introduced into a complex programme signal.

There is one more trap in the measurement of audio frequency response which we set out to avoid. All machines incorporate some form of

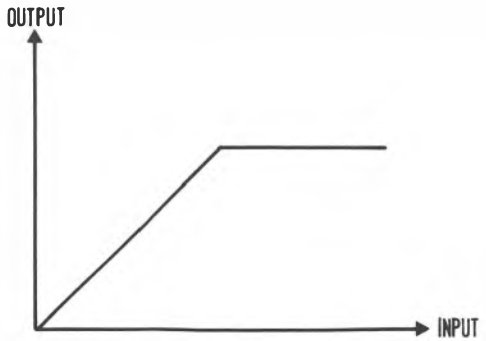


Fig 5(a). Limiter action: fast attack and recovery.

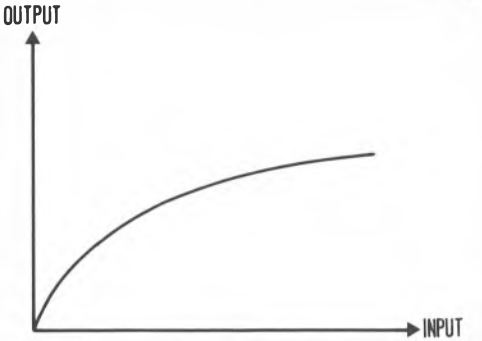


Fig 5(b). AGC action: fast attack, slow recovery.

overload protection against excesses of audio input. In some machines this only operates at the point where the tape might go into saturation, and has a fairly hard limiting effect (*Fig. 5a*). The recovery time of hard limiters like this is usually quite rapid, and they are normally set such that the normal broadcast signal, as received by the tuner, does not cause the limiting circuit to operate at all.

In these machines, the measurement of frequency response was straightforward, as the limiting circuitry had no effect at the test levels we used. In other machines, however, a slow, deep compression circuit (*Fig. 5b*) was incorporated, and we had to take steps to allow for its operation. If it was at all possible, we would simply disconnect the control line to disable the operation of the gain adjustment device. Usually, we had to resort to one of two tactics: if the recovery time of the circuit was sufficiently slow, we could take useful measurements by interspersing our test frequencies with long bursts of 1kHz tone at reference level. If the gain control circuit was operating on this composite signal, its action would be seen in changes in the replayed reference tone, and compensated for accordingly. More frequently, though, we would take the simplest course and record our tones at a sufficiently low level to render the gain control circuit inoperative. As we had already established that changing the level of the sweep tests did not significantly alter the results, we decided that this course of action would yield acceptably accurate figures.

Audio automatic gain control

It would be worthwhile at this juncture to

examine the two alternative forms of audio control more closely. Traditionally 'automatic level control', as popularly encountered on very inexpensive portable cassette recorders, has implied the use of a circuit which attempts to simulate the effect of an operator adjusting the recording level manually.

This sort of circuit never produces wholly satisfactory results, because unlike the human operator it is incapable of distinguishing between low level signals which are quiet because they are supposed to be quiet, and low level signals which ought to be turned up. As a result its use is confined to portable cassette machines where the destruction of the dynamic range of the incoming material is at least preferable to tape overload, and where the distortion introduced by its operation is deemed tolerable.

More recently, it has become popular in upmarket cassette recorders to include an optional 'limiter'. This is different from the previous circuit in that it acts only to remove occasional excesses of signal, and recovers very quickly afterwards. It can be distinguished from the previous type of circuit by its high threshold of operation and much faster recovery time.

When we come to video recorders for home use, we can see that there are two types of input signal which the machine may be required to handle – the sound from a broadcast transmission, or the sound from a microphone used in the course of a portable recording session. There may be others, of course, but these examples characterise two different types of signal requiring essentially different handling. The broadcast transmission will have a very carefully controlled level, and very little dynamic range, in keeping with the limited acoustic capabilities of the average down-market TV receiver. This sort of signal needs no level processing before being recorded on tape, as the predictable level and narrow range of the material is ideally suited for recording without further adjustment, manual or automatic. A limiter circuit (*Fig. 5a*) would do no harm, but probably no great good either.

Audio Compression measurement

We took particular trouble to measure the amount of compression applied to broadcast signals, on the grounds that any further compression on this signal (which is already heavily compressed) would be undesirable, and the more compression present the worse things would be. We applied an RF signal modulated with a 1 kHz tone at peak signal level, recorded it, and while the machine was running dropped the input signal level by 20dB, and let the machine carry on for a couple of minutes. We then replayed the tape and noted whether the level difference which we had introduced had been preserved, and if not by how much it had been reduced. The maximum possible compression is of course 20dB, the minimum zero.

Audio signal-to-noise measurements

Another side-effect of having audio circuits with a mind of their own arises in the context of signal-to-noise measurements. Where AGC is employed in some form, the audio stages will be running at full gain in the absence of any input signal. The absence of any input signal is of course part and parcel of taking signal-to-noise measurements, and in one particularly notable case a machine equipped with Dolby noise reduction was found to produce an improvement of only 3 dB when the noise reduction was switched on (during *both* record and playback).

The reason for this quickly became evident. The Dolby circuit was obligingly boosting the residual noise of the audio preamplifier circuitry (all working flat out) during recording, with the result that during replay, although the contribution due to tape noise was doubtless being reduced, the limiting factor was now the background hiss of the input circuitry itself. This is not very bright on the part of the manufacturer in question, and the results are left to speak for themselves.

Video noise measurements

Our reference instrument during video noise tests was the *video storspannungsmesser* produced by the redoubtable Röhde & Schwarz. Taking video noise measurements is not as easy as might first be thought, because in the absence of any picture the synchronising pulses will continue to punctuate the video waveform with their standard amplitude of 0.3V. Some method has to be found of looking at the picture section of the waveform while ignoring the presence of the sync pulses, and the R&S meter uses a sophisticated blanking circuit to do just that.

Another point of possible dispute and debate concerns the weighting to be applied to the results. Once upon a time there was the CCIR recommendation 451-2, which established distinct weighting curves for luminance (*ie* black-and-white) and chrominance (*ie* colour) channels. Now there is a unified weighting characteristic for the whole lot. These standards have been devised for broadcasting use, however, and are of dubious relevance to videocassette recorders,

so in all cases the video noise figures are unweighted, although a 10kHz high-pass filter was used to suppress LF content (mostly hum), some of which was unavoidably present on the input test signal at a level where it might interfere with the accuracy of the results.

Because the differing levels of picture brightness correspond to different recorded frequencies on the tape, we recorded sequences of blank frames of white, mid-grey (actually 59% grey, being green with the colour removed), and black onto tape. These were then replayed on the same machine, and fed *via* a variable-gain video amplifier into the Röhde & Schwarz meter.

The purpose of the variable-gain amplifier was to ensure that the video signal entering the noise meter was exactly 1 V p-p. While a small variation in output levels was encountered from machine to machine, it is only really of significance in this context.

Video Frequency Response

The response of the machine to various video-frequency signals was assessed in two ways. A video sweep generator was modified to cover the range from below 1MHz to 4MHz (left to right across the screen), and the resulting playback of its output signal was photographed and used to assess the −3dB (70%) point of the response. This is confidently expected to be much more meaningful than the bland assurances about lines of definition included in manufacturers specifications. (For every MHz of bandwidth you get 104 lines of definition).

An interesting aspect to the sweep tests was that the manner in which the responses fell away with increasing frequency was often very curious, being quite unlike any sweep curves we have seen before or since. There were strange plateaux, humps, ripples and bumps, all of which doubtless correlated with picture quality in some complex and mysterious way. Since examples of both are where possible printed alongside the test results, readers are invited to draw their own conclusions.

The sweep generator was also modified to produce the same sweep, but reduced in amplitude to 5% of full picture amplitude in order to assess the effect of the noise-coring mentioned earlier on low-level high-frequency picture content. Two figures were extracted from the resultant display on the waveform monitor during playback. First any loss of amplitude during the initial section of the sweep (which represents frequencies around 1MHz) was estimated as a percentage of the signal observed direct from the generator. Then the frequency at which the replayed low-level sweep disappeared into the noise was also assessed from the display.

These figures give a guide as to how much subtle detail may pass through the machine's record/replay process, and were included in an attempt to quantify the effects of noise-coring in a consistent, if as yet unrecognised, manner.

The second method of assessing frequency response was provided by the Philips *PM5519* test generator, which produces a three-step field-locked wedge pattern with outputs at 2.8, 3.0 and 3.2MHz. These frequencies are pretty much on the limit of resolution as far as the black-and-white signal is concerned, and in every instance the response of the machines was noted to be falling very rapidly between the lowest test frequency and the highest. In the few instances where it was possible for us to disable the coring circuit during playback, we did so, and noted another series of figures for playback without the noise reduction. As we expected, the output increased significantly, proving clearly that the forms of noise reduction used to improve the apparent signal-to-noise ratio of domestic videocassette machinery are not without considerable drawbacks as far as picture definition is concerned.

Colour Noise

A red field was recorded on tape from the Philips *PM5519* pattern generator. We recognised at the outset that measuring the noise from this field in a conventional fashion was not going to yield particularly meaningful results. By 'conventional fashion' we mean measuring the linear noise on the R&S by simply applying the playback signal to its input terminals, with or without *chroma* weighting. This method is likely to fail because a noise meter working in this manner is not decoding the colour signal, but measuring it without taking into account any phase jitter which might be present. There could be no doubt, from an examination of the vectorscope, that much of the damage being done to the colour signal by the taping process took the form of phase rather than amplitude variations, and the R&S as it stood would take cognisance of neither.

We therefore included in our complement of equipment a high-quality PAL decoder, the output of which was matrixed in the usual way to produce a signal corresponding to that which would be applied to the red gun of a picture tube, and the gain of the system was adjusted in order to produce identical results *on monochrome* when we measured the noise of one of our blank monochrome fields either directly in the usual

way, or *via* the decoder and matrix (running in monochrome).

CAMERAS

Whereas the home VCR meets fairly well understood and defined needs, such as broadcast time-shift and playback of videograms, the home video camera goals are vaguer. Of the range of possible uses for a home colour camera, the current crop of models and their matching VCRs will only work adequately under certain fairly limited conditions. We have developed a number of tests to make these possibilities and limitations clearer to newcomers, but before discussing consumer models, reference to broadcast and industrial colour cameras makes a useful way of introducing the engineering and operational principles.

Knowing something about principles is an advantage when studying the conflicting claims of the manufacturers of the various models. In common with other new fields, these offer a wide range of solutions to the problems of producing good television at low cost. The basic principles are the same for both black and white and colour. A lens or lenses are used to focus a real inverted image of the scene onto a pickup device which converts this image into electrical signals. This pickup device is similar to a miniature TV display, with the screen being replaced by a light sensitive target which is scanned by an electron beam, the whole device being enclosed in an evacuated glass bulb. Future image pickup devices will consist of smaller, flat solid state image sensors, but the principles and features will probably be very similar.

Colour pickup

As explained in the *Consumer Introduction* the display screen of the colour TV produces three basic (or primary) colours: Red, Green, and Blue. These can be combined in various proportions to simulate the infinite variety of the real world. It is useful to be aware of the way in which the other common colours are produced from these 'primaries':

Red + Green + Blue = White
Red + Green = Yellow
Red + Blue = Magenta (Purple)
Green + Blue = Cyan (turquoise)

Thus the correct amounts of red, green and blue light projected onto a white surface produce white, and an even mixture of all the colours of the visible spectrum (or the rainbow) produce white light, but red, green and blue crayons superimposed merely make a muddy grey. The BBC and IBA sometimes transmit a test signal consisting of the three primaries plus their complementaries, in a sequence of vertical strips, starting with white, and, in descending orders of brightness going: White, Yellow, Green, Cyan, Red, Magenta, Blue, Black (see Fig 6).

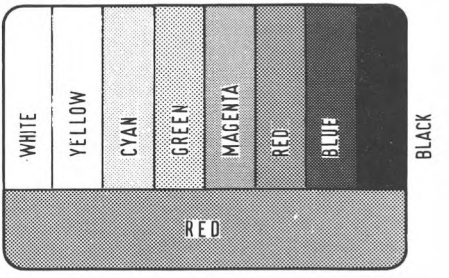


Fig 6. Representation of test colour chart.

Colour Separation

A normal mirror reflects virtually all incident light and a so-called 'one-way' mirror reflects about half the incident light, the remainder passing through (see Fig 7). Using special materials of very precise thickness for the coating, such a half mirror can be made to reflect light of only a limited range of wavelengths, *ie* colours. If, for example they are green, red and blue will pass through. If this half mirror is angled at 45 degrees to the colour camera lens axis, green is reflected and passes through an additional lens onto the screen, or 'target', as it is called, of a camera tube. A second angled screen coated with a blue reflecting mirror separates the blue range of colours which are picked up by a second camera. The range of red colours pass straight through both half mirrors and onto the target of the third identical camera (see Fig 8). These three single

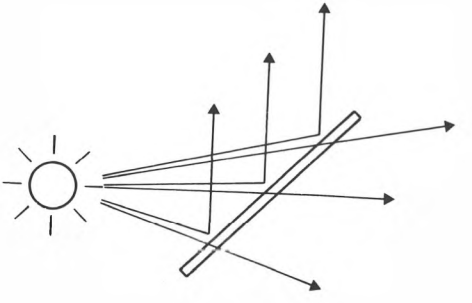


Fig 7. One-way mirror.

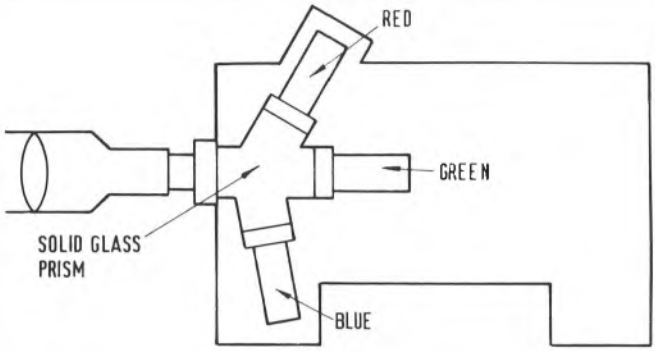


Fig 8. Three-tube colour camera.

colour camera 'channels', as they are called, plus the light splitting optics and allied electronics form, in principle, a colour camera.

In most broadcast cameras, the light losses and other defects are reduced by the use of a glass block made up from a number of sections, with the colour separating ('dichroic') coating on the inner surfaces (see Fig 9), and this technique is even used in one consumer camera (see review section). Each pickup tube and associated set of scanning and amplifying electronics has to be very precise and stable in order that they can be electronically superimposed to make perfectly registered colour pictures. If the three colour signals were connected by three cables directly to the three corresponding electron guns of the colour TV picture tube, this would give the best possible results. But for economy in broad-

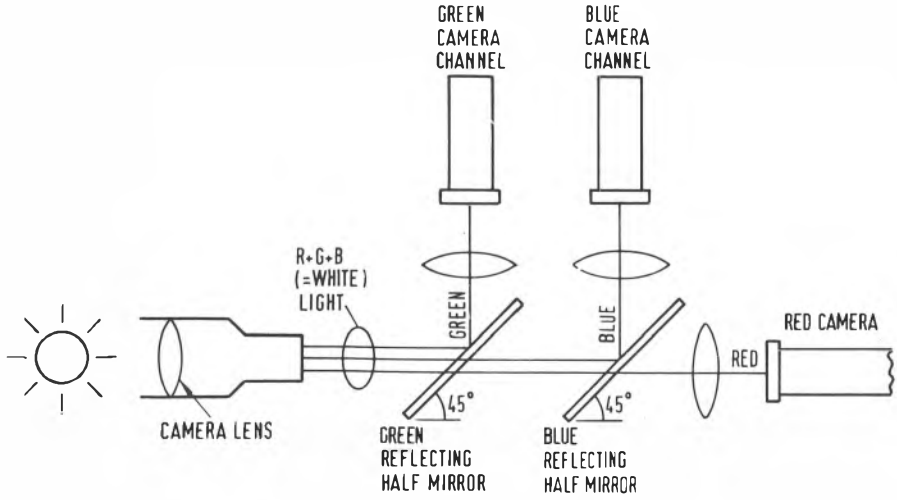


Fig 9. Three-tube colour camera schema.

casting and recording, these three signals are combined into a single signal according to one of the several established techniques (the PAL system in the UK and most of Europe).

The need for three precision cameras plus the complex optical colour splitter makes most three-tube cameras very expensive, so, with the exception of Sharp in Japan and Philips in Europe (see review section), most manufacturers now use special tubes and other electronic techniques to extract the red, blue and green signals from a single camera tube. The simplest single tube technique invented by RCA in America and now made by Hitachi in Japan uses sets of very fine red, green and blue vertical stripes in front of the tube target, each set being connected to a single contact. Thus a red object, for example, is seen by the camera through a fine vertical screen, and the other two primary colours likewise (see Fig 10). The rest of the electronics are simply those for a three-tube camera. The one disadvantage of the system is the distortion of fine detail and sharp edges of the televised scene. The answer here is to make the stripes so fine that they do not interfere with the picture and this Hitachi have recently achieved with their latest semi-professional camera, the *FP-10*. Sony's single tube cameras use similar stripes in a different way in their *Trinicon* tubes and JVC, National and others use different stripe techniques variously labelled as 'Step Energy', 'Frequency separation' etc.

These alternatives are all more complex and theoretically they are inferior to Hitachi's *Tri-Electrode* system described above, but clever electronic processing does not prevent them being competitive, as the reviews show. In fact we have taken a Sony single tube *Trinicon* industrial camera as an example of one which has every desirable feature or accessory that the home user might need, except for an affordable price!

Before getting down to camera details it is imporant to decide just what a domestic TV camera can be expected to do, and as broadcast television is the best known reference we must start with some awareness of what is needed to produce the standards we all know.

The broadcast reference

Broadcast studio cameras are about the size of a 26" console TV and cost £35,000 – £50,000. Moreover, the power and half the video processing electronics is usually placed in additional boxes mounted in racks in the studio technical areas, the sections being linked by multi-way cables. Studio cameras when used together in broadcasting are never in the automatic mode, despite their comparatively high inherent sensitivity and stability. Individual 'hands on' running adjustments are always needed to get the best pictures, particularly skin tones, between different cameras. Just as one would not record an opera with the sound mixer and tape recorder in an

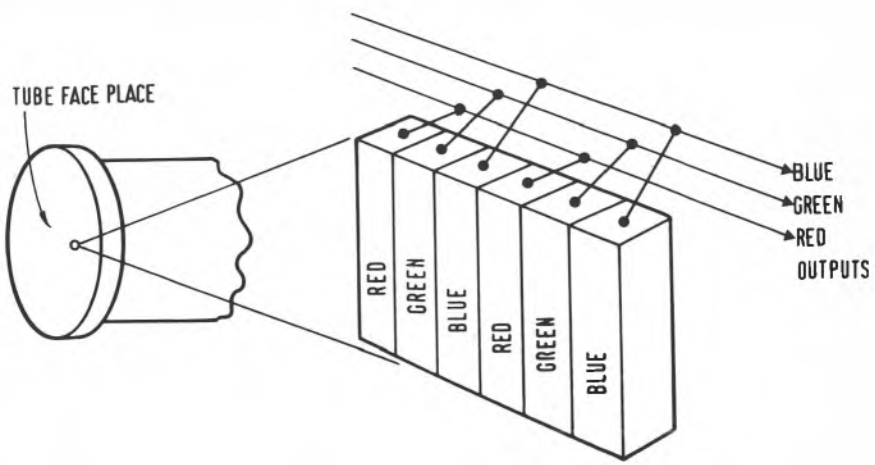


Fig 10. The technique behind the RCA/Hitachi single tube camera.

automatic mode, so the best studio and outside broadcast pictures are carefully monitored and controlled by hand. In the case of film, both still photography and cine whether for cinema or TV use, precise contrast adjustments and colour balance corrections are carried out at the processing stage. Likewise in broadcast TV studios, the hand and eye controlling the images is of course trained and highly experienced and is aided by precision monitoring facilities, unavailable to the home video programme maker. (Fig 11).

An area where broadcast TV is made under conditions nearer to the domestic user is in electronic news gathering (ENG). This new technique of production uses lightweight battery-driven cameras and video recorders to capture fast breaking news and record interviews etc. Tapes are often edited together without colour correction or other 'post production' facilities, and inserted in the news programmes. Results are variable: United States to UK news are often ghastly, and our own recent efforts at electronic news are by no means reliable, despite being made with VTR/camera combinations costing upwards of 25-times that of the consumer equipment we are considering.

The ENG camera (also known as the *minicam* because of its small size and low weight) can produce images of adequate broadcast quality despite its relatively low cost and size, even if not up to the very best of the large studio models. However, they are not often used in their portable versions for serious programme making, and there are a number of reasons. First, their automatic control of colour balance and iris produces adequate single shots, but the differences between the shots are objectionable. Without a Vision Control engineer making continuous adjustments to match each shot with the next, matching problems appear later on when the separate recorded sections are edited together at the post-production stage mentioned above. As a result of these difficulties with lightweight cameras, new equipment is being developed for colour-grading at the editing stage, but such equipment is not yet in general use. Thus, if a broadcaster needs good results from an out-of-doors event, such as tennis or football, he will take out several heavy studio-type cameras each connected by a long umbilical cord to a compact studio control room and technical area squeezed into one or two large vans.

For those who cannot afford this scale of operations for their TV programme making, accessories are available for the ENG cameras which makes them more suitable for serious production. Such accessories should be of particular interest to the home video programme maker in that they show the direction in which consumer video equipment needs to develop

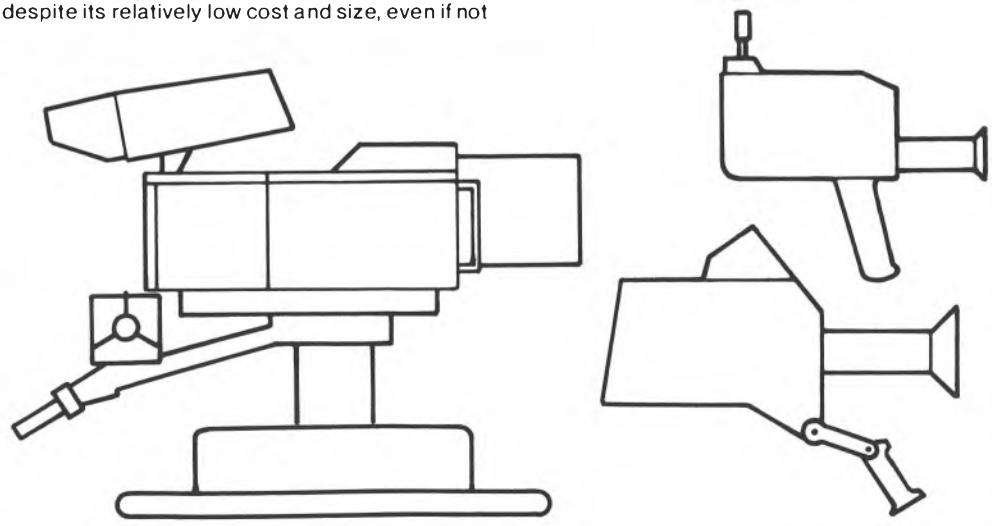


Fig 11. Three stages of camera: broadcast studio, ENG, and domestic.

before it can become really effective for programme making, as opposed to the recording of isolated events.

Few good pictures are shot from the shoulder despite the impressions given by the glossy leaflets; a good tripod with sturdy legs and adjustable mechanisms for allowing smooth camera movements is essential. Horizontal movement of the tripod requires the addition of a sub-assembly (called a dolly) with large wheels on pivoted brackets. This will of course only work on very smooth surfaces. From here it is impossible to set-up and follow good shots for any length of time when stooping over a camera equipped with the microscope-type eyepiece fitted to current consumer cameras. A larger viewfinder consisting of a high intensity TV display of 4–7" diagonal measurement can be viewed at a reasonable working distance. But now the camera must be provided with extension controls for zoom and focus adjustments of the lens. With such a set-up, live scenes can be gathered with camera movements which are to a degree professional, if lacking the ultra-smooth movements of the heavy studio camera on its massive and expensive mountings. Remember that the large viewfinder, like its broadcast counterparts, is still only black and white, leaving the camera operator to the particular task of lens and camera movements. (See Fig 12).

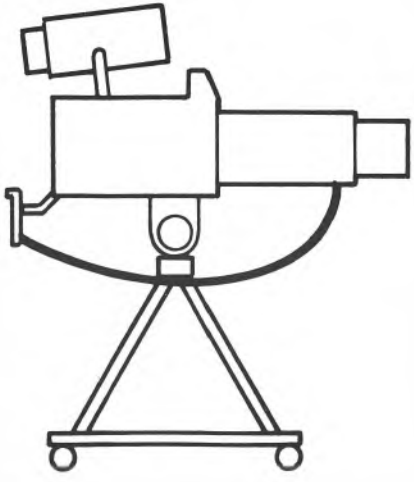


Fig 12. ENG camera tripod-mounted with remote control, for studio work.

Many ENG and some consumer cameras are equipped with some semi-automatic white balance system, so that the operator can zoom in to any white part of the scene to be televised (or hold out a sheet of paper or put a white translucent cap over the lens), and press a button which will balance the relative levels of blue and red sensitivity with reference to green. Results from this technique are not too reliable, particularly when the lighting is not under the complete control of a professional team, as is often the case with non-broadcast work. In particular, a mixture of tungsten lamps and daylight can fool the automatics, as can the fluourescent strip-lighting in common use. Under these conditions the most useful camera accessory you can have is a colour monitor connected directly to the camera, so that pictures can be directly monitored and corrected if needs be before they get onto tape. Colour balance errors of this sort are most noticeable on skin tones: we are well used to them in real life, and are all sensitive to slight green or magenta casts which would not look bad on other material.

Just as the most carefully exposed colour slides and cine film is improved and balanced at the processing stage, so future home video users will expect colour correction facilities at the post-production and editing stage. Whether such facilities are home-owned or hired will depend on equipment costs. After all, not many photographers and cinematographers own colour film processing equipment, so services like those of the JVC Video Centre in Piccadilly and the Fantasy Factory community video centre in Theobalds Road (both in London), providing low cost post production and editing facilities, will proliferate.

CAMERA TESTS

Sensitivity

If we start by observing that we have not yet seen a single consumer camera that will give good pictures at the illumination levels found in the domestic living room, it should be clear that sensitivity is an important issue. A professional camera crew shooting in domestic surroundings would always import considerable extra lighting in order to raise the light level from the five to twenty *foot candle* level typically found, up to one or two hundred *foot candles*. And even on a sunny day, when light pouring through the windows brings the levels up to the higher figure, lights would still be used to reduce the contrast and give the camera an easier time. Thus the

domestic camera is often expected to work under much tougher conditions than its professional counterpart, and will be greatly helped by the acquisition of the small low cost quartz lights made for the amateur cine market.

To measure sensitivity we used the BBC no. 57 grey scale chart, adjusting the illumination from quartz lamps to the minimum needed in each case that would give full output from the camera on the lightest section of the grey scale (see Fig 13).

The light level was measured with a Specto professional meter, and from these tests it might be thought that the domestic cameras were nearly as good as the vastly more expensive broadcast models, until one takes into account the important related factor of 'image sticking', or *Lag* as it is officially called.

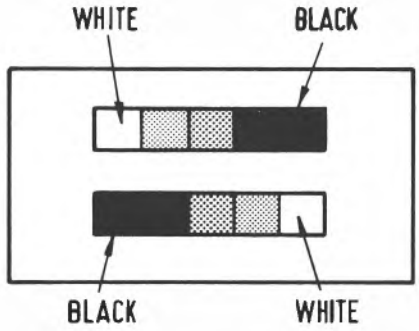
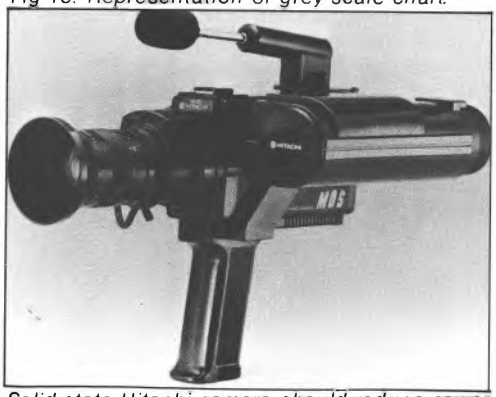


Fig 13. Representation of grey-scale chart.



Solid-state Hitachi camera should reduce power consumption and weight.

Lag

If a bright object moves across the camera's field of view (either as a result of camera panning, or of object movement), all domestic cameras produce a visible smearing. The degree of smearing or lag varied considerably, and was most noticeable when the bright object was moved against a dark background. Another influence was the overall light level; the lower this was, the worse the effect. Finally, the lag varied greatly from camera to camera.

This last factor encouraged us to develop our own lag measuring jig. This consisted of a rectangular black chart with a central hole corresponding to about ten per cent of picture width. A mechanical shutter driven from a heavy solenoid was arranged so that when it was activated it covered the hole within the period of a television frame (*ie* less than 1/50th of a second). The hole was illuminated from behind and the camera to be tested adjusted so that its iris gave just enough light for maximum output. The camera output was connected to an oscilloscope set to display the output for a period of just over 0.5 seconds, or over 25 television fields. A Polaroid film camera recorded the 'scope screen displaying the drop in light output after the light had been extinguished by the shutter (see Fig 14).

Broadcast cameras use special tubes and other techniques to achieve negligible image smear or lag, and tests on these cameras as references showed the output dropping from 100% to 10% within two fields, or 1/25 of a second. This result is principally due to the use of very expensive Philips *Plumbicon* tubes, but even the more economical *Saticon* tube used in the Sony *DXC-1800* industrial camera was almost

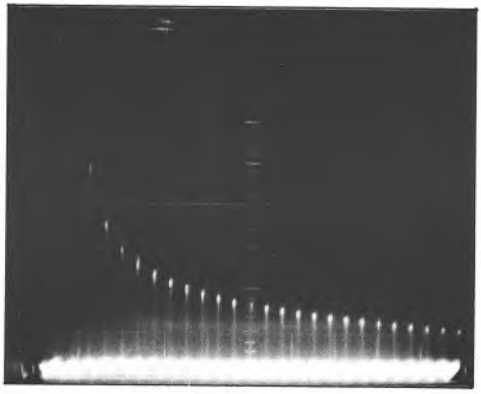


Fig 14. Camera 'lag' test, showing image-sticking.

as good in terms of lag under similar lighting conditions. The domestic cameras, which all used the much cheaper *Vidicon* tubes, had lag figures under similar lighting conditions of up to 24 frames: nearly 0.5 seconds. We must admit these measurements are comparative rather than absolute because the iris settings were not constant, but they did point up the real differences commented on by the users.

Noise
Noise is the term used for the 'grain' or 'snow' that is superimposed on the picture by all cameras to some extent, particularly at low light levels. For these measurements we used the industry standard Rhöde and Schwarz noise meter, the more recent Digitel was used as an added check, particularly where the shading errors were severe.

Resolution
Fine detail resolution is closely allied to noise, in that the camera designer can always trade one for the other. Sharp pictures achieved at the expense of noise were subjectively no better than noise-free pictures with less detail. We used an RCA transparency fitted to a Perspex diffuser illuminated with tungsten lights. The chart was analysed with a System Video waveform analyser equipped with digital line selection.

Colour Rendition
This is one of the harder factors to quantify, although experience with consumer cameras taught us to look at the *saturation* or richness of the primary colours, and the hue of the more difficult complementary colours (*ie* yellow, cyan and magenta), which revealed various weaknesses, particularly in the single tube designs. The more rigorous tests were based on the use of a set of coloured silk strips, arranged in order of brightness, the six strips covering the three primaries and three complementaries, as in the electronically generated colour bars. The silk colours are close to EBU standards, although the brightness of the colours (*ie* the saturation) was not to specifications. As a reference, the chart was first used with a near-broadcast standard three tube camera. This produced by far the most accurate results viewed on a high stability Prowest broadcast colour monitor. The electrical signal was photographed from the screen of a System Video vectorscope (*ie* a special colour oscilloscope).

Shading
This is a measure of the camera errors that produce variations in brightness, contrast, or colour, over the area of the image. It is measured by pointing the camera at a grey sheet, carefully lit to give even brightness. The camera output is inspected on an oscilloscope for evenness of output, and on a picture monitor for even colour at all points on the screen.

PORTABLE VCRs
The first point that needs making is that in general each model of portable VCR is married to a particular model, or at least a particular make of camera. We have not looked at the interchangeability of portable equipment: in principle connectors could be replaced or minor circuit changes made to match, say, the handy Sony *HVC-3000* colour camera with the equally handy Ferguson *3V24* lightweight portable VCR. But manufacturers wouldn't like it and dealers probably wouldn't do it. Therefore, when considering the merits of a particular portable recorder, the camera or cameras with which it will work must be taken into account.

Just as the exact role of the home camera is undefined, so the portable VCR needs quite different features from the mains powered off-air recording VCR. Lightness and portability may be put before ruggedness and picture locate extras. For a broadcast or industrial portable VTR, the sound and picture quality must be good enough for at least three 'generations' of copying (*ie* original recording, editing onto a master tape, then finally transferring this onto a distribution copy for playback elsewhere). In respect of sound and image quality, consumer portables are generally average to good examples of their particular format, but the format does not itself reach the standard needed for satisfactory multi-generation production work. This is true for the VHS and Beta formats so far, and we have not yet seen what can be achieved portably with the 2000 format.

The next most important feature is that of self-editing. When the VCR/Camera combination is paused during record, using the camera trigger, the recorder automatically rewinds the tape by an amount corresponding to a fraction of a second playing time. When record is re-activated, the VCR goes into play for a slightly shorter fraction of a second, only cutting to the record mode when the capstan has properly synchronised with the incoming signal. By this means smooth equivalents of film splices are made between shots.

To test the efficiency of this feature (which is imperfect in all low cost machines so far), stop

and start the recording a number of times with the camera aimed at a static scene containing vertical edges (*eg* buildings or test charts). On a perfect edit the change from one 'take' to the next will be invisible on playback. Next repeat the above, leaving the VCR in pause for several minutes (or as much as the built-in tape protection will allow). This may put small 'kinks' in the tape, which will reveal themselves as 'kinks' in vertical edges which roll through the picture on playback. Finally, look for disturbances in edits made on scenes with saturated colours at the edit points; these may appear on otherwise satisfactory recorders.

Finally, if the VCR is also to be used as an off-air recorder, look carefully at the features and specifications of the matching tuner/timer, as it will usually be limited in scope when compared with a single-purpose VCR, and almost certainly cost considerably more as a package (typically 30%).

TV RECEIVERS

One aspect of the video scene which has tended to be slightly neglected is the receiver actually used to watch the programmes. Since the recorders, cameras, games and so forth are new and unprecedented additions to the video market, much of the attention of the public, and most of the critical appraisal of the press, has been directed towards them. Most people already have a television receiver, and at the moment there is no particular effort being made to persuade them to undertake a critical judgement of its performance as a possible prelude to upgrading the installation.

It would be fair to say that all video recorders produce a picture worse than the usual standard of 'live' programme reproduction. If the receiver is working up to an averagely good standard of performance (and it is likely to be doing so if it is no more than two or three years old), then the degradation introduced by the recording process will be apparent to any reasonably attentive scrutiny of the picture.

Here one can detect echoes of an age-old audio/hi-fi proposition: even if your sound source is in some sense deficient, a high-grade system will sound better than a low-grade one because more information will be available to your ears and you will be spared any additional distortion which can only make matters worse, not better. If we test this line of reasoning in the video context by playing a low-grade source, such as a video tape recorder, through a high-grade TV receiver, we find that the argument appears to hold water. The picture obtained, even from videotape, on a high-quality receiver is markedly superior to one seen on a lesser box.

There is one good and technically defensible reason why this should be so. Although all video recorders restrict the amount of detail recorded by limiting the bandwidth of the picture signal, they do so most severely to detail occurring in the horizontal direction. The degradation of vertical detail is usually much more minimal.

So when a receiver with a better-than-usual ability to reproduce detail is connected to a VCR, more detail is invariably shown on the picture. The reason why a high-grade receiver might perform better than another in this respect has to do with the interplay of a number of factors, including the quality of the picture tube, the rigidity of the EHT supply, the standard of the tube drive stages, and the design of the receiver circuits.

In our assessments of receivers, we have set out to establish, by both subjective and objective means, which factors have a bearing on the quality of the received picture and sound, and how pleasing or otherwise the performance of individual receivers has been.

The first assessment consisted of a user trial along the lines of the VCR panel tests, though with fewer receivers than VCRs the tests involved fewer people for longer periods. Users were asked to rate the receivers in terms of facilities, style or design, and technical performance, both sound and vision.

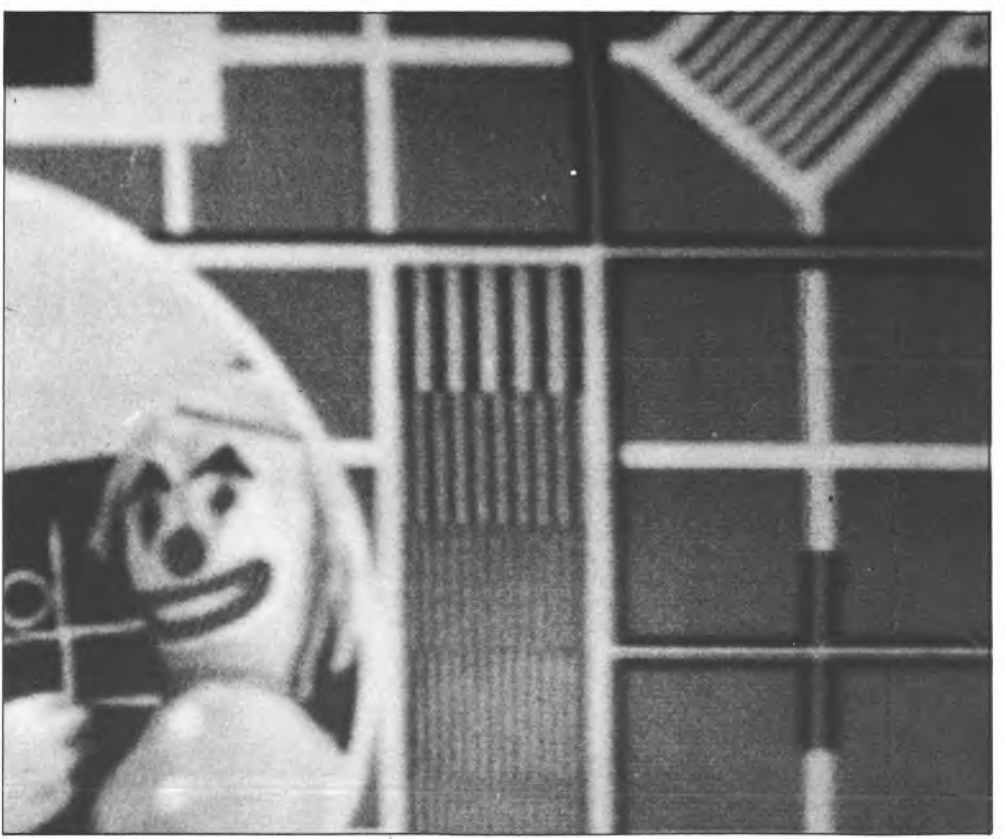
In parallel with this activity, we established measurements of video and audio responses which appear to have a bearing on the standard of the set. On the audio side we assessed the frequency response and distortion by conventional means; we also measured the available sound output acoustically using a sound level meter. The picture quality was assessed in terms of frequency response, geometric accuracy, and EHT stability. The interpretation of the results is given in our technical assessments in the body of each review.

Video frequency response was checked using the five-step monochrome grating provided by the Philips *PM 5519* colour signal generator, which has outputs at five frequencies between 0.8 and 4.8MHz. We attempted to assess the performance in both monochrome and colour modes (by switching the colour subcarrier on and off), though the poor performance of the colour-killer on the Sony prevented us from taking monochrome measurements. The output waveform from the receiver's circuitry was inspected

at the cathode of the green gun, using a low-capacitance probe and high-quality oscilloscope.

For the *chroma-on-luma* test the input signal was changed to the standard 100% colour bar signal, and the residual subcarrier evident on the tube drive signal with the colour control set to its normal position was analysed. The results of this inspection provide an indication of how much or how little patterning may occur round the edges or over the top of strongly-coloured areas of the screen. Where this effect does occur, it is due to imperfect filtering of the colour signal from the black-and-white signal route; it can be objectionable once noticed.

Weak signal performance was assessed using the output from the Philips generator with a number of known attenuator pads fitted between generator and set to reduce the signal input to 'fringe area' strength. A four step assessment (poor, fair, good, excellent) was applied, taking into account both the amount of noise evident on the picture and its positional stability. Sound measurements were also taken using the *PM5519* as signal source, with the output from the receiver being culled from the loudspeaker terminals. Wholly conventional techniques were used for the measurements quoted.



The off-air test-card detail corresponding to the photos included in VCR reviews.

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Akai VS9700E

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A slim, neat machine in two-tone livery of silver and grey, the Akai *VS 9700K* should cost around £540. It works on the VHS system.

Facilities

A simple, no-nonsense timer offering one programme of any duration up to eight days in advance is provided, with the clock display digits on the front panel doubling as duration and day indicators for the timer. The machine has straightforward mechanical transport controls for the usual functions, but no frills whatever are provided, and users seeking slow motion, still frame or fast picture search will have to look elsewhere (though not necessarily part with much more money).

The tuner has twelve channels, just enough for BBC 1, BBC 2 and ITV four times over. (The provision of this apparently pointless large number of channels is however commonplace, presumably to cater for European or American markets or future satellite telecasting, where the choice of channels may be much wider.) The selectors are touch-operated, with concealed presets. Video input and output are provided at the front of the machine rather than the back, which is an unusual but in our view welcome feature. The mains lead is detachable.

User Reactions – Facilities

The comparative scarcity of facilities meant that there was not much to react to. The timer was admired for its simplicity: the need to programme 'record duration' rather than the finishing time of the programme was preferred by one user because it made him sit down and figure out whether or not he had enough tape left! In the absence of any programme locators other than the 'memory' button on the mechanical tape counter, the lack of fast picture search meant that hunting for any section not logged or memorised was very tiresome. It was thought to be hard to judge winding periods even though the spooling itself was slow.

The mechanical function change operation was considered rather sluggish and noisy, and

although the 'touch tuner' buttons were thought to add a little touch of 'class' to an otherwise very ordinary machine, it did prove rather too easy to brush them accidentally.

It was appreciated that there was no pointless 'Video/TV' switch to change between the viewing of a tape or live programme, as fitted for example on the Sanyo and Sharp *7300* machines.

Style and design

The machine attracted favourable comments in this respect. Despite being small, it was still thought of as 'businesslike', with a rugged feel to the controls and a functional layout. One user thought that the setting buttons on the timer were awkwardly placed, another that the timer and clock might have been better off on the top of the machine. But on the whole the style of the machine was widely approved of.

User Reactions – Technical Quality

Picture assessment reported 'fuzziness' with such consistency that this was obviously a particular attribute of the machine. On captions and other sharp detail the machine was inferior to other VHS contemporaries, having a rather more smudged appearance to the replayed picture. Nevertheless, user reaction varied from 'very happy' to 'reasonably happy', so the effect was clearly not considered particularly objectionable.

On the sound side, one user experienced in professional radio broadcasting detected a hint of wow from time to time, although this passed unnoticed by the other users. It is however confirmed by the high wow measurement in our technical tests (see below). In addition, a slight background noise and a small degree of inter-carrier buzz were also detected, but these did not prevent the machine scoring nearly 5 (very happy) on the satisfaction scale, somewhat above the rating afforded the picture.

Technical Assessment

Video noise was about par for the course at −40dB, falling to −32dB with the noise coring disabled. The video sweep had a curious 'fish shaped' output on replay, with −3dB points first at around 1.5MHz and then again at 3MHz. There would appear to be some connection between this unusual response and the 'smudgy' comments made by the viewing panel, since this sort of response would tend to produce rather cluttered-looking edges to objects on the screen. The low-level sweep disappeared into the noise at 2MHz.

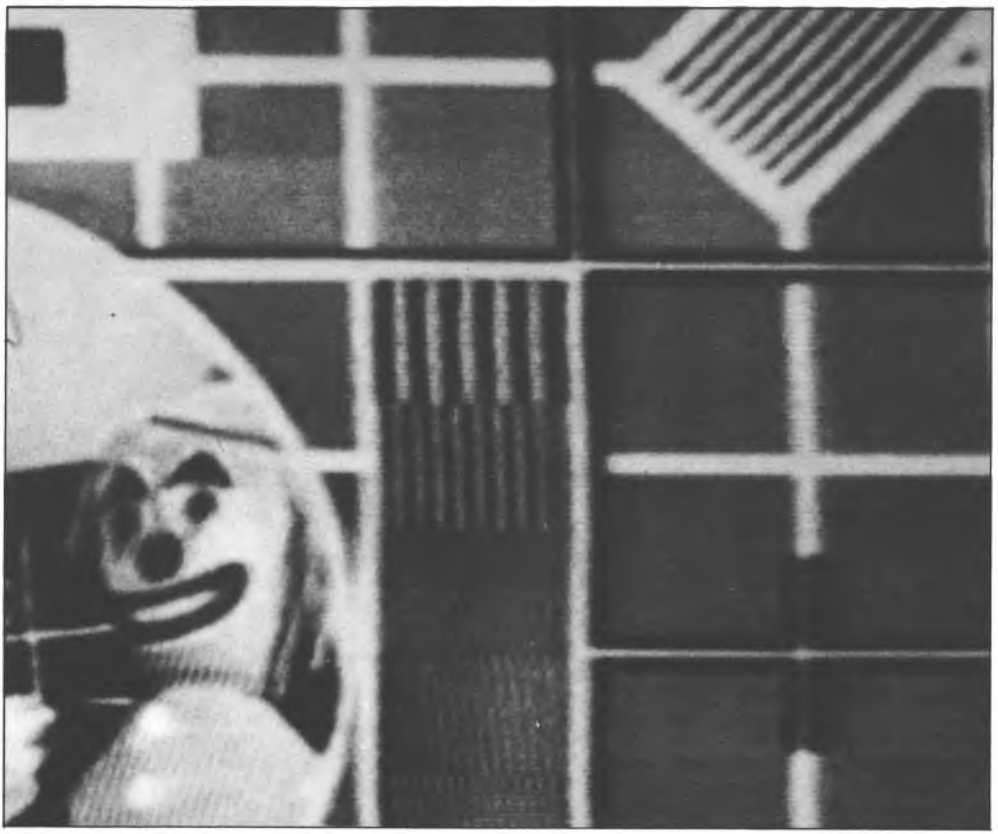
Sound noise levels were again around the average at −35dB, −41dB weighted, but wow and flutter came out very much higher than usual at 0.5%. The frequency response of 68Hz to 5.6kHz at the 3dB points was very restricted, but the audio compression applied to 'live' broadcasts was commendably low at 2dB.

Conclusions

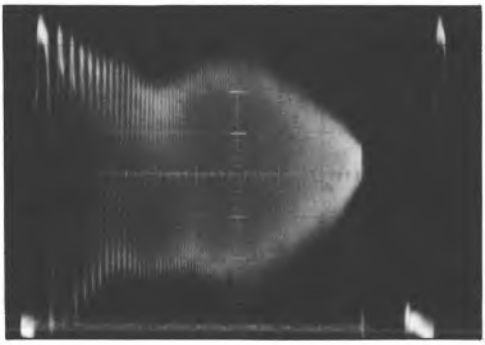
This is a neat, sensible, foolproof machine which was liked for its styling and whose performance, while scarcely remarkable, was well received by our fairly critical panel of users. On the other hand, the price seems rather high bearing in mind the primitive timer and lack of facilities, though shopping around may bring it down below £500, at which price the Akai should be worth considering.

The *9700* will continue for some time as a 'basic' model, and is to be supplemented during 1981 by two up market machines, the slant-front compact *VS-5EK* and front-loading *VS-10K*, both with multi-programme timers and infra-red remote control.

Data overleaf



Detail from off-tape testcard



Video sweep response, recorc/playback, 0.5MHz/div horiz.

Machine: **AKAI VS 9700E**

Video Performance

Noise (cored)	white field	−38dB
	grey field	−40dB
	black field	−41dB
(See tech intro.)	red field	−39dB
Frequency response	70%	1.5MHz
	2.8MHz	60%
	3.0MHz	65%
	3.2MHz	55%
Low level sweep noise point		2MHz

Audio Performance

Noise:	unweighted	−36dB
	weighted	−41dBA
Distortion at +4dB over reference		3%
Wow and Flutter		0.5%
Frequency response	±1dB ref 1kHz	150Hz/3.3kHz
	−3dB points	68Hz/5.0kHz
Audio compression		2dB

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Ferguson 3V22

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The Ferguson *3V22* is a basic VHS machine bearing a more than passing resemblance to the JVC *3300*. It sells for around £495.

Facilities

This is a very straightforward machine, with a single-option timer running up to eight days in advance, an eight-station tuner, and a conventional mechanical transport with only the basic fast forward/rewind/play/record/pause facilities. The operational controls are mainly located on the front panel, though the mains switch is hidden round the back, together with a colour/black-and-white selector switch, which gives the option of slightly better monochrome recording and playback quality if black-and-white pictures are all that are required, and also provides a test pattern to help users tune their receivers to the recorder. The machine as a whole is square, functional and looks not unlike an overgrown audio recorder, though it is reasonably compact by VCR standards.

User Reactions – Facilities

Like the Toshiba *V5470B* this machine was one of the earliest to do the rounds of the eager users, so similar caveats regarding over-enthusiasm and/or puzzlement may well apply here also. Ergonomically the machine found few detractors – one user complained about the rear location of the on/off and colour/mono switches, on the grounds that they were thus difficult to find, and he also thought that the set-up switch was too small and hard to locate. But more often users found the styling of the unit less to their taste than its actual *modus operandi*.

The mechanical transport was not exceptional as mechanical transports go. Rated highly on 'ease of use' by most respondents, it scored less well when it came to 'performance'. The wind/rewind speeds were considered too slow, and the pause control (which mutes the picture when operated) was thought to have too slow a pick-up time when released. In general the machine's mechanical facilities and their performance were considered to be utilitarian rather than impressive.

Style and design

One of the first encounters with this machine is likely to involve the instruction book, and this was not considered to be full and detailed enough for a newcomer to home video, particularly when compared with the very thorough offerings from several other manufacturers.

The machine itself attracted a number of negative remarks on design. The timesetting buttons were thought to be too small and in a rather inconvenient position, tucked underneath the clock display at the bottom of the front panel. The counter was also too small for easy use.

The time display in lurid red was 'not good for my eyes', according to one user not yet approaching pensionable age, and he indicated that a softer green (*cf* the Sony) would have been more pleasant. The cabinet itself was declared 'rather utility' by one user, while his son noted with displeasure that the 'record' button had to be pressed in order to watch the 'off-air' picture *via* the machine's tuner. (This feature does at least parallel 'through monitoring' in a number of audio cassette decks).

On a more positive note, many users commented that they would feel happy leaving junior member of the family alone with the machine, and that despite its clear lack of luxury or *finesse*, it nevertheless had a rugged, serviceable feel to it.

User Reactions – Technical Quality

Two 'reasonably happy' to one 'just about acceptable' was the ratio of responses to our standard query about picture quality. One respondent noticed slight line-pulling at the bottom of the picture, but we ought to note that his particular set was not one with an 'AV' or 'VCR' button to assist interfacing between machine and set.

The tuner section attracted some adverse comment, interestingly paralleling our experience with the virtually identical JVC machine, as it was felt that this was poorly aligned. In fact a better picture could be obtained by disabling the AFC, as this tended to ensure that the tuner was always tuned just slightly away from the best position.

Noise and fuzziness were repeatedly summoned out of the user's vocabulary of condemnation to describe the picture, the overall impression being that the machine was below average in this respect. On the other hand the sound was much more favourably received, gaining an overall rating of 'very happy', and including two 'totally satisfied' scores! Even taking the early arrival of this machine into account, this is not a score to be dismissed lightly, though it is not backed up by the technical measurements analysed below.

Technical Measurements

It was possible to disable the noise-coring of this machine, so that video measurements in both the cored and the uncored state have been taken. Basic signal-to-noise at 36–33dB is quite creditable, and the coring improves this by an average of 6dB to produce results within 2dB of the 40dB norm. The frequency response is down −3dB at 1.7MHz, and with the coring applied it staggers down to 5% at 3.2MHz. Detail loss is estimated at 50% from our special test, with the sweep signal vanishing into noise at 2.7MHz. Subjectively, however, the picture quality was poorer than these unexceptional figures might have suggested.

On the sound side the reverse is the case: −3dB points at 100Hz and 6kHz do not a hi-fi system make, yet no-one saw fit to comment on this during user tests. Perhaps matters were helped by the good(ish) signal-to-noise ratio of 42dB, the low peak distortion (2%), and the total absence of audio compression. All in all, a fairly good performance bar the frequency response, and one which was liked by all the users rather more than might have been suspected from the measured data. Wow and flutter was adequately low for most purposes at 0.25%.

Conclusions

This is not one of the more expensive machines, nor does it have any of the facilities now accepted as standard in the 'new generation'. It is however, simple to use and understand, and as child- or granny-proof as any VCR is likely to become. The picture quality was disappointing, but the sound quality was subjectively surprisingly well-received.

Machine:		**FERGUSON 3V22**
Video Performance		
Noise (cored)	white field	−38dB
	grey field	−42dB
	black field	−41dB
(See tech intro.)	red field	−37dB
Frequency response	70%	1.7MHz
	2.8MHz	30%
	3.0MHz	15%
	3.2MHz	5%
Low level sweep noise	point	2.7MHz
Audio Performance		
	weighted	−42dBA
Distortion at +4 dB over reference		2%
Wow and Flutter		0.25%
Frequency response	±1dB ref 1kHz	180Hz/4kHz
	−3dB points	100Hz/6kHz
Audio compression		0dB
Typical retail price		£495

Ferguson 3V24/3V25

Thorn Consumer Electronics Ltd., 284 Southbury Road, Enfield, Middlesex EN1 1TJ. Tel 01-363 5353

The *3V24* portable recorder and the *3V25* tuner/timer together form a system which has all the facilities of a single mains VHS VCR. Both are very similar to JVC's *HR-2200EK* and *TU-22EK* combination, but may be available at a lower price.

Facilities

To take the *3V24* recorder first; this is a microprocessor controlled unit, with light-touch transport switches, a liquid crystal tape counter with memory, and a cable-linked remote control pad. As well as the standard transport functions, it offers bi-directional speed-search and, from the remote pad only, frame advance on stills and variable speed slow motion. A small, fairly dim red light above the appropriate button indicates which function is active.

A facility particularly pertinent to portable use with a camera is the 'record lock' function. If one wants to take a longish break when recording, this button allows the power to be switched off without the tape unwrapping from the heads: this both saves on batteries, and preserves continuity on the tape. Moreover, in all instances when the recording is paused, the microprocessor shuffles the tape backwards slightly to ensure a clean edit.

Behind a plastic flap at the rear are inputs and outputs; BNC (hooray!) for video, and 3.5mm jack (ho-hum) for audio, as well as an RF output and the socket for the umbilical to the *3V25*. The socketry for the camera, remote control, and external microphone and earphone are on the front panel.

The unit is powered by a 12V nickel-cadmium rechargeable battery which slides into a compartment in the rear. Alternatively, when the unit is connected to the tuner/timer it receives power for both running and recharging its own battery. The recharging time, at 90 minutes, is notably quicker than the overnight period needed for most chargers.

The *3V25* unit is mains powered and incorporates a television tuner and timer for unattended recording of programmes. It has virtually the same dimensions as the recorder, and is styled in the same silvery trim, so the two can be neatly stacked when they are working together. The Japanese designers have gone to town on the tuner and provided twelve channel buttons – presumably to fill up the space on the bleak front panel. Tuning-in these channels is done with simple thumbwheels – one for each channel – hidden under a flap on the top.

User reaction – facilities

The timer on the *3V25*, though clear and easy to use, was thought rather limited with only the one programming facility. The fast winding was considered too sluggish by some, and the auto shut-off, whereby the machine turns itself off after four minutes of sitting on 'pause', was also criticised, although this feature could be defended by its savings on tape wear and battery life.

Despite the quite severe interference from noise bars, the speed search was widely regarded as a useful facility, and the variable slow motion, through its ease of use, was an amusing novelty though of limited utility. The freeze-frame was found to give good results by VHS standards.

Style and design

One of our panelists was almost rapturous about the appearance of the units: he, presumably, was keen to fill his front room with glittering, silver boxes; but from other quarters the praise was more reserved, mentioning the compact, neat appearance, with slight niggles about the fiddliness of some of the buttons.

The recorder fulfils the requirements of portability admirably. It's the smallest and lightest of the models we tested, and can be carried by either a rigid handle or a shoulder strap.

User reaction – performance

The recorder did not rate highly on the quality of the recorded pictures, and assessments ranged from 'not really adequate' to 'just about acceptable', noise being the major criticism. When used with the *3V20* camera, which we were unable to review fully, this proved to be the limiting factor as far as noise and definition were concerned, but the recorder was still felt to degrade the pictures unacceptably.

In contrast, the recorded sound quality prompted no complaint, and most people were very happy with it.

Technical performance

The video signal-to-noise ratio proved to be below average, with the white level S/N measuring −37dB. The signal-to-noise ratio has it seems been sacrificed to give an above average frequency response, the 70% mark being at 2MHz. These figures when taken overall are disquieting for a portable machine, which we should expect to perform better than average if it is to be tru'y useful in programme making. With such poor noise figures, the making of second generation copies by editing is almost precluded, which limits the recorder to casual use.

Measurement of the audio response, which is a narrow 200Hz to 3.3kHz between the −3dB points, contradicts the subjective assessments of our reviewers, but perhaps we need reminding that before 'hi-fi', a generation were content with their 'mellow' radiograms. Audio S/N ratio was moderate, but the peak distortion and wow and flutter were a little high at 4% and 0.6% respectively.

The recorder was found to give good results from stop-start edits using the pause control. This is a very desirable feature for a portable machine operating with a camera.

Conclusions

This is a splendid portable recorder in terms of size, weight and handling, but its poor technical performance hampers its usefulness as a serious machine for the home programme-maker. Although one of the cheapest portable machines available, £550 (plus £175 for the *3V25* or £60 for just a charger unit) is quite a lot to pay for the fairly mediocre results obtained from our sample. However one of our panelists recently went out and bought the JVC equivalent of this model, after comparing several portable machines, so perhaps current production has been improved, or we encountered a poorish sample for test.

Portable VCR: **Ferguson Videostar 3V24**

Technical measurements

Video Performance		
Noise (cored)	white field	−37dB
	grey field	−38dB
	black field	−37dB
(See tech intro.)	red field	−34dB
Frequency response	70%	2MHz
	2.8MHz	60%
	3.0MHz	50%
	3.2MHz	25%
Low level sweep noise point		2MHz
Audio Performance		
Noise: unweighted		−37dB
weighted		−47dBA
Distortion at +4dB over reference		4%
Wow and Flutter		0.6%
Frequency response	±1dB ref 1kHz	300Hz/2kHz
	−3dB points	200Hz/3.3kHz
Audio compression		5dB
Weight		5.2kg
Dimensions: (W x H x D)		29cm x 10cm x 27cm
Typical retail price (excluding tuner/timer units)		£600

Grundig 2x4 plus

Grundig International Ltd., 40/42 Newlands Park, Sydenham, London SE26 5NQ. Tel 01-659 2468

This is a distinctive machine using the Philips 2000 flip-over cassette format. It has a longer and less deep cabinet than most others, and is coloured dark brown with an angled control panel at the front. The price is around £645.

Facilities

Although at the time of writing supplies of the 2000 cassettes are more difficult to acquire than those of the VHS or Betamax format, the flip-over nature of the cassette means that running costs per hour should be lower with this format than any other. The timer offers four options from eight channels over a sixteen-day period, though whether this offer is taken up will depend on the user's ability to master setting the programming inputs within an extraordinary 12 second time limit. If you don't make it, the machine goes back to the beginning with (one imagines) a snort of (teutonic?) disdain.

The mechanical three-digit tape counter has a memory feature, and the machine also automatically registers the start and stop of each section of recording when rewinding with the tape laced. A faster rewind is available with the tape removed from the head drum by the 'tape' button, and in this mode the auto-stop on record breaks is disabled.

Still frame, slow and fast motion options are available by means of three buttons near the bottom of the front panel. These look a little like an afterthought, but in fact work extraordinarily well. External connections, apart from the aerial, are the European DIN type, which are not immediately compatible with the Japanese 259 or BNC standards.

User Reactions – Facilities

The instructions were described by one user as 'horrendous', even though a step-by-step guide is provided for keeping by the set. No-one could see the point in the twelve-second time penalty, and the timer gained the lowest ratings for 'ease of use' in the whole survey.

Little enthusiasm was registered either for the head wrap/unwrap option, which was thought by some to be another unnecessary complication, though one fairly technically-minded user liked it. The auto-seek function for locating the junctions between recordings was universally praised for its accurate action, while the option to bypass this by spooling 'unwrapped' was also liked, and

a high score was gained in all reports. The auto-tuning was considered uncertain in action and an unwelcome feature. The action of the mechanism was felt to be a little uncertain at times, and some commented that the mechanics felt and sounded rather delicate and fragile.

Style and design

Overall, eight out of ten for general looks was a good score: users thought the machine was neat and solid but a little 'dated' in appearance. The clock display was accused of 'glare', being a bright red, while the counter buried near the bottom of the panel was described as 'virtually invisible – like many others'.

Despite the front-loading of the cassette, Grundig had seen fit to include a variable 'sharpness' control on the top panel, labelled with a totally incomprehensible hieroglyphic yielding no clue as to its purpose. This was felt to be a silly place for a potentially useful control, which gives the user the option of balancing the 'crispness' of the picture against the noise to his own personal taste.

User Reaction – Technical Performance

One is inclined to be forgiving about some of the absurdities of the machine's ergonomics when one considers the positive aspects of the performance. Unlike the Philips machine of the same format (to which it bears absolutely no other resemblance) this machine offers a still-frame and slow/fast motion of as yet quite unsurpassed quality. This is due to the 'dynamic track following' feature of the 2000 system, which permits the scanning head to seek out the recorded track automatically, and which preserves almost normal picture quality during 'trick' effects.

For those people who have a particular requirement for slow motion or freeze frames there is at present no substitute for this machine in this respect. Reactions to the picture quality in normal operation averaged out at just over 4 – reasonably happy. Fuzziness, with colour flashing at the top was noted by one user without a VCR-modified receiver. Another noted that drop-outs were far too frequent for his liking, although others did not comment at all on this point. A further point of criticism concerned some inconsistency or uncertainty in 'locking in' to the track following system, both on normal and 'trick' play.

Our professional broadcasting user noticed flutter on sound, and also detected the presence of total audio compression, with noise emerging obtrusively during quiet passages. Reactions were surprisingly inconsistent to the sound quality – one bemoaning a poor frequency response, another praising it highly. Perhaps the machine itself gave a rather inconsistent performance from day to day.

Technical Measurements

The presence of the 'sharpness' control introduced an extra complication to the measurement process on video. At maximum sharpness noise was high, as might be expected, at about −36dB. The video sweep response revealed a 70% response well maintained to between 2 and 2.5MHz, depending on the setting of the crispener. At low level the video sweep descended into noise at the slightly low frequency of 1.6MHz.

Sound noise was excellent for a VCR at 50dB weighted, but the full 20dB compression is to be condemned, as is the high 4.5% distortion at peak level. Wow and flutter and −3dB frequency response limits were reasonable at 0.3% and 60Hz – 10kHz respectively.

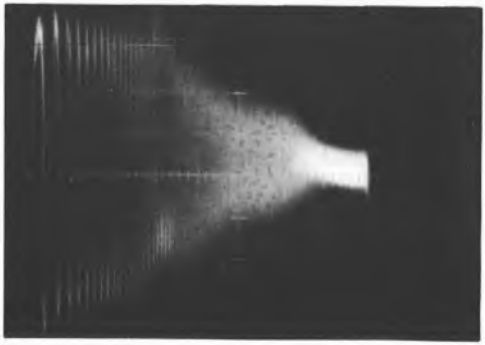
Conclusions

This machine shows the potential of the 2000 system far better than the Philips, though a number of ergonomic and design blunders prevent unqualified enthusiasm. The still-frame and trick-motion performance is exemplary, and if some of the design aspects commented on above were tackled this would be a still more worthy European challenger to the Japanese monopoly on VCR output. This *plus* model is clearly something of an interim design in any case, and hopefully the technical performance will be maintained and mated with improved ergonomics on Grundig's next 'second generation' model.

This replacement, known as the *2×4 Super*, was announced just before we went to press. It is a much more compact front-loader of conventional appearance, and appears to offer significant improvements in facilities and ergonomics. Though by no means a simple machine, it has the useful and presently unique facility of a counter operating in real time, showing tape time remaining, and incorporating remote control and 'go to' facilities (photo p. 8).

Data overleaf

Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Machine: **GRUNDIG VIDEO 2 x 4 PLUS**

Video Performance

Noise (cored)	white field	−34dB
	grey field	−37dB
	black field	−35dB
(See tech intro.)	red field	−36dB
Frequency response*	70%	2.25MHz
	2.8MHz	50/30/10%
	3.0MHz	30/20/5%
	3.2MHz	7/5/5%
Low level sweep noise point		1.6MHz

Audio Performance

Noise: unweighted		−43dB
weighted		−50dBA
Distortion at +4dB over reference		4.5%
Wow and Flutter		0.3%
Frequency response	±1dB ref 1kHz	150Hz/3.3kHz
	−3dB points	60Hz/10kHz
Audio compression		20dB
Typical retail price		£645

*affected by crsipener control: hence maximum, minimum and mean figures.

Hitachi VT8000E

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

This is a modern top-loading VHS machine of compact dimensions. It has a good range of facilities, and is available for about £525, or even less.

Facilities

The machine has an eight-channel tuner, and four of these are considerately labelled with UK programme names. These are tuned by conventional presets located behind a flap on the front cover. The tuner works well, is easy to tune, and is quite tolerant of weak signal inputs.

The timer is almost identical in operation to the one fitted to the earlier *VT 5000* machine, offering only one programme option up to nine days ahead. Its selection switch is located on the front panel, together with an operate/standby switch. Power for the unit as a whole can be interrupted by a switch on the back panel, while also round the back is a switch to generate a tuning test signal to help when setting up.

A small flap on the left-hand side of the front panel hides the phono audio-in and video-in sockets, together with a mike jack and a 3.5mm jack for the remote control. The remote control itself offers all functions except channel change and is connected *via* a single neat cord.

The mechanics are solenoid operated *via* light-action switches on the front panel, augmented by illuminated coloured lamps on the record, play and stop buttons. Speed search, still frame, audio dub and frame advance controls are provided, but there is no slow motion and no sound during the trick effects.

User Reactions – Facilities

The timer was considered to be rather limited in offering only one programme, but as a corollary setting it up was simplicity itself, with the instructions permanently affixed to the underside of the flap. A nice touch, this, and one which might be difficult to emulate in the more complex machinery!

The more minor mechanical controls are half the size of the major ones, and as such are a little on the small fiddly side. But the large record, play and stop buttons were appreciated. In operation the controls lacked the logical sophistication one might expect from a modern machine, in that one operation had to be well under way before another could be selected, which slows down the speed at which instructions can be fed to the machine. The fast wind/rewind mode was also considered to be on the slow side, a 2 hour cassette taking over three-and-a-half minutes to spool through.

The still frame picture was rather jittery, taking a second or two to grind to a halt and lock itself up, but nevertheless the noise bar was usually well suppressed and the standard of reproduction above average. The speed search picture

had severe noise bars, but was quite 'solid' and useful. The rate of search was also considered to be about right. The remote control, being cord-linked, worked exactly like the mains controls, although of course the disadvantages of a wired system are self-evident (particularly if active children are around.)

Style and design

Described as 'very Japanese-looking' by one recipient, this unit gains much from being only about two-thirds of the size of most of its rivals – it is a very neat and light machine. On the other hand, the labelling of the controls is miniscule and worsened by the attempts to highlight the major functions by printing their respective labels in different, barely legible, colours.

An overall rating of between seven and eight out of ten was gained by the machine, although its good looks were offset by the usual lack of ergonomic insight. Also disliked was the excessively bright, large and garish blue/green clock display; this reviewer felt compelled to turn the machine off at night if sleeping in the same room (and then of course you have to set the clock again etc).

User Reactions – Technical Performance

Subjectively the picture gained a 'reasonably happy' rating in our tests, with some noise being observed, together with slight displacement of the coloured areas of the picture. This latter fault was due to a timing error between the colour and black-and-white information, and may be attributable to slight maladjustment of our sample.

On the sound side, few complaints were noted. A little background hiss was evident at times, but if anything the sound emerged slightly brighter off-tape than 'live', although the lack of very high frequencies was evident to critical ears using above-average TV receivers.

Technical Measurements

Noise ratings were significantly better than the norm at an average of −45dB on video, although subjective edge-noise effects were clearly present. This indicates that quite heavy noise coring was probably present on the playback signal, although we were unable to disable this function internally.

The frequency sweep revealed a rather strange asymmetry of the replayed waveform, with a 70% point at around 1.5MHz, slightly on the low side. The response was maintained at 45% at 2.8MHz, however, which is quite fair. The low-level sweep descended into the noise at 2.2MHz, again quite a fair performance.

On the audio side, a signal-to-noise ratio of 36dB was improved to 44dB with 'A' weighting, a fairly typical and reasonably satisfactory figure. Peak distortion was on the high side at 4%, while wow and flutter was about average at 0.25%. There was 3dB of audio compression, which is acceptable. The frequency response fell to −3dB at 60Hz and 8.5kHz, a reasonable middle-of-the-road performance considering the current state of the art.

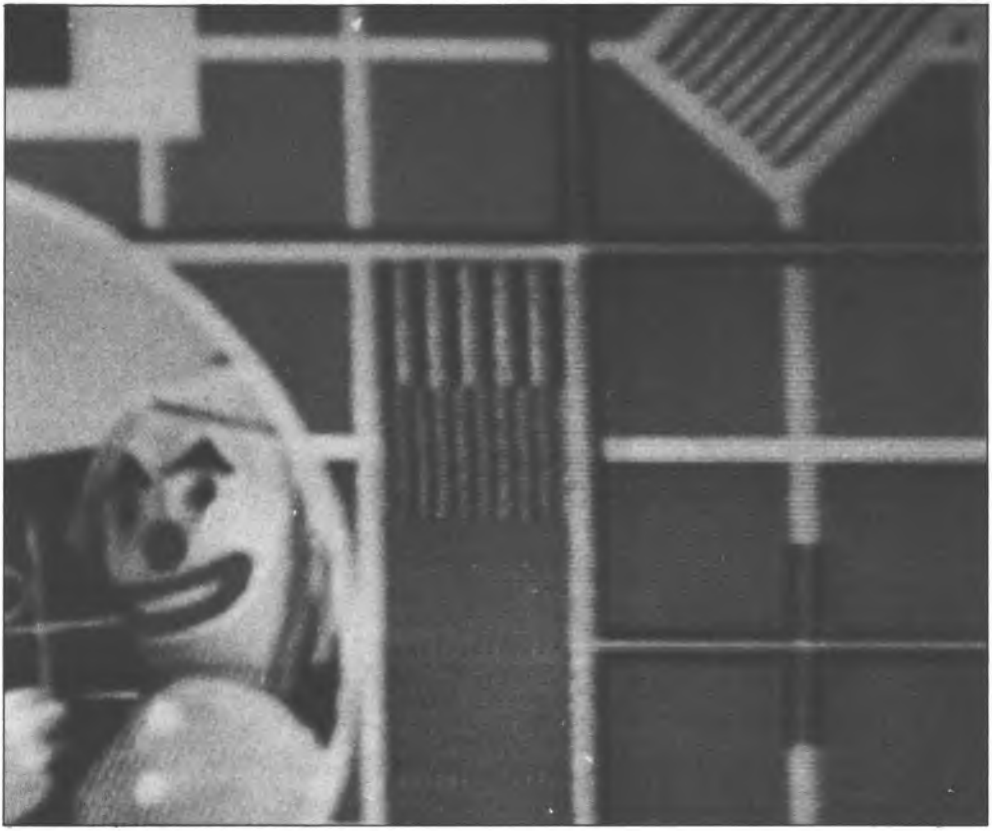
Conclusions

This machine provides a useful range of facilities at a commendably low price. Technically the performance is competent if unexceptional, and mechanically the machine responds reasonably well. Ergonomically the machine leaves something to be desired, and the simple timer, though easy to use, is rather restrictive. However, we feel inclined to recommend this machine highly as representing very good value for money.

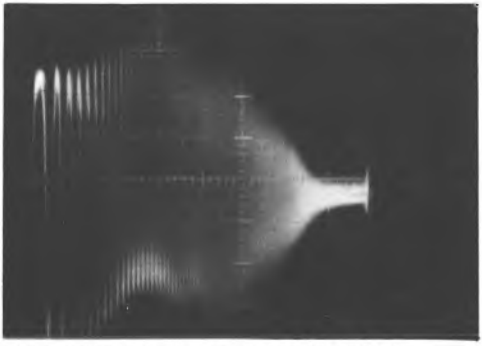
Those liking the machine but wishing for more comprehensive facilities might note that the *VT 8500* uses the same basic chassis but has rather more 'frills', including cordless remote control.

Hitachi 8500 is the more elaborate machine.

Data overleaf



Detail from off-tape testcard



Video sweep response, recorc/playback, 0.5MHz/div horiz.

Machine: **HITACHI VT8000E**

Video Performance

Noise (cored)	white field	−44dB
	grey field	−45dB
	black field	−46dB
(See tech intro.)	red field	−−dB
Frequency response	70%	1.5MHz
	2.8MHz	45%
	3.0MHz	30%
	3.2MHz	15%
Low level sweep noise	point	2.2MHz

Audio Performance

Noise: unweighted		−36dB
weighted		−44dBA
Distortion at +4dB over reference		4%
Wow and Flutter		0.25%
Frequency response	±1dB ref 1kHz	80Hz/6kHz
	−3dB points	60Hz/8.5kHz
Audio compression		3dB

Typical retail price £525

If everything were perfect...

It is rarely necessary to have to boost the bass response of a top quality high fidelity system, (although the Quad 44 tilt control does enable subtle changes to be made to the overall balance of the programme), but there are a number of high quality loudspeakers on the market, which because of their Lilliputian dimensions, necessarily have attenuated low frequency response and the Quad 44 is fitted with a bass control which in the lift position provides optimum equalisation.

Considerations of domestic harmony frequently dictate loudspeaker placement that is less than ideal. The almost inevitable result is the excitation of the fundamental eigentones of the room and music reproduction with a characteristic and unpleasant honk.

The step side of the Quad 44 bass control switch eliminates this problem without rolling off the low frequency information, simply by putting a 5dB step in the frequency response, reproducing domestic bliss and a closer approach to the original sound!

To learn all about the Quad 44 write or telephone for a leaflet.

The Acoustical Manufacturing Co. Ltd., Huntingdon PE18 7DB. Telephone: (0480) 52561.

QUAD

for the closest approach to the original sound

Hitachi VT5000E

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

This is one of two machines (the other being the JVC *3300*) included in this book which are now obsolete, in the sense that new production is no longer being shipped for sale in this country. This does not mean, however, that all such models are safely settled in contented homes up and down the country; rental companies in particular are likely to be dealing in machines like this for some considerable time, as trade-ins occur, enabling them to issue older models with no-deposit rental terms.

Facilities

This machine takes VHS cassettes as a top-loader. It has conventional mechanically operated controls for the standard functions, including audio dub and a pictureless pause. A nine-day single-shot timer operates using a large bright blue/green clock display on the front panel.

Eight tuner channels are available, helpfully labelled BBC 1, BBC 2 etc, but the infamous 'Video/TV' switch also rears its ugly head. This has to be operated every time you change from watching tape to watching 'live' TV, or *vice-versa*. As such, it necessitates a two-button change-over rather than one, which would be particularly galling if the television receiver was operated by remote control, in that the user would have to get up and operate a switch at the machine itself in addition to changing the channels.

An unremarkable three-digit tape counter with memory button more or less completes the facility hardware, though there is a 'black-and-white' switch at the rear of the machine to

improve the quality of monochrome recording.

User Reactions – Facilities

The timer was thought to be lacking in versatility, allowing only one programme to be recorded in advance, but it was appreciated for being extremely simple to use. The only gripe was that a mental calculation had to be carried out by the user to convert the details in the Radio Times to a figure corresponding to the duration of the programme. (To some this comes easier than to others.)

The transport controls undertook their responsibilities reasonably efficiently, if loudly, with a smooth if slightly 'tacky' feel to them. Wind and rewind times were thought to be on the slow side, and a rather rudimentary on/off governor gave some disturbingly abrupt changes in wind torque.

The facilities offered were as sparse as can be had – no speed search, still-frame or other trick effects – and many users noted this limitation in their replies, indicating that the inclusion of such features was not regarded as merely lily-gilding by our panel.

Style and design

Set alongside its successors, the *VT8000E*, this machine has a distinctly 'dated' look about it, being bulkier, heavier and altogether less sleek than the newer set. Nevertheless, an overall style score of around 6 out of ten indicates that it should not be too difficult to live with, unless you begin to hate the excessively bright and rather gruesomely blue-green clock display!

The presence of the Video/TV switch was as unpopular as ever, all regarding it as a positive impediment to easy operation. The labelling of the controls, being (unusually) white letters on a black background, raised murmurs of praise from a panel which has rarely approved of other attempts to carry out the labelling operation.

The action of the mechanical controls attracted little adverse comment, apart from some criticism of noise when a lever was released, and certainly less than some solenoid-run mechanisms have aroused.

User Reactions – Technical Quality

Picture playback earned a consistent 'reasonably happy' across our scoreboard. A little lack of detail and colour degradation was detected, and some mention made of more frequent dropouts than usual, but otherwise there were no obvious distractions. In general, the picture was regarded as pleasing, if of fairly mundane quality. On the sound side, no striking shortcomings were noted either, users awarding a score between 4 and 5 ('reasonably happy' and 'very happy').

Performance at our weak-signal site was regarded as fairly good, the recorded picture from a weak aerial signal being regarded as satisfactory under the circumstances.

Technical Measurements

On the whole, these give little cause for alarm. Video signal-to-noise ratio was better than average at 44dB typically, though the sweep responses were nearer the norm at 1.6MHz for the 70% point, and 30% reproduction of the 2.8MHz gratings. Low-level sweep loss was negligible, and the noise point was commendably high at 2.8MHz.

Audio-wise, very satisfactory noise readings of 40dB unweighted/46dB weighted were recorded, though both the peak distortion and the wow and flutter were a shade on the high side at 0.3% and 4% respectively. The audio frequency response was somewhat narrow, with 65Hz and 6.5kHz the −3dB points, but the measured 1.5dB of compression is a very good figure.

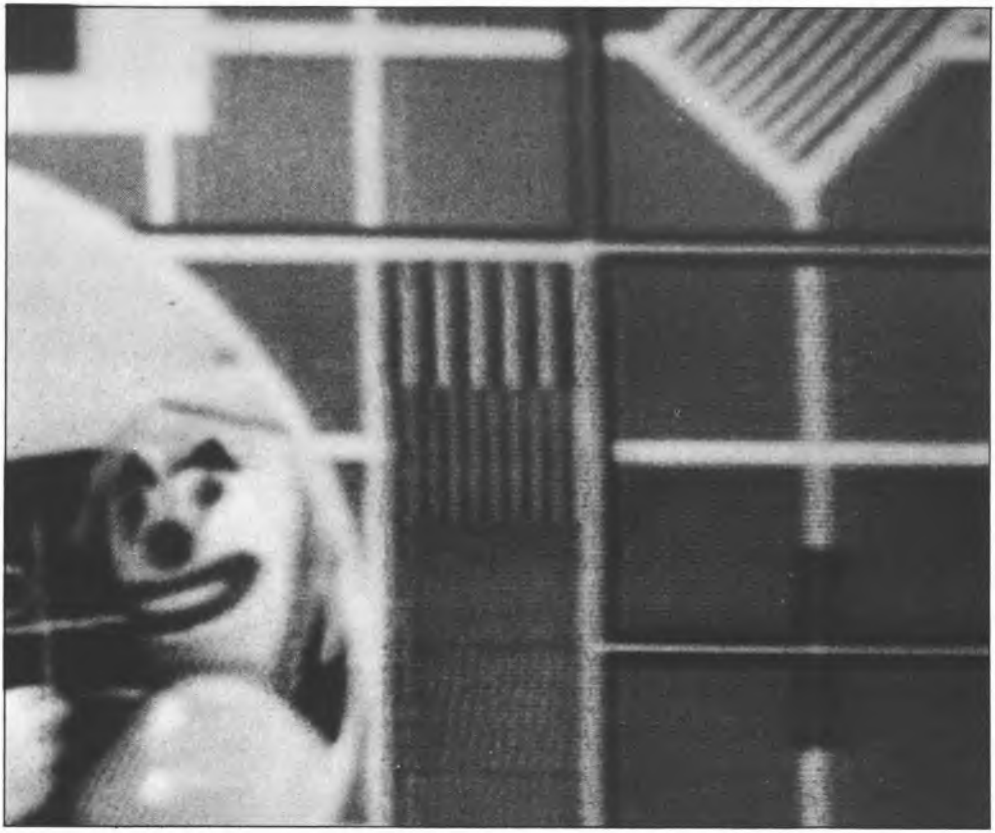
All in all, this machine provides a competent standard of technical performance which is not disgraced by comparison with much more up-to-date machines.

Conclusions

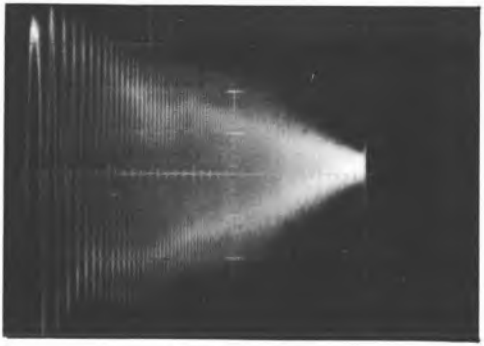
This is a very basic machine, providing the user with nothing more than totally straight playback of recorded programmes. The timer is elementary, but more useful than some in that it will work up to nine days in advance, and the recording duration is continuously variable. The machine as a whole is quite straightforward to use, although the 'Video/TV' switch is a nuisance.

In terms of performance, the machine is no worse than many others, having no major quality defects in either picture or sound. If offered on the rental market at a lower price than more up-to-date machines, it should definitely be worth considering.

Data overleaf



Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Machine: **HITACHI VT5000E**

Video Performance		
Noise (cored)	white field	−44dB
	grey field	−44dB
	black field	−43dB
(See tech intro.)	red field	−32dB
Frequency response	70%	1.6MHz
	2.8MHz	30%
	3.0MHz	18%
	3.2MHz	12%
Low level sweep noise point		2.8MHz
Audio Performance		
Noise: unweighted		−40dB
weighted		−46dBA
Distortion at +4dB over reference		4%
Wow and Flutter		0.3%
Frequency response	±1dB ref 1kHz	80Hz/5.6kHz
	−3dB points	65Hz/6.5kHz
Audio compression		1.5dB

Now obsolete

Hitachi VT7000E

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

This VHS portable recorder, companion to the *VKC750* colour camera, comes in a silvery case and costs around £580. The tuner/timer partner, the *VT-TU70E*, and mains power supply, *A-V70E*, were not made available for testing.

Facilities

The light-touch buttons on the near perpendicular front panel are under microprocessor control, which sorts out the commands to suit the machine's mechanics. There are all the basic transport functions, but the only 'trick' function is freeze frame, with frame advance only available on the remote pad at the end of 5 metres of cable. There is a three-digit mechanical tape counter with a memory button.

On a panel at the rear, behind a protective flap, are video and audio inputs and outputs (all phono sockets), a socket for the umbilical to the tuner/timer, and an RF outlet for direct connection to a television. The camera cable socket and the DC power input are on the side of the machine.

The 12V rechargeable battery is housed under a flap on the top of the machine, and a row of LED's (two green, one red) indicates the battery condition. To save needlessly running the battery flat, after five minutes the machine will

automatically either turn itself completely off if idle, or turn the motors off if on 'pause' while recording.

User reactions – facilities

Although light to the touch, there is a reassuring 'give' in the control buttons, which light up with a strong red indicator when the operation is being carried out. It was felt that some effort might have been made to distinguish at least the 'stop' and 'record' button from the otherwise identical row of controls.

The mechanical transport was thought particularly quiet and confidently smooth. Being spoiled by the experience of infra-red remote controls, having a cable did seem untidy, but the unit's workings and facilities provoked no complaint bar the comments about the identical appearance of the buttons. The latest, current versions use infra-red remote, which further improves the ergonomics.

The tracking control is given a place of prominence on the top of the machine, which perhaps overemphasises its necessity: tape interchangeability amongst VHS machines is better than manufacturers expected?

The automatic shut-off of the machine was found to be a little irritating at first by some users. But they found this taught them to appreciate the limited time available from the battery, so on reflection this feature, which did not appear on the other portable machines tested, was considered a good thing.

Style and design

While this machine would win no awards for its appearance, it is unobtrusive in its own Japanese way. The instruction manual is a trifle too complicated, showing lots of diagrams of the machines bristling with what look like acupuncture needles. Although some of the more subtle points are not clearly explained, this is essentially a straightforward VCR, and all our users quickly came to grips with it.

It's hard to comprehend why Hitachi supplied this machine with a carrying handle but not a shoulder strap. Without a shoulder strap it becomes a clumsy, burdensome piece of equipment: space has to be found to put it down every time one wants to use it, and carrying the recorder and camera with any other necessary equipment while trying to open doors becomes a nightmare. The machine is by no means too heavy to carry from the shoulder, and the benefits from being able to do so are immense. This fairly minor point is a major detraction from an otherwise very versatile portable VCR.

User reactions – performance

Pictures from the *VKC750* colour camera *(qv)* were not thought to do justice to the *7000*'s quality as a recorder, so in addition video signals from other cameras and an external tuner were fed in, and the results from these were appraised.

In general, the picture quality was judged to be very good, edge noise in particular looking better than average. A superior performance is of course highly desirable in a machine that may be used for mastering, where portions of a tape made on location with the portable machines are edited onto another machine.

The sound received some praise for its clarity, which again was classed as better than average.

Technical performance

The measurements of video signal-to-noise confirm the subjective assessments that the noise performance was better than average, and also show a (comparatively) impressive frequency response, with the 70% point at 2MHz.

On the audio side, the frequency response was reasonably wide, the −3dB points being 80Hz and 7kHz. But the wow and flutter was 0.7%, which is a disturbingly high figure for a portable machine which demands a high degree of robustness in its mechanical transport.

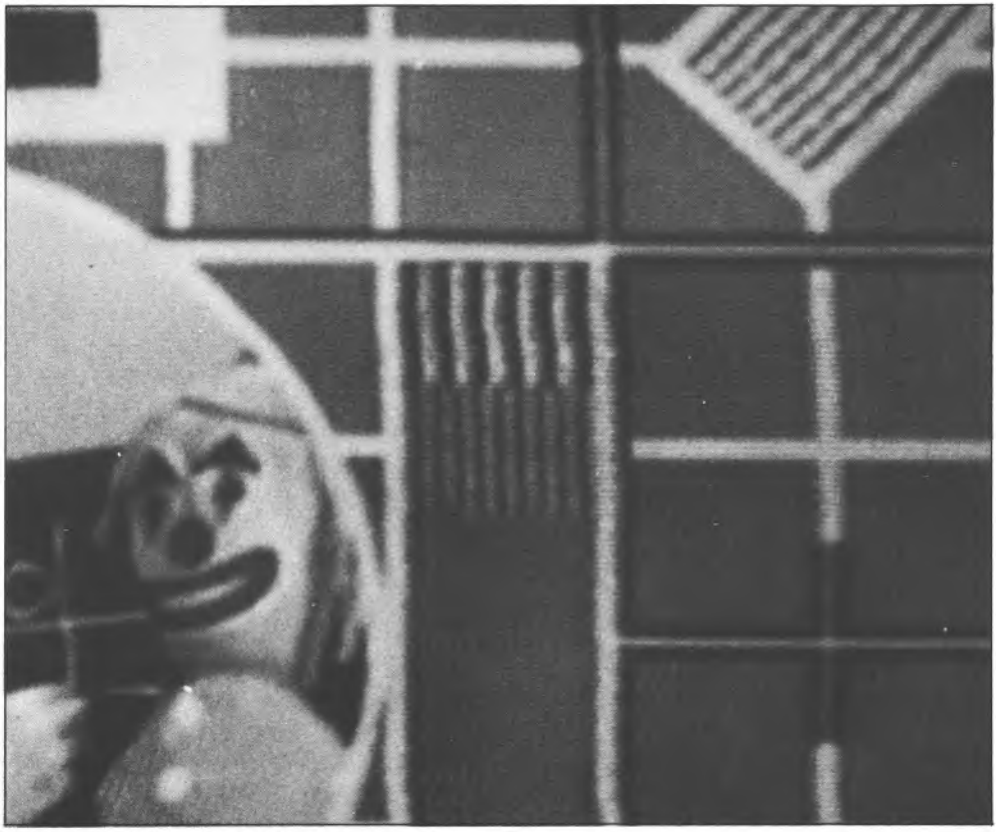
An important feature for portable recorders is the ability to give clean edits when the pause button is pressed between successive camera shots. The *7000*'s microprocessor tries to cater for this by winding the tape back a few frames when the pause is operated on record, to ensure continuity of the control track. The system was found to work reasonably well: cuts between still shots of the same scene – the most telling test – gave good results on most attempts; occasionally the edit was spoilt by a jitter of the picture and a momentary loss of colour.

Some slight damage to the tape was indicated by the presence of a brief rolling ripple of noise when the machine was left on pause for long periods. This was only apparent when the recorder was left on for the maximum possible period of five minutes (the motors switch off automatically after this).

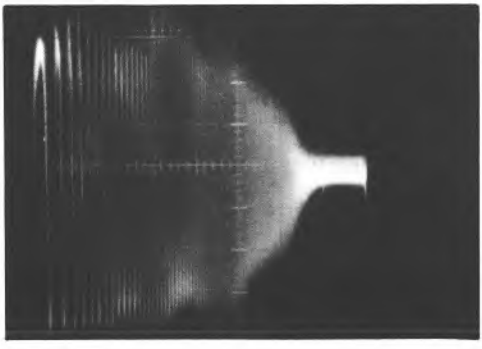
Conclusions

This machine has a good technical performance, as is expected of a practical portable recorder. At around £580 it is reasonable value, and should give satisfying results with a good camera.

Data overleaf



Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Portable VCR: **Hitachi VT-7000E**

Video Performance

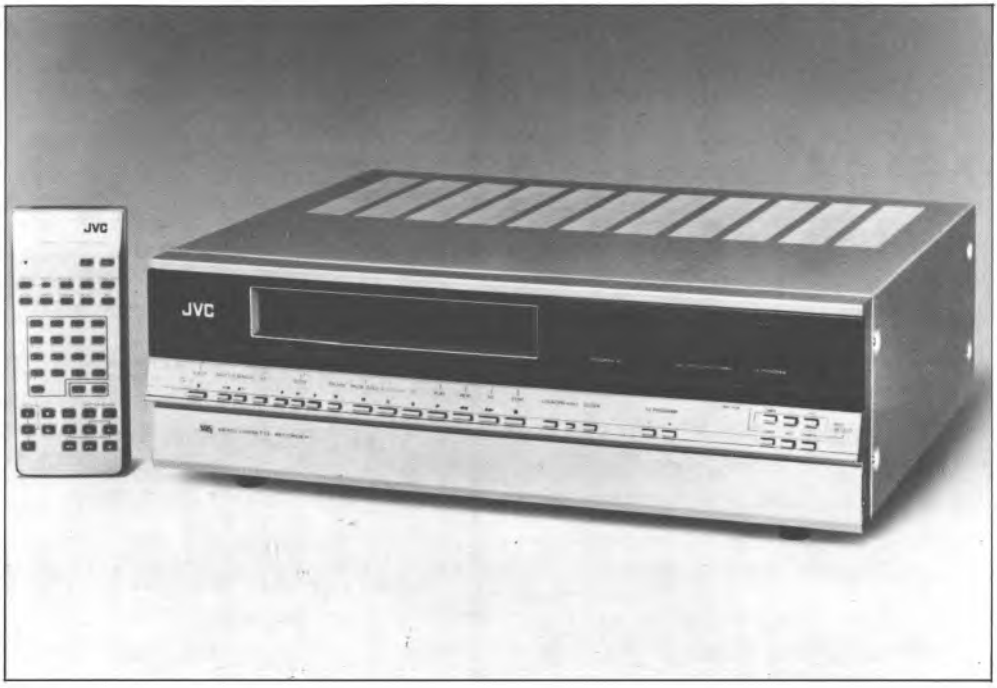
Noise (cored)	white field	−38dB
	grey field	−43dB
	black field	−44dB
(See tech intro.)	red field	−39dB
Frequency response	70%	2MHz
	2.8MHz	60%
	3.0MHz	20%
	3.2MHz	5%
Low level sweep noise point		1.6MHz

Audio Performance

Noise: unweighted		−42dB
weighted		−50dBA
Distortion at +4dB over reference		2.5%
Wow and Flutter		0.7%
Frequency response	±1dB ref 1kHz	200Hz/5kHz
	−3dB points	80Hz/7kHz
Audio compression		13dB (limiting at −25dB)
Weight		5.9kg
Dimensions: (W x H x D)		28cm x 13cm x 32cm
Typical retail price (excluding tuner/timer units)		£580

JVC HR7700EK

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



This is a top-of-the-market VHS front-loader 'from the people who invented the VHS system'. It sells for up to £785, and as such represents the most expensive machine in this survey (excluding portable packages).

Facilities

It has been said that this machine represents the best that VHS can at present offer, and it is certainly not short of features. The timer offers eight recordings from sixteen channels over fourteen days. Slow motion, freeze frame, fast picture search, a tape-remaining counter, Dolby noise reduction, double-speed playback (with 'normal' pitch sound!), programme locating coding and even a clock dimmer present a comprehensive range of facilities for the enthusiastic owner.

This is not, of course, achieved without a fearsome array of knobs and buttons, about half of which are concealed from view by a flap on the front panel. The remote control must also be one of the most involved we have ever seen, relying unfortunately on obscure symbols to denote some of the functions. Both the European and Japanese industries appear to have their own secret *cache* of caballistic symbols for various functions, and these are brought out when the need arises. Unfortunately as far as we can tell these are not widely understood even among VCR fans – perhaps a Highway Code for Video Signs is required!

User Reactions – Facilities

With a large number of buttons and a finite space to put them in, they must be small. First reaction was that the controls were small, badly placed, and not particularly logically laid out. Nevertheless, the subjective score for performance was invariably high, although the still frame picture was frankly not on a par with the Grundig (*qv*).

Speed search was well liked, and the facility for watching programmes at twice normal speed, while retaining normal pitched sound, aroused much interest. The sound is rather garbled, but is nevertheless intelligible, and music is also recognisable in this mode (sometimes it sounds better this way . . .), while time wasted watching the boring parts of a football match can be cut dramatically, even though ball trajectories appear a little

wierd. This machine also provides an automatic stop at the beginning and end of recorded programme sections on the tape, using pulses encoded when starting and stopping record, and this was greatly appreciated by users, though the inability to overide the system was a mild nuisance.

The ability to change channels from the remote contrôl unit by means of the keyboard in the centre of the unit was liked, as was the comprehensive nature of the remote control itself, which worked well over normal domestic distances, though somes users commented that they preferred a simpler, more basic, pad (*cf* Sony *C7*). Generally, although hardly a machine to delight Grandma, users mastered it without undue difficulty, and appreciated the range of facilities during the week or fortnight trials.

Style and design

The *7700* is a rectangular front-loading box. A black section along the top of the front panel accomodates the cassette entry and indicator displays. A silver chrome section below this is where the function buttons are located and the more occasional controls are to be found behind a flap. This machine nevertheless gained seven out of ten from our committee, who didn't as a rule much care for little fiddly buttons, particularly when hidden behind a flap.

The design of the tuner was derided for the automatic sweep tuning imposed on the user, although it might to difficult to imagine where sixteen preset tuning pots could be located.

One user expressed a desire to be able to see the tape reels during use, but of course this is never possible with video front-loaders.

User Reactions – Performance

One obvious machine to compare this model with is the much simpler JVC *3300*, reviewed on the previous pages. In a side-by-side comparison, it was surprising to note that the picture quality was if anything better on the down-market machine than on its costlier counterpart. In particular it was noted that a herringbone-type pattern was noticeable round the edges of highly-coloured objects. This is due to the colour information being presented on the screen as a monochrome signal – in broadcast TV the frequency of the colour information is very precisely controlled to minimise the visibility of this patterning, but with video home recorders this precision will be lost. Overall, though, the picture gained a score of 4 (reasonably happy) and the sound 5 (very happy), which is a marked improvement on most models.

Technical Measurements

Video signal-to-noise was slightly better than average at −42db, while the 70% resolution point was reasonably high at 1.9MHz, the response falling to 30% at 2.8MHz. Noise-coring was found to be improving the grey level noise figure by about 5dB, and worsening the 2.8MHz resolution from 50% to 30%. Signal loss on the low-level sweep was negligible, and the sweep disappeared into the noise at the fairly high level of 2.2MHz.

On the sound side, our noise measurements were foiled by the background noise of the machine's electronics, in that recording a theoretical silence onto tape, first with Dolby off, then with it in, revealed that the most prominent source of noise was within the machine itself, and the improvement effected by the Dolby switch was only of the order of 4dB. Nevertheless, the sound quality was subjectively well received, with fairly good distortion, frequency response and wow and flutter figures.

Conclusions

This is a great machine for the gadget-minded, or for those who want to take the video revolution into their lives wholeheartedly. The picture quality is no better during straight playback than many much cheaper machines, though the sound is very acceptable. So the price you pay is for all the facilities, and if you are sure that you will use most of them fairly regularly, the machine should be worth the money.

Machine:		**JVC HR-7700EK**
Video Performance		
Noise (cored)	white field	−41dB
	grey field	−42dB
	black field	−44dB
(See tech intro.)	red field	−38dB
Frequency response	70%	1.9MHz
	2.8MHz	30%
	3.0MHz	15%
	3.2MHz	8%
Low level sweep noise point		2.2MHz
Audio Performance		
Noise*: unweighted		−42dB
weighted		−46dBA
Distortion at +4dB over reference		1.5%
Wow and Flutter		0.35%
Frequency response	±1dB ref 1kHz	150Hz/7kHz
	−3dB points	82Hz/8.2kHz
Audio compression		0dB
Typical retail price		£700

*Dolby on

JVC 3300

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

This is a basic VHS top-loader which is now obsolete, being replaced by the externally similar *3320 EK*. However, it is still around in large numbers in both this and the Ferguson *3V22* guise.

Facilities

Straightforward mechanical transport controls of the conventional lever type protrude from the front of the cabinet to provide the usual functions. A single-option timer of commendable simplicity accompanies a red digital clock display on the bottom left-hand corner of the cabinet, and up to eight off-air channels may be selected on the tuner.

At the rear are the video and audio input and output sockets, the mains switch and the colour/black-and-white selector, which also doubles as a switch to turn on the test signal which aids tuning. This is a fairly compact machine as VCRs go, if rather square and unrefined.

User Reactions – Facilities

This machine was amongst the early arrivals, but some users were encouraged to reassess its performance later on, with the benefit of hindsight. One adverse reaction which was consistent throughout was to the small and rather badly positioned timer setting buttons, although the ease with which the timer could be set up was greatly liked after close encounters with more forbidding machines.

The pause button, which stops the tape movement but does not display a still frame, was thought to have a rather poor release action, taking some time to display normal picture and sound. Some users found it awkward to have to operate the stop lever while changing transport functions. Since some mechanically-operated mechanisms were well-liked (*cf* Toshiba), it is clear that there are significant variations between the feel and performance of mechanical lever mechanisms, and that this example was not among the best. One user commented that the mechanism was noisy, and further that the machine delivered a fairly startling report when cancelling its play or record function automatically at the end of tape or when the power was removed by the timer.

Style and design

'A nice small cabinet', said one; 'nice looking

machine', said another. A third found the controls easy to master. Evidently most users found the machine acceptable aesthetically, and a positive reaction to the smaller-than-average bulk of the machine was widely registered. Six out of ten was the mean rating overall.

On the other hand, the timesetting buttons were thought to be badly placed and too minute, with the tape counter also too small for easy use. The bright red clock was thought to be a little too ostentatious for easy living.

The most positive aspect of the design was its essentially foolproof operation. Most users felt that this model was amogst those on which they would be happy to let the family and babysitter loose without worries.

User Reactions – Technical Quality

The initially favourable reaction to the technical quality was revised downwards in later assessment. One fairly uncritical user noted poor colour rendition and picture unsteadiness, and another remarked that on reflection the picture standard was poor compared to many other machines. The final rating on the satisfaction scale was 3 – just about acceptable, with an estimated 50–60% 'quality' picture rating, expressed as a percentage of the quality of a 'live' transmission.

Sound came out generally rather better, with an overall satisfaction score between 4 and 5 (reasonably/very happy). 'Just a slight muffling of the sound' and 'some flutter' were amongst the defects observed.

One aspect of the performance which interestingly parallels that of the almost identical Ferguson machine was that the standard of the internal tuner left something to be desired. Even allowing for the fact that the tuner on this well-travelled ex-dem sample was not well aligned (we were able to make minor adjustments to improve the performance), and although its performance on weak signals was good, the tuner was one factor contributing to a poor overall technical performance. The picture on monitor mode was felt to be unduly noisy, even in good signal areas.

Technical Measurements

This is one of the machines where noise coring on the video signal is carried out by two readily-accessible diodes, so these were shorted out to conduct resolution and noise measurements both with and without coring applied. Uncored video noise averaged −34dB, a fair figure, improving by around 8dB with coring applied.

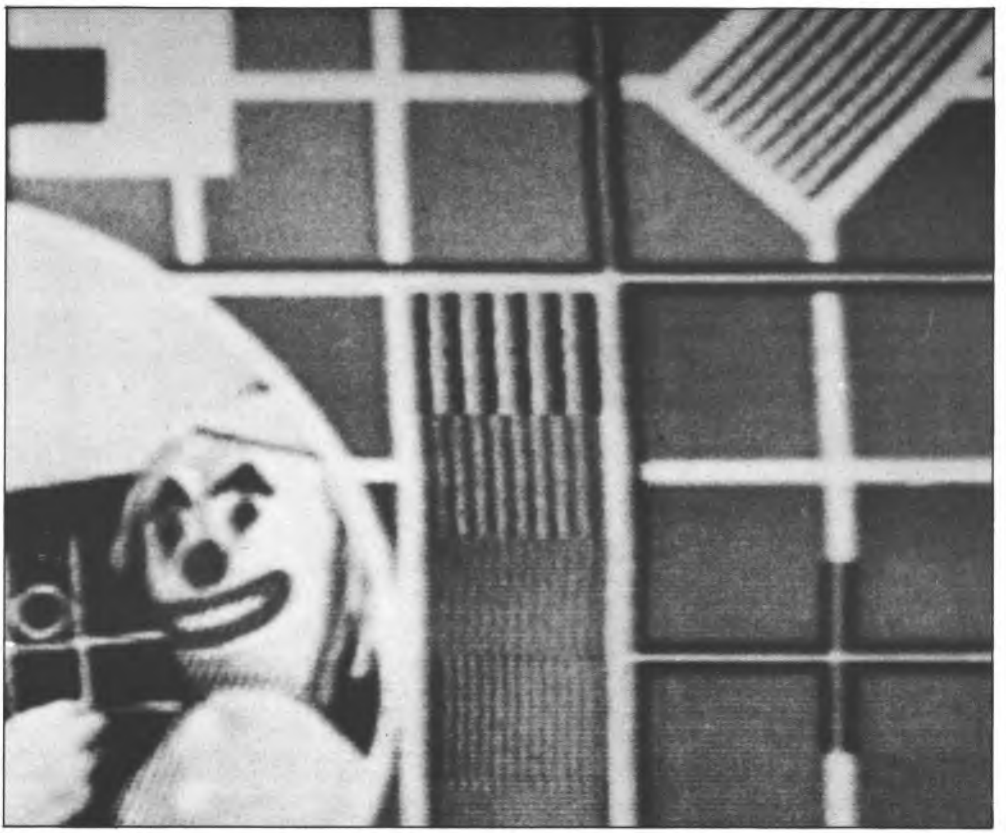
Video sweep 70% points were 2.6MHz, with a remarkable 55% output at 3.2MHz measured with the coring shorted out. Restoring normal operation produced a 70% point at 1.6MHz, but the response at 3.2MHz was still a good 30%. The low-level sweep disappeared into noise at 2MHz. These results are very good, and indeed indicate a rather better technical performance than the user reports might have led one to expect.

On the sound side, although weighted S/N was unusually poor at −32dB, and the frequency response limited to 60Hz and 6kHz at the −3dB points, the distortion was reasonable at 3% peak, while wow and flutter was adequate at 0.3%. No audio compression was observed.

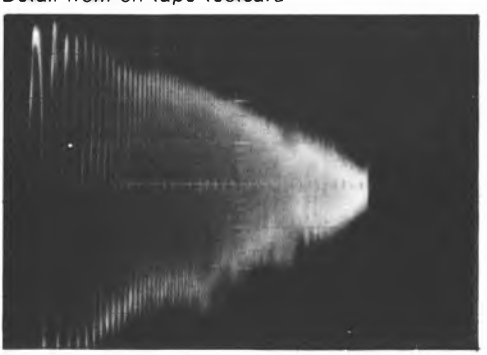
Conclusions

If you are likely to be satisfied with a basic VHS machine, you are likely to be satisfied with the JVC *HR3300EK*. The performance of the tuner was disappointing, but otherwise the machine performs well for the price, and should be easy for the entire household to master.

Data overleaf



Detail from off-tape testcard



Video sweep response, recorc/playback, 0.5MHz/div horiz.

Machine:		**JVC HR-3300EK**
Video Performance		
Noise (cored)	white field	−40dB
	grey field	−42dB
	black field	−44dB
(See tech intro.)	red field	−−dB
Frequency response	70%	1.6MHz
	2.8MHz	45%
	3.0MHz	35%
	3.2MHz	30%
Low level sweep noise point		2MHz
Audio Performance		
Noise: unweighted		−25dB
weighted		−32dBA
Distortion at +4dB over reference		3%
Wow and Flutter		0.3%
Frequency response	±1dB ref 1kHz	100Hz/4.7kHz
	−3dB points	50Hz/6kHz
Audio compression		0dB
Typical retail price		£495

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Misubishi HS-300B

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

This is an up-market machine, selling at around £650 including remote control, and operating on the VHS system.

Facilities

The machine has an all-electronic transport mechanism which can be controlled *via* an infra-red remote control. It features slow motion, still frame and picture search operations, a six-option seven-day timer, and an eight-channel tuner. The operation of the remote control covers all facilities, including channel change, so the machine can be used as a remote broadcast channel switch as well.

User Reactions – Facilities

The timer was given a good rating for both ease of use and performance, and its versatility is likely to be sufficient for the majority of users. Particularly liked was the fast, positive response of the mechanical transport, whether on the front panel controls or *via* the remote control. The interlinking logic enabling the user to go from one function to another without having to hit the 'stop' button was also considered to be an agreeable feature.

The 'still frame' and 'slow motion' options were capable of reasonable definition after a bit of edging back and forth, and the pause control was regarded as 'crisp', being quick to pick up after being released. Pulsing through frame by frame was seen to be carried out efficiently by the appropriate control. Several users commented that the 'speed search' was not as fast as they would have liked, but that it was nevertheless possible to locate desired items very quickly using it.

The machine was observed to be more than usually tolerant of weak aerial input signals, and gained a 'good' rating in this respect from our bottom-of-the-valley viewer and our lab tests.

Style and Design

Rated very highly in terms of 'overall design', the machine was particularly liked for its confident handling of mechanical activities and the general air of competence and confidence it exuded.

It was however commented that the transport buttons were too small, and that they ought perhaps to be better signposted by larger fascia indications. The tape footage counter was also felt to be too small, but the good old-fashioned

mechanical 'eject' button on the top was preferred to the prospect of a little fiddly panel key.

Despite these minor gripes, the machine quickly won the confidence of all users.

User reactions – Technical quality

The picture was reported to be 'not as crisp as some' by one experienced VCR user and another user complained of a 'curious element of noise' in the picture when using the VCR tuner either 'live' or replaying tape. It was noted that pictures generally looked crisper after being passed *via* the VCR's own tuner to the receiver, compared with the results using the receiver 'straight'. This is as a result of some high-frequency 'lift' in the video response through the VCR tuner, and although not normally detrimental to quality as perceived by the viewer (quite often the reverse), it is possible that this may slightly exaggerate some noise.

The compatibility of sound and picture between the machine's own tapes and those recorded on another VHS machine was described by one user as poor, although this should not be taken as implying that all such transfers will give poor results. If you intend to play other people's tapes on this machine, it might be as well to take one of them along (assuming that you are sure it is of good quality) to the shop where you see the Mitsubishi and ask to try it.

The sound quality was universally praised, although one user would have liked less instability of the sound track when changing between normal playback and any of the slow/fast modes, or at least a mute circuit to cut out the stranger contortions of the soundtrack.

Technical Measurements

Noise figures averaged the usual target of 40dB on plain fields, with about 6–7 dB of noise reduction attributable to the 'coring' circuit (which we were fortunately able to disable as required during the measurements.)

Video frequency response (cored) was down to 70% at 1.7 MHz, not a particularly high figure, and the coring was clearly having a marked effect on the response higher up, with 3 MHz test gratings tumbling from a creditable 50% with the coring off to only 15% with it switched in.

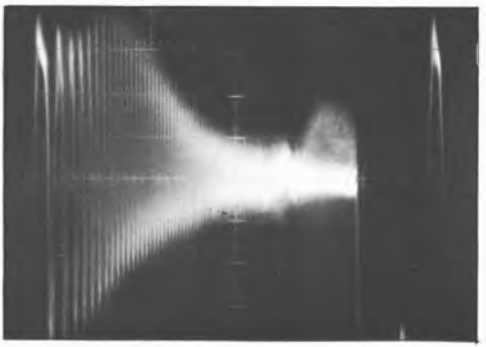
The audio quality was subjectively noted to be good, and this was confirmed by a response at 3dB points of 80 Hz and 10 kHz, wow and flutter of only 0.15%, a peak distortion figure of 2.5%, and a weighted S/N ratio of 40dB. All these results represent a considerable improvement on the norm for VHS machines, although the signal-to-noise ratio could well be further improved. There was 3dB of signal compression on audio from a broadcast source, which is quite acceptable.

Conclusions

This is an up-market machine with an extremely confident feel to it. It was universally liked by our panel for its swift response to commands, the sound quality was well above average, and the picture quality, though by no means exceptional, was no disgrace to the rest of the system.

Data overleaf

Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Machine: **MITSUBISHI HS-300B**

Video Performance

Noise (cored)	white field	−39dB
	grey field	−40dB
	black field	−41dB
(See tech intro.)	red field	—dB
Frequency response	70%	1.7MHz
	2.8MHz	25%
	3.0MHz	15%
	3.2MHz	10%
Low level sweep noise point		1.6MHz

Audio Performance

Noise: unweighted		−34dB
weighted		−40dBA
Distortion at +4dB over reference		2.5%
Wow and Flutter		0.15%
Frequency response	±1dB ref 1kHz	200Hz/8.5kHz
	−3dB points	80Hz/10kHz
Audio compression		3dB

Typical retail price £650

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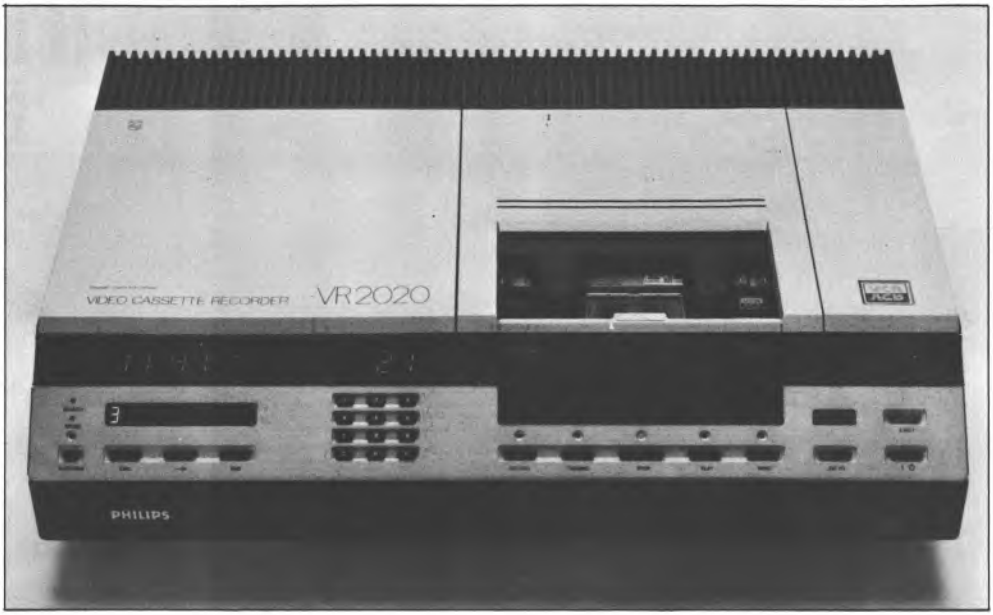
VIDEO CLUB

Philips VR2020

Philips Electrical Ltd., City House, 420/430 London Road, Croydon CR9 2QR. Tel 01-689 2166



This Video 2000 machine is the product of Western rather than Oriental thinking and manufacturing. It is normally offered at about £650, though we have seen it advertised for much less.

Facilities

The first and most noteworthy aspect about this machine is the format used. V2000 cassettes look like larger versions of the audio cassette, and share with this medium the ability to be turned over and used again 'on the other side'. So the longest playing cassette lasts eight hours in total – four on each side.

This does not confer any advantages to the user who wishes to make many hours of recording in his absence (*cf* Sony *Betastack*), since of course the machine is incapable of turning its own cassette over. But the 2000 system does perform the remarkable feat of recording pictures and sound using an effective tape width of only ¼ inch – the same width as standard audio reel-to-reel tape.

Despite the space-age keyboard-operated panel layout, the facilities provided are actually fairly limited. There is remote control of the solenoid operated mechnical transport, but there are no speed search or still-frame facilities. However the user has the option of winding with the tape wrapped or unwrapped from the drum: by going direct to wind from play, when the button is released the machine instantly reverts to play, enabling quite convenient rapid searching of a tape. This is further enhanced by a 'go to' facility which allows one to 'dial in' a tape counter setting remotely. Philips seem to have gone overboard on tuner channel selection, providing no fewer than 26 different preset receiving frequencies, making one wonder who in Europe is capable of receiving 26 different programmes! The timer provides five options over sixteen days, a fair and versatile selection. The instruction booklet is reasonably clear and helpful.

User Reactions – Facilities

Tuning is accomplished by an automatic search system, not least because it would be difficult to find room for 26 preset controls. This was not liked by our users, who had by now become efficient and accomplished at tuning the 'old-fashioned' way, and were less than keen on the inflexibility of compulsory 'search tuning'.

The mechanical transport was reasonably quiet and effective, although the interlinking logic between 'stop', 'play' and 'wind' was thought by some to be 'a bit too clever'. Again the timer attracted the word 'clever' rather than awe-

inspired wonder, with its sequential programming modes and involved logic. Doubtless one would get used to it, but one wondered why one should have to. Nevertheless one user noted that this was the only sophisticated machine whose facilities were sufficiently logical to be tackled without the manual.

Style and design

Your reviewer quite likes this one, mainly perhaps because Japanese boxes all look like Japanese boxes at the end of the day, while this box is clearly not among them. Still, the fiddly-button syndrome seems to have caught on in the EEC as well, with the programming keyboard being smaller than one would normally expect from a pocket calculator, and the rest of the controls very slim and discreet.

Some users thought that the timer could be 'fun to play with' but that it required 'too much thought to tackle in a hurry or if distracted,' whereas another found it refreshingly straightforward, considering its sophistication. The timer display was a 'large inscrutable blank area' until used, and someone thought that maybe it ought to be doing something useful during standby or playback. The four-digit tape counter with the 'go to' facility was well received, and considered unusually legible and useful. 'The displays themselves ought to have been labelled for what they do', said one user, and another complained that the whole machine was much harder to understand than it needed to be (again some inconsistency in reaction here.) A further source of irritation was that the standby mode, to which the machine reverts automatically shortly after it is stopped, disables the aerial to receiver connection, so the remote channel change will not provide extra benefit for the user of a manual TV.

User Reactions – Technical Quality

The picture quality was on balance well received, though with quite a spread of reactions from the team. Never worse than 3½ (between 'just about acceptable' and 'reasonably happy'), and often scoring higher, it was clear that whatever else the V2000 format may have going for it, the picture quality is no worse than the competition, and in many cases better.

Some comment was made about 'lack of detail' and slight 'colour flashing at the top of the picture' (the latter remark was from users without a VCR-modified receiver, and was not noted by anyone else.) Generally it was felt that although the degradation imposed on the picture by the recording process was clearly perceptible, it remained 'innocuous'.

Sound also attracted little adverse comment. 'Some lack of HF' came to light, and our hi-fi enthusiast marked the machine down as 'not really adequate' on this count, but other users recorded themselves as being 'very happy' with the performance.

Technical Measurements

Philips have a mind of their own when it comes to interfacing their equipment with the rest of the world. There is an extremely unusual (non-standard?) DIN socket at the back of the machine for connecting sundry items. No BNCs, no PL259s, nothing that any other machine will speak to. Not knowing what to do with this strange socket, and not possessing the optional extra box which Philips can supply to standardise the direct access points, we carried out our tests with a UHF input signal modulated with the test patterns and signals.

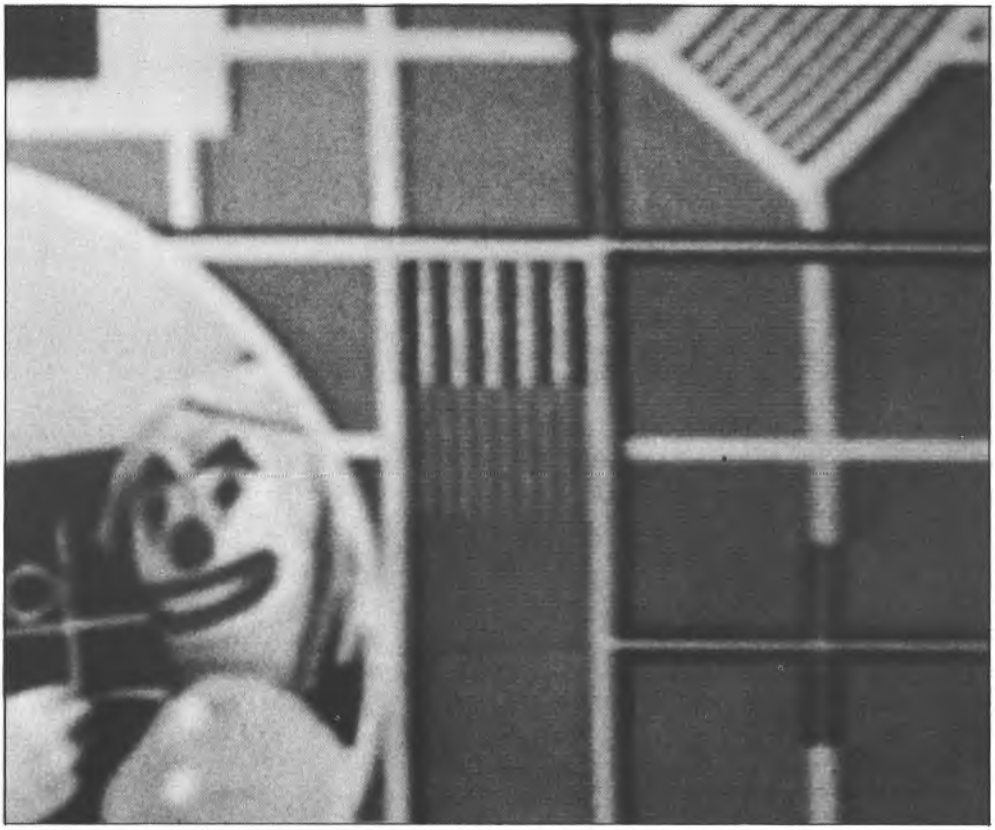
Signal-to-noise ratio emerged at around −37 dB, which is somewhat below average. The 70% resolution point was not high at 1.5 MHz, while the video response cut off very sharply around 3 MHz. Low level sweep signals disappeared into the noise at around 1.6 MHz. These figures are not startling, but combined with the subjective responses suggest that the video response has at least been engineered for reasonable subjective results, rather than just allowed to happen.

Sound measurements were confused by the automatic gain control, which placed the maximum amounts of compression possible (20 dB) on the incoming signal, and rendered our −27 dB weighted S/N ratio likely to be considerably better in practice. Distortion at peak level was high at 5%, but wow and flutter was commendably low at 0.13%. The frequency response was fair-to-middling, with 100 Hz and 7 kHz being the −3 dB points. Again, subjective results show that more thought than meets the test equipment has probably gone into the sound response.

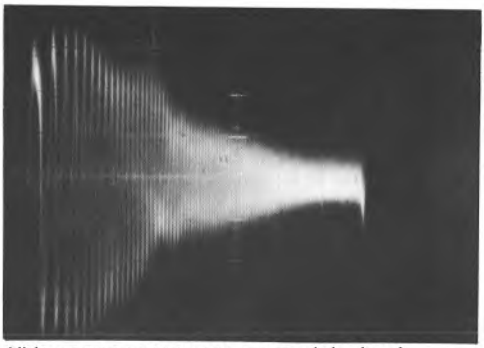
Conclusions

A lot of thought has clearly gone into this machine, but it requires not a little concentration on the part of its owner, and attracted the accusation of being rather too 'clever' for some. Both picture and sound quality are commendable but for its high price the facilities offered are rather more basic than one might expect, despite the futuristic appearance of the machine. However these do offer some alternative to the 'standard JEI package', which intrinsically makes the machine an interesting alternative.

Data overleaf



Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Machine: **PHILIPS V2020**

Video Performance

Noise (cored)	white field	−37dB
	grey field	−36dB
	black field	−37dB
(See tech intro.)	red field	−−dB
Frequency response	70%	1.5MHz
	2.8MHz	35%
	3.0MHz	20%
	3.2MHz	5%
Low level sweep noise point		1.6MHz

Audio Performance

Noise: unweighted		−14dB
weighted		−27dBA
Distortion at +4dB over reference		5%
Wow and Flutter		0.13%
Frequency response	±1dB ref 1kHz	560Hz/5.6kHz
	−3dB points	100Hz/7kHz
Audio compression		20dB

Typical retail price £625

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Sanyo VTC9300

Sanyo Marubeni (UK) Ltd., Sanyo House, 8 Greycaine Road, Watford, Hertforshire. Tel Watford 46363

This is a large, black, rather austere-looking Betamax model right down at the the bottom of the price range at around £395. The tested *P* model has now been replaced by the restyled but otherwise identical *PN* version.

On the back of the machine, input sockets are provided for a camera, and for video and audio input and output, the video on *PL259* connectors, the audio DIN. There is also provision for a test pattern to be switched on to assist tuning a receiver to the recorder.

Facilities

A basic mechanical transport is provided, with a 'still frame' picture held during pause operation. There is an eight-position tuner operated on the front panel, with tuning controls hidden behind a flap. The timer is extremely crude, offering only a variable start time with the choice of 30 minutes, 60 minutes or until-the-tape-runs-out recording duration, and only three days advance recording is possible.

One facility is provided which everyone agreed could have been done without. This is a 'Video/TV' switch, which performs the apparently quite superfluous function of switching the RF output (from the machine to the TV set) from the aerial signal to that generated by the machine. This means that this switch has to be operated when going from watching 'live' programmes to watching tape, in addition to changing the channel selector on the receiver. It is difficult to imagine why this should be necessary or desirable, but there it is.

User Reactions – Facilities

Unusually, the clock doubles as an electronic position counter for the tape, and this feature was liked by many users, although some tape slippage or stretch was noted when using the counter to locate accurately certain spots on the tape. The mechanical transport was regarded as faster to respond than some (such as the Ferguson *3V22*), but it was also thought to have a rather flimsy, 'cheap' feel to it. The freeze-frame picture available during 'pause' was regarded as almost useless on account of the high level of noise and picture disturbance present.

Despite its simplicity, no-one was enthusiastic about the timer. It was felt to be unduly inflexible, the controls were too small, and the instruction manual was not well received as an *aide-de-combat*.

The absence of 'speed search' facilities was noted by our user panel, who perhaps had by this time come to appreciate its usefullness on other machines.

Style and design
One user felt extremely hostile towards the design of the machine, rating it at 2 out of 10 and commenting that it 'would make a good toolbox'. Others picked up on more specific good and bad points. The fact that the sockets on the back were inclined half-way between horizontal and vertical was noted with appreciation, because it made the sockets and the line-up switch more readily accessible from the front of the machine. Otherwise, the control labelling was regarded as too small, the counter-timer controls too fiddly, and the record button (a one-button operation starts recording)was felt to be too easy to hit by accident.

The Video/TV switch was universally condemned as a redudant irritant, as might be expected and is a particular nuisance for those with remote controlled receivers.

User Reactions – Technical Performance
A very poor rating was accorded the picture quality in our subjective tests, averaging below 2 (not really adequate). Asked to elaborate on their reactions, users said that the picture was 'fuzzy' with 'poor definition', 'crude colour', plus speckling and flaring, especially on highly coloured scenes.

One user noted that he experienced 'some difficulty' in getting satisfactory tuning for colour without an accompanying sound buzz, although the tuner in the machine was commended for its performance on weak signals. The sound was better liked, hitting an average score of 4 (reasonably happy), remarks being confined to 'slightly wooly' and 'slightly distorted'.

Technical Measurements
Video signal-to-noise ratios were good at typically 37dB uncored, 43dB with noise reduction. But the 70% resolution point at 1.25MHz was very low, although the response was maintained at 25% with a 3MHz input. Detail loss on the 5% sweep was put at 15%, and the noise point at 2.5 MHz. These figures are poor but by no means untypical for a VCR machine. Subjectively the picture quality was thought to be worse than was actually indicated by the measurements, particularly in respect of colour noise and flaring.

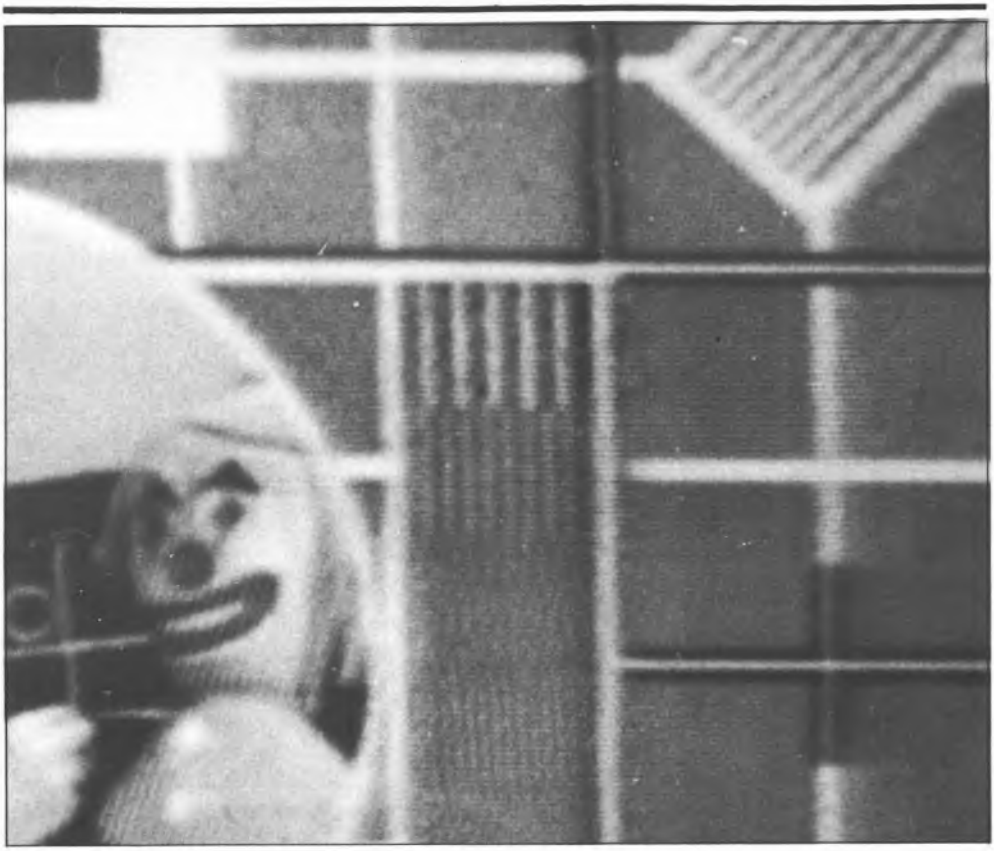
On the audio front a weighted S/N ratio of 41dB was recorded, with a tolerable 2.5% distortion on peak modulation. Wow and flutter was acceptable for most occasions at 0.25%, but the frequency response was restricted to 6.5kHz at the upper −3dB limit, although the lower −3dB point was well extended at 50Hz. Audio compression of broadcast signals was excessive at 12dB.

The most positive result emerging from the lab tests was the very good response of the machine to weak, noisy aerial input signals, indicating that the tuner inside the machine had considerable merit.

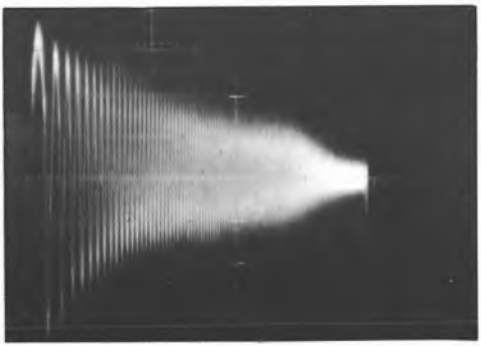
Conclusions
The most favourable aspect of this machine is its price – not much more than you might expect to pay for a large-screen colour receiver. But for this you get an extremely basic machine with an elementary timer and poor picture quality. Still, if you're desperately keen to get into home video and can't spare any more money, the *VTC 9300* does record programmes and play them back. Because of the very competitive price we will not dismiss the machine entirely, but would suggest that prospective buyers make a point of looking at the off-tape picture carefully to see if it is adequate in the eye of the beholder, particularly as we have heard that recent samples (including the *PN* model with revised styling) have shown significant improvements, attributable perhaps to improved head design.

Sanyo 9300PN has attractively revised styling.

Data overleaf



Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Machine:		**SANYO V7C9300**
Video Performance		
Noise (cored)	white field	−44dB
	grey field	−43dB
	black field	−43dB
(See tech intro.)	red field	−32dB
Frequency response	70%	1.25MHz
	2.8MHz	30%
	3.0MHz	25%
	3.2MHz	20%
Low level sweep noise	point	2.5MHz
Audio Performance		
Noise: unweighted		−38dB
weighted		−41dBA
Distortion at +4dB over reference		2.5%
Wow and Flutter		0.25%
Frequency response	±1dB ref 1kHz	100Hz/6kHz
	−3dB points	50Hz/6.5kHz
Audio compression		12dB
Typical retail price		£395

Sharp VC7300

Sharp Electronics (UK) Ltd., Sharp House, Thorp Road, Manchester M10 9BE. Tel 061-205 2333

This basic VHS front-loader has a silvery-toned case, and should be available for about £500.

Facilities

This machine is blessed with a quite detailed instruction book, which is at pains to show exactly which buttons must be pressed and what is subsequently supposed to take place. For those whose enthusiasm for video is more towards the software than the hardware, this is quite a boon.

The front panel bears twelve channel selector buttons and the customary transport controls, which are solenoid operated. The pause button does not display a still frame when operated. A rather bright digital clock and illuminated channel selector display complete the electronic displays on the front of the machine, but there is also a four-digit mechanical tape position counter with a memory button.

There are three flaps hiding the more occasional controls: the tracking, record select and microphone input jack are to be found behind a black flap at the bottom of the front panel; the timer buttons are hidden behind a silver flap under the clock display; and on top of the machine the twelve tuning knobs are similarly secreted.

User Reactions – Facilities

The timer was simple, permitting only one programme to be recorded in the user's absence, either on the same day or at the same time every day. Within this limitation, it was generally well received: one user thought that the 'fast' mode of operation (where the numbers hurtle round at a fair rate of knots as the button is held down) was too fast, but the ability to go backwards as well as forwards when setting the timer was generally appreciated.

The mechanical transport was less well-liked. The buttons were said to be too small and badly marked, and the spooling was regarded as lethargic and mechanically noisy. It was felt that the RECORD button was too easy to hit accidentally, and the action of the EJECT function was described by one user as 'tedious'. The amount of clunking, whirring and whining emanating from the machine during its mechanical peregrinations was described as excessive.

Style and design

A general lack of prominence of the controls and displays, with the exception of the clock, was bemoaned by all users. Perhaps the general Japanese trend towards making everything

small, fiddly and unobtrusive has gone too far for Western fingers and eye appeal, or maybe these buttons just seemed out of scale on a machine as large as a VCR. The front loading was thought to be advantageous given that many people would want to stack the machine directly above or below their TV receiver. The option for replacing the one-to-twelve channel indicators with slip-in legends saying BBC 1, BBC 2 etc. was liked.

However, the tape counter was described as 'virtually invisible', the channel indicator 'not prominent enough', and users felt that the machine was rather primitive.

User Reactions – Technical Performance

Picture quality gained a mean score of 3 (just about acceptable) on our subjective rating scale. Flaring on night scenes was particularly noticeable, with 'fuzz', noise, lack of detail and blue 'snow' all making themselves apparent to our panel. This was not one of the better machines in this respect.

Sound fared a little better under our scrutiny. Although one user complained that it was hard to tune his television receiver to obtain both an acceptable picture and sound without distortion, the mean satisfaction rating was 4 (reasonably happy). There were no outstanding defects noted, just a general feeling that the sound was noticeably less good than the original. The weak-signal performance of the machine was considered fair.

Technical Measurements

Signal-to-noise measurements barely reached 40dB on video, which appears to be the minimum standard generally aimed at, although the specification supplied with the machine makes no promises at all in this direction.

Technically the measurements would tend to suggest a better performance than was actually observed in practice, but then the complaints we received were to do with streaking and certain types of colour noise which are not highlighted by our technical measurements. The upper frequency limit of the video record/playback path was maintained at a creditable 70% at 2.8MHz.

Sound checked out as being quite wideband but rather noisy, the −3dB points being quite far apart at 60Hz and just over 10kHz. The penalty paid for this response comes in the form of a noise ratio which even after 'A' weighting reached only −35dB. There was no audio compression on broadcast sound (praise be). Wow and flutter at 0.3% was not excessive, and the distortion of the audio signal was a fairly typical 3% at +4dB.

Conclusions

This is a basic machine with a basic performance. The picture is not exceptional, and the sound is adequate, with most users being inclined to regard the former as 'just about acceptable' and the latter as making them 'reasonably happy'. On the plus side, it was considered neat-looking, if a bit fiddly button-wise, and the convenience of front-loading may be considered an asset, even if its action is a shade pedestrian. On the other hand, users who are content with the technical performance may find themselves frustrated by the simple timer or the lack of other facilities before long.

Machine:		**SHARP VC7300H**
Video Performance		
Noise (cored)	white field	−37dB
	grey field	−40dB
	black field	−39dB
(See tech intro.)	red field	−35dB
Frequency response	70%	2.8MHz
	2.8MHz	75%
	3.0MHz	60%
	3.2MHz	25%
Low level sweep noise point		2MHz
Audio Performance		
Noise: unweighted		−22dB
weighted		−35dBA
Distortion at +4dB over reference		3%
Wow and Flutter		0.3%
Frequency response	±1dB ref 1kHz	80Hz/10kHz
	−3dB points	60Hz/10.5kHz
Audio compression		0dB
Typical retail price		£495

Sharp VC 7700H

Sharp Electronics (UK) Ltd., Sharp House, Thorp Road, Manchester M10 9BE. Tel 061-205 2333

This is a VHS front-loader with a silver-grey case available for around £650. It has advanced features and comprehensive remote control.

Facilities

Externally, this machine closely resembles the less sophisticated *VC-7300H*, the extra facility controls being hidden behind a profusion of plastic flaps. It possesses a twelve-position tuner with conventional presets concealed under a flap on the top of the cabinet. The selector buttons themselves are presented on the front panel, with illuminated legends numbered 1–12 which may be replaced by station identifications if desired.

Cassettes are loaded pillar-box style into a flap on the front panel, being steered in and out by a motor mechanism. A row of LED's to the left of the entry slot provide a crude but necessary indication of how much tape is left to run, since the cassette is totally out of sight during operation. This indicator does, however, need to be switched between E180/120 and E60/30 tape, by a button concealed in a not-very-obvious place behind a silver flap on the front panel.

A bright green clock/timer display dominates the front panel, with its associated programming buttons hidden behind (another) flap just beneath it. The timer offers a fairly versatile choice of seven options over seven days.

Tape transport is logic-linked and solenoid operated by light-action keys. Seemingly something of an afterthought, a paperback book-sized infra-red receiver can be connected by means of an overgrown DIN plug to a socket behind the fourth and final flap near the bottom of the front panel. The remote control itself offers the basic mechanical motions, plus 'trick' modes, but no record or channel change.

User Reactions – Facilities

The timer was fairly well received, although one must of course remember to press the 'timer' button after mastering the microprocessor. It was felt to be rather more complicated than strictly necessary, and the fiddly button syndrome, much-noted in these reviews, again attracted displeasure.

The mechanical transport was considered to be noisy and a shade sluggish. The logic linking the buttons worked sensibly, permitting any order of commands, and rejecting any absurdities.

The remote control pad was more basic than most, but at least it was readily comprehensible, and worked satisfactorily over normal domestic ranges. No channel-change or record facility was observed by one to be an unfortunate omission.

By now the lace-up time of the VHS system was beginning to be noticed as a drawback in the 'cold start' situation, but the still frame gained some plaudits for performance, the precise words being 'very good for VHS'. Again, the twice/half speed picture quality was approved of, but why the machine could not also have incorporated the speed search facility as well remains a source of mystery.

The absence of a line-up test display was lamented by some, and the presence of a 'Video/TV' switch, necessitating physically going to the set to effect a two-button changeover from tape to live broadcast, was regarded as a real nuisance, particularly by those using remote-controlled receivers.

Style and design

The front-loading was regarded as neat and useful for stacking, but the machine gained only six out of ten on a general appraisal, with a rather 'square box' look not helped by the drab grey colour.

The number and nature of the button-concealing flaps attracted much adverse comment. Seemingly about as flimsy and crude as plastic mouldings can be, they were condemned for being difficult to open (slide finger under flap too small for finger), although obviously they helped to conceal the more frightening controls from the nervous.

The controls were thought to be too small, too easy to hit by mistake, and difficult to see on the perpendicular front panel unless viewed at the appropriate angle. Considering the high price of the machine, our main comment was that the hardware felt unreasonably flimsy and fiddly. The remote control pad was liked better than its receiver, which was considered too large and unsightly. On the other hand, the essential straightforwardness of the basic *7300* machine has not been lost with this new model.

The automatic programme locator device was little-used on account of its unfamiliarity, and was considered of rather doubtful utility.

User Reactions – Technical Performance

Subjectively, both picture and sound quality attracted little adverse comment. The usual lack of detail was observed on picture playback, but the sound was well up to the usual VCR standard. The machine was capable of playing back other VHS cassettes recorded on different machines very competently.

Weak signal performance was not good, but this should only be a problem in a few areas, and can probably be alleviated by attention to the aerial system. A rating of 'reasonably happy' for picture and 'very happy' for sound was the mean.

Technical Measurements

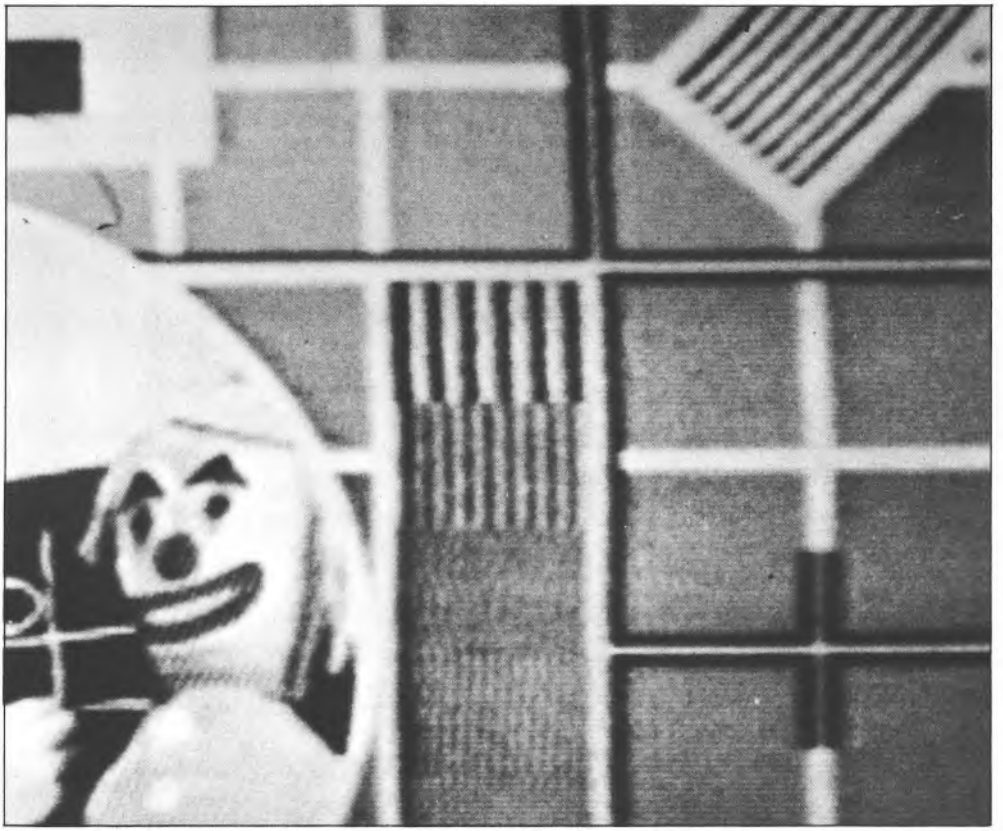
Signal-to-noise ratio on video exceeded the 40dB norm by 2 or 3dB, a creditable result, but this was achieved somewhat at the expense of bandwidth, with the 70% point being 1.6MHz. Low level sweeps showed a noise entry point of 2.2MHz, which is fair.

On the sound side, despite a negligible 1dB of compression, the weighted S/N ratio reached only −32dB, due to some leakage of frame buzz onto tape, but subjectively this passed almost unnoticed. Peak distortion was a tolerable 3%, but wow and flutter was high at 0.5%. Frequency response was reasonably wide, with 90Hz and 9kHz being the −3dB points.

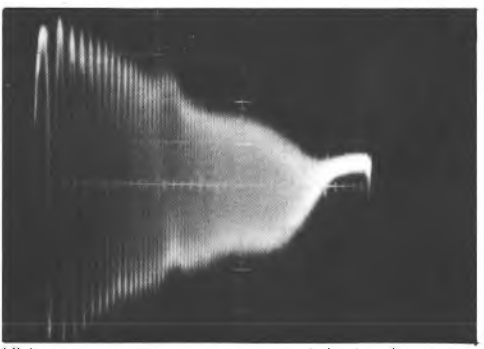
Conclusions

This machine seems rather overpriced for the facilities offered, and gives the impression of being more a case of a cheap machine with add-on refinements than a sophisticated model in its own right. The performance is quite reasonable, however, and if shopping around brings the price below £550 or thereabouts, it is worth considering.

Data overleaf



Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Machine:		**SHARP VC-7700H**
Video Performance		
Noise (cored)	white field	−42dB
	grey field	−43dB
	black field	−44dB
(See tech intro.)	red field	—dB
Frequency response	70%	1.6MHz
	2.8MHz	30%
	3.0MHz	15%
	3.2MHz	5%
Low level sweep noise point		2.2MHz
Audio Performance		
Noise: unweighted		−23dB
weighted		−32dBA
Distortion at +4dB over reference		3%
Wow and Flutter		0.5%
Frequency response	±1dB ref 1kHz	200Hz/8.5kHz
	−3dB points	90Hz/9kHz
Audio compression		1dB
Typical retail price		£650

Sony C7

Sony (UK) Ltd., 134 Regent Street, London W1. Tel 01-439 3874

This is a large, solid machine, operating on the Beta format and finished, in battleship grey.

Facilities

The timer was felt to be difficult to operate, but the handy reminder sheet provided by Sony was of considerable help. Four programmes could be selected from seven channels over a period of a fortnight, which represents a fair level of versatility. The machine offers still-frame with continuous speed adjustment up to slow motion, and a frame-by-frame advance of the picture in the still mode. Speed search (in forward or reverse) is available, though with no accompanying sound.

Tuning is effected by an automatic scanner circuit, which hunts for broadcast transmissions and tunes them in automatically. A remote control unit is provided from which all the transport functions except for the variable slow motion can be operated, and channel change may also be effected.

User reactions – facilities

The setting buttons on the timer were felt to be rather small and fiddly, and there were one or two operating pitfalls to be avoided. It was also necessary to remember to put the machine into 'timer' mode, but any obstacles are likely to be overcome by familiarity.

The picture produced in the pause and slow-motion modes was considered to be of poor quality and thus doubtful merit; picture vibration, instability and noise gave rise to universal complaint, particularly when set beside the excellent performance of the Grundig 2000 format machine. Nevertheless this sort of facility will only normally be used occasionally, so not too much weight need be attached to this shortcoming.

Similar comments arose regarding the state of the picture in the speed search modes. This was regarded as 'not very watchable at all' by one user, which indicates perhaps that this facility is being used not merely to find a particular section of tape, but in order to gain a *resumé* of a particular programme in this fast-living age. The response of the remote control in this mode was well liked.

The general appearance of the transport mechanism was well received. Though the auto-search facility functioned well, it was ocassionally thought to be a nuisance, and one user

expressed the desire that this should be optional. The auto rewind taking place at the end of the tape was regarded as a pleasant time and patience saver, and the cassette loading and unloading mechanism was regarded as neat, positive and confident.

The remote control unit was received very favourably, and was noted to have a good working range and a positive action without the need for accurate aiming.

User Reactions – Style

The square, grey, heavy look of the machine was generally favourably received, being described as unobtrusive, and the concealment of the minor controls for the timer and tuner was also thought to improve the machine's domesticity.

No-one was particularly enthusiastic about the buttons on the machine; the timer buttons were felt to be particularly small and fiddly, and one user expressed doubt about the lifetime of the little channel select buttons on the front of the machine, on the grounds that one had already become sticky in operation. The automatic tuner search, although it made tuning relatively easy, was also felt to be a nuisance, inasmuch as it was tiresome to have to go right round the whole TV band if one missed the programme desired.

The main transport controls, although they inspired confidence in operation, were felt to be too easy to lean on accidentally. The style of the remote unit was generally liked, and it was felt to have struck the right balance between facilities and simplicity.

User reactions – performance

The picture quality on normal playback gained consistently above-average ratings. Many users commented that this was probably the best machine in this respect in the survey as a whole. Defects noted were confined to a little artificial and some shimmering of the edges, particularly on landscape scenes. Overall the machine gained either a 'reasonably happy' or a 'very happy' grading on the satisfaction scale.

The sound quality reactions were somewhat inconsistent. One user, noted for his highly-trained ears in the esoteric realms of hi-fi, came down fairly heavily on the sound quality, describing it as 'muffled and generally unconvincing', and criticising a poor signal-to-noise ratio on music. A clue to the origin of this latter comment may be gleaned from the views of another user, who noticed that the AGC circuit on the audio record circuitry was bringing the noise of quiet soundtracks up to an unacceptable level. Otherwise, though, the sound quality did not attract particularly adverse comment.

Technical Measurements

The good picture quality correlates well with the low noise measurements achieved on both colour and monochrome fields. The high-frequency response of the video section was better than average, scoring 30% at 2.8MHz, while the loss of low-level detail at 1MHz was put at 30%, and the low level sweep vanished into noise at 1.6MHz. It seems that the balance in this machine has been tilted in favour of a noise-free picture rather than a detailed one, in a manner of which users generally approved.

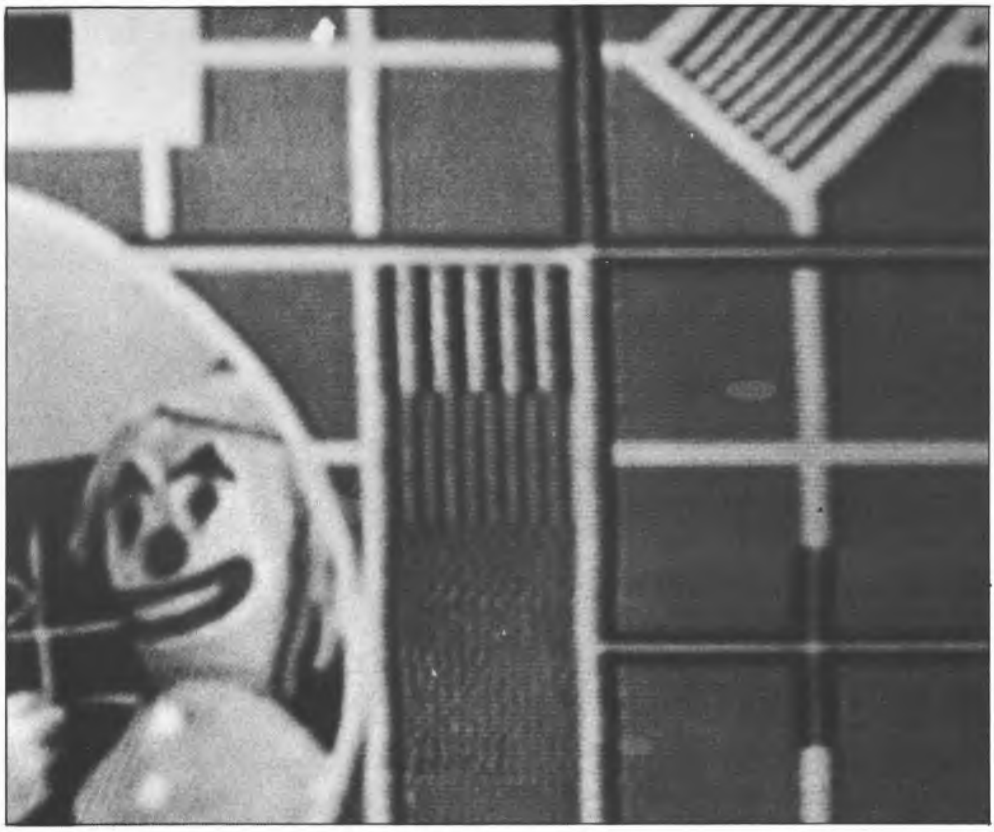
On the sound side there was no apparent justification for the 'muffled' claim of one user, the useful high-frequency response extending just beyond 8kHz. But our measurement clearly revealed the undesirable action of the audio AGC circuit, putting a near-maximum value of 18dB compression onto our test piece.

Internally the mechanics and electronics are cluttered by comparison with any European machine. On one count, twenty-eight different circuit boards, randomly dispersed about the mechanical skeleton, will be a serviceman's nightmare. Therefore, against the good marks for features and performance must be set low marks for serviceability in the longer term.

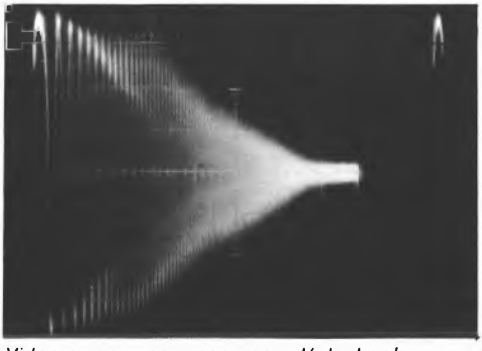
Summary

A well-liked machine with no major defects, the Sony would benefit from the redesign of the audio automatic gain control and perhaps slightly less fiddly press buttons. Nevertheless it was rated extremely highly on picture quality; at a selling price of £650 it is expensive, but is likely to be a satisfying investment. *Data overleaf*

Sony C5: £500 for the 7 without frills?



Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Machine:		**SONY C7UB**
Video Performance		
Noise (cored)	white field	−37dB
	grey field	−45dB
	black field	−46dB
(See tech intro.)	red field	−42dB
Frequency response	70%	1.8MHz
	2.8MHz	30%
	3.0MHz	15%
	3.2MHz	10%
Low level sweep noise point		1.6MHz
Audio Performance		
Noise: unweighted		−34dB
weighted		−41dBA
Distortion at +4dB over reference		2.5%
Wow and Flutter		0.15%
Frequency response	±1dB ref 1kHz	200Hz/8.3kHz
	−3dB points	70Hz/8.5kHz
Audio compression		18dB
Typical retail price		£650

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Sony SL 3000

Sony (UK) Ltd., 134 Regent Street, London W1. Tel 01-439 3874

This is the only portable VCR currently available using the Betamax format. It is the largest and heaviest of the machines we tested, and at around £630 the most expensive as well.

Facilities

Very simple in external appearance, the *SL3000* has only the basic transport functions: play, wind, rewind, record, audio dub and eject are operated by lever-type mechanisms, with a long 'stop' bar and a small 'pause' button above these. A bright green light indicates when the machine is on pause: after several minutes of idling thus, the machine will automatically start running again. Also on the front panel is a simple meter which indicates the state of the battery, and a mechanical tape counter.

Sockets at the side of the machine are for RF output, video output (BNC) and audio output (phono), and on the front panel there are 3.5mm jack sockets for microphone and earphone, and a multipin connector for the camera cable. There are no conventional inputs for video or audio, which makes the use of a camera without a Sony plug difficult, and means that only a microphone can be used for subsequent audio dubbing.

The unit is powered by a 12V rechargeable battery that fits into a compartment in the top, and may be charged *in situ via* the DC inlet on the side panel. A red light on the front panel (misleadingly labelled 'stand by') warns when the battery voltage drops too low.

Style and design

Breaking away from the Japanese affinity for the flashy and fiddly, this machine in its stern battleship grey looks slightly dated, but it is undoubtedly robust and practical. A tough brown plastics-coated carrying case is available for additional protection outdoors.

The undersides of the transport levers were colour coded, and it was agreed that it would have been useful if the upper sides could have had this simple distinguishing arrangement too. It required some force to engage the levers, which was not liked by some people, although

others felt it a useful precaution against accidental operation, which can happen when using some of the machines with light-touch buttons.

The machine weighs over 9kg – considerably more than the other portables, and this is indeed a major drawback. With the shoulder strap it is possible to carry it around, but it is very tiring to be recording with it around your neck. It's best described as mobile rather than portable; it can be carried to a location, but ideally needs to be put down before it can be used. The 2½ metres of cable that comes with the camera (*HVC 2000P* and *HVC 3000P qv*) suggests Sony have this in mind too.

User reactions – facilities

This machine is a portable recorder, and makes no claims to be otherwise, so the lack of facilities like trick-speeds, remote control and so on was not thought to diminish its usefulness, although a fast-search would have made editing easier.

The mechanical transport mechanism was thought to be a little noisy, and if the camera was too close to the recorder the edits could be punctuated by the clunk of a solenoid. Another drawback noted was that there was no output from the unit when it was not running. This meant that it was not possible to tune a TV set into the VCR's output unless a tape was playing; more importantly, no power was supplied to the camera, so that camera shots could only be set up if the machine was set to record and put into pause. It is not advisable to have the recorder on pause for long periods of time, as wear of the tape and heads results (as well as running down the battery).

User reactions – performance

Despite the bruised shoulders, all our users were very pleased with the performance of the recorder. Accurate assessment is made difficult with the output from the home colour cameras, because these are so inferior to professional standards. But using a special adaption in the lab to record off-air pictures, it was certainly obvious that the quality at least matched the best mains machine.

Better-than-average performance from a portable VCR is an essential feature in an editing set-up, where the original material must be of the highest quality to withstand the degradations of copying.

Technical performance

Although the sweep photograph indicates the presence of spurious effects at higher frequencies, the response is excellent, with the 70% point at 2.5MHz. Noise is better than the norm by about 3dB, and these results confirm the subjective quality of the pictures.

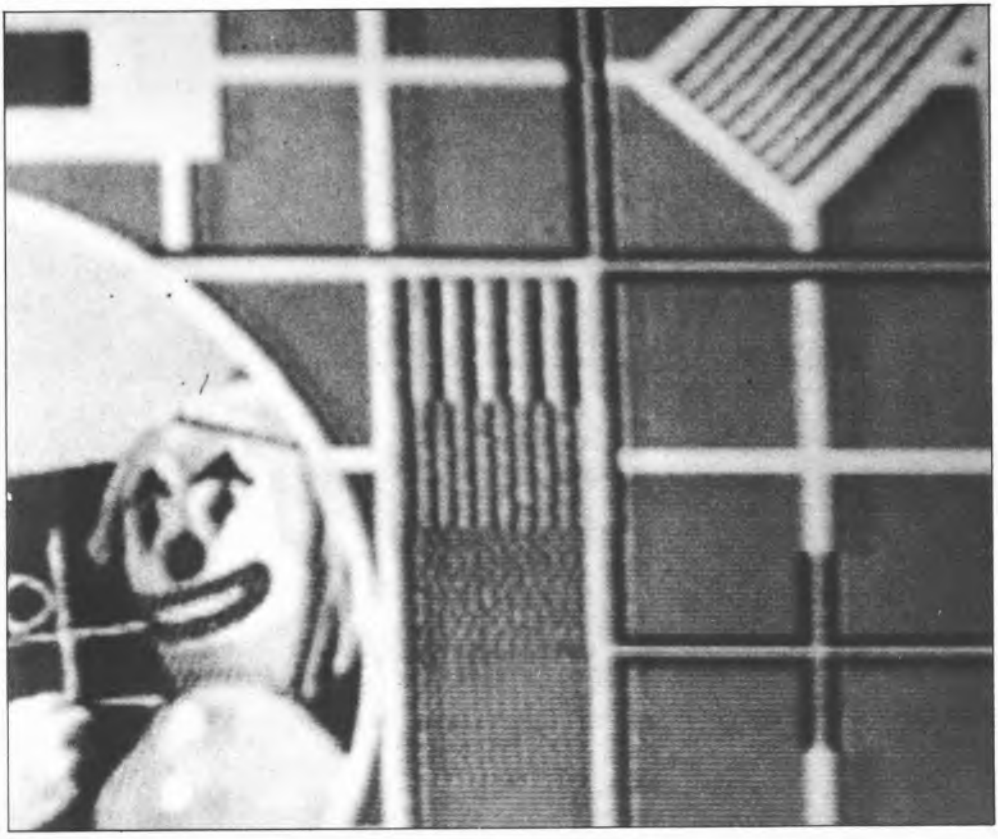
The sound side is more average: the unweighted S/N ratio is only −31dB, but the wow and flutter figure of 0.15% is low, and indicates robust mechanical transport and control. The audio frequency response is fairly restricted, with −3dB points at 200Hz and 6kHz, but this is unlikely to sound too incomplete on the average TV loudspeaker.

The machine performed well in paused edits. When put into pause while recording, it automatically back-spaces the tape through a few frames, to give a clean join and avoid interference effects. Even when left on pause for the maximum possible time (the pause is released after 6 minutes), there was no sign of a rolling noise ripple (which would be an indication that the tape had been damaged by the prolonged head contact). However most edits were marked by a brief flicker of noise, which was most noticeable when the recorder was stopped and started on the same stationary scene.

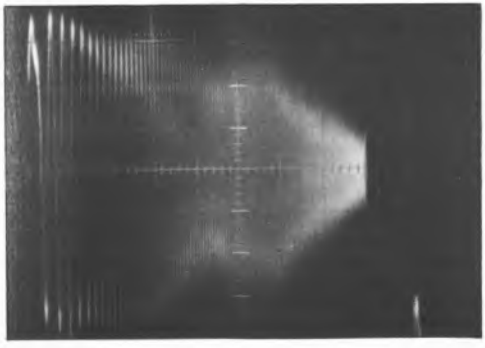
Conclusions

This is a machine with clear pros and cons: against it is its weight, but in its favour is the technical performance, which equals Sony's *C7* mains machine. Although expensive at around £630, it is worthy of the price. However one should note that the matching tuner/timer *TT3000* is also rather more expensive than others at £235, so the total package may cost about 20% more than the competition.

Data overleaf



Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Portable VCR: **Sony SL-3000E**

Video Performance

Noise (cored)	white field	−43dB
	grey field	−43dB
	black field	−42dB
(See tech intro.)	red field	—
Frequency response	70%	2.6MHz
	2.8MHz	60%
	3.0MHz	50%
	3.2MHz	45%
Low level sweep noise point		2.5MHz

Audio Performance

Noise: unweighted		−31dB
weighted		−37dBA
Distortion at +4dB over reference		3%
Wow and Flutter		0.15%
Frequency response	±1dB ref 1kHz	300Hz/5.6kHz
	−3dB points	200Hz/6kHz
Audio compression		18dB (ref −20dB) (limiting at −30dB)
Weight		9kg
Dimensions: (W x H x D)		13cm x 30cm x 34cm
Typical retail price (excluding tuner/timer units)		£625

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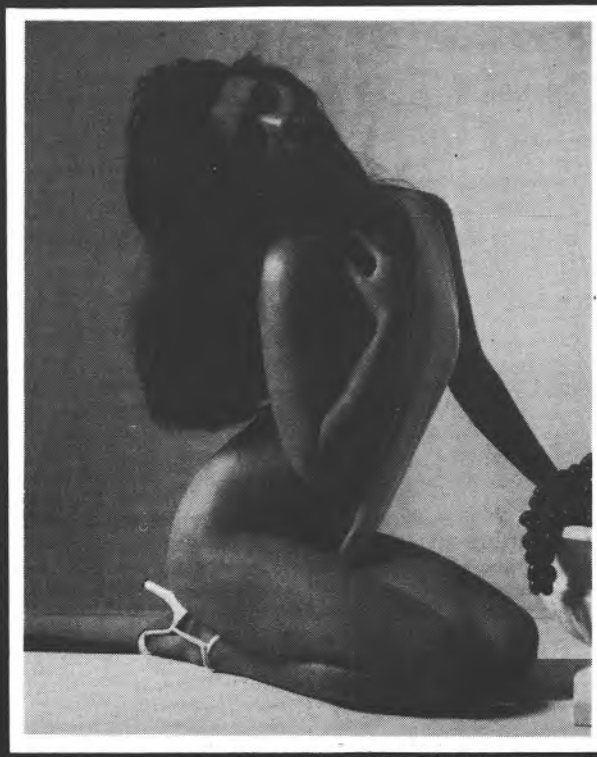

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Toshiba V5470B

Toshiba (UK) Ltd., Toshiba House, Frimley Road, Camberley, Surrey GU16 5JJ. Tel (0276) 62222

As Beta machines go, this is a small machine, dwarfed by the Sony *C7*. It costs around £550 and has a woodgrain cabinet finish.

Facilities

The *V5470B* offers three timer options over seven days, has a ten-channel tuner, and facilities for freeze-frame, slow motion and picture search activities. It has mechanical transport controls, but they have a light and pleasant action. Unusually the clock/timer display is an LCD type (like most digital watches), and the cabinet itself is again untypical with its wipe-clean woodgrain finish. A cord-linked remote pause is also supplied.

User Reactions – Facilities

The timer was described by one user as 'daunting', another confessed that he (or maybe it) 'made a lot of mistakes'. The laminated card supplied with the machine provided clear step-by-step instructions, and was deemed indispensable. The pause control produced a still-frame which proved to be much more satisfactory to our panel than the Sony C7 attempt in this respect. (The comparison is drawn because both these machines are Beta format).

The mechanical transport was generally liked: no-one seemed even to notice the fact that the buttons worked mechanically rather than on fiddly little buttons, and certainly no-one seemed to mind, the mechanical transport gaining consistently between 8 and 10 out of ten for 'ease of use' and 'performance'.

It is worth mentioning that this was one of the first machines to be circulated to our viewing panel, and coming as it did usually after a very basic machine or no machine at all, it was greeted with perhaps slightly more rapture and/or puzzlement than it strictly deserved in this particular context. Nevertheless, the speed search and slow motion pictures were well received, although the slow motion quality (which was neither exceptionally good or bad as these things go) did attract some adverse comments. The auto-stop facility, braking the transport and the beginning or end of recording segments in fast forward or rewind mode, was

generally appreciated.

Other positive points noted were that the timer held its settings for about three minutes if the supply were accidentally disconnected (attributable to the low-consumption LCD display), and that in one instance the slight boost applied to the RF aerial signals passing through the machine appeared to improve the picture quality on normal off-air television reception. The instruction book was considered to be well thought-out.

Style and design

Simulated teak was democratically (rather than unanimously) approved of. An average style rating of 6 out of 10 was achieved, users claiming that the layout of the machine was 'cluttered' and 'bitty'. Although it was 'not easy to find function switches without careful looking' the big, no-nonsense transport levers were favoured. The LCD display was regarded as inferior to the LED or fluorescent alternatives from the point of view of reading at a distance, although it might reasonably be thought that the digital clock display is fairly incidental to the point and purpose of the machine.

User Reactions – Technical Quality

Again we suspect that a general lack of detailed response from our viewers arose from inexperience rather than complacency – nevertheless, in retrospect the pictures still seem good, being smooth and relatively free of noise. Viewers noted some fuzziness and a little 'juddering' on the picture, but all but one of the sets in use did not have a 'VCR' timebase setting to assist the receiver in coping with the slightly irregular signal from a VCR. Sound was criticised less for general quality than for the 'wow' produced when the tape was started or stopped; the mechanical problem of getting the tape running up to its normal linear speed from a standstill shows up more on the soundtrack than on the picture. Some excessive brightness and sibilant emphasis was mentioned as rather irritating by one user.

Technical Measurements

Video noise was generally low reaching –43dB on grey and black fields and tallying well with the subjective assessments. The high-frequency video response was down to 70% at 1.8MHz, lower than some machines, and the 5% video sweep dropped into the noise at 1.2MHz. With the absence of any unusual video defects, this sums up a performance weighted slightly in favour of low noise rather than fine detail, but is none the worse for that.

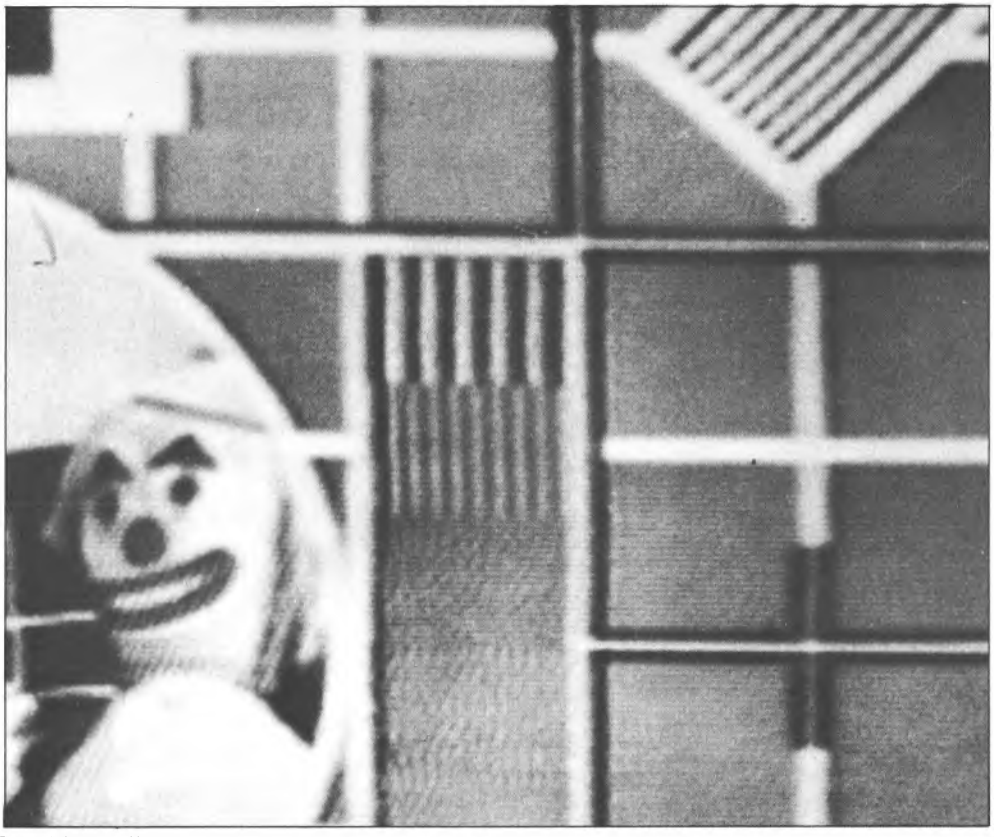
The sound noise measurements were less impressive: –33dB unweighted or –38dB weighted according to the 'A' curve. There was a slow and presumably deliberate bass roll-off on the record/replay through response, being –1dB at 800Hz, and –3dB at 220Hz. At the HF end the –3dB point was measured at 6.8kHz. This is utilitarian rather than hi-fi quality, although the absence of audio compression was welcome and on not-so-delicate loudspeaker systems, as fitted to domestic television sets, this level of performance may not be particularly distracting.

Conclusions

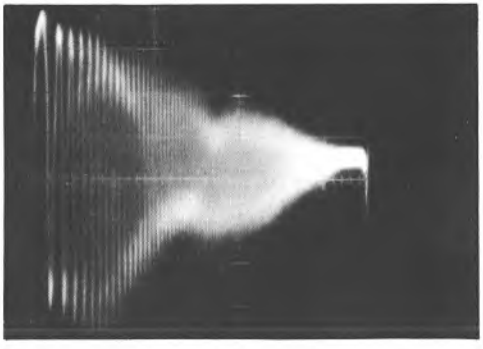
At its price, this machine provides a comprehensive and sensible range of facilities and good picture quality. It is an ideal middle-ground machine between the expensive remote-controlled microprocessor driven models (some of which actually deliver worse pictures than this Toshiba), and the rather bare and basic offering at the bottom end of the market. The sound quality is poorer than average, so it would be worth listening to it first to see how acceptable it is.

Although the *5470* offers a surprising number of features, for its price, Toshiba have just announced the 'luxury model' *V-8600B*. This costs about £120 more, is even more compact, uses a wired remote control, and doubles up on video heads (to 4) to give improved still frame and slow motion.

Data overleaf



Detail from off-tape testcard



Video sweep response, record/playback, 0.5MHz/div horiz.

Machine: **TOSHIBA V5470B**

Video Performance

Noise (cored)	white field	−36dB
	grey field	−43dB
	black field	−43dB
(See tech intro.)	red field	−39dB
Frequency response	70%	1.8MHz
	2.8MHz	35%
	3.0MHz	25%
	3.2MHz	15%
Low level sweep noise point		1.2MHz

Audio Performance

Noise: unweighted		−33dB
weighted		−38dBA
Distortion at +4dB over reference		3%
Wow and Flutter		0.2%
Frequency response	±1dB ref 1kHz	800Hz/5kHz
	−3dB points	220Hz/6.8kHz
Audio compression		0dB

Typical retail price: £550

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Hitachi VK C750E

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

Features, presentation etc

This is a small, light camera intended for use with a portable VCR, such as the Hitachi *VT-7000E*. Light enough for hand-held use, the hand grip may be detached when fixing to a tripod. The styling is unremarkable Japanese silver and black.

A small centre-zero meter gives an indication of the correct white balance, which is adjusted with a single knob. This was a simple system that was well liked, but it was felt that there was not quite sufficient control range to deal with all lighting conditions. The iris is manually controlled with an aperture ring, and the zoom ratio was about 2.8:1, the lowest of the cameras tested.

The most unsatisfactory feature of this camera is the viewfinder, which is a simple optical system, rather than an electronic monitor. The split-image method makes focusing easy and accurate, but that is the only thing to recommend this approach. An optical viewfinder can only tell you what scene you are pointed at. It can give no information about what the television picture being produced actually looks like. There is no way of telling whether the picture is under- or over-exposed; if there is lag or 'comet-tailing'; what the contrast is like. In close-ups even the framing is misleading. Until such time as methods for automatically detecting and compensating for these problems are incorporated into a camera, an optical viewfinder remains a short cut made on the grounds of cost, which is simply not justified if one expects reasonable pictures.

Lab performance

The sensitivity of the camera was reasonably good, but the lag at high sensitivity was unacceptably poor, so good results can only be expected when it is used in bright outdoor light.

The camera was poor on most of the other aspects tested: resolution was less than the other units under test, shading around the edges was noticeable, and the pictures were noisy, although this was not too apparent in the very bright lighting needed to give acceptable pictures.

In general, the colour rendition was acceptable, although the reds and yellows tended towards orange.

Subjective impressions

This camera is light and easy to use, both hand-held with a portable VCR, and on a tripod. But the quality of the pictures in almost every aspect gives the impression that it is, as one person commented, 'not much more than a toy', and not a device to be considered by people seriously interested in creatively using the video medium.

Conclusions

At around £360, this is one of the cheapest colour video cameras on the market. But considering the difficulties of producing acceptable pictures from it – because of lack of monitoring through the viewfinder, and its craving for light – it is difficult to recommend it as a worthwhile purchase.

Camera	**Hitachi VK C750**
Technical Measurements	
Lag (no. of fields for output to fall to 12.5%)	(norm sens) 24
Sensitivity (minimum illumination	norm 540 lux
to give peak output)	high 320 lux
Resolution (output at 100/200/300 lines per picture height)	90%/45%/20%
Shading: line (horizontal)/field (vertical)	15%/15%
Peak white amplitude/sync amplitude	0.72V/0.35V
Noise (lens capped, gain max)	−37dB
Technical data	
Weight	1.8kg
Dimensions (W x H x D)	8cm x 13cm x 34cm
Tube size and type	⅔ inch vidicon
Viewfinder system and size	optical
Lens aperture	f2
Zoom range/zoom ratio	13.5mm – 38mm/2.8×
Price	£360

Hitachi VK C500E

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

Features, presentation etc

This is a single 1 inch *vidicon*-tube camera, intended to work with a mains power supply and a non-portable VCR. The unit is styled in silver and black, and its most striking feature is the long zoom lens which extends 18cm out to the front. The accompanying mains unit is a small neat box with a socket for the camera cable, phono sockets for video and audio outputs, and inputs to allow recordings to be replayed on the viewfinder tube.

The controls are few and simple. A single knob labelled 'Color Temp' sets the white balance electronically. Recognisable symbols show the rough settings for incandescent, fluorescent, sunny and cloudy light. However, to check the balance which has been set, it is necessary to watch a colour monitor, as no white balance indication is provided on the camera itself: this is no bad thing, for a colour monitor is essential to obtain a good white, or more importantly, good flesh tones.

A contrast control is a feature of this model not found on any other camera we tested. This was found to be useful for getting more pronounced pictures, and for coping with difficult lighting environments.

There is no automatic control of the iris: an aperture ring opens the iris to a maximum of f2. The zoom has a range of 17 to 102mm; the longer than average maximum focal length could be useful for telephoto work.

There is an LED which flashes if insufficient light is reaching the tube, but it is secreted in a hood and hidden by the viewfinder, as if it were not the manufacturer's intention for us to see it. All the other cameras we looked at had this indication within the viewfinder, which would seem a more sensible place to put it.

Lab performance

The camera showed itself to be relatively sensitive and, at high sensitivity, to exhibit a fairly low degree of lag. However, compared with the new generation of *saticon* tubes (such as the Sony *DXC 1800* camera described in the Introduction), the lag was still objectionable, and rules out the use of this camera in less than moderately lit indoor conditions.

The resolution (65% at 200 lines) was a little disappointing considering the tube is larger than average, but is nevertheless typical of home colour cameras.

Subjective impressions

It's perhaps a little optimistic of Hitachi to provide a hand grip for this camera, unless they hope to sell it to lumberjacks or wrestlers. It is only really feasible to support the 3kg weight on a tripod, where the camera sits, nicely balanced about it's fixing hole. As with other cameras, it could be said that when working on a stand it needs a larger viewfinder screen that that provided.

The colours produced were bright and bold, but sadly not accurate. It knew nothing of reds, preferring to render them all as convincing oranges. Blues were pale and purpley, and yellows tinged with green.

Overall, the camera was not disliked; its performance in lesser lighting was appreciated, and it is straightforward to use. But it lacks the versatility of some other units.

Hitachi VC-K770 has effectively replaced the 500.

Camera	Hitachi VK C500
Technical Measurements	
Lag (no. of fields for output to fall to 12.5%)	7
Sensitivity (minimum illumination to give peak output)	540 lux
Resolution (output at 100/200/300 lines per picture height)	95%/65%/40%
Shading: line (horizontal)/field (vertical)	5%/5%
Peak white amplitude/sync amplitude	0.65V/0.35V
Noise (lens capped, gain max)	–38dB
Technical data	
Weight	3.5kg
Dimensions (W x H x D)	12cm x 18cm x 46cm
Tube size and type	1 inch vidicon
Viewfinder system and size	electronic, 1½ inch
Lens aperture	f2
Zoom range/zoom ratio	17mm - 102mm/6X
Price	£600

NB this model has now been effectively replaced by the more up-to-date and competitive *VC K770*.

Philips V200

Philips Electrical Ltd., City House, 420/430 London Road, Croydon CR9 2QR. Tel 01-689 2166

Features, presentation etc

Philips have adopted a very different approach to domestic camera design. They have not tried to 'squeeze' single-tube technology to give good results, but have adapted more conventional three-tube techniques for the home market.

The *V200* is a fairly large but slim camera, styled to match the Philips VCRs. Because it is intended to work with a non-portable VCR, it comes with a drum containing 20 metres of connecting cable. Built into the drum is the mains power supply for the camera, as well as a UHF

modulator, BNC video outlet, and a 6-pin DIN AV outlet (as found on Grundig machines).

The iris control on the camera is completely automatic, and the zoom has a ratio of 8:1, with a range of 8 to 64mm, a relative aperture of f1.8, and a macro facility. A small switch gives control of sensitivity: there is one position for 'normal' operation, two settings for the threshold of the auto-iris, and two other settings which give amounts of extra gain.

White balance is achieved simply and automatically by pointing the camera at a white object and pressing a button. The circuits will 'hunt' until they decide upon a proper balance, and then the information is digitally stored within the camera until the next time there is a need to reset the balance.

The problem with any three-tube camera of adjustment so that the images from the red, green and blue tubes are exactly coincident (known as *registration*) is again solved automatically. Using the special lens cap, you just press the buttons, and the camera shuffles the three images around until they all lie on top of one another without any coloured fringes. Once again the registration information is stored until it needs to be re-set.

The viewfinder lies along the length of the top, with the screen at the back of the camera. If the camera is connected to a Philips VCR, an LED gives indication of the tape running.

Lab performance

The lag results can be seen as good compared to other *vidicon* home cameras, but still this represents a lag about four times longer than a *plumbicon* or *saticon* tube. The sensitivity is moderately good, and in combination with the lag performance this means that the camera can just about be used indoors where the light through the windows is strong.

Resolution is not startling, but the impressive noise measurement suggests that there is scope for the manufacturers to incorporate some crispening to enhance the picture at the expense of a little extra noise. Although the pictures were subjectively very noise-free, the outstanding figure obtained probably points to some deficiency in our tests, as noise measured with the lens capped can be hidden by black-crushing in the camera.

Subjective impressions

The most immediate impression was the quality of the colours compared with other home cameras. They were all accurate in hue; only greens appeared a little desaturated. This was certainly the most lifelike of the cameras tested.

The picture shading around the edges was noticeable, particularly on captions, but this was one of the few detractions from a picture quality which was felt to be very good.

However, it was not felt that the camera was well designed physically/ergonomically. Hand-held use is virtually precluded by the weight, the tall thin shape, and because it must be held at arm's length to see the viewfinder screen. Even on a tripod it is unbalanced and clumsy; the controls at the front are hard to reach: and the viewfinder screen is smaller than ideal for the application.

Another point which mars the design is the sensitivity switch, which is small, fiddly, and not positive in action, and feels as if it could snap off after a few weeks of use. Otherwise this is a neat and robust unit.

Conclusions

This is an admirable camera, giving probably the best pictures of all the models tested. But it is let down by an awkward clumsy shape. The performance is excellent for well-lit, non-portable applications, and the three tubes and sophisticated electronics give results which justify the highish price.

Camera	**Philips V200**
Technical Measurements	
Lag (no. of fields for output to fall to 12.5%)	(sens '0') 6
Sensitivity (minimum illumination	sens '0' 2100 lux
to give peak output)	sens '4' 750 lux
Resolution (output at 100/200/300 lines per picture height)	70%/50%/20%
Shading: line (horizontal)/field (vertical)	30%/30%
Peak white amplitude/sync amplitude	0.9V/0.3V
Noise (lens capped, gain max)	−52dB
Technical data	
Weight	3kg
Dimensions (W x H x D)	4.4cm x 8.5cm x 26cm
Tube size and type	3 x ⅔ inch vidicon
Viewfinder system and size	electronic, 1½ inch
Lens aperture	f1.8
Zoom range/zoom ratio	8mm – 64mm/8×
Price	£650

Sanyo VCC 545P

Sanyo Marubeni (UK) Ltd., Sanyo House, 8 Greycaine Road, Watford, Herts. Tel Watford 46363

Features, presentation etc

The basic camera body (*VCC 540*) is available with two alternative sets of components, to make up either the *VCC 545P* with an electronic viewfinder and zoom lens, or the simpler *VCC 542P* version, with an optical viewfinder and fixed focal length lens.

The camera has been designed to rest on the shoulder when in portable use, so it has a cushioned underside, and a handgrip which is sharply angled forward with a steadying hand-strap. The viewfinder (on both variants) is at the front left hand side of the camera, with a mirror deflecting the image from the laterally positioned tube. The eyepiece tilts up and down, but this is the only freedom of movement in the viewfinder assembly.

The long lens barrel incorporates the 6X zoom, which is manually operated, and the iris opening ring. The lens attaches to the camera body with the standard C-mount, allowing other lenses to be fitted if required.

This camera can be used with any VCR, as the mains unit which accompanies it has standard output sockets: a *PL259* for video, and phono for audio, as well as a socket for a special connecting lead to a Sanyo VCR. Furthermore, the plug on the camera lead is of the K-type found on Sony VCRs, so battery-powered operation is possible with the Sony *SL-3000E* portable recorder.

The optical viewfinder option is considerably less flexible in use: because the viewfinder image cannot track with a zoom lens, a fixed lens has to be used. Although the viewfinder does have the same LED monitoring indications as the electronic version, it is of little use other than for simply framing a shot. There can be no information about the reproduced image, unless the camera is connected to a monitor – an arrangement which is now hardly portable.

Subjective impressions

This camera handled very well, despite being larger and heavier than most of the other cameras we tested: the weight is easily supported by the shoulder rest and the right arm is well tucked in when holding the hand grip, so the camera is manoeuverable but not tiring. It was not possible to adjust the eyepiece sideways to suit all users head sizes, but the image in the viewfinder was large and clear, and the bigger-than-average rubber eyecup was much appreciated by myself and other bespectacled users.

The picture quality was impressive; colour rendition was excellent, and under good lighting the lag was less noticeable than most of the other cameras. In common with the other cameras, it was only practical to use this one in good light–bright outdoor conditions preferably. The definition appeared poor, particularly when compared against broadcast pictures, giving 'soft' images with some smearing of large areas of bright colours. The pictures looked less noisy than average.

The absence of a vast array of knobs to twiddle means the camera is simple to operate, but the camera loses something in versatility: for example, it cannot easily provide the special exposure settings needed for back-lit scenes. The white balance controls, although not as straightforward as on some other cameras and needing some time to master, do provide a wide degree of control. The instruction leaflet for the camera is noteworthy for its clear and helpful explanation of colour temperature and white balance setting-something lamentably lacking from most other manufacturers.

Conclusions

Priced at about £650, this is among the more expensive home cameras. The picture quality compares very favourably with its competitors, although it lacks some of the subtler versatility. Overall, the *VCC 545P* is to be recommended, though an administrative problem at our end prevented the full technical exploration from being carried out.

Camera	**Sanyo VCC 545P**

Technical data

Weight	3.6kg
Dimensions (W x H x D)	21cm x 27cm x 46cm
Tube size and type	1 inch vidicon
Viewfinder system and size	VCC545P: 1½ inch electronic (VCC 542P: optical)
Lens aperture	f1.8
Zoom range/zoom ratio	17.5mm–105mm/6X
Price	£650

Sony HVC 3000P

Sony (UK) Ltd., 134 Regent Street, London W1. Tel 01-439 3874

Features, presentation etc.
This model is identical in appearance to the Sony *HVC 2000P (qv)* with the exception of the lens barrel. The lens is faster (*ie* it lets in more light) than the *2000*, and this more recent model does not have the little meter indicating iris opening.

Lab performance
All-round this is a better camera than the *2000*, and a good performer in the context of the group tested. Lag and sensitivity were both moderate. It is worth noting that both this model and the *2000* have their output limited to about 70% of its peak value when in the 'auto' sensitivity mode. So although the 'auto' pictures will be more consistent, they will never be as bright as is possible when full output is achieved in the 'low' or 'high' sensitivity modes.

Another point of interest is that even when the iris control was switched to manual, the iris began to close of its own volition when the illumination reached about 1000 lux. This is no bad thing, as 1000 lux is fairly bright illumination, sufficient for the camera to be working well, and it affords a measure of protection against accidental overload.

The resolution was good (85% at 200 lines), although it must be remembered that a professional camera would deliver no less than 100% resolution at this modest line density.

Subjective impressions
As was noted in the review of the similar *2000*, this is a well-designed camera to carry about and use, although perhaps tending towards over-complexity. The picture performance of this model was superior in many respects to the earlier model: the irritating streaking was not apparent, and it is useable indoors under reasonable lighting.

The colours were considered not as good as the *2000*; the blue shades were too green, and the reds pale and orangey. But the degree of criticism is not as severe as applied to some of the other cameras evaluated.

Conclusions
Although roughly £70 more expensive, the *3000* is to be preferred over the *2000* because of its all-round better performance. Indeed this camera is to be recommended among all the cameras tested on the grounds of ease of use as a portable camera and picture quality.

Camera	**Sony HVC 3000P**
Technical Measurements	
Lag (no. of fields for output to fall to 12.5%)	(low sens) 6 (high sens) 14
Sensitivity (minimum illumination to give peak output)	low 2100 lux high 270 lux
Resolution (output at 100/200/300 lines per picture height)	90%/85%/70%
Shading: line (horizontal)/field (vertical)	10%/0
Peak white amplitude/sync amplitude	0.70V/0.23V
Noise (lens capped, gain max)	−40dB
Technical data	
Weight	2.7kg
Dimensions (W x H x D)	22cm x 20cm x 35cm
Tube size and type	⅔ inch vidicon
Viewfinder system and size	electronic, 1½ inch
Lens aperture	f1.4
Zoom range/zoom ratio	6X
Price	£620

Sony HVC 2000P

Sony (UK) Ltd., 134 Regent Street, London W1. Tel 01-439 3874

Features, presentation etc

This camera is designed to rest on the shoulder, with the right hand giving support to the front. If the hand strap is correctly adjusted, it is possible to support and manoeuvre the camera with just the right hand.

The electronic viewfinder is located laterally across the front of the camera body, with a mirror bringing the image into the line of view. The assembly can slide and rotate to bring the eyepiece into just the right position. The tube, which is monochrome, can also be used as a monitor to view recordings.

There is a wide range of in-view monitoring facilities. One LED indicates insufficient light, and another shows VCR running or low batteries. On the viewfinder screen itself there is provision to monitor either the output frame waveform, the white balance, or the iris setting.

Zooming can be done manually or *via* a single speed motor, operated by a rocker switch easily accessible to the fingers of the right hand. The relative aperture of the zoom is f1.8, and it has a focal range of 12.5 to about 75mm, giving a zoom ratio of 6:1. Iris control is automatic, although this can be over-ridden if conditions dictate. A tiny meter on the barrel of the lens roughly indicates the f-number of the iris.

The white balance controls can accommodate a wide range of lighting conditions, with a four-position switch for coarse settings and a knob for fine adjustments. The balance is set both electronically and with the aid of an optical filter, which drops in when the outdoor coarse settings are selected. Further facilities include a 'sharpness' switch (which is all too reminiscent of a top-cut filter), and the useful option of automatic fades (on sound and vision).

Lab performance

Lag and sensitivity, those crucial indicators for a home camera, were poor, among the worst of the cameras tested. The pictures were also extremely noisy; this was most apparent in dim lighting conditions, where as well as 'grain', serious streaking and patterning across the picture was noticed.

Colour rendition in good outdoor light was reasonably good, only the reds looking slightly desaturated (*ie* 'washed-out'). The vectors from the reference colour bar chart confirmed that there was very little error in hue.

Subjective impressions

This camera was certainly found to be the nicest to handle. Being shoulder-resting, it was stable and light when carried about, and it was also reasonably well balanced on a tripod.

The controls are straightforward and give a wide range of adjustment. However there doesn't seem to be any justification for the 'sharpness' facility offering a less-sharp picture, when the resolution of these cameras is so much less than broadcast pictures. Likewise the 'peaking' switch, which according to the handbook should give a sharper picture in the viewfinder: it didn't seem to have much effect on the image, which some thought too 'muddy' anyway.

It is hard to be enthusiastic about the picture quality. One reviewer found the indoor sporting event he tried to tape was reduced to weird Top of the Pops special effects, where vast swirls and smears were left behind all moving objects, and people appeared semi-transparent if they moved fast against a fixed background.

Results outdoors were less disheartening, but it needed bright sunny conditions before you would say the pictures were good, and this must be a bit restrictive in the British climate.

There was no real cause for complaint about the quality of sound from the small built-in omnidirectional microphone, but it did tend to enlarge the sound perspective: people sounded more distant than they actually were. Also, more annoyingly, it did pick up the noise of the zoom motor, fingers fumbling around the lens, and even the operator's breathing: the assorted grunts and wheezes gave a curious commentary to the visual images.

Camera	**Sony HVC 2000P**
Technical Measurements	
Lag (no. of fields for output to fall to 12.5%)	low sens 10
	high sens 28
Sensitivity (minimum illumination	low 3200 lux
to give peak output)	high 750 lux
Resolution (output at 100/200/300 lines per picture height)	90%/65%/55%
Shading: line (horizontal)/field (vertical)	10%/0
Peak white amplitude/sync amplitude	0.75V/0.22V
Noise (lens capped, gain max)	−32dB
Technical data	
Weight	2.7 kg
Dimensions (W x H x D)	22cm x 20cm x 35cm
Tube size and type	⅔ inch vidicon
Viewfinder system and size	electronic, 1½ inch
Lens aperture	f1.8
Zoom range/zoom ratio	12.5mm – 75mm/4×
Price	£580

Sony DXC 1800P

Sony (UK) Ltd., 134 Regent Street, London W1. Tel 01-439 3874

Although this camera is probably out of the reach of all but the most enthusiastic, being priced at about £2,200, it incorporates nearly all of the facilities we feel are desirable in a home video camera. Although aimed at the professional market, its inclusion is worthwhile as a pointer to developments in the home market in the future.

Features and facilities

To date, nearly all home cameras have used a *vidicon* tube, with consequent poor performance in low light levels, The *saticon* tube used in the *1800* is more sensitive and gives far less lag, so indoor shooting in ordinary lighting conditions becomes feasible. *Saticon* tubes are starting to be used in some top-of-the-market home cameras, and could become standard in the next few years.

The motorised zoom offers a choice of two operating speeds, although this falls short of the ideal of a continuously variable speed control, especially useful when the camera is tripod-mounted. It is difficult to reach the manual zoom control at the front.

Iris control is normally automatic, although for special circumstances it can be set manually. Alternatively the automatic setting can be locked ('auto lock') when, for instance, the illumination of the subject is constant but the background level is changing.

Three optical filters are provided as coarse control of the white balance, and fine adjustment is carried out automatically. The accomplishment of white balance is indicated by a light in the viewfinder housing. Automatic control of contrast is possible with the 'auto black level'

switch, which will blacken the darker areas without affecting the lighter areas on scenes with high overall brightness.

The gain control is usually automatic, but it is possible to hold the sensitivity constant, fixing the gain at either 0dB, 6dB or 12dB. The fixed settings could be used where a scene is made to look darker or brighter than normal for effect.

The audio and video outputs may be faded in and out with the auto fade facility, to give an alternative to 'cut' edits. The fade time is variable between 1 and 4 seconds.

Several still more elaborate facilities are available for use with other cameras or video sources, or in studio set-ups. A 'gen lock' input allows the camera to be exactly synchronised with other cameras, so mixing or cutting between two sources is possible. An optional Camera Control Unit (*CCU-1800P*) permits the remote aligning of picture quality and colour (described in more detail in the introduction), as well as providing an intercom facility to the cameraman using the camera in a studio. A switch on the camera substitutes a colour bar signal for the picture output to help set up colour monitors.

Presentation and design

The camera with all its facilities weighs 5.3kg, which is more than most portable home VCRs. But through extremely efficient design the weight is not a burden and the camera is easy to handle. With a special padded support, the camera rests on the shoulder; the weight of the lens at the front is balanced by the battery on the back. The camera is steadied at the front by a hand-grip for the right hand, from where it is possible to remotely start a VCR and control the motor zoom.

The viewfinder extends out to the front on a bracket, which can be moved around so the camera rests against the side of the head and the eyecup lines up snugly with the eye.

The *1800* is more robust than a typical home camera, with the housing constructed in diecast aluminium rather than plastic.

The camera can be completely self-contained with its own battery, which attaches to the rear (although of course it can be powered externally). A small meter indicates the state of the battery, and in addition a lamp in the viewfinder will blink when the voltage is low and before the camera shuts off, to prevent complete discharge of the battery. Having separate batteries for camera and VTR roughly doubles the operating time.

Technical performance

The *1800* was put through the same tests as the home cameras, and the results are presented here for comparison.

As expected, the lag was significantly lower than the other cameras, being only 2½ fields at maximum sensitivity. That maximum sensitivity was also greater: 320 lux was needed to give full output, compared with typically 1000 lux for a vidicon. More sophisticated electronics gave resolution which is also significantly improved, giving 90% output at 200 lines.

Quite a lot of noise is produced (S/N 30dB) when the gain circuits are working flat out, but subjectively this noise is only noticeable from very dimly lit scenes (when the other cameras would not work at all), and in good lighting the pictures are very noise-free.

The main output is *via* a Sony 14 pin connector, and the camera is intended for use with industrial ¾ inch VCRs (U-matic). But it does have a BNC video output, so use with most domestic VCRs is fairly simple.

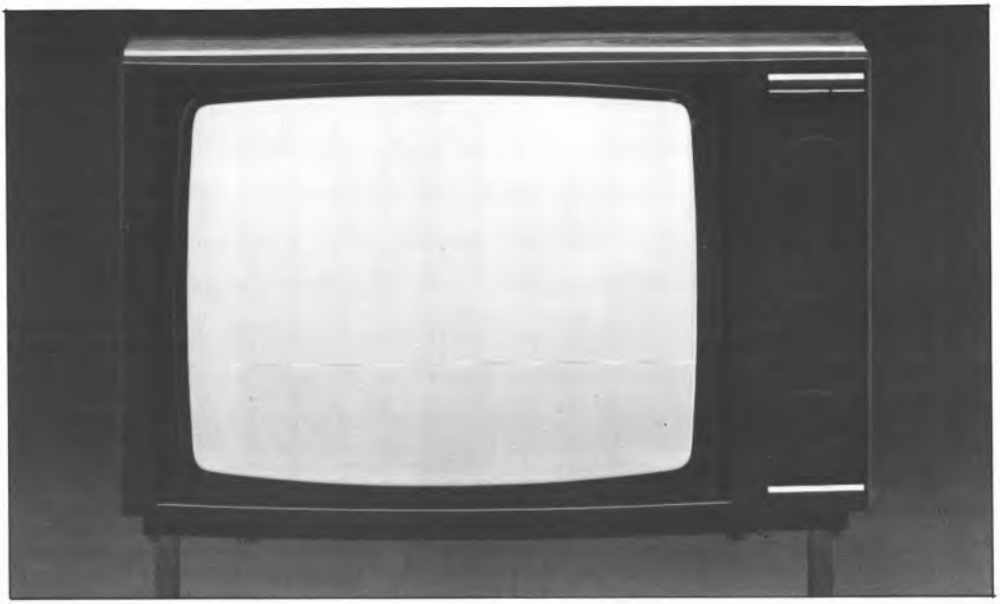
Conclusions

This camera has all the facilities found on ENG cameras costing around £25,000, although its image quality does not come near professional standards. With these facilities, and a picture quality which is nevertheless greatly superior to most home cameras, this industrial grade camera is good value for money, and should be seriously considered by those home video users who can afford it and who are seriously interested in exploring the programme-making capabilities of modern domestic video.

Camera	**Sony DXC 1800P**
Technical Measurements	
Lag (no. of fields for output to fall to 12.5%)	auto sens 2.5
Sensitivity (minimum illumination to give peak output)	auto sens 320 lux
Resolution (output at 100/200/300 lines per picture height)	100%/70%/35%
Shading: line (horizontal)/field (vertical)	0/0
Peak white amplitude/sync amplitude	0.75V/0.30V
Noise (lens capped, gain max)	−30dB
Technical data	
Weight	5.3kg
Dimensions (W x H x D)	25cm x 36cm x 60cm
Tube size and type	⅔ inch saticon
Viewfinder system and size	electronic, 1½ inch
Lens aperture	f1.4
Zoom range/zoom ratio	11mm – 70mm/6.4×
Price	£2,200

B&O 8800

Bang & Olufsen (UK) Ltd., Eastbrook Road, Gloucester GL4 7DE. Tel (0452) 21591



This is a twenty-six inch colour television set in a slim plastic cabinet, with a remote control pad which is shared with its teletext-equipped brother, and which is intended in the future to encompass operation of B&O's anticipated VCR.

Facilities

Sixteen channels may be preset by means of manual controls popping out from a spring-loaded flap near the top of the set. They may be selected in strict numerical order by means of two "forward/reverse" buttons beside the tuning controls, or in any order from a numerical keypad on the remote unit. The remote unit permits up-and-down adjustment of volume, channel, colour intensity and brightness from four 'rocker' knobs. Speaker mute and on/off functions are also remote-controlled.

Whenever the channel change buttons are operated or a recall button pressed, the channel number selected appears for a few seconds as a green seven-segment display within a black box electronically cut out of the picture in the top right-hand corner of the screen.

On the set control panel, rotary controls are provided for adjusting and pre-setting brightness, colour and contrast, as well as bass, treble and volume; a 'reset' button on the remote unit will restore these preset settings.

User Reactions – Facilities

The remote control unit, a heavy, cigar-shaped artefact with clearly labelled buttons, attracted much favourable comment. One minor complaint arose out of the need to operate 16 channels from only ten buttons, so that in order to access channel 12 you had to press button one and then button two immediately afterwards; the corollary is that as often as not flipping quickly from channel one to channel two resulted in arrival at channel twelve. Apart from this the remote performed very well; the 'rocker' controls were liked and considered a more stylish way of presenting 'up and down' touch buttons on a single pedestal which could pivot forwards or backwards as needed.

The set itself was unusual in providing bass and treble controls to suit the user's taste – these and the other rotary controls worked over an adequate range. The absence of touch-buttons on the set itself (where they are not strictly necessary for technical reasons) was much appreciated – most manufacturers seem just to double up on the up/down touch buttons provided on the remote.

Style and Design

It is not easy to make a 26-inch colour television which does not look like a large square box, but

Bang and Olufsen have succeeded in making this receiver a very stylish piece of furniture. The front panel is totally black, with a plastic escutcheon round the screen and three slightly raised circular pads covered with acoustically transparent material on the right hand side. The size of the receiver is disguised by breaking up the bulk into various segments – from front to back along the top there is the plastic escutcheon, then some silver trim, then a three-inch wide strip of teak woodgrain, followed by some metal ribbing providing ventilation slots, and then the plastic back itself.

Looking at the front of the receiver, all that can be seen is a very subdued red power indicator which glows when the receiver is connected to the mains but running in standby, plus the on-off switch and headphone socket, both of which are very discreet.

All in all a highly commendable design, although the receiver is rather awkward to lift and carry, and the metal ribbing is sharp and slightly hazardous, and could certainly damage doors or paintwork if the set is not transported with some care.

User Reactions – Technical Performance

The sixteen tuning presets are very close together, for obvious reasons, and it was difficult to adjust one without knocking the adjacent ones off-tune. It was important to tune the receiver quite precisely for the best picture, as no AFC action was apparent, and the receiver would display a poor quality picture if the tuning was not set just right.

Once tuned in correctly, the picture was of very high quality, with excellent grey-scale accuracy. A surprisingly high level of brightness was available before defocusing set in, and it was possible to set the contrast, colour and brightness controls for a pleasing picture with many subtleties.

Technical Inspection

After removing only two screws (full marks on this point) the whole back and sides of the cabinet come off, permitting easy access to the innards. One extremely thoughtful touch comes in the form of a brown envelope tucked inside, which contains one of the neatest and best laid-out circuit diagrams this reviewer has ever seen (and he's seen a few!).

EHT stability was exemplary at 2.5%, while the video response revealed a gentle fall-off over the usual passband, being 84% at 1.8MHz, and 56% and 25% at 2.8 and 3.8MHz respectively. This confirms the gentle, slightly 'soft' appearance of the picture. Colour patterning was minimal at only 3% on the bars, and much less than usual at 20% on transitions. The weak signal performance was excellent, with the colour-killer knocking out the 'confetti' effect on weak signal by forcing monochrome operation. The alignment of the decoder showed only very minor departures from the ideal.

There was a +2dB 'hump' on the audio response at about 100Hz, presumably to improve the bass reproduction from the loudspeaker, but above that the electrical response of the set was within 1dB from 300Hz to 12kHz. Distortion was lower than normal at 2%, but there was room for improvement in the background noise level, which was only −46dB 'A' weighted. The acoustic power of 102dBA at 30mm was considered to be more than adequate for any domestic situation.

Conclusions

This is a very stylish set with pleasing picture and sound quality. There are receivers with sharper pictures and there are receivers with better sound, but we feel kindly disposed towards this receiver because of its impeccable styling and design. It is worth noting that it has to be tuned rather more scrupulously than others in order to get the best results.

TV Receiver Test Results **B&O**

Picture		
EHT voltage:	Zero beam current	23.6kV
	Max beam current	23.0kV
	Stability	2.5%
Video response:	0.8MHz reference	
	1.8MHz	84%
	2.8MHz	56%
	3.8MHz	25%
Chroma on luma:	Bar	3%
	Transitions: peak	8%
	typical	20%
Weak signal performance		excellent
Decoder performance		very good
Sound		
Maximum output voltage (electrical)		10V p-p
Maximum electrical power		1.5 Watts
Frequency response ± 1dB ref 1kHz		300Hz, 12kHz
Residual noise: Unweighted		−34dB
Weighted		−46dB(A)
Distortion at quarter power		2%
Maximum acoustic power at 30mm		102dBA
Typical retail price		£580

VIDEO-NEWS

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Ferguson 3765

Thorn Consumer Electronics Ltd., 284 Southbury Road, Enfield, Middlesex EN1 1TJ. Tel 01-363 5353

This is a 22 inch receiver from the well-known Thorn empire, advertised on TV by the prominent conductor André Previn as possessing the 'best picture of all time'. Unfortunately we had to return the set before carrying out technical measurements, so this 'short review' is largely gleaned from user reports.

Presentation

This is not a luxury model with remote control, teletext or any other trimmings. Instead we have a receiver with good old fashioned rotary knobs which are there for all to see instead of hidden away somewhere. They are just underneath the channel-change buttons, and control volume, contrast, brightness and colour in much the same way as did sets of old. Six channels may be preset on the electronic tuner, and these are tuned by means of presets hidden behind a plastic flap near the bottom of the front panel.

The set is quite neat and stylish, and comes with an easy-to-assemble stand with rolling castors.

Technical Performance

Since an orchestra conductor has pronounced the picture as being the best of all time, perhaps we should hesitate to comment any further! In fact, the picture on our sample was very sharp, well-converged, and with no major defects. There was a tendency for the black level and grey-scale (the neutrality of the black-and-white picture) to drift preceptibly during warm up, and the back was taken off a few times until an optimum setting had been achieved.

The picture was not quite of the same calibre as the Sony, which had a better ability to produce really sharp edges at high contrast, but it was certainly totally adequate for all our users. Sound was unexceptional, but again aroused no particular complaints.

Internally, the receiver was astonishingly empty, with one neat chassis bearing about as many components as one might expect in a ten year-old monochrome set! As usual with this brand of receiver, component locations were clearly marked and servicing should be quite straightforward. We had a word with a friend in the trade, who said that this chassis has so far given very little bother.

Conclusions

Thorn has a reputation for innovative design. They were responsible in 1967 for the first ever all-transistor colour TV chassis, and they are to be credited today for producing a very neat and straightforward receiver (a very far cry from the complex 1967 set). The price is extremely reasonable, and the reliability disadvantages, once endemic in UK receivers compared with the Japanese competition, seem to have been overcome. Certainly the gap is closing. We therefore recommend this receiver as an excellent choice for the budget-conscious customer who wants a simple set with no frills.

Mitsubishi CT 2606

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

This is a 26 inch colour television receiver with a full infra-red remote control pad, and a built-in digital clock-timer.

Facilities

There is a green digital clock display at the top right-hand corner of the front of the cabinet, offering alarm and sleep facilities reminiscent of clock-radio state of the art (perhaps there was a surplus of ICs??) Unfortunately this reviewer found the display too bright for sleep, and turned the set off at the mains before retiring (along with everything else that glowed excessively in the dark).

Eight gently-illuminated touch-tuning buttons are provided, the tuning itself being driven by eight manual presets behind a rather badly cut-out flap on the right-hand side of the cabinet. Touch controls for volume, colour and contrast, and rotary controls for brightness (centre indented) and tone (mainly top cut) are found behind a flap at the bottom of the front panel, underneath the forward-facing elliptical loud-speaker.

User Reactions

The same criticisms regarding touch-control of volume and other analogue functions noted in the Sony review apply here (and elsewhere) also: the action of the Mitsubishi's touch buttons was faster to respond than some, and thus slightly easier to use.

The contrast, colour and volume controls return to predetermined norms whenever the set is switched off, or if the 'normal' button beside the touch controls is pressed. Unfortunately these preset settings were considered far too high for both contrast and colour saturation, resulting in a grossly overcontrasted and garishly-coloured picture which might just look acceptable in a bright window display, but which was far too overpowering for satisfactory viewing in normal domestic lighting.

The remote control was straightforward in design and worked well, providing channel change and control of contrast, colour saturation and volume, plus sound mute for when the 'phone rings.

Style and Design

By no stretch of the imagination could this be called a neat or stylish set. It is enclosed in a large chipboard box a foot deep from front to back, covered with the ubiquitous light brown wood veneer finish (which fools no-one). It is about the same size as many much older-style

models from the pre-slimline colour tube era, and users did not find it aesthetically attractive. The clock/timer feature was thought to be of limited usefulness. The most positive aspect of the installation was the remote control pad, which is the same size and shape as the unit supplied with the Mitsubishi VCR, and was praised for its simple layout and ease of use.

User Reactions – Technical Performance

One of the disadvantages of using a 26 inch screen, as opposed to a smaller one, is that all other things being equal, the picture will never be quite as bright and sharp-looking as one from a smaller tube. This is because the electron guns firing at the screen are only capable of supplying a finite amount of energy. It is rather like a cine or slide projector; the further away the screen and thus the bigger the picture, the less bright and sharp-looking the picture will become, partly because the energy from the lamp is more spread out, and partly because the amount of detail per unit area has decreased.

This particular receiver gave an adequately bright picture under domestic lighting, but was not capable of the same intensities at the same level of focus provided by the Philips or Bang & Olufsen receivers, and tended to defocus rather readily on highlights. The picture was reasonably detailed, tending towards softness rather than enhancement. Sound quality was considered to be mundane but not unpleasant, with the tone control set a little way back from maximum treble, but some buzz was noted on quiet passages. The performance of the remote unit was considered to be highly satisfactory.

Technical Inspection

Internally, the circuitry is contained on a number of panels which are interconnected by plugs and sockets. The set should be relatively easy to dismantle for repair, although the location of the clock panel is a little awkward to reach, on account of the considerable depth of the cabinet.

On tests, the EHT stability was average at 6.4%, with a tendency for the width of the picture to change just perceptibly between bright and dark scenes. The video response check confirmed the generally 'soft' nature of the picture, with the response falling smoothly and gently over the band 1.8–3.8MHz. *Chroma* patterning on the black-and-white information was well down at 5%, though reaching 50% on some colour-bar transitions. Subjectively this was not normally perceptible at typical viewing distances.

The performance on a weak aerial input was good, but the decoder alignment was judged to be only fair, on the evidence of the display from the Philips *PM5519* generator, which discloses decoder alignment errors as colour (or its absence) on a specially-generated test signal.

On the sound side, an electrical power of 1 Watt across the 8ohm speaker gave rise to an adequate 94dBA, measured at 12 inches from the speaker. The residual noise from the sound section was excessive at only −25dB unweighted, or −34dB after 'A' weighting. This was less audible than might be supposed, as it consisted elmost entirely of pulses at line frequency (15.625kHz), which is only just inside the audible spectrum for many people and was not a frequency at which the loudspeaker itself was particularly sensitive. Frequency response was unremarkable at 125Hz to 16kHz ±2dB, and likewise the 2.5% distortion level (including the HF pulses) at a quarter of the nominal output power.

Conclusions

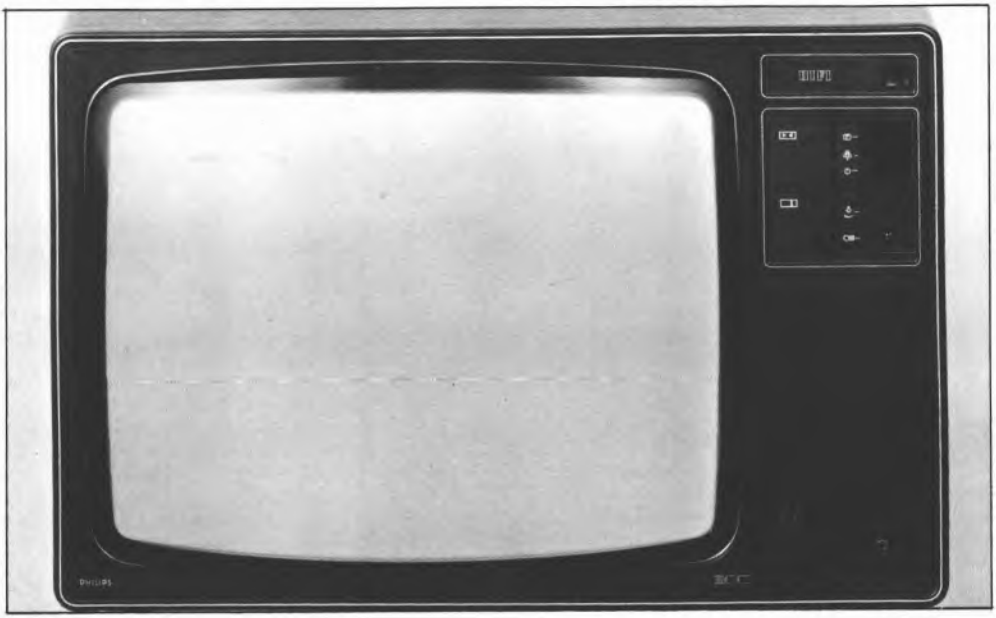
This is not a particularly elegant or stylish receiver, but it gives a soft, easy-to-watch picture which many will find pleasing. The remote control works well and has an action which is quite easy to master. The sound quality is utilitarian but not unpleasant, though the level of background buzz on our sample was thought to be excessive.

TV Receiver Test Results **MITSUBISHI C72606BM**

Picture		
EHT voltage:	Zero beam current	22.0kV
	Max beam current	20.6kV
	Stability	6.4%
Video response:	0.8MHz reference	
	1.8MHz	82%
	2.8MHz	62%
	3.8MHz	42%
Chroma on luma:	Bar	5%
	Transitions: peak	50%
	typical	20%
Weak signal performance		good
Decoder performance		fair
Sound		
Maximum output voltage (electrical)		8V p-p
Maximum electrical power		1 Watt
Frequency response ± 1dB rel 1kHz		125Hz, 16kHz*
Residual noise: Unweighted		−25dB
	Weighted	−34dB(A)
Distortion at quarter power		2.5%
Maximum acoustic power at 30mm		94dBA
Typical retail price		£460

Philips 797

Philips Electrical Ltd., City House, 420/430 London Road, Croydon CR9 2QR. Tel 01-689 2166



This is a Swedish-made set in a simulated wood-grain case with a black plastic front panel. It bears the distinctive legend 'Hi-Fi' on a front panel near the top right hand corner.

Facilities

The tuner can select any one of twelve channels, which are tuned by a row of twelve presets in a tray which springs out from the front panel. Another tray immediately above this brings forth the channel change buttons, plus touch-control brightness, colour intensity and volume adjustments, and rotary controls for contrast, volume, bass and treble.

All these functions, with the exception of bass and treble but with the addition of speaker mute and function reset, are available from the remote control pad; the set may also be switched off to standby from the remote unit, and completely from the front panel. A headphone socket with optional speaker muting is provided, plus the unusual (but welcome) feature of a continuously variable brightness control of the LED channel indicator display.

User Reactions – Facilities

Brightness is definitely not the sort of variable to be consigned to the digital inexactitude of touch-button controls. Of all the controls provided on a television, brightness is the one where a strong case may be argued for there being only one correct setting: which is where the darkest parts of the picture, transmitted at what video engineers call the 'black level', *just* cut off the tube brightness. This is a tricky adjustment at the best of times, and it is particularly difficult using touch controls.

The operation of the controls was almost invariably carried out using the remote unit, since the positioning of the main controls on the receiver is such that they can only be operated from a position uncomfortably close to the screen. Channel-changing was thought to be a mite sluggish, but the touch-controls worked well enough.

A green 'granny button' on the remote control pad provides a quick return to preset levels of volume, brightness and colour intensity, should the operation of the touch-buttons prove too overwhelming. It was thought that the colour intensity was preset rather too high, though this is to some extent a matter of personal taste; however unlike the *B&O*, for example, this preset could not be adjusted by the user, and switch on therefore required such balance adjustments to be made afresh each time.

Style and Design

The obligatory wood-grain finish covers a wood-chip cabinet less substantial than the Mitsubishi's, with a black plastic front escutcheon coming flush up to the sides of the cabinet. The red LED channel display is thoughtfully provided with a dimming control, while the tuning presets and operating controls are concealed from view.

It was felt that the controls on the receiver itself could have been better placed; spring flaps are fine for hiding occasional controls, but channel change is hardly one of them. The controls themselves were very small and fiddly, and labelled by assorted Euroglyphics (the Western equivalent of the Japanese hieroglyphics – broadly similar in some respects, but usually more complicated, being from The People Who Brought You The DIN Plug). The remote control was quite well received, though again a little fiddly to handle.

User Reactions – Technical Performance

One had begun to feel very depressed about TV sound after examining the first couple of samples: one round and one elliptical speaker of fairly trivial dimensions driven by very ordinary IC output stages of highly limited fidelity. So with a 'Hi-Fi' label prominently displayed on the breast of the beast, one started with higher hopes for the Philips; these were not unrewarded.

Particularly noteworthy was the ability of the receiver to reproduce relatively clean and distinct bass notes at low or moderate volume levels. This is most uncommon in domestic television receivers, and in this respect the Philips was easily the best receiver in the survey. There was a slight tendency towards stridency at high volume levels, but generally the sound quality was very well-received.

Picture quality was also good, though less remarkable than the sound. The receiver was capable of a bright and well-focused picture, but it seemed to emphasise noise on transmission or recordings more than others, and the performance on weak signals was judged to be rather poor, the colour-killer circuit not operating properly and producing a confetti-like effect on signals weak enough only for reasonably monochrome reception.

Technical Investigations

The bulk of the circuitry was contained on a single, vertically-mounted printed circuit board, mounted on a metal frame. For servicing, this panel hinges sideways like a door, pivoting clear of the cabinet and permitting very easy access for repair and adjustment. Subsidiary circuit boards are plugged into multi-way connectors, again for great ease of servicing.

EHT regulation was slightly below par at 7%, and the slightly over-enhanced noise may possibly be accounted for by a rise in the video response at what might in an audio analogy be called 'the low end of the treble range', the 1.8MHz gratings being reproduced at 120% of the level of the 0.8MHz and 2.8MHz bars. Colour patterning was excessive at 40% amplitude on bars, and the decoder alignment was only fair (and that using a Philips generator, too!)

Sound gained excellent noise figures of −52dB, −55dB weighted, and gave a punchy acoustic output of 98dBA.

Conclusions

This receiver certainly provides sound reproduction considerably better than average for a television receiver, though the term 'Hi-Fi' may require some downgrading to fit into a television context. Picture quality is reasonably good, but this is not a receiver for use in very difficult reception areas.

We understand that this particular model is no longer available, though Philips are planning further 'Hi-Fi' sets for the immediate future, and the elaborate 'videocentre' (photo p. 146) is based on this chassis and offers further improved sound quality.

TV Receiver Test Results **PHILIPS**

Picture		
EHT voltage:	Zero beam current	24.0kV
	Max beam current	22.3kV
	Stability	7%
Video response:	0.8MHz reference	
	1.8MHz	120%
	2.8MHz	100%
	3.8MHz	60%
Chroma on luma:	Bar	40%
	Transitions: peak	60%
	typical	40%
Weak signla performance		fair
Decoder performance		fair
Sound		
Maximum output voltage (electrical)		8V p-p
Maximum electrical power		2 Watts
Frequency response ± 1dB rel 1kHz		70Hz, 13kHz
Residual noise: Unweighted		−52dB
	Weighted	−55dB(A)
Distortion at quarter power		3%
Maximum acoustic power at 30mm		98dBA
Typical retail price		£500 (if available)

Sony KV2206B

Sony (UK) Ltd., 134 Regent Street, London W1. Tel 01-439 3874

This is a 22 inch colour television receiver with full teletext and remote control operation. A further Prestel-equipped version is also available, using the same control pad.

Facilities

From the front of the receiver, all that is to be seen is the soft red channel indicator and on/off switch. In positions one to seven, a manually-preset broadcast signal can be received, while in the eighth the tube and loudspeaker respond to direct video and audio signals introduced by rear BNC and phono sockets. Output sockets carrying the tuner signal are also provided.

Behind a plastic flap are touch buttons for channel changing, colour, contrast and volume levels. There are also conventional rotary controls for brightness, volume level and tone (mainly top-cut). The remote control unit provides access to the teletext facilities as well as the usual functions.

User Reactions

Touch buttons are fine for changing channels, which is a nice clean digital function. When it comes to adjusting an analogue function in this 'up-a-bit- down-a-bit-up-a-bit' fashion, the limitations of the format become evident. Touch buttons never seem to act as subtly as rotary controls, nor do they always operate as fast or as slowly as one might like.

Apart from this gripe, the controls were reasonably laid out, and fairly clearly labelled, though why Sony should persist in calling 'picture' the control everyone knows as 'contrast' remains one of the mysteries of the Orient. The remote control was rather less of an ergonomic delight, with a multicoloured labelling system doing little to dispel the feeling that there is considerable room for improvement in the design of remote units. Teletext has never been the easiest of systems for which to produce a coherent control pad, and the proliferation of silly hieroglyphics here was no aid to enlightenment.

Style and Design

The cabinet is plastic throughout, with a distinctly unconvincing teak-style surround on the top and sides. The front of the cabinet bears a plastic escutcheon in a fairly drab but neutral grey.

One unusual aspect of the Trinitron tube, used exclusively by Sony, is that the shape of the glass screen facing the viewer is different from other tubes. The tube is completely flat in the vertical plane, and appears to be curved slightly more than usual in the horizontal plane. This gives the receiver an unusual appearance, though it is neither distracting nor unpleasant.

User Reactions – Technical Performance

The picture was at first sight very sharp, with what appeared to be rather over-enhanced edges to objects. After a while some misconvergence was noticed distributed fairly evenly across the screen. Though slight, it was enough to be perceptible, particularly on black-and-white programmes, where slight coloured fringing could be seen. The focus of the picture, while never poor, was observed to be better round the edges of the screen than at the centre. This was particularly obvious on teletext information, which, being inherently very 'sharp', will reveal any display shortcomings mercilessly.

The sound was unexceptional, quite shrill-sounding on much material, but with considerable 'presence' at low listening levels. At higher volumes some bass unpleasantness was clearly heard, the limitations of the small (4") round loudspeaker making themselves uncomfortably apparent.

Our remote control sample did not work at all well; the unit had to be aimed very accurately at the set to work at all, and many instructions were ignored. We would be very surprised if a manufacturer as reputable as Sony were to issue a unit with such a performance standard as the norm, so we take it that our sample was faulty. Nevertheless, one should perhaps make a point of checking the operation of the remote unit in the shop if thinking of buying this receiver, just in case ours is not the only duff one.

Teletext displays were decoded correctly from a none-too-wonderful aerial installation in a rather hilly, multipath-prone area of town, so we would expect no particular problems in this area.

Technical Inspection

The chassis is unusually complicated by modern standards, with a sizeable number of preset adjustments and an internal construction offering rather poor accessibility for repair.

EHT stability was better than average at 4.9%, while resolution up to 2.8MHz could scarcely be bettered at 100% all the way. The response at 3.8MHz was down to 50%. This confirms the sharp and detailed assessment of the picture in subjective tests. Colour patterning could have been less, with a residual level of 14% rising to as much as 50% on some transients. The picture geometry was very good, with scarcely any errors visible, although some convergence errors were noted.

On sound the receiver puts 10V peak-to-peak maximum across a small round Goodmans speaker, corresponding to 1.5W of electrical power. On programme material a maximum of 92dBA was recorded at 12" from the loudspeaker.

Conclusions

Assuming that our problems with the remote control are unique to this specimen, this receiver gives a good overall standard of performance marred by slight carelessness in setting up. Focus, convergence and colour patterning are likely to be improved by more careful adjustment prior to installation.

The very sharp picture proved initially impressive, though after a while it was thought to be a little too 'aggressive' on some shots. Teletext worked well, but the sound quality was very ordinary, and disappointing alongside the picture.

TV Receiver Test Results — **SONY KV2206B**

Picture		
EHT voltage:	Zero beam current	22.6kV
	Max beam current	21.5kV
	Stability	4.9%
Video response:	0.8MHz reference	
	1.8MHz	100%
	2.8MHz	100%
	3.8MHz	50%
Chroma on luma:	Bar	12%
	Transitions: peak	50%
	typical	20%
Weak signal performance		good
Decoder performance		good
Sound		
Maximum output voltage (electrical)		10V p-p
Maximum electrical power		1.5 Watt
Maximum acoustic power at 30mm		92dBA
Typical retail price		£670 (£500 w/o teletext)

Toshiba C2295

Toshiba (UK) Ltd., Toshiba House, Frimley Road, Frimley, Camberley, Surrey GU16 5JJ. Tel (0276) 62222

This receiver bears the legend 'Blackstripe', a Toshiba buzzword referring to the fact that the face of the screen is black between the coloured stripes which make up the picture, thus improving the contrast (so the tale is told).

Presentation

The receiver has the standard mock woodgrain cabinet and a black plastic escutcheon on the front, which includes a flap behind which the tuning and main controls are to be found; another smaller flap at the bottom conceals a headphone output socket.

The set has neither fully manual nor automatic tuning, but a rather strange, and as far as we know unique, cross between the two. There is only one tuning pot, and this has to be tuned in turn to each of the programmes you require, its setting being 'remembered' by pressing a 'memory' button. If you haven't tuned the station in properly, the AFC locks in hard, though it was very slightly off-tune from the optimum position. This is a more compact arrangement than a set of presets, and certainly performed well, though whether it is actually superior to a more traditional arrangement is open to question.

Also behind the flap were the usual picture controls: unusually in this receiver the saturation (or 'colour') control is not electronically ganged to the contrast control, so if you turn the contrast up you have to turn the colour up as well to retain the same relative colour intensity. There were also buttons for setting the clock, which worked on a 24-hour format, and could be dimmed if required.

Technical Quality

Apart from slightly over-enhanced edges due entirely to the slight mistuning of the AFC circuit, this receiver gave a very pleasing picture, with good convergence and focus over the whole screen area. EHT stability was rather below average at 7.2%, and the sound quality was unremarkable, being rather boxy but not grossly unpleasant. Four crosshead screws need to be removed to gain access to the works, which are well laid-out and should present no servicing difficulties.

Unfortunately we were unable to complete our technical appraisal on this model as we managed to disable the power supply to the set during the tests (our fault, not Toshiba's!)

Conclusions

With a performance marred mainly by very slight misalignment, the Toshiba is likely to be a satisfactory receiver for day-to-day domestic use. The sound quality is unremarkable, but the picture is bright, steady and sharp. There are no operational hang-ups once the unusual tuning arrangement has been mastered.

Japanese television receivers have always tended to be more expensive than the home product, but have made up for this in terms of reliability and picture quality. If you are in the market for a 22 inch set, it would be worth comparing this receiver with the Ferguson *3765*, which is considerably cheaper, and seeing whether the extra cost is justified for a digital clock and an only slightly better picture.

TV Receiver Test Results **TOSHIBA C72295**

Picture

EHT voltage:	Zero beam current	25.0kV
	Max beam current	23.8kV
	Stability	7.2%
Typical retail price		£540

Despite carrying out a lot of work and testing dozens of cassette samples, it would be wrong at this stage to publish conclusive reviews of tape. That is we cannot give a clear recommendation for any one brand or type. Our tests have led us to the point where we now know what needs doing technically, and where we can accurately compare any two tapes. But this does not solve the problem of consistency. Without testing a large number of samples from different batches of tape over a long period we cannot be sure that the user will be getting the best product. And assuming that one does arrive at a strong recommendation, it is still possible that the manufacturer will be unable to maintain his standards if demand for a successful product rises.

To see why this is especially true for home video recorders one needs to remind oneself of the structure of tape and the mechanism of helical scan recording. Fig 1 shows that the bulk of tape is a Polyester base made by two or three large manufacturers for all the tape companies. Beta and VHS use approximately the same base thickness for all playing times (except, for the moment, the long play *E 240* VHS). We found that the base thickness did vary a little and that tape strengths varied slightly more. There were no mechanically weak tapes, and any well adjusted machine would work reliably with all the tapes tested. In other words, VHS and Beta machines are quite gentle on tape unless they are out of adjustment. (A maladjusted early JVC *HR3300E* was the roughest machine on tape and the most likely to damage them; in such a case a slightly stronger base has some advantage, but it still makes better sense to correct the machine fault rather than rely on heavy duty tapes.)

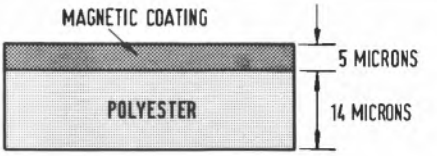


Fig 1. Cross section of video tape.

Video tape performance can be divided into two categories: (a) consistency and lack of drop-outs (the blemishes which are the video equivalent of scratches on film); (b) noise or continuous grain superimposed on the picture.

A special feature of home video formats is their extraordinarily high recording density. This imposes unparalleled limits on tape cleanness, consistency, surface finish etc in manufacture and assembly. With film, 35mm wide stock is used for the best professional results, with 16mm second best and 8mm for home use. Thus, 8mm at one quarter the width will have approximately one sixteenth the area: film grain and dust will therefore be roughly sixteen times more visible, other factors being equal. Similarly compact audio cassettes use tape at about one sixteenth the rate of studio open-reel recorders. Compared with the above, home VCRs consume tape at one-hundredth of that of a broadcast recorder; this extreme density of recording makes the magnetic signals on the tape minute.

Fig 2 shows a length of ½" tape with the track length and angle drawn to scale for the Beta PAL format. This single track contains one colour image, as might be seen on a carefully adjusted still frame (lasting for 1/50 sec. in real time).

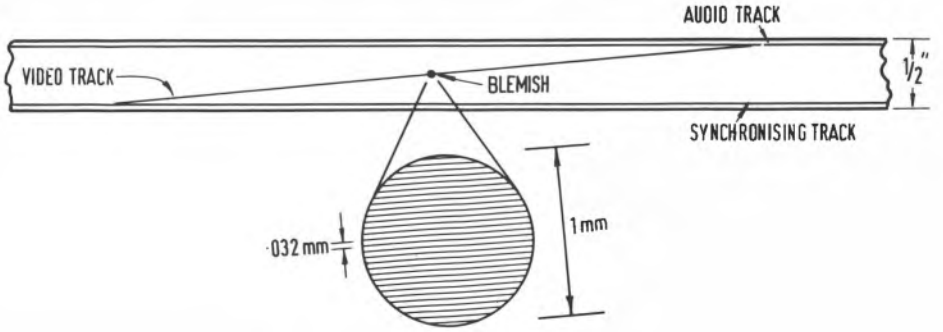


Fig 2. Beta video track, showing 1mm blemish (enlarged).

Dropouts

We cannot draw the width of a single track to scale, as at only 30 microns (or under 1/100th of an inch) it would be too fine to print. Assuming there was a 1 mm circular blemish, here drawn as a black dot, this would appear as a band of interference across the TV screen, visible for over half a second. Clever electronics in all home VCRs attempt to conceal such drop-outs but they are never wholly successful. This then is a principal problem with home videotape, and the subject of our first range of tests.

An *HR3300* VHS was kindly lent by JVC (UK) and set up with the various signal sources and lab instruments for dropout counting and noise measurement. The former measurements were made with the interesting JVC *VD-3E* counter, linked directly to the replay chain of the VCR. If the signal from the video heads dropped to less than one-tenth of its normal value for more than 5 microseconds, *ie* about 1/10th of the visible TV line, the counter was activated. Measurements were taken over a period of four minutes and because there was such a wide variation between the centre and the ends of a tape, we repeated the tests at the start (head), one-third, two-thirds distances, and at the tail. Although the tape manufacturers prefer to discount the first two minutes in dropout measurements, we did not, as users have not been instructed and do not expect to start their recordings two minutes into the tape.

Taking a random sample of five recently purchased JVC *E120* tapes gave us the results in the first section, Table 1. Our total measurements on all tapes gave us an average dropout figure of all tapes tested of 22 counts per minute. This enabled us to scale value judgements on the performance of samples, which showed a wide variation.

The two samples of TDK *SuperAvilyn E180* were similarly tested with no less variation. Three short Akai *E30*s were tested, and although Akai are purported to obtain their tape from the same sources as JVC, their dropout averages were high. Two Ampex cassettes were samples provided by Ampex for evaluation; their dropout counts were embarassing.

The three Memorex *E180*s came out well, with the best averages of the group. We should hasten to add that the fact that Memorex (UK) had kindly lent us items of video test equipment had no relation to our good opinion of their tapes. It is however possible that the fact that Memorex makes spot checks on their imported VHS cassettes has helped them weed out poor samples from their manufacturer.

Noise

For the noise tests we used a Shibasoku *925C*, because this model is most often used by manufacturers in Japan. In fact we found the *925C* gave more optimistic measurements than either the Digitel or the Rhöde & Schwarz noise meters! There are several reasons for this which are outside the scope of these notes; but apart from the differences between the instruments, our eyes told us that the VCRs were all noisier than their specifications revealed (more on this later). Table 1 shows relatively small measured differences which were nonetheless visible; in particular the TDK and Ampex, at −43 and 42.5 respectively, were visibly worse than the Memorex and JVC which were visually equal.

High Grade Tapes

In Japan, which is the prime well-informed market for home VCRs, there exists two grades of Beta and VHS cassette: Normal, and High Grade, the latter costing about 20% extra. This very fact supports our view that videocassettes are too variable. But to find out whether there are solid advantages in the High Grade idea we picked up a selection of such tapes during a recent visit to Tokyo. As can be seen from Table 3, on this small sample, high grade tapes were a cut above average. (This cut may be larger in Japan, where the standard tapes are generally inferior to ours.)

This is not to say that individual samples of the standard product may not be as good, but rather that the expenditure of slightly more money could, in principle at least, give a better tape. Please note that these high grade tapes are not sold in Europe, so the wise user will have to look for consistency in his available tape purchase within the existing range of products at the moment.

More on noise

With all the tapes tested the noise looked worse than the figures indicated in the tables. One reason given in the *Tech Intro* earlier is the trick of noise concealment used in the VCRs: the technique whereby noise, together with fine detail, is suppressed in flat areas of the scene. As explained earlier, this noise remains visible on edges as a shimmering effect. We switched out the noise concealment circuits in our tape tests, and all the figures worsened by 3dB with the JVC *HR3300* (to the non-technical: this is quite a lot).

Doing this still did not give a subjectively true figure for noise, as even without the noise

suppressor the edges were still worse than the flat areas. We went on therefore and set up a special edge-noise test, and this turned out to be the most accurate indicator of picture noise so far. At last the eye and the instruments were in agreement, and the visually inferior noise performance of the Ampex and TDK samples was measureable. Edge-noise on a good VHS tape plus machine can be around −36dB and on a poorer combination −30dB. As both these figures are on the lower limit of what is acceptable, even by the domestic user, one can see and now measure what is so often commented upon by our panel of users.

TABLE 1

Memorex E180
Luminance noise= −43dB

Sample	*Position on Tape*	*Dropouts/ Min.*	*Rating*
1	Head	22 *	V. Good
	1hr in	14	
	2hrs in	13	
	Tail	4	
2	Head	20 *	V. Good
	1hr in	14	
	2hrs in	9	
	Tail	12	
3	Head	31 *	Good
	1hr in	15	
	2hrs in	23	
	Tail	13	

AKAI E30
Luminance noise = −42dB

Sample	*Position on Tape*	*Dropouts/ Min.*	*Rating**
1	Head	83	
	Centre	88	Poor
	Tail	53	
2	Head	60 *	
	Centre	47	Poor
	Tail	55	
3	Head	42 *	
	Centre	34	Fair
	Tail	27	

JVC E120
Luminance noise= −43.5dB

Sample	*Position on Tape*	*Dropouts/ Min.*	*Rating*
1	Head	12 *	
	40 mins	9	V. Good
	80 mins	6	
	Tail	11	
2	Head	29 *	
	40 mins	18	Good
	80 mins	18	
	Tail	32	
3	Head	82	
	40 mins	48	Poor
	80 mins	40	
	Tail	35	
4	Head	50 *	
	40 mins	24	Fair
	80 mins	31	
	Tail	23	
5	Head	48 *	
	40 mins	23	Fair
	80 mins	34	
	Tail	25	

TDK Super Avilyn E180
Luminance noise= −43dB

Sample	Position on Tape	Dropouts/ Min.	Rating
1	Head	185	
	1hr in	77	V. Poor
	2hrs in	82	
	Tail	28	
2	Head	25 *	
	1hr in	14	Good
	2hrs in	21	
	Tail	11	

Ampex E105
Luminance noise= −42.5dB

Sample	*Position on Tape*	*Dropouts/ Min.*	*Rating*
1	Head	93	
	Centre	47	Poor
	Tail	58	
2	Head	238	
	Centre	70	V. Poor
	Tail	135	

Videocassettes

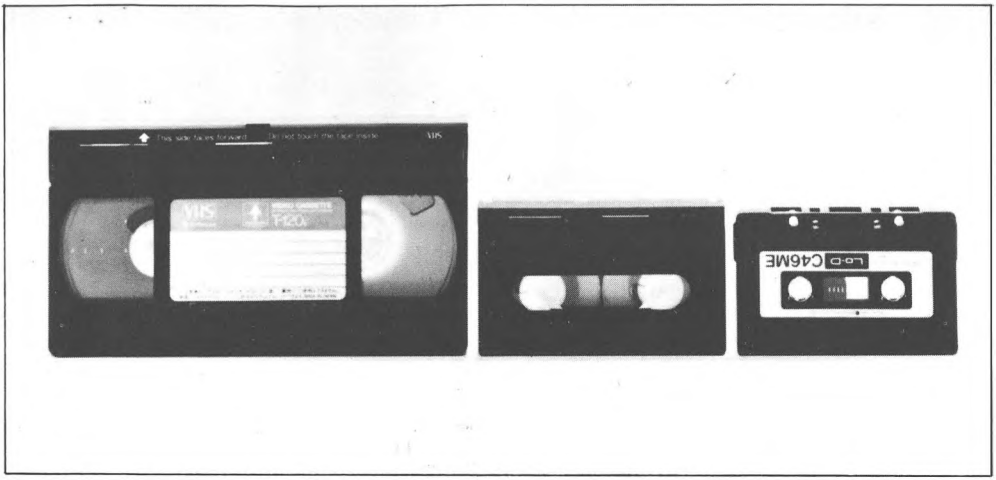


TABLE 2 — High Grade Tapes

Maxell HG T120
Luminance noise=−44dB

Tape Position	*Dropouts/Min.*	*Rating*
Head	25	
Centre	27	Good
Tail	21	

National HG T120
Luminance noise=−43.5dB

Tape Position	*Dropouts/Min.*	*Rating*
Head	13	
40 mins	13	V. good
80 mins	9	
Tail	7	

TDK HG T120
Luminance noise=−44dB

Tape Position	*Dropouts/Min.*	*Rating*
Head	21	
40 mins	8	V. good
80 mins	5	
Tail	10	

Tape Prices

VCR manufacturers' tape prices tend to be slightly higher than those of tape-only manufacturers. Their products are often better, but as our tests show, not always. Someone with a particularly good product will often be in short supply, and will therefore not offer discounts. Bulk buying of a known and tested brand is the most reliable answer to low costs.

There are back street suppliers of imported VHS cassettes made in Taiwan and Singapore, sometimes loaded with tape in the UK. The samples of such cassettes which we have tested are not quite as dangerous as the more legitimate manufacturers would have us believe. But they were certainly very poor in terms of dropout and noise.

CONCLUSIONS, BEST BUYS AND RECOMMENDATIONS

Having lived with assorted VCR's for very many months now, I have to confess that I will not be particularly anguished by their departure, unlike many of our panelists. Personally, I prefer real life to second-hand experiences such as television. And there are few programmes which stick in my mind as having had a momentous impact on my outlook or worldly development. Nevertheless occasionally there are things I would particularly like to see, so it would certainly be useful to have one around in the household (Landlord please note!) I suspect that my own requirements will be sufficiently few and far between for 'occasional access' to suffice.

It is quite interesting to observe how the attitudes of our panel of users developed during the course of their assessment of the various recorders. One user was a shift worker, normally at work from 6pm until well after midnight, and he found the ability to record popular viewing material from the previous night and view it during the afternoon such a delight that he will no doubt buy or rent a machine as soon as he can afford to. Despite being the least technically-inclined of our panel, he was astonishingly adept at figuring out exactly how each machine worked, and even what its little gremlins were, without the aid of an instruction book or any prompting from me.

Other users were more qualified in their enthusiasm, many noting difficulty in finding time to sit down and watch the programmes which had been duly recorded and stored for them by the apparatus. Many appreciated the child-pacifying effects of the machinery, building up small stocks of cartoons and similar material for children's entertainment as and when the need arose. One user found that having the machines around helped to awaken a dormant interest in TV production, and he is now carting video cameras around with him wherever he goes. Another user said that he wouldn't have one in the house, because he thinks he watches the box too much as it is, and that the VCR only makes temptation worse.

Reactions to individual machines developed over time, and some models went for re-runs if they had been among the first to arrive. As the tests proceeded, users became more critical of picture and sound quality, and more observant about the presence or absence of various facilities. Complaints about ergonomics and general design also increased as time went on, indicating that familiarity with video machines *per se* does not necessarily offset the difficulties arising from clumsy and ill thought-out layout and design.

As to the machines themselves, I still find myself remarking with wonder that the whole home video recorder business works at all. When you bring a videocassette machine into your house, you have in your hands a piece of apparatus much more sophisticated, and with mechanical parts working to much closer tolerances, than probably anything else in your home. That it all works quite reliably is a considerable tribute to the amount of design effort which has gone into home video recorders. Every one of the machines we tested worked when it came out of the box, and even the worst samples produced pictures and sound of perfectly adequate quality for following the fortunes of Dallas or Crossroads.

Turning now to individual machines, we have decided not to label the reviews with 'Best Buy' or 'Recommended' flashes at this early stage in the video review game. This is not because we have no opinion to the effect that some machines offer better value for money than others – we do indeed, and our attitudes will be made clear in the notes which follow. We feel rather that we ought to withhold these particular accolades until we have refined our techniques of measurement, assessing our own assessments in the light of the work embodied in this book and any subsequent feedback. Furthermore, the market and its machinery is in such a state of flux that one necessarily and perhaps unfairly is often comparing models from different 'generations'.

Many publications are offering reviews of video equipment, though few take the trouble to check through many technical measurements because (a) if they did, their readers would most likely be none the wiser and (b) the necessary equipment is expensive and not very easy to get hold of. (Some merely reprint the manufacturers' specifications at their face value!) We hope that we have provided a reasonable amount of both objective and subjective assessment of the products – though in retrospect there are some video measurements we would have liked to carry out had there been time to construct (note, not buy) the necessary test equipment.

VCRs under £500

Ferguson 3V22 (VHS, around £495)
This is a straightforward machine, granny and child-proof, with a one-shot eight-day timer and no-nonsense operation. Picture and sound was widely acceptable, though the tuner tends to suffer from misalignment. Best to check quality

before buying. Being one of the older models, it is now likely to be falling in price, but represents quite good value even at the price quoted above.

Hitachi VT 5000E (VHS, obsolete)
This straightforward, slightly dated machine has a good performance and no major nasties. It is worth tracking down on the ex-rental or second-hand market as a machine which in terms of straight playback and recording does no worse than many new ones, though dropouts were rather noticeable.

JVC HR 3300 EK (VHS, around £495)
This machine is virtually identical to the Ferguson *3V22*; indeed it is the 'parent' of quite a family of offspring, including many machines available with rental company brand names on them. The *3V22* comments above apply generally to this series.

Sanyo VTC 9300P (Beta, around £395)
This is an exceptionally low-priced machine which gives rather below average pictures, but might nevertheless prove satisfactory to the less critical user for whom the price is the greatest attraction. The timer is highly rudimentary (one-shot, three days, fixed duration), but the tape counter is excellent. Also available at the same price is the slightly tarted-up *VTC 9300PN*; although nominally idential, we hear that some have found significant quality improvements, so this machine is certainly worth checking out.

Sharp VC 7300H (VHS, around £495)
This is a neat-looking front-loader with adequate performance, arguably the most stylish of the lower-priced machines. Technical performance and timer versatility is mundane, but light-action keys replace mechanical controls.

VCRs from £500 to £600

Akai VS 9700E (VHS, around £540)
This is a basic machine with good picture and sound performance, but straight recording and playback only is provided. It is perhaps a little expensive, but a fine machine for the user who wants good quality reproduction without having to pay for all the trimmings.

Hitachi VT 8000E (VHS, around £525)
An up-to-date machine with touch controls, still frame and speed search, though only a basic nine-day timer. Very good performance for the price.

Toshiba V5470B (Beta, around £550)
Electrically identical to Bush models, this Beta machine gave a reasonable picture, though the sound quality was less well-liked. A seven-day three-option timer, full picture search and freeze-frame facilities put it in the category of good value for money.

VCRs £600 +

Grundig Video 2x4 Plus (V2000, around £645)
Something of an interim design, this machine shows off the potential of the V2000 system well, though it is somewhat taxing ergonomically and seemed to give rather inconsistent performance from day to day. A worthy challenge to the Japanese, with refreshingly different styling.

JVC HR 7700EK (VHS, around £785)
A very sophisticated machine with all standard facilities and trick effects. Rather daunting for those with twinges of technofear, but all the facilities work well. Picture quality was no better than cheaper models, and Dolby sound gave some improvement. However, it is only for the pretty enthusiastic at this high price.

Mitsubishi HS 300B (VHS, around £650)
This is a very competent machine well-liked by our users, with swift and accurate response to remote commands, and above-average sound quality. Speed search, still frame and slow motion available with excellent control logic.

Philips V2020 (V2000, around £675, but also discounted)
Ergonomically quite different from Japanese recorders, this one produced a mixed bag of reactions. It has original styling and good technical performance, with a useful 'go to' search facility, but is felt to be a little expensive for what is offered.

Sharp VC7700H (VHS, around £650)
A stylish front-loader, but it gives the impression of being a souped-up *7300H* rather than a sophisticated machine in its own right. No speed search, but variable speed playback and good stills are available. The remote control receiver is rather bulky. Rather expensive at the above price, it is worth considering if shopping around knocks off a significant amount.

Sony C7 UB (Beta, around £650)
This large battleship-grey machine was liked for its solid feel and gave the best Beta picture around.

Sound was acceptable, remote control fairly straightforward, but the still frame rather poor. It is very good value if the above price is significantly discounted.

Finally, a little rummage around the technical measurements, tabulated in the comparison chart. Subjectively, the best picture came from the Sony and Grundig, the best sound from the Mitsubishi (also good picture). Other good picture quality came from the Toshiba, the Sharp *7700*, the Philips, the Grundig, both Hitachi models, the Akai, and the up-market JVC *7700*. Some reservations remained concerning the JVC *3300*/Ferguson *3V22* model, the Sanyo, and the Sharp *7300*.

Most of the machines produced sound to which fairly uncritical TV viewers would not normally object. The machines which were rated poorest in this respect, the Grundig and the Toshiba, may well perform quite adequately for your requirements, and you should make a point of listening carefully to see how acceptable you find the sound if you are thinking of buying one of these models.

For those particularly sensitive to wow and flutter, the best machines in this respect were the Philips, the Mitsubishi and the Sony. And if pressed we would say that the latter two machines are probably our favourites overall from the VHS and Betamax camps respectively. With the V2000 format, the Grundig shows off the 'trick-frame' performance well, but the Philips has an appeal which grows on one when its unusual layout and ergonomics have been mastered. We would certainly not write off either of these machines as a lost cause simply because this is at present the third most popular format in the UK.

COLOUR CAMERAS AND PORTABLE VCRs

The first point to be made again here is that cameras and portable VCRs do not, so far as we can discern, have a clearly defined use, unlike the mains VCR. From our limited sample, where the truest colour pictures at reasonable cost are needed, the **Philips V200** camera provides just that, with a high sensitivity good zoom lens with close-up (macro) feature and efficient auto white balance. In operating principle it is the only model reviewed with the classic three tube and prism colour splitter found in broadcast colour cameras, and the results are justified where the lack of battery operation and awkward hand-held operation can be accepted: on a tripod it is alright.

Where battery operation and hand-held or shoulder operation is required, the **Sony HVC-3000P** had far and away the strongest mix of technical performance and operator acceptance: in appearance and features it imitates the bigger brothers used in broadcasting for news gathering. The colour processing principle used may not please the theoretician, but at first acquaintance this does not matter. In the long term, such a design is harder to adjust and repair when compared with the Hitachi range, but we expect

that its virtues will outweigh that fact. A rather more negative factor is that this handiest of cameras is married to the least handy portable VCR; the **Sony SL-3000**. This heavyweight machine is at least sturdy and gives good recording quality.

Although we were unable to do the technical measurements, subjectively the **Sanyo 545P** provides very close competition for Sony's *3000* camera, at a roughly comparable price.

Topmost marks for total colour camera performance and versatility must go to the Sony **DXC-1800P**, but this is only relevant to those willing to fork out the three-fold price difference between this industrial model and its consumer competition.

The neatest combination of performance and convenience in a portable VCR was found in the **Hitachi VT-7000E**, even if the accompanying **VK-C750** camera did not rate too well. However Hitachi has the widest range of colour cameras in the broadcast, industrial and consumer categories of any manufacturer. The **VK-C500** which we reviewed is clearly no longer representative of Hitachi's state of the domestic art and illustrates the rapid rate of improvement in cameras (*cf* also Sony *2000 vs 3000*). Its replacement the *VK-K770* is now being supplemented by a *saticon VC-K800* model at under £800.

For those wishing to use rather than entertain and impress, black and white cameras should not be ruled out. We tested the little **Sanyo VC 1400**, it was quite sharp, had low lag, high sensitivity, low weight, and much the lowest cost. Where simple activities have to be recorded, such a camera is much less bother to use. And when pictures are needed in hostile lighting conditions a black and white camera is less distracting than any colour camera.

TELEVISION RECEIVERS

Turning now to the television receivers, it was pleasing to note that the development of more adjustment-free sets (as described in the Technical Introduction) has led to a more uniformly high standard of performance. Most of the defects which we noted were minor, but it is important to point out that for the most part they could have been corrected by slight adjustments internally – to focus or convergence controls, or occasionally to tuned circuits in the receiver or the colour decoder parts of the set.

What this means is that the ultimate quality of picture and sound is still very much at the mercy of the skill with which the receiver has been adjusted, and also how stable these settings remain after a period of time. With the average period between service calls lengthening as each new design comes out, it is all the more important for the analogue performance of the receiver to remain stable for a long period, since previously a slight 'tweak' here and there just to restore optimum focus or colour balance would have been part and parcel of a normal service call. In the early days of colour television, it was not uncommon to have three service calls a year; nowadays, once in two or three years is more usual.

So there is no such thing as a 'greenish' model, or a set for people who prefer 'pastel' colours. A properly designed colour receiver will be capable of giving exactly the same colour reproduction as any other properly designed and adjusted receiver. But looking at the ghastly displays of picture in rental company windows (no names, no pack drill), one fears that very few dealers in the mass rental market have showroom staff who are capable of manipulating even the brightness, colour and contrast controls correctly (never mind the fancy controls inside). For their benefit, and for anyone else who wants to have a go, this is how to set a colour TV up.

Start by turning the colour control to minimum, and turn the contrast control down until the picture is very faint (turning the brightness control up so that you can still see it). Now adjust the brightness control so that the *darkest* parts of the picture are *just* black. Leave it in this position, and turn the contrast control up until the picture is sufficiently bright for your taste.

Do not over-advance the contrast control, because a protection circuit known as the 'beam limiter' may come into operation to prevent bright pictures overstressing the tube and other high-voltage components. The effect of this circuit is to reduce the contrast on bright scenes, while

letting it run riot on very dark scenes, which produces an unnatural and unpleasant effect. The best setting for the contrast control is well back from the point where the tube begins to defocus on the bright parts of the screen.

To recap then – turn the contrast right down, adjust the brightness so that the dark parts of the picture are just black, then turn the contrast up (but not too much) to get a reasonable picture under subdued domestic lighting. Excessive settings of contrast or brightness will wear the tube out before its time. To make fine adjustments, use the brightness control to set the brightness of the *dark* parts of the picture, and the contrast control to set the brightness of the *light* bits.

Now that you have got a satisfactory monochrome picture (with the colour control turned right down) you can check three things quite easily. First of all you may notice coloured fringes round objects, particularly those round the edges of the screen. This is known as *misconvergence*, so-called because it arises when the three red, green and blue pictures fail to converge exactly on top of each other. Normally this should be only just noticeable at normal viewing distance.

The second thing to look for on the monochrome picture is whether or not it is actually black-and-white, or whether some parts of the picture (usually the dark areas) have a residual tinge. If they do, the colour reproduction will be slightly out, particularly in the dark areas. If you do notice a coloured tinge to the black-and-white picture, the phrase to impress your TV engineer with is 'poor grey-scale tracking'. He may think you are an insufferable know-all, but at least he'll know what to do!

Thirdly, you may notice slightly discoloured patches in certain areas of the screen. This is called 'impurity' and arises from residual magnetism being collected by the shadowmask plate inside the tube. This can be cured by demagnetising the set using a special coil, and is a job for a technician.

Having got the black-and-white picture right, the next step is to advance the colour control to get the amount of colour you require. Again this control should not be overadvanced – there were people in the early days of colour (and there are probably some still around today) who took the view that having paid dear for a colour set and licence they were going to make sure they got their money's worth, and turned the colour up as far as it would go. The effect of this is to destroy all the pastel shades and make everything a lurid red, green or blue. The correct setting may be determined by the purist aided with a magnifying glass.

If you look at the testcard, you will see that the girl is wearing a red dress. Take a magnifying glass, and inspect the screen where it is showing the dress. With the receiver set to monochrome, you will notice strips or dots of red, green and blue evenly illuminated. As you turn the colour up, the red dots or strips will get brighter and the green and blue dots will get dimmer. The correct setting for the colour control is *just* at the point where the blue and green strips or dots are extinguished. If the control is advanced beyond that point, some of the subtlety of the colour will begin to be lost.

In summary, the receivers which we tested were all capable of a creditable picture when carefully set up. Some may find the Sony's picture a little too sharp, and the B&O will outperform the Philips on a very weak and noisy signal. The best sound came from the Philips, with the B&O a close second and the others trailing behind with mundane if not objectionable quality. The Ferguson is far and away the cheapest of the sets, and comes out very well from our inspection nonetheless.

Philips Video Centre: an attractive Swedish design using a similar TV section to the 797, but further improved sound, a VCR, and a monitor.

As with radio tuners, a set can only be as good as the signal it receives. The best place for a set-top aerial is usually the dustbin, unless you live close to a transmitter and there is an unobstructed path from the aerial to the transmitting mast. Otherwise, a roof-mounted aerial of the correct type, lined up accurately towards the transmitter, is a necessity.

POST SCRIPTUM

On our tests

There is a feeling amongst both TV engineers and the public that broadcast television tests and specifications are esoteric rituals designed to amuse technical staff when the station is off the air. Nothing could be further from the truth! All the original parameters for picture quality were based on the reactions of normal viewers in good, but not exceptional viewing conditions. Individual pieces of the television transmission chain may look good on paper and to the eye, but taking the whole chain from camera to viewers screen, there are a dozen or more links which introduce distortions which add up to a real loss in quality to the ordinary, non-technical viewer.

The worst offenders are still the video recorders. Despite their £50,000 price tag, the double or triple copying needed for certain productions produces blurred and streaky colours (particularly bright reds).

Imagine you take a portable VCR and camera on holiday and shoot a total of three hours of tape. Unless you are hopelessly self indulgent you will admit that fifteen or twenty minutes are worth keeping. You cannot cut these good bits out with scissors (as is the case with home cine), so you edit them by transferring the selected passages onto a new 30 minute tape, possibly adding titles as you go (this operation needs a second VCR with special features).

Now your aged aunt in Australia asks to see a photograph of the children. Doing one better, you re-hire the second VCR used for your editing, and copy the complete thirty minutes onto a third cassette.

You now have a 'third generation' tape in TV jargon, because it is a copy of a copy of an original. Such editing and copying is normal in broadcast television, and one can often see the blurred colours that come from doing this work with a slightly maladjusted studio video recorder. No home video recorder made so far will do what we described above without such severe distortions that even the failing eyesight of the aunt will be offended. Some carefully selected machines with very carefully selected tapes might *just* get away with it, but not reliably, for long.

And yet, using the expensive Shibasoku noise measuring set, which is the industry standard for Japanese home VCR manufacturers, the measurements we obtained on domestic machines are on a par with the £50,000 broadcast machines. This should in theory allow for several generations of copying. But the eye tells us that one recording is visibly deficient, and that copying gives quite bad results. This fact spurred us on to find measurements which would give the reviewer and the user yardsticks which agree with the eye. We can now relate our measurements to what the viewer might call the 'fuzz factor'.

As viewer awareness develops, this 'fuzz factor' of current VCRs will become an increasingly important issue; *after* which I expect the manufacturers will start improving their VCRs in this key area.

With cameras measurements are easier. The conventional though not necessarily easy tests for sharpness, sensitivity in low light levels, colour accuracy etc, which are applied to all professional cameras, can and should be used to guide the would-be-purchaser through the minefield of manufacturers' claims. We have been disappointed at how few objective measurements are attempted by the many home video journals now on the market. On a more practical level, as we have seen, neither the manufacturers nor the magazine reviewers have come clean on just how difficult it is to get decent pictures in the normally lit domestic room. Additional lighting of the kind developed for home cine to the tune of at least one thousand watts of quartz iodine bulbs is needed.

VCR Features

Operationally almost all reasonable features likely to be needed are distributed among the various machines offered. Bearing in mind the large storage capacity of the medium (from 3 to 8 hours maximum), the ability to *locate* a programme is a feature worth paying extra for, particularly if the owner wishes to put all twenty parts of an Open University series onto one tape.

The most often missed feature is an easy to set timer. It is not just the non-technical who had trouble with machines like the Grundig . . . As one who has had to design multiple on-off switches for institutional off-air recording, I can vouch for the fact that there is much room for improvement here.

CONCLUSIONS, BEST BUYS AND RECOMMENDATIONS

Which format is best?

This is a common question which no one wants to tackle: it is much easier to talk individual features than to attempt to assess the fundamental merits of the three contenders. Despite the reviewers' wish to sit on the fence, it needs to be remembered that the tapes themselves could well cost more than the machine in the end, so a decision made now is likely to lock the owner onto a tape format which he may not wish to afford to change for a long time, despite several changes of machine.

The Philips/Grundig V2000 system had the most advanced features including the longest cassette playing time, the best slow motion, and *potentially* the best sound and picture quality. However both Philips and Grundig are behind the Japanese in the exploitation of their ideas: some features which were intended to be unique are already found in VHS and Beta models! Also, the European and American manufactured cassettes used in the V2000 series machines are generally inferior to those made in Japan for Beta and VHS, which has put a real, if perhaps unfair, handicap on the system. Other handicaps are the lack of a battery portable (Grundig have suggested there's not too long to wait) and the lack of pre-recorded programmes (there are signs that these are now becoming available in quantity). So being *potentially* best has not so far been good enough. And while wishing the European effort well, one just wonders whether it will be out-manoeuvred by the competition.

Of the other two, Betamax is *technically* best, with its larger scanner and very well controlled tape path. Our user-panel generally confirmed that the Sony *C7* Betamax gave the best pictures so far on a home machine (with the Toshiba not far behind). However even this does not get us away from the fact that Sony with their Beta format have, for once, been out-manoeuvred by the rival group led by Matsushita (JVC and Panasonic), their VHS format being adopted by a larger grouping of political and manufacturing weight. This has the inevitable consequence that VHS has the largest PAL (*ie* UK playable) catalogue of pre-recorded tapes.

In the future

Mains VCRs will give less fuzzy pictures with better tapes – possibly including metal formulations. Hopefully there will be improved timers that even the non-engineer can set. Facilities for quick and easy programme location will be further developed, and if the Philips/Grundig camp really get organised, their DTF system should permit useful single frame recording, or animation features.

Funai/Technicolour lightweight portable

Sony's suggested camera/recorder format

Portables are unlikely to get much smaller or lighter using the present three formats, but the new Technicolour minirecorder based on a very small 30 minute ¼-inch tape is the forerunner of several portable alternatives to the home time-shift VCR formats. Another development in the portable field is now on sale in Japan, as the Sharp *VC2000*, in the form of a battery/mains VHS recorder with built-in timer and tuner, the battery option allowing occasional use in the field. With its 39 x 30 x 15cm dimensions and 8.8kg all-up weight it is no worse than some stereo portable radio cassettes. (Available Nov '81 as *VC2300* in UK, priced at £570.)

Cameras will progress in the direction of higher sensitivity, with reduced image stick, or lag, so that recording under domestic lighting conditions will be possible. This is almost available

The world's favourite home video system now has an 8-programme, 14-day memory.

STOP PRESS
Total production now reached 2m sets.

VHS is already far and away the world's favourite home video system.

Our VHS recorders owe their superb picture quality to their quartz-locked, direct-drive video cylinder motor and rugged aluminium diecast chassis. A design combination born of the Matsushita group's matchless experience in the demanding fields of audio components and TV studio equipment.

Now the NV-7000, with a compact new motor and chassis, raises performance and flexibility to new heights. While taking up even less space than its predecessor.

It can be programmed to make up to eight separate recordings on the same or different channels. Up to 14 days ahead.

The remote control supplied with the 7000 commands twelve different functions. Including scene seek. (Press the cue and review button and you can scan a tape backwards or forwards at nine times normal speed).

You can also flip through a tape at double speed to reach the action. Then slow it down to half-speed. Freeze it. Advance the picture frame by frame.

The 7000 has a 12-channel preset electronic tuner. Dolby* noise reduction. Feather-touch electronic switches that enable you to instantly change from, say, rewind to play without pushing the 'stop' button.

In fact, this is the smartest, most sophisticated video recorder we've ever offered for your home.

But don't take our word for that. Go along to your Panasonic dealer and see for yourself.

Any video recorder sets a family free from TV time-tables. But you're clearly better off with a Panasonic.

VHS

Home Video Recorder

National Panasonic

Just slightly ahead of our time.

Panasonic, National and Technics are brand names of Matsushita Electric.

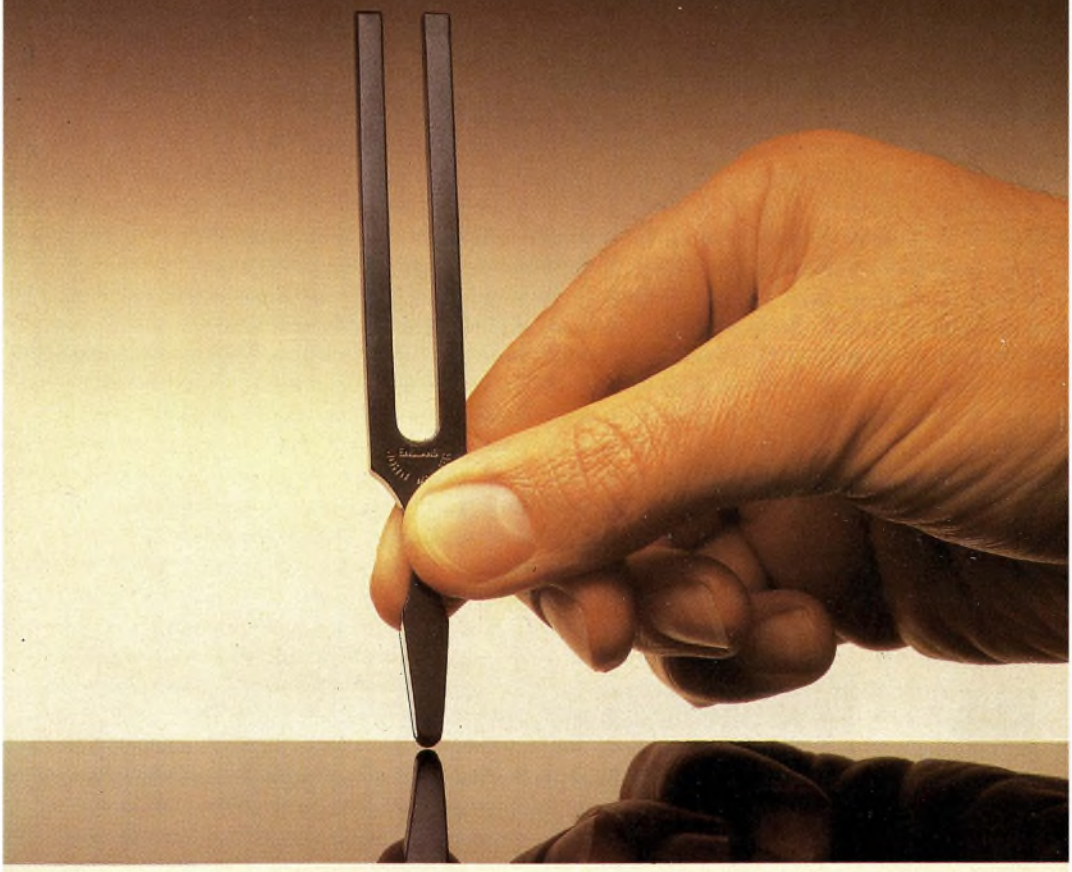
TV pictures/mulated Recording and playback of material may require consent. See Copyright Act 1956. *Dolby and double-D symbol are trademarks of Dolby laboratories.

For further details please contact: National Panasonic (U.K.) Ltd., 300/318 Bath Road, Slough, Berks. SL1 6JB. Tel: Slough 34522.

If some Japanese speakers sound a little oriental in tone, it's not that they're any less well engineered than their European counterparts but simply because they're tuned to different tonal values. What sounds ideal in Japan however, can sound rather off-key to a European ear and vice versa; which is why Sony have taken the rather unusual step of building their loudspeakers in Europe and tuning them to the ears of a European listening panel, rather than those of a Japanese engineer.

The result is a tonal balance of which any European loudspeaker would be proud, together with an enviable level of engineering, designed to optimise sound performance and not merely flatter the eye.

The vital difference between Sony and Japanese speakers.



In our SS-G series all three cones are "plumb-in-line" so that the sound waves travel the same distance to the ear, thus minimising phase distortion.

An acoustic grooved baffle absorbs unwanted waves and gives a clearer, cleaner sound, while specially designed stands reduce "floor boom," and position the high frequency units at their ideal level, ear height.

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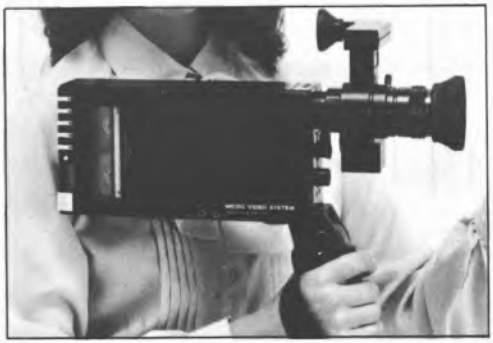
VT

CONCLUSIONS, BEST BUYS AND RECOMMENDATIONS



Hitachi (top) and Matsushita mini-formats.

with the Sony *DX 1800* industrial camera, but of course the price is not feasible for most private individuals. The sensitivity of this Sony camera is a result of its *Saticon* tube. Such tubes are already offered as an alternative in certain Japanese home-price cameras. For example, in Japan the Sharp *XC-1P* costs around £300, while its *XC-1S Saticon*-tubed version is around £350. Neither are available in Europe yet, but Hitachi (the inventors and proprietors of the *Saticon* tube) will probably be first in the UK with a home *Saticon* camera, having announced the *VC-K800* to the trade in May 1981) followed possibly by JVC and others during 1981 and 1982. I expect less from the much-vaunted solid state (CCD) camera, because I think the tube camera will progress during the next few years, getting smaller, lighter and more sensitive, thus staying ahead of the fundamentally more attractive solid state sensor. However, low power consumption remains a powerful incentive to develop CCDs.

In the near future the video enthusiast will be treated to System TV, equivalent to unit audio, where colour display monitors of various sizes will be matched by tuners, VCRs, video mixers, caption generators, and other desirable accessories.

Sharp's mains/battery VC2300, available Nov '81

Hitachi VC-K800 offers a saticon tube for £800.

TVgames

Ten years ago, if you had asked someone to explain a television game to you, the chances are that they would have started discussing TV shows like 'The Golden Shot' or 'Take Your Pick'. Ask the same question today and you'll probably hear words like 'Space Invaders' or Atari and Intellivision. These are not television quiz shows, but sophisticated, electronic interactive video games. The TV game today is one of a host of electronic systems taking part in the so-called video revolution, a revolution so significant that it is completely changing the public attitudes towards the domestic television receiver.

The TV set today is no longer restricted by programme schedulers, Video cassette recorders can 'time shift' transmitted programmes to more convenient times. The latest feature films are now available on pre-recorded cassettes, often costing little more to purchase outright than taking a family of four to the cinema. Powerful data banks can now display their contents via transmission systems like *Teletext* and *Prestel*. In the last year or so, potent home computers allow anyone with enough cash to become a computer 'expert' in the comfort of their own home. All of these machines owe their public acceptance to an ingenious development first devised in the late sixties: the TV game.

The TV game is basically a simplified computer, wherein the program or game has been built into the computer during manufacture. The patterns (or graphics) that make up these games are generated by a series of microchips. To put them into a form acceptable by the domestic television receiver they are fed to a device known as a modulator, which converts the signals into high frequency radio waves suitable for insertion into the TV receiver's aerial socket.

The latest generation of TV games use the ubiquitous microprocessor chips to create games of even greater complexity; Two of the most recent machines even allow the user access to the microprocessor *via* a typewriter keyboard. With just a few hours instruction it is possible for users to write their own new games. These developments tend to overshadow the short but eventful history of the domestic TV game which has been with us for just eight years.

The story so far

The true roots of the TV game can actually be traced right back to the early sixties. A young graduate student at the Massachusetts Institute of Technology named Steve Russell devised a computer program called *Spacewar*. Details of the program soon reached computer programmers working on industrial and commercial computers. Conservative estimates at the time reckoned that several million dollars worth of computer time was lost by programmers playing Spacewar on their employer's machines between 1962 and 1966.

The first attempt to use a TV receiver for a television game display was in 1967. A gentleman called Ralph Baer developed the first fully interactive TV game whilst working for a company called Sanders Associates. The game was quite sophisticated by today's standards, but the available technology couldn't justify a mass produced version at a realistic price. Baer's game was finally developed by one of America's largest TV manufacturers, Magnavox. The first public demonstration came in 1972 when Magnavox launched the *Odyssey* game. It was quite crude compared to modern games, but it gained immediate public acceptance, despite Magnavox's claim that it would only work on their sets.

A couple of month's prior to the Magnavox launch, another small company called Atari had demonstrated the first coin operated TV game, in a bar called Andy Capp's in Sunnyvale, California. Within two days of the machine being installed the owner of the bar had complained to Atari that the machine had broken down. An engineer was dispatched. Unable to find a fault with the electronics he checked the coin box mechanism; it was jammed full of coins!

Magnavox had the domestic TV game market pretty much to themselves for four years. In 1976 the Scottish plant of General Instruments (one of America's largest semiconductor manufacturers) announced a device that was to revolutionise the TV game market. This device was a microchip designated *AY38500*. It was the very first single chip TV game. Prior to the GI chip the electronics used to generate a TV game had consisted of dozens of seperate chips. The *AY38500* was able to generate six separate games, now familiar to most of us as the ball and paddle versions of Soccer, table tennis, squash, solo and two shooting games. Almost overnight, hundreds of small companies sprang up to manufacture TV games. Companies like Magnavox, relying on obsolete technology, were effectively cut out of a very lucrative market.

The GI chip dominated the market for a couple of years until another semiconductor manufacturer, Fairchild, developed the programmable TV game in 1978. Now, for the first time, the TV game market began to stabilise. The programmable TV game meant that a game would not

become obsolete as soon as a new game appeared. Instead the game was sold in two parts: the *master console*, which contained all of the circuitry needed to generate a TV picture and sound effects; and the *game cartridge*, which contained all of the information to make up the graphics for each game. In theory all a TV game needed was a constant supply of new cartridges to remain forever up to date.

Poor marketing strategy by Fairchild and some quick thinking by the Atari company led to a new game, programmable of course, being launched by Atari with some substantial backing from Warner Brothers (now Warner Communications). The Atari *Video Computer System* is now the most popular programmable TV game on both sides of the Atlantic but even that could change with the recent launch of a new game called the Mattel *Intellivision*, the fourth generation of TV games.

The ground work for the fourth generation was laid by Philips with a machine called the *G-7000*. This was an undistinguished programmable TV game, but it did have one important bonus: it allowed the user access to the microprocessor inside the games console *via* a keyboard. Philips made one crucial error with the *G-7000*: they used a rather complicated computer language known as Hexadecimal. Few people outside the computer industry could ever hope to become familiar with the machine, but the potential of such a system was immediately recognised by Mattel, one of the largest multinational toy companies.

The only other likely game in the programmable group is our own *Rowtron* machine. This was only launched a few months ago, but the range of cartridges already exceeds that offered for the Philips game. From the point of view of game content the *Rowtron* also scores highly, most of the games being based upon the ability to think, rather than react quickly. At £69.95 this could become the best sub £100 game available.

The only other game worth serious consideration is of course the Mattel *Intellivision*. There are some 20 different cartridges available at the moment, each one being several times better in terms of graphics and playability than comparable Atari games. The rather restrictive price tag of just under £200 is likely to drop in the near future. With the addition of a computer keyboard and a few hours of tuition it can become a powerful minicomputer, while still costing less than computers of comparable ability.

Specialist games

Though we have tended to look only at the pub or arcade type TV games, it is as well to know that there are one or two specialist TV games that are beginning to make their presence felt. The first and most obvious is the Space Invader game that has taken over public bars up and down the country. The game is felt to be so compelling that one company has developed a purely dedicated Space Invader game from one of their minicomputer systems. The company in question, Tangerine Computers Ltd, employ one of their highly successful *Microtan* computers in a dedicated role. If the game should ever pall the unit can be easily converted back into a computer.

The second of the specialised games is the chess computer developed by Optim Games Ltd. This machine is similar to the many chess computers now on the market, except that it displays the board directly onto the TV screen. This machine is really only of interest to confirmed chess enthusiasts, as the chess cartridge for the Atari TV game is almost as powerful and provides a machine with greater versatility for about the same cost.

Before we leave the super-dedicated game altogether, a few quick words on the current craze surrounding the pub and arcade games might no come amiss. Most of the coin-operated TV games use a similar setup to the *Intellivision* game, in that they employ a powerful microprocessor to do all the work. Before *Intellivision* was launched the arcade games had a virtual monopoly on high resolution graphics. This situation has now changed, and it has become apparent that the threat posed by *Intellivision* has led arcade game manufacturers to look towards even more powerful computers. There are however practical and financial limitiations that prevent arcade games from progressing much further. Already predictions from the US point out that the next generation of TV games will depend to a greater degree on the skill and imagination of the software engineers. These battles to develop games with even more sophisticated graphics will inevitably lead to spin-offs in the domestic TV game sector, so it is possible that the days of the pub and arcade games are numbered. Which will at least offer some relief to those who believe that a pub is a place for drinking, not fighting intergalactic space battles.

Future trends

A fifth generation of TV game is already making its way across the Atlantic. Frontrunner is undoubtedly the *Imagination* machine from Ohio Scientific. The main difference between this and the previous generation is the change of emphasis in marketing strategy. The technology, now well established, holds few surprises. *Imagination* relies solely on the fact that it is first and foremost a computer. The game side of its nature can be seen on the two hand controllers which sport a pair of joysticks. It is a rather sobering thought that the computer, once held in awe by the general public, is now sold as a TV game.

Predicting the ultimate fate of the TV game is about as easy as sexing a wild ferret, but there are a few pointers to be found based on past experience. Public acceptance of new games has been progressing on a logarithmic scale. The first ping-pong games held us all entranced for a couple of years. Simple dexterity games like *Breakout* enjoyed a life of just over a year or so. *Space Invaders*, although still to be found in the odd pub, has already made way for the more upmarket *Galaxian* games. Within the past few months new space games like *Meteorite* have been draining our pockets, but not quite so readily as past games.

The domestic games manufacturers tend to follow the coin-operated games, so it would seem that the space game era is drawing to a close. This would tend to tie in with the move towards user programmability. This facility lends itself to those games that rely less upon the dexterity factor. Currently the amateur computer market is obsessed by the so-called *Adventure* or 'Dungeons and Dragons' type games, where a degree of brainwork is needed to win. And as this type of game is not suitable for the short duration coin operated games, it would therefore seem reasonable to assume that the pub game will ultimately disappear. This void could well be filled by the traditional – and quieter – pub games that are rumoured to be making a comeback. The domestic TV game will develop into a home computer in its own right, with the capability to interface directly with other data systems like *Prestel* and *Teletext*. Using standard data transmission systems such as those already used over the telephone system would enable people to play games on their machines against opponents hundreds or thousands of miles away. It is even possible to envisage electronic game olympics with the contestants linked by satellite. That may sound rather far fetched, but not we suspect as improbable as the TV game concept might have sounded to Mr Logie Baird.

Mattel had really done their homework. They had taken the best points of all the TV games and combined them into a new game that will undoubtedly dominate the TV game market for some time to come. The *Intellivision* game uses the most powerful microprocessor that can be practically incorporated into a TV game. In the first instance this gives the Intellivision incredibly versatile graphics. The quality of the games are such that it is tempting to compare them with high quality cartoons, unlike the rather crude 'boxy' shapes that are used by the Atari and Philips machines. The second advantage of such a large microprocessor (at least twice as powerful as any previously used) is that user access is not only possible but actually desirable.

Intellivision uses BASIC (Beginners All-purpose Simple Instruction Code) language, which

can be used by almost anyone with a working knowledge of the English language. With the addition of an optional typewriter/keyboard unit, the *Intellivision* becomes one of the most powerful home computer systems on the market. Ironically the *Intellivision* computer is considerably more powerful than the machine used by Steve Russell to play *Spacewar*.

The state of play today

The TV game market today is clearly stratified into three distinct sections. At the low end of the scale are the simple 'dedicated' games based on the *AY38500* and its derivatives. Usually these simple games cost well under £30; for example, the current market leader in this country is produced by Binatone and costs just £18.95 (including a pistol for the two shooting games).

The middle of the market is dominated by the programmable TV games. Costing from £70.00 to a little over £100.00, we have the Atari *VCS*, Philips *G-7000*, a couple of close relatives of the early Fairchild game, and a new machine that was designed and built in this country by a company called *Rowtron*.

The last group has only one member at the moment; the Mattel *Intellivision*. At just under £200 this is the most expensive TV game ever. It's also the most versatile.

It has become clear over the past two years that programmable TV games are firmly in the province of the fringe computer industry. Early ball-and-paddle games were devised by electronic engineers, hence the simplified graphics and rudimentary reaction-type formats. The programmable TV game offers much more scope for imaginative use of the game's microprocessor. Many of the games devised for machines like the Atari are actually written by 'moonlighting' software engineers, because the training and demands made by the computer industry are ideal conditions for budding games-writers. This is more than apparent in two recent games cartridges launched by Atari: *Superman* and *Adventure* are in fact simplified versions of the so-called 'Dungeons and Dragons' games surreptitiously played by software engineers on large computers, and rely more upon logical thinking than manual dexterity. This trend, coupled with the 'dual personality' of a user programmable game is likely to continue; indeed on the *Intellivision* it is difficult to tell where the dividing line between computer and TV game lies.

The movement towards thinking games is well illustrated by our very own British game the *Rowtron*. The games cartridges for this particular

machine are heavily biased in favour of logical games, and although these games appear superficialy simple in content, half an hour's play on games such as 'Four In A Row' will convince most people otherwise. The ability of machines like the *Intellivision* to accept programs written by the user offers unequalled scope for imaginative and budding computer programmers. Experience has shown that the pretty graphics games tend to pall after a few hours play. Games like chess, with powerful programs that will challenge a Grand Master, will outlive the simpler basic games.

Choosing a game system

From past experience many of us have learnt that the electronic industry moves with alarming speed. But of course it's not just advances in technology that can make domestic electronic equipment redundant, fashion plays an important role. And unfortunately the whims of fashion have made many otherwise excellent TV games out of date even before they are removed from their packing. For those of you in the market for a TV game, here are some of the more salient DOs and DON'Ts to bear in mind when parting with your money.

Simple dedicated TV games are undoubtedly the cheapest, but by their very nature they are incapable of playing anything besides the games built in during manufacture. Some dedicated games do purport to be programmable, but these should be avoided at all costs. The glut of dedicated games after the launch of the first programmable game prompted one or two enterprising manufacturers to use dedicated games in cartridges for semi-programmable systems. The problem lies with the simple fact that it is highly unlikely such systems will ever get any new games. Early dedicated game chips like the *AY38500* relied upon the chip to do all the work. Modern programmables use a microprocessor which is programmed by the game cartridge. All

of the current game cartridges are in fact 'memory' chips, cheap and simple to produce. Semi-programmable games use the dedicated games which are expensive to produce. These games are easily identified, firstly by the unusually low price (under £50.00), and also by the titles of the half dozen or so games, which almost always include a speedway game and a simple tank game.

By far the best buy at the moment is the Atari game. Worried by the announcement of the Mattel system and with the possibility of they themselves developing their own computer-oriented TV game, Atari have reduced the price of their system to a little under £100. There are indications however that this price may not be held for much longer, and a price-tag of about £120 is considered by some to be more realistic.

Currently there are some 32 different cartridges in the Atari range, plus another dozen or so unofficial cartridges being manufactured by a company called Activision. Each of the Atari cartridges has, on average, some twenty variations, so taken overall there are some 800 different games for the Atari. This, plus excellent customer back-up facilities in the form of clubs and user-groups, has ensured its survival.

Less fortunate is the Philips *G-7000*. After the initial launch euphoria and understandable optimism by Philips, it looks as though this machine has reached its peak. With just 18 cartridges and no apparent moves by Philips to add to this, it seems destined to become a reluctant museum piece.

RECOMMENDATIONS/SUMMARY

Atari Video Computer System

The Atari was, and still is, the most popular user-programmable TV game. Over 30 different game cartridges are now available. Each cartridge has on average 30 game variations making over a 1,000 game possibilities. With the recent 'second sourcing' of cartridges from a company called Activision, the range of cartridges for the Atari *VCC* system will soon double.

The Atari can be found for as little as £99.00 in some discount stores, though on average expect to pay around £120 for the basic game unit (including one cartridge), plus £13 to £30 for each additional cartridge. At present the *Space Invaders* cartridge is the most popular game in the Atari range.

Mattel Intellivision

At around £200 for the basic *Intellivision* unit, the popularity of this machine has taken the video game market by surprise. This machine sells on its superb graphics and on its ability to expand into a sophisticated home computer system, with optional extras like the keyboard unit (£300 extra) and a variety of peripherals like floppy disc drives and printers.

As a pure video game the *Intellivision* owes much to the groundwork already carried out by companies like Atari, plus the recent dramatic reduction in semiconductor logic circuitry costs. Around 20 game cartridges are available at the moment with about the same number already in the pipeline. The *Intellivision* is also finding favour in educational establishments, where the flexibility of the accessible on-board microprocessor can be used as a powerful teaching aid.

Philips G-7000

The Philips *G-7000* is technically in-between the Atari and Mattel programmable games, in that it allows for a degree of user programmability but in a limited and complicated computer language known as machine code. The 20 or so game cartridges available for this machine offer fairly unsophisticated graphics, but one or two of the games do demand more than just simple dexterity to compete.

The limited interest shown towards this machine by the public has made the introduction of new cartridges somewhat doubtful. The relatively high price, when compared with other programmables (around £99) has also reduced the appeal of this otherwise innovative machine. Extra cartridges cost from £13 to £18.

Rowtron Computer System

Several middle market machines all share the same basic circuitry. But the Rowtron in particular stands out as an earnest attempt by a British company to compete in this highly lucrative market. The basic machine costs around £70 (inclusive of one cartridge) and additional cartridges cost £12 each. The software for this machine has been largely written in this country and reflects the current state-of-the-art in British programming.

Much of the emphasis in American games and games intended for the American market is placed on the visual appeal of the graphics and the simplified nature of the games themselves. The Rowtron system is different in that many of the games require a degree of thought, rather than the more easily acquired dexterity that soon enables a game to be easily beaten.

Binatone TV Master 6

The *Master 6* is one of the few surviving examples of TV games built around the *AY38500* integrated circuit that revolutionised the manufacture of TV games. This dedicated TV game plays six 'ball and paddle' dexterity games, including a couple of 'target' games. (This involves the use of an optoelectronic gun that 'recognises' a moving spot of light on a TV screen.)

The *TV Master 6* is now sold under the Binatone banner, and sells in most chain stores for under £20. This includes the gun needed for the target games, and all of the graphics are in colour.

Binatone Superstar

The *Superstar*, again from Binatone, is an example of a semi-programmable TV game. The low price of around £30 hides the fact that there is virtually no possibility of any new games ever being produced for this machine. Only about a dozen games are available for this and similar systems, and all of them involve rather dated graphics and fairly simply mastered games.

Extra cartridges for the *Superstar* cost about £11, so buying this machine and its range of cartridges could be a poor investment compared with an Atari or Rowtron system, as these average more games per cartridge than the whole range of *Superstar* cartridges put together.

Other games worth looking out for.

Database: programmable, similar to Rowtron. Typical price around £75.

Acetronic: similar to Rowtron and Database. Typical price around £80.

Sportsworld 10: updated version of the *TV Master 6*. Price around £25.

Videograms

Television is the most technically inadequate of all the mass media. It fails to achieve its objective more completely than the cinema, than hi-fi, than photography, or than the printed word.

For example, if the purpose of a hi-fi system is to enable you to close your eyes and imagine you're in a concert hall, while you might well argue that this has not yet been achieved, you probably wouldn't fall about laughing at the concept.

Listening to a simple piece of music on a very good hi-fi system could very well lead you to make the observation that it 'sounds as if the performer is in the room'. But have you ever felt the urge to reach out and shake hands with the image of Richard Baker when he reads the news? Of course not.

The reason that TV simply doesn't work in this sense is that your eyes are used to coping with very much more information than your ears, and technology has not yet come within a mile of producing a device which will do for our eyes what a loudspeaker can do for our ears.

We have all seen top quality television pictures: most of us spend several hours each day looking at them, so we know that 'hi-fi video' is not a realistic concept at the moment. By this token *any* further degradation in the TV picture quality will be noticeable; much more than a couple of extra decibels of noise from an audio amplifier, for example.

So, we have a television system with a technical specification, which is the equal of any other in the world, but which is hampered by some very serious compromises. And there are three competing home video systems which have technical specifications set far below broadcast standards in order to maintain a realistic selling price.

When it comes to pre-recorded tape duplication, this clearly means that there is no margin for further signal degradation. Sadly if not unexpectedly, however, standards tend to fall still further, and we find that the constraints of the technical specification is just one of many limitations.

Let's start at the beginning. An independent pre-recorded cassette distributor has obtained the video rights of a major feature film. Half a dozen cans of film arrive at his office, what happens next?

If he's conscientious – and most of them are – he will simply sit down and watch the movie. If he's lucky he'll have been given a new and uncut print made from the original negatives.

More likely, however, is that some film has arrived which has already been run for seven days of continuous performances at a dozen or so flea-pits up and down the country. It'll have been broken, damaged, had coffee thrown over it, and caught fire when the projector motor failed. If the print came from America and had been used for television, whole chunks may have been cut out to satisfy the sensitive morality of the North American TV audience.

It's at this point that he gets on the telephone to the owner of the film and, we like to think, threatens terrible consequences unless a better copy is provided. And, given a little persistence, he should eventually get the standard of original film he wants.

I said earlier that TV is an inferior medium to cinema films. Anyone who has ever been to a video performance at a cinema, or even looked at the standard of definition on a large-screen projection TV, will realise that the picture is nowhere near as sharp.

But there's no real problem here. Converting high definition films to low-definition video should present no difficulties. True enough, except that the pictures are usually the wrong shape!

Television screens have an aspect ratio of four to three – that's to say the height of the picture is three-quarters of the width. This is approximately true also of normal 35mm cinema films, but nowadays Cinemascope and 70mm wide-screen films are commonplace. Since the TV screen obviously can't be made wider (though we understand the Japanese are working on this! *Ed.*); there has to be yet another compromise.

This can take three forms. Either the overall size of the picture may be shrunk, which results in a blank strip above and below the picture and a reduction in definition because of the wasted space. Alternatively bits can be chopped off each end of the picture, so that something gets lost but at least a normal-looking picture results. Or the edges may be squashed inwards and the picture stretched upwards: nothing is missed, but all the characters look anorexic.

In fact different circumstances demand different techniques, and quite often a combination of these methods is used.

Clearly it would be absurd to cut the ends off the opening and closing credits, because they would be impossible to read. At the same time viewers find the distortion caused by 'squashing' on normal pictures very disturbing.

In practice the normal approach, at least in the section without titles, is to cut off the outer edges and use an experienced operator to 'pan' to and

fro with the action.

This works fine for ninety-five percent of the time, but when it goes wrong it may go badly wrong. For example, in Magnetic Video's version of *The Alien* there are important sequences where the viewer needs to read written information displayed on the visual display unit of a computer. This fills the screen at the cinema, but when the telecine operator cut a third of the screen area off, the sequence was effectively destroyed.

At the time of writing this transfer technique is an art which is almost perfect when practised by the BBC and ITV companies. But things can still be a little slapdash with some of the video companies. No doubt however matters will improve fairly quickly with experience.

So now our video distributor has transferred his film to video tape by some means or another. This is normally one-inch broadcast-quality mastering tape, although there is still the odd company using Sony's semi-professional U-matic cassette system. What happens next?

If you think professional tape duplication companies use sophisticated high-speed precision duplication equipment then forget it. They make their VHS, Betamax, and Video 2000 tapes in exactly the same way as you and me – and usually on the same machines.

It probably comes as some considerable shock when the innocent arrives at a duplication house and finds himself confronted with hundreds of standard domestic video recorders, all connected to a single open-reel mastering machine. The operator takes ordinary blank cassettes, inserts them into each of the machines, and then makes the recording in the normal way. No automation, no high-speed working, no bulk tape.

This apparently primitive approach does work surprisingly well, and it is a tribute to Japanese manufacturing skills that their machines will work so long and hard with reasonable reliability.

Nevertheless, quality control is a problem. Unlike the better hi-fi audio cassette recorders, it is not possible to monitor recordings as they are being made. It would be prohibitively expensive to provide special machines with two video head drums, and it would also be uneconomic to pay someone to sit and watch each tape all the way through for faults, although each tape is normally checked briefly at several points along its length before depatch.

The duplication houses basically rely upon a rigid programme of machine maintenance and the provision of a reliable tape cassette for quality control. Happily high standards are possible in both these areas, though the arrangement falls far short of the ideal.

In practice, experience has shown that something like ten percent of pre-recorded tapes are definitely unsatisfactory. Most of the remainder I would regard as *almost* as good as home-made ones. Usually the sound quality is the first to suffer: non-Dolby VHS and Betamax can only achieve a 40dB signal-to-noise ratio at the best of times, and this is soon degraded if the audio heads get dirty. The picture is also often noticeably noisier than home recordings.

While most people in the industry would agree that the present duplication procedures have significant shortcomings, progress on improving the situation seems slow.

Various companies are talking vaguely about more rugged 'professional' slave machines which would improve the consistency of the product, although the recording would still need to be done in 'real time'.

A more elegant idea is rumoured from Panasonic. They are reported to be working on an inductive system, whereby a special master tape carries an enormously powerful signal. This is strong enough that simply pressing a blank tape against it transfers the recording and makes the copy, rather like a printing machine.

There are unfortunately significant technical problems with this kind of approach, and the cost of the master tape is said to be very high, so it is difficult to tell whether this is a realistic proposition at present.

Of course the duplication techniques which are clearly technically superior to present cassette copying processes are those used for video discs. Both JVC's *VHD* and Philips' *Laservision* have a specification virtually identical to broadcast standards (but have of course the fundamental disadvantage that the user can't make his own recordings). And, despite claims to the contrary, it has still to be proved that they can be manufactured in bulk more cheaply than cassettes. Thereby, however, hangs another tale.

Meanwhile, despite their shortcomings, pre-recorded video cassettes normally do produce acceptable (though far from inspired) sound and video recording quality, and are an increasingly economic method of providing good 'cinema' entertainment at home.

FEATURE FILMS

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ACES HIGH	Malcolm McDowell, Chris. Plummer	110	37.50	EMI
ACQUSANTA JOE	Ty Hardin		38.95	JUB
ADVENTURES OF SHERLOCK HOLMES' SMARTER BROTHER, THE	Gene Wilder, Madeline Kahn	87	29.95	MAG
AFRICA – TEXAS STYLE		109	39.95	GHV
AFRICAN QUEEN, THE	Bogart, Katherine Hepburn	101	19.95	MAG
AGONY AND THE ECSTASY, THE		134	39.95	MAG
AIRPORT '77		116	39.95	CIC
ALASKA WILDERNESS ADVENTURE	Pioneer life in Alaska	90	39.95	INT
ALIEN ENCOUNTERS	Great story with a twist	90	29.90	VCL
ALL ABOUT EVE	Bette Davis, George Sanders	132	39.95	MAG
ALLEGHENY UPRISING/BACK FROM ETERNITY	John Wayne, George Sanders/Anita Ekberg, Rod Steiger	165	39.95	KVD
ALL IN A NIGHTS WORK	Dean Martin, Shirley Maclaine	91	29.95	MAG
ALL QUIET ON THE WESTERN FRONT	Richard Thomas, Ernest Borgnine	123	39.95	PRV
ALL THE PRESIDENT'S MEN		135	39.95	WHV
ALPHA BETA	Albert Finney	65	39.95	INT
ANGELS WITH BOUND HANDS	mafia involvement in boxing	87	39.95	INT
ANTONY AND CLEOPATRA	Royal Shakespeare Company	162	39.95	PRV
ASPHYX, THE	Robert Stevens, Robert Powell	76	39.95	INT
ASSAULT ON PRECINCT 13	Austin Stoker, Laurie Zimmer	91	39.95	VPD
AUTUMN SONATA		92	29.95	PRV
BACK TO BATAAN/ROADBLOCK	John Wayne, Anthony Quinn/ Charles McGraw, Joan Dixon	165	39.95	KVD
BAIT		79	39.95	VTX
BAIT, THE	Donna Mills, Michael Constantine	72		RNK
BALLAD OF DEATH VALLEY		90	39.95	INO
BATTLE OF EL ALAMEIN	Michael Rennie			IFS
BELSTONE FOX, THE	Animal adventure fim	99		RNK
BERLIN EXPRESS/ISLE OF THE DEAD	Robert Ryan, Merle Oberon/ Boris Karloff	165	39.95	KVD
BEST OF THE BADMEN/SEALED CARGO	Robert Ryan,Claire Trevor /Dana Andrews, Claude Rains	165	39.95	KVD
BEYOND ATLANTIS	John Ashley, Patrick Wayne	95	39.95	INT
BIBLE, THE	George C Scott, Richard Harris	151	39.95	MAG
BIGGEST BATTLE, THE		110	39.95	HOK
BIG FLAME, THE	BBC TV drama	85		BFI
BIG LAND, THE/PIONEER BUILDERS	Alan Ladd, Virginia Mayo/ Richard Dix, Ann Harding	165	39.95	KVD
BIG SKY, THE/CODE OF THE WEST	Kirk Douglas, Arthur Hunnicutt /Raymond Warren	165	39.95	KVD
BIG SLEEP, THE		95	29.95	PRV
BIM		104	29.95	WOV
BLADE		91	36.95	GHV
BLAZING FLOWERS	Dope and the Mafia	90	39.95	INT
BLOOD AND SAND	Tyrone Power, Linda Darnell	120	29.95	MAG
BLOOD FEUD	Sophia Loren, Marcello Mastroianni	92	29.95	PRV
BLOOD ON THE SUN	James Cagney	120	29.95	MNT
BLOODY KIDS	Derrick O'Connor, Garry Holton	87	29.95	PRV
BLUE BLOOD	Oliver Reed, Fiona Lewis	86	39.95	INT
BLUE MAX, THE	George Peppard, James Mason	149	39.95	MAG
BOND ITIS	Frank Born suffers from Bonditis	93	39.95	INT
BONNIE AND CLYDE	Warren Beatty, Faye Dunaway	111	39.95	WHV
BOSS, THE	Henry Silva		38.95	JUB
BOSTON STRANGLER, THE	Henry Fonda, Tony Curtis	110	29.95	MAG
BOYS FROM BRAZIL, THE		124	39.95	PRV
BRAVE BUNCH, THE	John MMiller, Maria Xenia	90	39.95	GOV
BREAKING AWAY		96	34.95	MAG
BRIDGE TOO FAR, A		176	5.95	INT
BRIEF ENCOUNTER	Celia Johnson, Trevor Howard	86	34.95	RNK
BRIEF ENCOUNTER	Sophia Loren, Richard Burton	99	29.95	PRV
BRUTE, THE	Julian Glover, Sarah Douglas	90	29.95	BWV
BUILD MY GALLOWS HIGH/HELL'S HIGHWAY	Kirk Douglas, Robert Mitchum/Richard Dix	165	39.95	KVD
CALL OF THE WILD	Charlton Heston, Michelle Mercier	100	34.50	VID
CAREFREE/EASY LIVING	Fred Astaire, Ginger Rogers/ Victor Mature, Lucille Ball	165	39.95	KVD
CARNAL KNOWLEDGE	Jack Nicholson, Candice Bergen	93	29.95	MAG
CARQUAKE	David Carradine		34.50	LVC
CASABLANCA	Humphrey Bogart,Ingrid Bergman	102	5.95	INT
CASSANDRA CROSSING		126	39.95	PRV
CC AND COMPANY	Joe Namath, Ann-Margret	91	29.95	MAG
CHAMPION	Kirk Douglas	98	30.00	PGV
CHARLY	Cliff Robertson, Claire Bloom	103		RNK
CHEVIOT, THE STAG AND THE BLACK, BLACK OIL	BBC TV drama	90		BFI
CHINATOWN	Jack Nicholson	131	N/A	CIC
CIRCUS WORLD	John Wayne, Claudia Cardinale	132	39.95	INT
CLEOPATRA	Liz Taylor, Richard Burton	176	39.95	MAG
CODY	A boy, a dog & a miracle	74	34.50	IFS
COMING HOME	Jane Fonda, Jon Voight	127	5.95	INT
COMMANDOS	Lee Van Cleef	100	36.95	GHV
CONTRACT	Kenneth Farrington	33	26.00	IFS
CONVOY	Kris Kristofferson, Ali McGraw	106	39.50	EMI
COOL HAND LUKE		115	39.95	MAG
CORNERED/WOMAN ON PIER THIRTEEN	Dick Powell,Walter Slezak /Robert Ryan, John Agar	165	39.95	KVD
CORONATION STREET	The first episode	26		BFI
CORONATION STREET	Episode P694/482	26		BFI
CORONATION STREET	Episode P694/483	26		BFI
CORONATION STREET	Episode P694/697	26		BFI
CORONATION STREET	Episode P694/822	26		BFI
CORONATION STREET	Episode P694/823	26		BFI
COTTER/ISLAND OF LOST WOMEN	Don Murray, Rip Torn/ Alan Napier, Venetia Stevenson	165	39.95	KVD
COUNT OF MONTE CRISTO		98	29.95	PRV
CRACK-UP/I WALKED WITH A ZOMBIE	Pat O'Brien, Claire Trevor/ Famed horror movie!	165	39.95	KVD
CROSS OF IRON	Maximilian Schell, James Mason	128	37.50	EMI
CRUEL SEA, THE	Jack Hawkins	121	37.50	EMI
CULLODEN	BBC TV drama documentary	70		BFI
DAM BUSTERS, THE	Richard Todd	119	37.50	EMI
DAMNED, THE		84	39.95	WHV
DANCING YEARS, THE		143	39.95	PRV
DARING GAME	Lloyd Bridges	79	34.60	IFS
DAY OF THE WOLVES/GANGBUSTERS	Richard Egan, Martha Hyer Myron Healey	165	39.95	KVD
DAY THE EARTH CAUGHT FIRE, THE	Worldwide chaos	100	39.95	INT
DAYS OF HOPE: JOINING UP	BBC TV drama	95		BFI
DAYS OF HOPE: 1921	BBC TV drama	100		BFI
DAYS OF HOPE: 1924	BBC TV drama	80		BFI
DAYS OF HOPE: GENERAL STRIKE	BBC TV drama	135		BFI
DEADLY FEMALES, THE	Tracey Reed, Rula Lenska	103	34.50	IFS
DEADLY HERO	Don Murray, Dinah Williams	98	29.95	MAG

DEAREST LOVE		118	5.95	INT
DEATHCHEATERS	2 stunt men become spies	75	36.95	GHV
DEATH GAME	Sondra Locke	85	39.95	INT
DEATH OF A SNOWMAN	Joey Gallo against the Mafia	84	39.95	INT
DEATH ON THE NILE	Peter Ustinov, Jane Birkin	135	39.50	EMI
DEATH WISH	Charles Bronson	93	N/A	CIC
DEER HUNTER, THE	Robert de Niro, Meryl Streep	176	39.50	EMI
DELIVERANCE	Jon Voight	105	34.95	WHV
DELTA FACTOR	Christopher George	90	29.90	VCL
DETECTIVE, THE	Frank Sinatra, Jack Klugman	110	29.95	MAG
DEVIL'S CANYON/A CRY IN THE NIGHT	Dale Robertson, Virginia Mayo/ Natalie Wood, Raymond Burr	165	39.95	KVD
DIAL M FOR MURDER		102	39.95	WHV
DIARY OF ANNE FRANK, THE		144	39.95	MAG
DIRTY HARRY		103	39.95	WHV
DIRTY MARY, CRAZY LARRY	Peter Fonda, Susan George	89	29.95	MAG
DISAPPEARANCE, THE	Donald Sutherland	90	29.90	VCL
DOGPOUND SHUFFLE	Ron Moody, David Soul	93	29.95	PRV
DOLL SQUAD, THE	Fast moving action	90	29.90	VCL
DOMINO KILLINGS, THE	Gene Hackman	95	29.95	PRV
DON'T LOOK NOW	Don Sutherland, Julie Christie	106	45.00	EMI
DRESSED TO KILL	Basil Rathbone, Nigel Bruce	120	39.95	MNT
DRIVER	Ryan O'Neal, Bruce Dern	88	39.50	EMI
DR JEKYLL AND MR HYDE	Musical version with Kirk Douglas	90	29.90	VCL
DRUMBEAT/TO BEAT THE BAND	Alan Ladd, Charles Bronson/ Johnny Mercer, Hugh Herbert	165	39.95	KVD
EAGLE HAS LANDED, THE		131	39.95	PRV
EL CID	Charlton Heston, Sophia Loren	150	39.95	INT
ELECTRIC HORSEMAN, THE		120	N/A	CIC
ENCHANTED ISLAND/WESTWARD PASSAGE	Dana Andrews, Jane Powell/ Laurence Olivier, Ann Harding	165	39.95	KVD
ENGLAND MADE ME	Peter Finch, Michael York	90	29.90	VCL
ESCAPADE IN JAPAN/A GIFT FOR HEIDI	Cameron Mitchell, Teresa Wright/ Sandy Descher, Douglas Fowley	165	39.95	KVD
ESCAPE TO ATHENA	Roger Moore, Telly Savalas	115	39.95	PRV
EVERYBODY'S WAITING		11	15.00	AVM
EVERY MAN IS MY ENEMY	Robert Webber, Elsa Martinelli			IFS
EXISTANCE	Jack Wild	86	34.50	IFS
EYEWITNESS	Mark Lester, Lionel Jefferies	88	29.95	PRV
FABULOUS DORSEYS, THE	Tommy & Jimmy Dorsey	120	29.95	MNT
FALL OF THE GIANTS	Jack Palance	91	39.95	INO
FALL OF THE ROMAN EMPIRE, THE	Sophia Loren, Stephen Boyd	178	39.95	INT
FALLEN IDOL, THE	Michele Morgan	91	37.50	EMI
FAMILY ENFORCER		81	34.74	INT
FAMILY LIFE	Sandy Ratcliff	102	39.50	EMI
FAREWELL MY LOVELY	Robert Mitchum, Charlotte Rampling	91	29.95	PRV
FAR FROM THE MADDING CROWD	Julie Christie, Alan Bates	159	45.00	EMI
FERRY TO HONG KONG	Orson Wells, Curt Jurgens		34.50	LVC
55 DAYS AT PEKING	Charlton Heston, Ava Gardner	148	39.95	INT
FIVE DESPERATE WOMEN	Robert Conrad, Anjanette Comer	73	36.95	GHV
FLIGHT TO HOLOCAUST	Patrick Wayne, Christopher Mitchum	90	29.90	VCL
FLORIDA CONNECTION, THE	Dan Pastorini, June Wilkinson	102	39.95	INT
FLYING LEATHERNECKS/DANGER PATROL	John Wayne, Robert Ryan/Harry Carey	165	39.95	KVD
FORGOTTEN MAN, THE	Dennis Weaver, Anne Francis	71		RNK
FOR LOVE OF IVY	Sidney Poitier	102	39.95	GHV
FORTY MILLION BUCKS	Rod Taylor, Stuart Whitman	82	39.95	DAV
FOXHOLE IN CAIRO	True story about Eppler's career	80	39.95	INT
FRAGMENT OF FEAR	David Hemmings, Gayle Hunnicutt		34.50	LVC
FRANK SINATRA SHOW, THE		53	29.95	VTX
FREELANCE	Ian McShane	95	39.95	DAV
FRENCH CONNECTION, THE	Gene Hackman, Fernando Rey	100	29.95	MAG
FROM HOLLYWOOD WITH LOVE		52	25.46	VCL
FROM THE EARTH TO THE MOON/JACK AND THE BEANSTALK	Joseph Cotten, Debra Paget/ Abbott & Costello	165	39.95	KVD
FUGITIVE, THE/FOLLOW ME QUIETLY	Henry Fonda, Ward Bond William Lundigan	165	39.95	KVD
FURY ON WHEELS	Tim Ligon, Logan Ramsey	85	39.95	INT
GANGSTERS: EPISODE 6	BBC TV drama	50		BFI
GENTLE GIANT	Dennis Weaver	79	34.50	IFS
GENTLEMEN PREFER BLONDES	Marilyn Monroe, Jane Russell	88	29.95	MAG
GETTING OF WISDOM, THE		100	36.95	GHV
GETTING OVER	featuring the Love Machine	107	39.95	INT
GIRL IN EVERY PORT, A/RETURN OF THE BADMEN	Groucho Marx, William Bendix/ Robert Ryan, Randolph Scott	165	39.95	KVD
GIRL IN GOLD BOOTS		90	25.46	VCL
GO-BETWEEN, THE	Julie Christie, Alan Bates	112	40.00	EMI
GODFATHER, THE		171	N/A	CIC
GOODBYE, NORMA JEAN		91	39.95	INT
GREAT BALLOON ADVENTURE, THE	Katherine Hepburn	84	39.95	INT
GREAT EXPECTATIONS	Michael York, Sarah Miles	119	39.95	PRV
GREAT HEROES OF THE BIBLE	Abraham's sacrifice	45		VCL
GREAT HEROES OF THE BIBLE	Daniel and the lion's den	40		VCL
GREAT HEROES OF THE BIBLE	Daniel and Nebuchadnezzer	50		VCL
GREAT HEROES OF THE BIBLE	David and Goliath	36		VCL
GREAT HEROES OF THE BIBLE	The deluge	50		VCL
GREAT HEROES OF THE BIBLE	Joseph and his brothers	50		VCL
GREAT HEROES OF THE BIBLE	Joshua and Jericho	56		VCL
GREAT HEROES OF THE BIBLE	The judgement of Solomon	32		VCL
GREAT HEROES OF THE BIBLE	Moses	60		VCL
GREAT HEROES OF THE BIBLE	Samson and Delilah	50		VCL
GREAT HEROES OF THE BIBLE	Sodom and Gomorrah	48		VCL
GREAT HEROES OF THE BIBLE	The story of Esther	50		VCL
GREAT HEROES OF THE BIBLE	The ten commandments	50		VCL
GREAT HEROES OF THE BIBLE	Tower of Babel	50		VCL
GREAT HOUDINIS, THE	Paul Michael Glaser	96	38.95	GHV
GREAT MONKEY RIP OFF, THE	Alan Hale	87	39.95	INT
GREEN BERETS, THE	John Wayne	135	39.95	WHV
GRIFFIN AND PHOENIX	Heartwarming love story	94		RNK
GRISSOM GANG, THE	Kim Darby	128	38.95	GHV
GUNS OF THE TIMBERLAND/BENGAZI	Alan Ladd, Jeanne Crain/ Richard Conte, Victor McLaglen	165	39.95	KVD
HALFBREED/WALK SOFTLY, STRANGER	Robert Young,Janis Carter /Joseph Cotten, Alida Valli	165	39.95	KVD
HAZELL MEETS THE FIRST ELEVEN	Thames TV drama	51		BFI
HEARTBREAK KID	Charles Grodin, Cybill Shepherd		39.95	MAG
HEIST, THE	Virna Lisi, Charles Aznavour	90	39.95	INT
HELL IN THE PACIFIC	Lee Marvin, Toshiro Mifune	103	38.95	GHV
HELL IS EMPTY	Anthony Steel	105	39.95	DAV
HELL IS EMPTY	Martine Carol, James Robertson Justice	90	39.95	HVS
HELL ON FRISCO BAY/THE MAD MISS MANTON	Alan Ladd, Edward G Robinson/ Henry Fonda, Barbara Stanwyck	165	39.95	KVD
HELL'S ANGELS ON WHEELS	Jack Nicholson	95	34.95	MAG
HENRY VIII & HIS SIX WIVES	Keith Mitchell, Donald Pleasance	120	39.50	EMI

HERCULES CHALLENGE		95	39.95	INO
HEROES, THE	Duccio Tessari, Rod Steiger		34.50	LVC
HIGHER AND HIGHER/STRICTLY DYNAMITE	Frank Sinatra, Victor Borge/ Jimmy Durante, Lupe Velez	165	39.95	KVD
HIGH RIDERS	Mel Ferrer	88	34.50	IFS
HOLLYWOOD KNIGHT		80	39.95	VUL
HONEY BABY	Diana Sands	90	34.50	IFS
HOT ROCK, THE	Robert Redford, George Segal	97	29.95	MAG
HOUSE OF THE SEVEN CORPSES	John Ireland	89	39.95	DAV
HUMAN EXPERIMENT, THE			29.95	JAG
HUMAN FACTOR, THE	David Attenborough	115	39.95	RNK
HUMAN FACTOR, THE	George Kennedy, John Mills	91	34.50	IFS
HUSSY	Helen Mirren, John Shea	85	39.95	VIP
HUSTLER, THE	Paul Newman, Jackie Gleason	130	39.95	MAG
I'M ALL RIGHT JACK	Ian Carmichael, Peter Sellers	101	37.50	EMI
IN BROAD DAYLIGHT	Richard Boone	73	36.95	GHV
INDISCRETION OF AN AMERICAN WIFE	Jennifer Jones, Montgomery Clift	72	36.95	GHV
INGLORIOUS BASTARDS, THE		87	39.95	HOK
IPCRESS FILE, THE	Michael Caine	108	39.95	RNK
ISLAND OF THE LOST	Adventure			IFS
JAWS	Robert Shaw, Roy Scheider	124	N/A	CIC
JAWS 2	Roy Scheider	116	N/A	CIC
JESSI'S GIRLS		86	34.74	INT
JESUS OF NAZARETH	(four films) Ave.	142	29.95	PRV
JOE PANTHER	Brian Keith, Ricardo Montalban	105	39.95	INT
JUST A GIGOLO	David Bowie	90	29.90	VCL
KID DYNAMITE		60	16.95	WOV
KILLING OF SISTER GEORGE, THE	Beryl Reid, Susannah York	134		RNK
KIND OF LOVING,A	Alan Bates	107	37.50	EMI
KLUTE	Jane Fonda, Donald Sutherland	114	39.95	WHV
KNIFE FOR THE LADIES	Jack Elam, Ruth Roman	51	31.95	GHV
KOTCH	Walter Mathau	114	38.95	GHV
LADY CAROLINE LAMB	Sarah Miles	118	39.50	EMI
LADY VANISHES, THE	Elliot Gould, Cybill Shepherd	99	39.95	RNK
LAST DAYS OF POMPEII, THE/MYSTERIOUS DESPERADO	Preston Foster, Basil Rathbone/ Tim Holt, Richard Martin	165	39.95	KVD
LAST OF THE VIKINGS	Action adventure	100	39.95	INO
LAST VALLEY, THE		122		RNK
LAST WAR, THE	Doomsday drama	76	34.50	IFS
LEAGUE OF GENTLEMEN, THE		112		RNK
LEGACY	Roger Daltrey, Katharine Ross	95	39.95	VIP
LEGEND OF ALFRED PACKER, THE	Survival in the Rocky Mountains	90	39.95	INT
LEMON POPSICLE		95	39.95	HOK
LENNY	Biography of Lenny Bruce	112	5.95	INT
LICENSED TO LOVE AND KILL	Gareth Hunt, Nick Tate	92	39.95	INT
LITTLE PRINCESS, THE	Shirley Temple, Cesar Romero	120	29.95	MNT
LONG DAY'S JOURNEY INTO NIGHT	Katharine Hepburn, Ralph Richardson	135	30.00	PGV
LONG DAY'S JOURNEY INTO NIGHT	Laurence Olivier, Constance Cummings	162	39.95	PRV
LONGEST DAY, THE	John Wayne, Robert Mitchum	169	39.95	MAG
LOVE AND BULLETS	Charles Bronson, Rod Steiger	99	29.95	PRV
LOVE HATE LOVE	Ryan O'Neal, Lesley Warren	70		RNK
LOVE IS A SPLENDID ILLUSION	Simon Brent, Andree Flamand	87	39.95	INT
LOVE STORY	Ryan O'Neal, Ali McGraw	100	N/A	CIC
MACKINTOSH & TJ	Roy Rogers, Clay O'Brien	93	39.95	RNK
MADAM SIN		89	29.95	PRV
MADIGAN'S MILLION		89	39.95	INO
MAGNIFICENT MEN IN THEIR FLYING MACHINES, THOSE	Sarah Miles, Stuart Whitman	127	39.95	MAG
MAGNUM FORCE	Clint Eastwood as Dirty Harry	124	39.95	WHV
MAIN EVENT, THE	Barbra Streisand, Ryan O'Neal		39.95	WHV
MALACHI'S COVE	Donald Pleasance, Dai Bradley	89	39.95	INT
MALPERTUIS	Orson Welles, Susan Hampshire	89	39.95	INT
MANHUNT	Woody Strode		36.95	JUB
MARCH OR DIE	Gene Hackman	99	29.95	PRV
MEAN JOHNNY BARROWS	Fred Williamson, Roddy McDowell	80	39.95	INT
MEAN STREETS/MOVIES ARE MY LIFE		180	39.50	HIK
MEMORY OF US		87	34.74	INT
MERCHANT OF VENICE		128	39.95	PRV
MIGHTY JOE YOUNG/DOUBLE DANGER	Ben Johnson, Robert Armstrong/Preston Foster	165	39.95	KVD
MISSION BLOODY MARY		99	39.95	INO
MISS JULIE	Helen Mirren	105	36.95	GHV
MOBY DICK	Gregory Peck	110	39.50	EMI
MORGAN – A SUITABLE CASE FOR TREATMENT	Vanessa Redgrave, David Warner	93	37.50	EMI
MOSES THE LAW-GIVER		141	39.95	PRV
MR BLANDINGS BUILDS HIS DREAM HOUSE/MEXICAN SPITFIRE AT SEA	Cary Grant/Lupe Velez,Leon Errol	165	39.95	KVD
MR KINGSTREET'S WAR/GHOST SHIP	John Saxon, Tippi Hedren/Richard Dix	165	39.95	KVD
MR SYCAMORE	Jason Robards, Sandy Dennis	85	39.95	INT
MURDER ON THE ORIENT EXPRESS	Albert Finney	122	39.50	EMI
MY BOYS ARE GOOD BOYS	Ralph Meeker, Ida Lupino	85	39.95	INT
MY SON THE VAMPIRE	Arthur Lucan, Bela Lugosi	120	29.95	MNT
MYSTERY SUBMARINE	Incredible adventure	92	39.95	INT
NAKED AND THE DEAD, THE/HI GAUCHO	Cliff Robertson, Raymond Massey/John Carroll	165	39.95	KVD
NAKED CIVIL SERVANT, THE	John Hurt	88	39.50	EMI
NAKED KISS, THE		95	39.95	VUL
NEITHER THE SEA NOR THE SAND	Susan Hampshire	94	36.95	GHV
NETWORK	Peter Finch, Faye Dunaway	121	5.95	INT
NICKELODEON	Burt Reynolds, Ryan O'Neal	117	37.50	EMI
NIGHT TO REMEMBER, A	Kenneth More	123	44.95	RNK
96 FILM, THE		11	15.00	AVM
NO-MERCY MAN, THE		91	34.74	INT
NO 1 LICENSED TO LOVE AND KILL		92	34.74	INT
NO 1 OF THE SECRET SERVICE	Nicky Henson, Richard Todd	91	39.95	INT
NORMA RAE	Sally Field, Jeff Bridges	109	34.95	MAG
NORTH WEST FRONTIER	Lauren Bacall, Kenneth More	87	34.95	RNK
OIL THE BILLION DOLLAR FIRE	Stuart Whitman, Ray Milland	91	39.95	INT
OKLAHOMA CRUDE	George C Scott, Faye Dunaway	111	34.50	LVC
OLD MAN WHO CRIED WOLF, THE	Edward G Robinson	74	36.95	GHV
ONE FLEW OVER THE CUCKOO'S NEST	Jack Nicholson, Louise Fletcher	129	39.50	EMI
ONIBABA	Nobuko Otowa, Kitsuko Yoshimuro	105	39.95	INT
OUTLAW, THE/LAW OF THE UNDERWORLD	Jane Russell, Walter Huston/ Anne Shirley, Chester Morris	165	39.95	KVD
OUTRAGE	Robert Culp, Marilyn Mason	77	36.95	GHV
PAID WITH BULLETS, THEY	Peter Lee Lawrence	85	39.95	INT
PANIC CITY	Austin Stoker, James Pickett	92	39.95	INT
PANIC IN NEEDLE PARK		106	39.95	MAG
PATTON	George C. Scott, Karl Maiden	164	39.95	MAG

PAWNBROKER, THE	Rod Steiger	109	30.00	PGV
PENNY GOLD	Francesca Annis, James Booth	90	39.95	HVS
PERILS OF PAULINE, THE	Betty Hutton	120	29.95	MNT
PORRIDGE		95	29.95	PRV
POSEIDON ADVENTURE, THE	Gene Hackman, Ernest Borgnine	113	29.95	MAG
POWER PLAY		98	39.95	RNK
PRESSURE		110	5.95	INT
PRIVATE VICES, PUBLIC VIRTUES	Mayerling story	102	39.95	INT
QUEEN FOR CAESAR, A	Gordon Scott	95	39.95	INO
RABBLE ROUSERS		64	39.95	MNT
RAISE THE TITANIC	Jason Robards, Richard Jordan	109	39.95	PRV
RANK AND FILE, THE	BBC TV drama	75		BFI
RATTLE OF A SIMPLE MAN	Harry H Corbett, Diane Cilento	91	29.50	EMI
RAW DEAL	Gerard Kennedy, Gus Mercurio	94	36.95	GHV
REACH FOR THE SKY	Kenneth More	136	44.95	RNK
REBEL ROUSERS	Jack Nicholson	64	39.95	MNT
RELUCTANT HEROES, THE	Ken Berry, Jim Hutton	80	36.95	GHV
RETURN OF THE PINK PANTHER, THE		108	29.95	PRV
REVENGE	Shelley Winters, Stuart Whitman	90	36.95	GHV
RIDDLE OF THE SANDS, THE	Jenny Agutter, Michael York	102	39.95	RNK
RING OF DEATH	Franco Nero, Florinda Balkan			IFS
ROBE, THE	Richard Burton, Jean Simmons	129	39.95	MAG
ROCKY	Sylvester Stallone's boxing saga	121	5.95	INT
ROCKY II		N/A	5.95	INT
ROGUE LION	Conflict in game reserve	60	23.80	VCL
ROLLERBALL	Futuristic drama — James Caan	123	5.95	INT
ROLLING MAN	Dennis Weaver, Don Stroud	71		RNK
ROME EXPRESS		91	34.95	RNK
ROSE, THE	Bette Midler	114	39.95	MAG
RULERS OF THE CITY	Jack Palance		38.95	JUB
RUN, ANGEL, RUN	Fast action USA		34.50	IFS
RUN OF THE ARROW/CRY DANGER	Rod Steiger, Charles Bronson/ Dick Powell, Rhonda Fleming	165	39.95	KVD
RUSSIAN ROULETTE	George Segal, Christina Raines		34.50	LVC
SABOTAGE	Sylvia Sidney	73	34.95	RNK
SALOME		84	39.95	VTX
SAND PEBBLES, THE	Steve McQueen	110	39.95	MAG
SATURDAY NIGHT FEVER	John Travolta	119	N/A	CIC
SCARLET STREET	Edward G Robinson	120	29.95	MNT
SCUM	Ray Winstone	96		PTV
SECOND CHANCE/GREAT DAY IN THE MORNING	Robert Mitchum, Jack Palance/ Robert Stack, Raymond Burr	165	39.95	KVD
SECOND CHORUS	Fred Astaire, Paulette Goddard	55	29.95	MNT
SEMI-TOUGH	Kris Kristofferson, Burt Reynolds	108	5.95	INT
SEVEN GOLDEN MEN	Action adventure	90	39.95	INO
SEVEN YEAR ITCH, THE	Marilyn Monroe, Tom Ewell	101	29.95	MAG
SEVERED ARM, THE	Suspense drama			IFS
SHALIMAR	Rex Harrison, Sylvia Miles			HOK
SHANGHAI LIL		92	5.95	INT
SHARK	Burt Reynolds	87	34.50	IFS
SHARK'S CAVE		83	39.95	HOK
SHERLOCK HOLMES IN THE SECRET WEAPON	Basil Rathbone, Nigel Bruce	120	29.95	MNT
SHOCK CORRIDOR	Sam Fuller's classic	101	39.95	VUL
SHOUT, THE	Susannah York, Alan Bates	83	44.95	RNK
SILENT PARTNER	Christopher Plummer, Elliott Gould	105	39.95	IPC
SIN	Raquel Welch, Richard Johnson	93	39.95	INT
SINATRA VOL - 1		120	39.95	WOV
SISTERS OF DEATH	Sherry Boucher, Claudia Jennings	87	39.95	INT
SKY RIDERS	James Coburn, Susannah York	88	29.95	MAG
SLAVERS	Trevor Howard, Britt Ekland	95	39.95	INT
SLEUTH	Laurence Olivier, Michael Caine	132	39.95	MAG
SMALL CHANGE		104	5.95	INT
SMOKEY AND THE BANDIT	Burt Reynolds	96	N/A	CIC
SMOKEY AND THE HOT WIRE GANG	Carla Ziegfeld	81	39.95	MNT
SOME MAY LIVE	Joseph Cotton, David Spencer	87	39.95	INT
SONS OF THE MUSKETEERS/THE MYSTERIANS	Cornel Wilde, Maureen O'Hara/Japanese sci-fi	165	39.95	KVD
S.O.S. PACIFIC	Sea-plane force-lands	91	39.95	INT
S.O.S. TITANIC	David Janssen, Cloris Leachman	98	37.50	EMI
SPANISH MAIN **plus** MOTOR MANIACS	Maureen O'Hara, Paul Henreid/Edgar Kennedy			
MY PAL **plus** WHO'S ZOO IN AFRICA	'Flame' the dog/James Finlayson			
		165	39.95	KVD
SPARROW OF PIGALLE, THE		101	5.95	INT
SPECIAL COP IN ACTION		100	39.95	HOK
SPECIAL DAY, A		105	5.95	INT
SPIRAL STAIRCASE, THE	Dorothy McGuire George Brent	83	36.95	GHV
SPY STORY	Harry Palmer returns	92	39.95	INT
STAGECOACH/DEADLINE AT DAWN	John Wayne classics Susan Hayward, Paul Lukas	165	39.95	KVD
STAGE STRUCK/THE GIRL MOST LIKELY TO	Henry Fonda, Susan Strasberg/Cliff Robertson, Jane Powell	165	39.95	KVD
STARDUST	David Essex, Adam Faith	108	39.50	EMI
STAR IS BORN, A	Barbra Streisand, Kris Kristofferson		39.95	WHV
STILETTO	Alex Cord, Britt Ekland	96	29.95	MAG
STING, THE		129	N/A	CIC
STRAW DOGS	Dustin Hoffman, Susan George	113	38.95	GHV
SUDDENLY SINGLE	Hal Holbrook, Barbara Rush	71		RNK
SUMMER OF '42		103	39.95	WHV
SUNBURST	Peter Hooten, Katherine Baumann	76	39.95	INT
SUNDAY IN THE COUNTRY	Ernest Borgnine, Michael J Pollard	89	39.95	INT
SUPERMAN — THE MUSICAL		90	29.90	VCL
SUPPOSE THEY GAVE A WAR A NOBODY CAME?	Tony Curtis, Ernest Borgnine	113	38.95	GHV
SURABAYA CONSPIRACY, THE	Fast moving thriller	90	29.90	VCL
SWEENEY!	John Thaw, Dennis Waterman	94	37.50	EMI
SWEET WILLIAM		88	39.95	HOK
TALE OF TWO CITIES, A	Dirk Bogarde in Dickens epic tale	112		RNK
TAMARIND SEED		119	39.95	PRV
TARKA THE OTTER	Narrated by Peter Ustinov	91	39.95	RNK
TEARS	Marta Vancurova	83	34.50	IFS
TEN COMMANDMENTS, THE	Cecil B DeMille	219	N/A	CIC
TENSION AT TABLE ROCK/REVENGE IS MY DESTINY	Richard Egan, Dorothy Malone/ Chris Robinson, Sidney Blackmer	165	39.95	KVD
TERROR BY NIGHT	Basil Rathbone, Nigel Bruce	120	29.95	MNT
THAT'LL BE THE DAY	David Essex, Ringo Starr	86	39.50	EMI
THEY PAID WITH BULLETS	Peter Lee Lawrence	85	39.95	INT
THEY SHOOT HORSES, DON'T THEY?	Jane Fonda, Michael Sarrazin	108		RNK
THIEVES OF BAGHDAD	Roddy Mcdowell, Peter Ustinov		39.95	SML
THIRSTY DEAN, THE	John Corsidine	82	39.95	DAV
THIRTY-NINE STEPS, THE	Robert Donat, Madeleine Carroll	78	34.95	RNK
THIRTY-NINE STEPS, THE	Robert Powell, John Mills	102	39.95	RNK
300 YEAR WEEKEND, THE	William Devane, Michael Tolan	80		RNK
THREE SISTERS, THE	Alan Bates	158	39.50	EMI
TIGER LILY	Diane Cilento, John Gregson			IFS
TO BUILD A FIRE		52	39.95	IPC
TOO LATE THE HERO	Michael Caine, Cliff Robertson	133	38.95	GHV
TORA! TORA! TORA!	Story of Pearl Harbour	138	39.95	MAG

TOUCH ME NOT	Lee Remick	82	39.95	INT
TOUCH OF SATAN	Michael Berry	87	39.95	DAV
TOUCH, THE	Elliott Gould, Bibi Andersson	112	38.95	GHV
TROJAN WAR, THE		100	39.95	INO
TURNING POINT	Anne Bancroft, Shirley Maclaine	114	34.95	MAG
TWELFTH NIGHT	Alec Guinness, Tommy Steele	104	29.95	PRV
TYCOON/SIX GUN GOLD	John Wayne, Anthony Quinn, Tim Holt	165	39.95	KVD
ULTIMATE THRILL, THE	Barry Brown, Britt Ekland	84	36.96	GHV
UNDER THE MILKWOOD	Dylan Thomas's classic	87	29.95	MAG
UNDERWATER/THE BIG STEAL	Jane Russell, Richard Egan/ Robert Mitchum, William Bendix	165	39.95	KVD
UNFAITHFUL WIFE, THE		98	5.95	INT
UNKNOWN POWERS		86	34.74	INT
UNMARRIED WOMAN, AN		119	34.95	MAG
UPSTAIRS, DOWNSTAIRS	Nine day wonder: May 1926	60		BFI
VALLEY OF THE DOLLS	Patty Duke, Paul Burke	118	29.95	MAG
VANISHING POINT	Barry Newman, Dean Jagger	96	29.95	MAG
VISITOR, THE	Susan Player, Hugh Griffiths	96	39.95	INT
VON RYAN'S EXPRESS	Frank Sinatra, Trevor Howard	112	29.95	MAG
VOYAGE OF THE DAMNED	Max von Sydow, Malcolm McDowell	178		PRV
VOYAGE TO THE BOTTOM OF THE SEA	Walter Pidgeon, Joan Fontaine	101	29.95	MAG
WACKY TAXI	John Astin, Frank Sinatra Jr.	87	39.95	INT
WAGONMASTER/DOUBLE DYNAMITE	Ben Johnson, Ward Bond/ Frank Sinatra, Groucho Marx	165	39.95	KVD
WAR GAME, THE	BBC TV drama documentary	47		BFI
WARRIORS, THE	New York street gangs	94	N/A	CIC
WEAPONS OF DEATH	Henry Silva	96	39.95	INO
WEREWOLVES ON WHEELS	'The Devil's advocates'	82	39.95	VUL
WHERE DANGER LIVES/SPLIT SECOND	Robert Mitcham/ Richard Egan, Jan Sterling	165	39.95	KVD
WHITE TOWER, THE/VALLEY OF THE SUN	Glen Ford, Alida Valle/ Lucille Ball, Cedric Hardwicke	165	39.95	KVD
WHO'S AFRAID OF VIRGINIA WOOLF?	Elizabeth Taylor, Richard Burton	126	39.95	WHV
WICKER MAN, THE		83	37.50	EMI
WILD GEESE, THE	Richard Burton, Roger Moore	129	39.95	RNK
WILD LITTLE BUNCH, THE	(existance)	86	34.50	GHV
WINGS OF AN EAGLE	Starring the golden eagle Lady	84	39.95	INT
WINTER COMES EARLY	Trudy Young, Art Hindle	85	39.95	INT
WITCHFINDER GENERAL		87	39.95	HOK
WITCHMAKER, THE	Anthony Einley	100	39.95	DAV
WITHOUT RESERVATIONS/FOOTLIGHT VARIETIES	John Wayne, Claudette Colbert/Liberace	165	39.95	KVD
WOMAN IN GREEN	Basil Rathbone, Nigel Bruce	120	29.95	MNT
WONDER WOMEN	Nancy Kwan, Ross Hagen	90	29.90	VCL
YOUNG INNOCENT	Derrick de Marney	77	34.95	RNK
YOUNG LIONS, THE	Marlon Brando	161	39.95	MAG
ZULU DAWN	Burt Lancaster, Peter O'Toole	115	39.95	INT

CLASSIC FILMS

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ABILENE TOWN	Randolph Scott, Ann Dvorak 1945	89	28.00	HVS
ADVENTURERS, THE	Dennis Price, Jack Hawkins 1950	82	29.95	MAG
AFTER MEIN KAMPF	Rarely seen footage of Hitler	60	28.00	HVS
ALGIERS	Charles Boyer 1938	95	28.00	HVS
ALL ABOUT EVE	Bette Davis, George Sanders 1950	132	39.95	MAG
ANGEL AND THE BADMAN	John Wayne, Gail Russell 1947	100	28.00	HVS
AMAZING YEARS OF EARLY CINEMA 2, THE	The Clowns — The Cowboys	50	35.00	EMI
ANIMAL FARM	George Orwell's Classic 1955	73	34.95	RNK
ARCH OF TRIUMPH	Ingrid Bergman, Charles Boyer 1948	87	39.95	INT
ASSASSIN OF YOUTH	1935	60	28.00	HVS
BEAT THE DEVIL	Humphrey Bogart, Jennifer Jones 1953	90	29.95	MAG
BILL OF DIVORCEMENT, A	John Barrymore, Katherine Hepburn 1940	75	36.95	GHV
BILLY LIAR	Tom Courtenay 1963	94	37.50	EMI
BIRTH OF A NATION, THE*	Directed by D.W. Griffith 1915	158	30.00	PGV
BLACK DRAGONS	Bela Lugosi 1937	60	28.00	HVS
BLACKMAIL	Anny Ondra, John Langdon 1929	86	29.50	EMI
BLACK PIRATE, THE	Douglas Fairbanks Sr 1926	83	30.00	PGV
BODY AND SOUL	John Garfield, Lilli Palmer 1947	104	39.95	INT
BRIGHTON ROCK	Richard Attenborough 1947	89	37.50	EMI
BULLDOG DRUMMOND ESCAPES	Ray Milland 1937	82	28.00	HVS
BUS STOP	Marilyn Monroe	90	39.95	MAG
CALL IT MURDER	Humphrey Bogart 1933	73	28.00	HVS
CANADIAN PACIFIC	Randolf Scott, Victor Jory	81	39.95	INT
CAN-CAN	Frank Sinatra, Shirley McClaine 1960	126	39.95	MAG
CASABLANCA	Humphrey Bogart, Ingrid Bergman 1942	102	5.95	INT
CAUGHT	Barbara bei Geddes, James Mason 1948	88	39.95	INT
CHANDU OF THE MAGIC ISLE	Bela Lugosi 1935	70	28.00	HVS
CHARLIE CHAPLIN - THE IMMIGRANT*		111	42.50	EMI
CHARLIE CHAPLIN - THE TRAMP, THE PAWNSHOP, EASY STREET*		50	25.00	PGV
CHARLIE CHAPLIN III - MAKING A LIVING*		115	30.00	PGV
CHARLIE CHAPLIN IV - AT NIGHT		54	25.00	PGV
CITIZEN KANE	Orson Welles, Joesph Cotten 1941	114	37.50	EMI
COLDITZ STORY, THE	John Mills 1954	93	37.50	EMI
COLLEGE	Buster Keaton 1927	65	30.00	PGV
CRUEL SEA, THE	Jack Hawkins 1952	121	37.50	EMI
DAM BUSTERS, THE	Richard Todd 1954	119	37.50	EMI
DARK MIRROR, THE	Olivia de Haviland, Lew Ayres 1946	85	39.95	INT
DEATH KISS	Bela Lugosi 1940	60	28.00	HVS
DOOMED TO DIE	Boris Karloff 1937	65	28.00	HVS
DOUBLE LIFE, A	Ronald Colman, Signe Hasso 1947	103	39.95	INT
DR JEKYLL & MR HYDE*	John Barrymore 1920	63	30.00	PGV
DUEL IN THE SUN	Jennifer Jones, Gregory Peck, Joseph Cotten 1946	130	38.95	GHV

EAST OF EDEN	James Dean 1954	105	34.95	WHV
ECSTASY	Hedy Lamarr 1930	70	28.00	HVS
EXTRA GIRL, THE*	Mabel Normand 1923	65	30.00	PGV
FAREWELL TO ARMS	Gary Cooper 1932	76	28.00	HVS
FARMER'S DAUGHTER, THE	Loretta Young, Joseph Cotten 1947	97	36.95	GHV
GARDEN OF ALLAH, THE	Marlene Dietrich, Charles Boyer 1936	85	36.95	GHV
GENERAL, THE*	Buster Keaton 1927	76	30.00	PGV
GLORIFYING THE AMERICAN GIRL	Eddie Cantor 1929	90	28.00	HVS
GOOD DIE YOUNG, THE	Laurence Harvey, Marg Leighton 1954	95	29.95	MAG
GREAT COMEDIANS OF THE SILENTS*	Feet of mud and 3 others	56	25.00	PGV
GREAT EXPECTATIONS	John Mills, Alec Guinness 1946	118	39.95	RNK
GREAT GUY, THE	James Cagney 1936	75	28.00	HVS
HALLELUJAH I'M A TRAMP	Al Jolson 1933	77	39.95	INT
HAMLET	Laurence Olivier 1948	155	44.95	RNK
HAROLD LLOYD 'THE UNSINKABLE'*	Rooms To Let/The Royal Swindle/ Good Neighbours/Haunted Spooks 1919 – 1920	52	30.00	PGV
HEIDI	Shirley Temple, Jean Hersholt 1937	75	29.95	MAG
HELL'S HOUSE	Bette Davis 1932	75	28.00	HVS
HENRY V	Laurence Olivier 1944	137	44.95	RNK
HOBSON'S CHOICE	Charles Laughton 1953	102	29.50	EMI
HOUSE OF SECRETS	Charlie Chan mystery thriller 1937	70	28.00	HVS
HUE AND CRY	Alastair Sim 1946	78	29.50	EMI
HUNCHBACK OF NOTRE DAME	Charles Laughton, Maureen O'Hara 1939	112	37.50	EMI
HUNCHBACK OF NOTRE DAME, THE*	Lon Chaney 1923	93	30.00	PGV
HURRICANE EXPRESS	John Wayne 1934	80	28.00	HVS
HUSTLER, THE	Paul Newman, Jackie Gleason	130	39.95	MAG
I AM A CAMERA	Laurance Harvey 1955	95	29.95	MAG
I'LL BE SEEING YOU	Ginger Rogers, Joseph Cotten	85	36.95	GHV
I'LL GET YOU FOR THIS	George Raft, Colleen Gray	81	29.95	MAG
INTERMEZZO	Leslie Howard, Ingrid Bergman	70	36.95	GHV
INTOLERANCE*	Directed by D.W. Griffith 1916	113	30.00	PGV
IRON MASK, THE	Douglas Fairbanks Snr. 1929	87	28.00	HVS
KIND HEARTS AND CORONETS	Dennis Price, Alec Guinness 1949	102	29.50	EMI
KING KONG	Fay Wray, Bruce Cabot 1933	96	37.50	EMI
KLASSIC KEYSTONE KOMEDY KAPERS	Charlie Chaplin, Buster Keaton	60	19.95	JVC
LADYKILLERS, THE	Alec Guinness, Cecil Parker 1955	87	29.50	EMI
LADY OF BURLESQUE	Barbara Stanwyck, Michael O'Shea 1943	91	28.00	HVS
LADY VANISHES, THE	Hitchcock's 1938 original	93		RNK
LAURA		84	39.95	MAG
LAVENDER HILL MOB, THE	Alec Guinness 1951	78	29.50	EMI
LES MISERABLES		131	39.95	PRV
LET GEORGE DO IT	George Formby 1940	81	29.50	EMI
LET'S GET MARRIED	Anthony Newley, Anne Aubrey	88	29.95	MAG
LETTER FROM AN UNKNOWN WOMAN	Joan Fontaine, Louis Jordan 1948	90	39.95	INT
LETTER TO THREE WIVES, A	Jeanne Crain, Linda Darnell	100	29.95	MAG
LOST MOMENT, THE	Robert Cummings, Susan Hayward 1947	89	39.95	INT
LOVE AMONG THE RUINS	Katharine Hepburn, Laurence Olivier 1974	120	38.95	GHV
MAGGIE, THE	Paul Douglas, Hubert Gregg 1953	90	37.50	EMI
MAN IN THE WHITE SUIT, THE	Alec Guinness 1951	82	29.50	EMI
MACBETH	Orson Welles, Jeanette Nolan 1948	107	39.95	INT
MARIJUANA	Weed from the devil's garden 1936	60	28.00	HVS
MARK OF ZORRO, THE*	Douglas Fairbanks Sr 1920	82	30.00	PGV
MAGNIFICENT MATADOR, THE	Anthony Quinn, Maureen O'Hara 1955	94	39.95	INT
MARS ATTACKS THE WORLD	Flash Gordon saving Earth 1937	79	28.00	HVS
MIRACLE OF THE BELLS, THE	Fred MacMurray, Valli 1948	120	39.95	INT
MOBY DICK	Gregory Peck 1956	110	39.50	EMI
MOHAWK	Scott Brady, Rita Gam	80	39.95	INT
MOULIN ROUGE	Jose Ferrer, Zsa Zsa Gabor 1952	114	29.95	MAG
MURDER BY TELEVISION	Bela Lugosi 1937	60	28.00	HVS
MY LEARNED FRIEND	Will Hay 1943	71	29.50	EMI
MYSTERIOUS MR WONG	Bela Lugosi 1940	70	28.00	HVS
NEVER TO LOVE	Maureen O'Hara, Adolphe Menjou	74	36.95	GHV
NICHOLAS NICKLEBY	Cedric Hardwicke, Stan Holloway 1947	103	37.50	EMI
NORTHWEST STAMPEDE	Joan Leslie, James Craig	76	39.95	INT
NOTORIOUS	Cary Grant, Ingrid Bergman 1946	103	38.95	GHV
ONE TOUCH OF VENUS		90	34.74	INT
OTHELLO	Laurance Olivier 1965	170	44.95	RNK
OTHER LOVE, THE	Barbara Stanwyck, David Niven 1947	96	39.95	INT
PARADINE CASE, THE	Gregory Peck, Ann Todd, Charles Laughton 1947	116	38.95	GHV
PHANTOM OF THE OPERA*	Lon Chaney 1925	74	30.00	PGV
PORTRAIT OF JENNIE	Joseph Cotten, Jennifer Jones 1948	86	36.95	GHV
PSYCHO	1960	108	N/A	CIC
QUEEN OF SPADES, THE	Anton Walbrook, Edith Evans	90	29.50	EMI
REACHING FOR THE MOON	Douglas Fairbanks Snr. 1931	90	28.00	HVS
REBECCA	Laurence Olivier, Joan Fontaine 1940	130	38.95	GHV
REBEL WITHOUT A CAUSE	James Dean 1955	105	34.95	WHV
REEFER MADNESS	Moment of bliss – life of regret 1936	780	28.00	HVS
RESTLESS BREED, THE	Scott Brady, Anne Bancroft	81	39.95	INT
MR ROBERTS	Henry Fonda, James Cagney 1955	120	39.95	WHV
MR ROBINSON CRUSOE	Douglas Fairbanks Snr. 1932	80	28.00	HVS
ROCKETSHIP	Flash Gordon vs Atomic Monsters 1937	89	28.00	HVS
ROOM AT THE TOP	Laurence Harvey, Simone Signoret 1958	113	29.95	MAG
RUBY GENTRY	Jennifer Jones, Charlton Heston 1952	82	36.95	GHV
RUTHLESS	Zachary Scott, Louis Hayward 1948	104	39.95	INT
SABOTAGE	Sylvia Sidney 1936	73	34.95	RNK
SALLY OF THE DAWDUST*	W.C. Fields 1925	86	30.00	PGV
SCOTT OF THE ANTARCTIC	John Mills 1948	105	39.50	EMI
SEARCHERS, THE	John Wayne 1956	119	39.95	WHV
SECOND CHORUS	Fred Astaire, Paulette Goddard 1941	83	28.00	HVS
SCARED TO DEATH	Bela Lugosi 1940	70	28.00	HVS
SECRET BEYOND THE DOOR	Joan Bennett, Michael Redgrave 1948	79	39.95	INT
SECRET LIFE OF ADOLF HITLER	The Nazi Party	60	28.00	HVS
SERVANT, THE	Dirk Bogard, James Fox 1963	112	40.00	EMI
SHANE	Alan Ladd	117	39.95	CIC
SILENT CLOWNS*	Big moments from little pictures	77	30.00	PGV
SILENT CLOWNS*	Saturday afternoon 1922	80	30.00	PGV
SINCE YOU WENT AWAY	Claudette Colbert, Jennifer Jones 1944	172	38.95	GHV
SOMETHING TO SING ABOUT	James Cagney 1938	75	28.00	HVS
SON OF THE SHEIK*	Rudolph Valentino 1926	64	30.00	PGV
SPELLBOUND	Ingrid Bergman, Gregory Peck 1940	111	38.95	GHV
SPIDER BABY	Lon Chaney		28.00	HVS

SPIRAL STAIRCASE, THE	Dorothy McGuire, George Brent 1946	83	39.95	GHV
STAGE DOOR CANTEEN	Tallulah Bankhead, K. Hepburn 1943	132	28.00	HVS
SWING HIGH, SWING LOW	Carole Lombard 1937	95	28.00	HVS
SWORD OF MONTE CRISTO	Swashbuckling lady cavalier	88	39.95	INT
THEY MADE ME A CRIMINAL	John Garfield, Ann Sheriden 1939	92	28.00	HVS
THIEF OF BAGHDAD, THE*	Douglas Fairbanks Sr 1924	137	30.00	PGV
THIRD MAN, THE	Orson Welles, Joseph Cotton 1949	99	40.00	EMI
THIRTY-NINE STEPS, THE	Robert Donat, Madelein Carroll 1935	78	34.95	RNK
TIGER AND THE FLAME, THE	Authentic reproduction of legendary warrior-queen's war	92	39.95	INT
TILL THE CLOUDS ROLL BY	Judy Garland, Frank Sinatra 1946	136	28.00	HVS
TITFIELD THUNDERBOLT, THE	Stanley Holloway 1952	80	29.50	EMI
TOP HAT	Fred Astaire, Ginger Rogers 1935	96	37.50	EMI
TREASURE ISLAND	Orson Welles 1971	84	34.50	VID
TWELVE O'CLOCK HIGH	Gregory Peck 1948	127	39.95	MAG
VAGABOND LOVER	Rudy Vallee, Marie Dressler 1929	70	28.00	HVS
VAMPIRE BAT, THE	Lionel Atwill, Melvyn Douglas 1933	63	28.00	HVS
VICTORIA THE GREAT	Anna Neagle 1937	106	37.50	EMI
WHATEVER HAPPENED TO BABY JANE		129	39.95	WHV
WHISKY GALORE	Basil Radford, Joan Greenwood 1948	80	29.50	EMI
WILD HEART, THE	Jennifer Jones	82	36.95	GHV
WOODEN HORSE, THE	Leo Genn 1950	98	37.50	EMI
YOUNG AND INNOCENT	Derrick de Marney 1937	77	34.95	RNK
YOUNG ONES, THE	Cliff Richard 1961	104	37.50	EMI

* Silent films.

CHILDREN

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ADVENTURES OF JOE, THE — LITTLE JOE IN ANTSVILLE	Cartoon	60	24.95	VDM
ADVENTURES OF JOE, THE — SLEEPING BEE BEAUTY	Cartoon	60	24.95	VDM
ADVENTURES OF TOM SAWYER, THE		76	36.95	GHV
ALADDIN AND THE MAGIC LAMP	Cartoon	70	29.95	VDM
ALADDIN'S LAMP	Delightful classic fairy story	74	39.95	INT
BARBAPAPA	13 original cartoons	53	25.00	PGV
BARBAPAPA VOLUME II	13 original cartoons	60	25.00	PGV
BIG BAD WOLF, THE		55	24.96	VOV
BLACK BEAUTY		104	39.95	HOK
BLACK ISLAND/SHOOTING STAR	Tin Tin	80		JVC
BUBBLIES, THE	Twelve tales	60	19.95	JVC
BUBBLIES VOL II	Fun for Bubblies' fans	60	19.95	JVC
BUGS BUNNY CARTOON SHOW		50	29.95	VTX
CALCULUS AFFAIR	Tin Tin	60		JVC
CALIMERO	13 stories	54	25.00	PGV
CALIMERO AND THE WONDERFUL SUMMER	13 cartoon stories	55	25.00	PGV
CALL OF THE WILD	Charlton Heston	100	36.95	GHV
CANDY CANDY	A soap opera....for children	3x60	39.95	INT
CAPTAIN HARLOCK	Space pirate protecting earth	2x30	19.95	JVC
CAPTAIN MARLOCK	Space pirate	3x60	29.95	INT
CAPTAIN NEMO	Exploits of intrepid submariner	2x30	19.95	JVC
CAPTAIN NEMO VOL II		60		JVC
CARTOON SHOWS 1 - 9		30 each	21.95 each	KRY
CHARLIE RIVEL	World's greatest clown	30	19.55	VCL
CINDERELLA STORY	Richard Chamberlain, Gemma Craven			VID
CIRCUS WORLD CHAMPIONSHIPS	Spectacular competition	60	23.80	VCL
CLOWNS-MAGIC-SENSATIONS	Circus performance in Russia	60	19.95	JVC
CRAB WITH THE GOLDEN CLAWS, THE	Tintin	60	19.95	JVC
DAILY FABLE	13 stories	55	25.00	PGV
DAILY FABLE — MISS ANT	13 stories and 3 songs	55	25.00	PGV
DESTINATION MOON	Tintin with Snowy, Cpt.Haddock	60	19.95	JVC
DOGS TO THE RESCUE		70	5.95	INT
DOT AND THE KANGAROO	Guest Artist: Spike Milligan	80	36.95	GHV
EXPLORERS ON THE MOON	Tintin adventures	60	19.95	JVC
FABLE OF THE GREEN FOREST	Johnny Chuck, Peter Cottontail	86	19.95	JVC
FABLES OF THE GREEN FOREST	Johnny Chuck, Peter Cottontail	3x60	39.95	INT
FOLLOW THAT RAINBOW		95		JVC
FRED BASSETT	Hilarious adventures	60	19.95	JVC
FRED BASSETT VOL II	With Jock the Scotty	60	19.95	JVC
FROM AFRICA WITH LOVE		60	25.46	VCL
FUNNY FOREST	Puppet show	60	19.95	JVC
GLORIOUS MUSKETEERS, THE	Feature Cartoon	67	19.95	VIP
GULLIVER'S TRAVELS	Cartoon	80	29.95	DAV
GULLIVER'S TRAVELS	Musical Cartoon	82	39.95	MNT
GULLIVER'S TRAVELS	Fully animated	70	29.90	VCL
HANS CHRISTIAN ANDERSON	Peter Ustinov	45	30.00	EMI
HERE COMES NODDY AGAIN	Narrated by Richard Briers	51	25.00	PGV
HUGO AND JOSEPHINE		90	34.75	INT
JACK AND THE BEANSTALK	musical fantasy	95	39.95	INT
KINGDOM IN THE CLOUDS, THE		72	5.95	INT
LAND THAT TIME FORGOT, THE	Doug McClure, Susan Penhaligon	86	37.50	EMI
LEGEND OF THE NORTHWEST	American family film	80	34.50	IFS
LESLEY JUDD'S ALLSORTS		60	19.95	MBH
LITTLE LULU	With Tubby, Iggie, Wilbur	3x60	29.95	INT
LITTLE MERMAID, THE	Hans Christian Andersen's tale	66	39.95	INT
LITTLE ORBIT, THE ASTRO-DOG	Cartoon	75	29.95	VDM
MAN FROM BUTTON WILLOW, THE	Dale Robertson	79	29.95	INT
MAN FROM CLOVER GROVE		97	39.95	VPD
MATTIE THE GOOSEBOY	feature cartoon	77	36.95	GHV
MEN OF SHERWOOD FOREST		74	5.95	INT
MUPPET MOVIE, THE		97	29.95	PRV
NOBODY'S BOY	A tear jerker	82	39.95	MNT
NODDY GOES TO TOYLAND	Richard Briers	55	25.00	PGV
NUTCRACKER, THE		29	19.95	RNK
ONCE UPON A BROTHERS GRIMM	Dean Jones, Paul Sand	90	29.90	VCL
ONCE UPON A TIME		55	24.95	VOV
PADDINGTON'S 1ST "ANYWHEN"	TV Show	25	25.00	EMI
PADDINGTON'S 3RD "ANYWHEN"	TV Show	25	25.00	EMI

PADDINGTON'S 5TH "ANYWHEN" TV Show		25	25.00	EMI
PETER USTINOV TELLS STORIES FROM HANS CHRISTIAN ANDERSEN		45	25.00	PGV
PINOCCHIO'S STORY-BOOK ADVENTURES		76	34.74	INT
POOR GLASS BLOWER, THE	Fascinating fairy tale	25	19.55	VCL
POPEYE CARTOON		50	29.95	CVD
PRINCESS AND THE MAGIC FROG, THE	Enchanting children's entertainment	90	29.90	VCL
RAILWAY CHILDREN, THE	Jenny Agutter	104	40.00	EMI
RED RACKHAM'S TREASURE	Tintin	60	19.95	JVC
RING OF BRIGHT WATER	Bill Travers, Virginia McKenna	109	38.95	GHV
RIP VAN WINKLE	Famous legend of the sleeper	70	39.95	INT
SANTA AND THE THREE BEARS	An enchanting tale	64	39.95	INT
SEVEN CRYSTAL BALLS/PRISONERS OF THE SUN	Tin Tin	80		JVC
SNOW WHITE		74	23.76	VOV
SNOW WHITE & ROSE RED		55	24.95	VOV
SPECTREMAN	12 one-hour programmes	2x30	28.95	INT
SPUNKY & TADPOLE	Whimsical mis-adventures	3x60	29.95	INT
STARBIRD AND SWEET WILLIAM		90	29.90	VCL
STORIES FROM HANS CHRISTIAN ANDERSEN		45	26.09	EMI
STORM BOY	Young boy and his tame pelican	89	36.95	GHV
SUMMERDOG	'Hobo' the abandoned terrier	86	39.95	INT
SUPERMAN	Cartoon Spectacular	49	29.95	MNT
SUPERMAN	Colourful, exciting cartoons	30	19.55	VCL
SUPERSEAL		80	39.95	INT
SWALLOWS AND AMAZONS	Virginia McKenna, Ronald Fraser	88	40.00	EMI
TALES OF BEATRIX POTTER		86	40.00	EMI
TALES OF MAGIC	Animated Fairy Tales	60	19.95	JVC
TARKA THE OTTER		91	39.95	CVD
TERRYTOWN CARTOONS(5)	Deputy Dawg	29	17.50	MAG
TERRYTOWN CARTOONS(5)	Heckle & Jeckle	29	17.50	MAG
TERRYTOWN CARTOONS(5)	Mighty Mouse	29	17.50	MAG
THUNDERBIRDS TO THE RESCUE	from the puppet TV series		29.95	PRV
TREASURE ISLAND	Exciting adventure	64	39.95	INT
WELL DONE NODDY		58	25.00	PGV
WHALE OF A TALE, A	William Shatner	90	29.90	VCL
WILD BABIES		60		JVC
WINDOWS	Animals at work and play	54	25.00	PGV
WOMBLING FREE	"The Wombles"	96	39.95	RNK

COMEDY

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ABBOTT AND COSTELLO MEET CAPTAIN KIDD/THE THREE MUSKETEERS	Walter Abel, Alan Hale	165	39.95	KVD
ADVENTURES OF POPEYE, THE		52	29.95	MNT
ANIMAL HOUSE	American satire	109	N/A	CIC
ANNIE HALL	Woody Allen's 'nervous romance'	93	5.95	INT
BAD NEWS BEARS	Walter Mathau, Tatum O'Neal		34.50	LVC
BENNY HILL SHOW, THE		104	39.50	EMI
BLAZING SADDLES		90	39.95	WHV
CANDID CAMERA CLASSICS	from TV series	120	39.95	VMK
CAN I DO IT TILL I NEED GLASSES?		72	39.95	VPD
CARRY ON ABROAD	Sid James, Kenneth Williams	89	34.95	RNK
CARRY ON CLEO	Sid James, Joan Sims, etc.	91	39.50	EMI
CARRY ON COWBOY		88	42.60	JVC
CARRY ON MATRON	Sid James, Barbara Windsor	89	34.95	RNK
CARRY ON NURSE	Kenneth Williams, Hattie Jacques	84	37.50	EMI
CARRY ON UP THE JUNGLE		87	34.95	RNK
CARTOB CLASSICS OF THE 1930's		59	29.95	VPD
CHARLIE CHAPLIN	The Tramp/The Pawnshop/Easy Street	50	25.00	PGV
CHARLIE CHAPLIN	Immigrant/His New Job/The Vagabond/ The Champion/Work/The Adventurer	111	30	PGV
CHARLIE CHAPLIN 4	AT NIGHT A Night At The Show/ One AM/A Night Out/The Rounders	54	25.00	PGV
COME PLAY WITH ME	adult comedy	93	39.95	HOK
CONFESSIONS FROM THE DAVID GALAXY AFFAIR		95	39.95	HOK
DOCTOR AT SEA	Dirk Bogarde, Brenda de Banzie	89		RNK
DOCTOR IN THE HOUSE	Dirk Bogarde, Muriel Pavlow	92	39.95	RNK
DRAWS		75	29.95	WOV
EDDIE CANTOR SHOW, THE	Eddie Cantor	57	29.95	MNT
EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT SEX	Woody Allen '	88	5.95	INT
FIND THE LADY	Mickey Rooney, Dick Emery	90	39.95	INT
FLYING DEUCES	Laurel & Hardy	60	29.95	MNT
FUNNIEST MAN IN THE WORLD, THE	Charlie Chaplin profile	90	39.95	INT
GENEVIEVE	Kay Kendall, Kenneth More	86	34.95	RNK
GEORGE AND MILDRED		89	29.95	PRV
GONE WITH THE WEST	Comedy western with James Caan	90	29.90	VCL
GORGEOUS BIRD LIKE ME, A		98	5.95	INT
GREAT COMEDIANS OF THE SILENTS	four short features	56	25.00	PGV
GREAT ICE RIP-OFF, THE	Lee J Cobb, Gig Young	72		RNK
GREAT MCGONAGALL, THE	Peter Sellers, Spike Milligan		29.95	VDM
GUESS WHO'S SLEEPING IN MY BED?		74	36.95	GHV
HAROLD LLOYD 'THE UNSINKABLE'	Rooms To Let/The Royal Swindle/ Good Neigbours/Haunted Spooks	52	30.00	PGV
HEAVENS ABOVE	Peter Sellers	113	29.50	EMI
HEAVEN CAN WAIT		101	39.95	CIC
HOAX, THE	Comedy set in Los Angeles	90	29.90	VCL
HOBSON'S CHOICE	Charles Laughton, John Mills	102	29.50	EMI
HOW DO I LOVE THEE	Jackie Gleason, Rosemary Forsyth	87		RNK
HUE AND CRY	Alastair Sim	78	29.50	EMI
I'M ALL RIGHT JACK	Ian Carmichael, Peter Sellers	101	37.50	EMI
INSPECTOR GENERAL, THE	Danny Kaye	96	39.95	MNT
IT SHOULDN'T HAPPEN TO A VET	John Alderton, Colin Blakely	90	39.50	EMI
KENNY EVERETT VIDEO SHOW		104	39.50	EMI
KIND HEARTS AND CORONETS	Dennis Price, Alec Guinness	82	29.50	EMI
LADYKILLERS, THE	Alec Guinness, Cecil Parker	87	29.50	EMI
LAVENDER HILL MOB, THE		78	29.50	EMI
LET GEORGE DO IT	George Formby	81	29.50	EMI
LIKELY LADS, THE	James Bolan, Rodney Bewes	86	37.50	EMI
LUCKY JIM	Ian Carmichael	91	37.50	EMI
MAD MAD MOVIE MAKERS	Michael Pataki	86	34.50	IFS

MAGGIE, THE	Paul Douglas, Hubert Gregg	90	29.50	EMI
MAGNIFICENT SEVEN DEADLY SINS, THE		107	38.95	GHV
MAGNIFICENT TWO, THE		96	39.95	RNK
MAN IN THE WHITE SUIT, THE	Alec Guinness, Joan Greenwood	82	29.50	EMI
MARCH OF THE WOODEN SOLDIERS	Laurel and Hardy	75		JVC
M*A*S*H	Elliott Gould, Donald Sutherland	111	29.95	MAG
MASTERMIND	Zero Mostel as Japanese sleuth	92		RNK
MORECAMBE AND WISE SHOW, THE	Written by Eddie Braben	104	39.50	EMI
MOVIE, MOVIE	George C Scott	102	29.95	PRV
MUPPET MOVIE, THE		97	29.95	PRV
MY FAVOURITE BRUNETTE	Bob Hope, Dorothy Lamour	120	29.95	MNT
MY LEARNED FRIEND	Will Hay	71	29.50	EMI
NICKELODEON	Burt Reynolds, Ryan O'Neal	117	37.50	EMI
NORMAN CONQUESTS	1: Table Manners	108	39.50	EMI
NOT NOW, DARLING	Leslie Phillips, Julie Ege	93	36.95	GHV
OH! CA_CUTTA		95	39.95	HOK
OH, GOD	John Denver, George Burns	104	34.95	WHV
ONE TOUCH OF VENUS		90	34.74	INT
ONLY TWO CAN PLAY	Peter Sellers	101	37.50	EMI
PICTURE SHOW MAN, THE	John Mellon	99	36.95	GHV
PINK PANTHER STRIKES AGAIN, THE	Peter Sellers, Herbert Lom	110	5.95	INT
PLEASE SIR!	John Alderton	101	39.95	RNK
PORRIDGE	Ronnie Barker, Richard Beckinsale	90	29.95	CVD
RETURN OF THE PINK PANTHER, THE		108	29.95	PRV
REVENGE OF THE PINK PANTHER, THE	Peter Sellers, Herbert Lom	99	5.95	INT
RISING DAMP	Leonard Rossiter	90		PRV
SECRET POLICEMAN'S BALL		93	39.95	HOK
SEMI-TOUGH	Kris Kristofferson, Burt Reynolds	108	5.95	INT
SILENT CLOWNS	Big moments from little pictures 1923	77	30.00	PGV
SILENT CLOWNS	Saturday afternoon	80	30.00	PGV
SILVER STREAK	Gene Wilder, Jill Clayburgh	108	34.95	MAG
SIMON, SIMON	Graham Stark, Norman Rossington	30	19.95	GHV
SMOKEY AND THE BANDIT	Burt Reynolds	96	N/A	CIC
SOFT BEDS, HARD BATTLES	Saucy WW 11 spy spoof	94		RNK
S.P.Y.S.	Donald Sutherland, Elliott Gould	100	37.50	EMI
STEPTOE AND SON	Wilfred Brambell, Harry H Corbett	93	39.50	EMI
SUPPOSE THEY GAVE A WAR AND NOBODY CAME?	Tony Curtis, Ernest Borgnine	113	38.95	GHV
TAKE THE MONEY AND RUN	Woody Allen	83		RNK
THATS CARRY ON	"The Carry On Gang"	95	39.95	RNK
TILL DEATH US DO PART	Warren Mitchell, Dandy Nichols	99	39.50	EMI
TITFIELD THUNDERBOLT, THE	Stanley Holloway	80	29.50	EMI
TO SEE SUCH FUN	comedy compilation introduced by Frank Muir	84	29.95	VID
TOYLAND	Laurel & Hardy	72	39.95	MNT
TRAMP, THE – plus the pawn-shop and easy street		50	26.09	EMI
12 + 1		95	5.95	INT
TWO-WAY STRETCH	Peter Sellers, Wilfred Hyde-White	84	29.50	EMI
UNE FEMME EST UNE FEMME	(A woman is a woman)	80	39.95	VUL
UP POMPEII	Frankie Howard	86	37.50	EMI
WHAT'S UP, NURSE		82	39.95	HOK
WHAT'S UP SUPER-DOC?		94	39.95	HOK
WHISKY GALORE		80	29.50	EMI

SPORTS

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
(* Indicates instructional cassettes)				
ANGLING				
ANGLER'S CORNER, Bream, Tench, Roach, Chubb		45	29.99	IPC
ANGLER'S CORNER, Salmon, Grayling, Trout		45	29.99	IPC
FOOTBALL				
BEST IN EUROPE, 1980	European cup/cup winners cup	60	21.50	JVC
CUP FINAL HISTORY 1923 - 1978		55	27.75	MIR
*FOOTBALL	*Part 1(120) and Part 2(90)	10	85.10	VSA
FOCUS ON SOCCER - 1	Mick Channon	50	29.95	RNK
FOCUS ON SOCCER - 2	Ray Clemence, Colin Todd	50	29.95	RNK
FOCUS ON SOCCER - 3	Trevor Brooking, Kevin Keegan	75	34.95	RNK
GIANTS OF BRAZIL	Pele	52	23.80	VCL
PELE	The world's greatest footballer	60	37.57	VCL
SOCCER	The game of the century	58	35.00	PGV
1978 WORLD CUP SERIES	Highlights	87	31.45	CVD
GOLF				
BRITISH OPEN 1971	Lee Trevino	52	29.99	IPC
BRITISH OPEN 1972	Lee Trevino	52	29.99	IPC
BRITISH OPEN 1973	Troon, Scotland	52	29.99	IPC
BRITISH OPEN 1974	Gary Player	52	29.99	IPC
BRITISH OPEN 1975	Gordon Jackson narrator	52	29.99	IPC
BRITISH OPEN 1979	Severiano Ballesteros	52	29.99	IPC
TEE TO GREEN	Basic golf with Vivien Saunders	120	31.95	GPL
*GOLF	*"How to play Golf"	120	46.00	VSA
THE HISTORY OF GOLF		60	29.99	IPC
THE HISTORY OF GOLF-ST.ANDREWS LADIES OF THE LINKS		51	29.99	IPC
STORY OF GOLF, THE			29.99	IPC
*MASTER GOLF(series of 13)	*Neil Coles & Richard O'Sullivan	36	19.95	RNK
MOTOR RACING/RALLYING				
AVONTOUR/3 DAYS IN AUGUST 1975		57	29.99	IPC
BEST OF THE BEST 1972/FAST COMPANY 1973		55	29.99	IPC
CATCHING UP	Motorcycling in USA	60	23.80	VCL
CINESPORT RALLY TAPE A	1976 Welsh Int/ Scottish Int/Manx/Jim Clark	30	20.00	CIN
CINESPORT RALLY TAPE B	1976-77 Lindisfarne/Mintex Int/ Scottish Int/Hartlepool Autotest	30	20.00	CIN
CINESPORT RALLY TAPE C	1977-78 Burmah Int/RAC Int/ Mintex Int/Felixstowe Autotest	30	20.00	CIN
CINESPORT RALLY TAPE D	1978 World Cup Karting/ 2 CT cross Int/Blackpool sprint/ Happy eater rally	30	20.00	CIN
CINESPORT RALLY TAPE E	1978-79 Motor sport round up/ RAC Int rally/Lakeland stages/ Unsung heroes	30	20.00	CIN
CINESPORT RALLY TAPE F	1979-80 Lindisfarne/Happy eater/ RAC Int/Motor sport and music	30	20.00	CIN
CINESPORT RALLY TAPE G	1980 Mintex Int/Esso breakfast Autotest/Rogers Carpets/Easter Autotest	30	20.00	CIN

DASH OF THE IRISH 1971, A/ROAD TIME 1973	59	29.99	IPC
DAY IN JUNE, A '78 Isle of Man TT	17	29.95	RON
FAST COMPANY Jackie Stewart	30	19.55	VCL
FAST DRIVE IN THE COUNTRY, A	52	29.99	IPC
FASTER THAN FAIRIES/PHIL READ WORLD CHAMPION Agostini, Phil Read, Percy Tait	61	29.95	RON
FASTEST MAN ON EARTH, THE	52	29.99	IPC
FLYING FINNS 1968, THE/The Golden Age of Rallying	54	29.99	IPC
GOODWOOD NINE HOURS 1955/FINAL VICTORY 1959	51	29.99	IPC
GRAND PRIX TRIO 1955/GRAND PRIX d'EUROPE 1958	56	29.99	IPC
HIGHLIGHTS OF THE I.O.M. TT 1979	29	29.95	RON
IF YOU'RE NOT WINNING, YOU'RE NOT TRYING 1973	60	29.99	IPC
INCA ROAD 1970/SCENE 75, TAKE 7	67	29.99	IPC
1976 IRISH MASTERS SQUASH CHAMPIONSHIP	50	29.99	IPC
IRON MEN AND STEEL MACHINES/FLAMES OVER THE SAHARA Motor Racing/Balloonists	55	19.95	JVC
JAGUAR STORY, THE	60	25.00	VTV
JAMES HUNT: World Champion 1976/THE PHOENIX 1977	46	29.99	IPC
KING KENNY Kenny Roberts	28	23.95	RON
MAGIC MOMENTS NOS 1 - 25 average	42	29.99	IPC
MOUNTAIN LEGEND 1965 Targa Florio, Sicily	43	29.99	IPC
1979 LOMBARD RAC RALLY	70	25.00	VTV
1980 LOMBARD RAC RALLY	52	27.00	VTV
1980 MINTEX INTERNATIONAL RALLY	60	25.00	VTV
1981 MINTEX INTERNATIONAL RALLY	40	24.95	VTV
1980 SCOTTISH INTERNATIONAL RALLY	46	25.00	VTV
1981 SWEDISH INTERNATIONAL RALLY featuring Hannu Mikkola	40	24.95	VTV
1980 1000 LAKES RALLY Finland's grand prix with Marku Alen	30	24.95	VTV
1980 Welsh Int/Scottish Int/Hartlepool Autotest/Manx Int	30	20.00	CIN
1970/80 – GRAND PRIX OF A DECADE	22	29.99	IPC
NURBURGRING 1000 KMS 1956/MONACO GRAND PRIX 1957	60	29.99	IPC
ON ANY SUNDAY	79	39.95	HOK
ONCE UPON A WHEEL	53	25.46	VCL
ONE BY ONE Jackie Stewart, Mike Hailwood	79	39.95	INT
RACECRAFT 1973/COLLISON COURSE 1976	44	29.99	IPC
LA RONDE INFERNALE 1969 – Le Mans	39	29.99	IPC
ROUEN ROUND 1962/BRANDS HATCH BEAT	54	29.99	IPC
SCOTTISH RALLY 1973/12 HOURS IN ARGYLL 1974	40	29.99	IPC
SIDE BY SIDE Side car racing	27	23.95	RON
STAGES TO VICTORY 1976 Castrol/Autosport Rally	40	29.99	IPC
STATUS QUO – OFF THE ROAD Offroading (motor sport) plus Quo in concert	30	19.55	VCL
TIME TO CHANGE 1976, A/APPOINTMENT AT PENHA 1977	52	29.99	IPC
TWICE AND FUTURE KING 1974, THE/A SPECIAL BREED 1975	52	29.99	IPC
UNCROWNED CHAMPIONS 1970/HOUSE OF STEWART	56	29.99	IPC
UNTAMED WHEELS Agostini, Mike Hailwood	30	19.55	VCL
VTV MAGAZINE EDS. 1 – 3 (MOTORING)	60	25.00 each	VTV

SAILING/SKIING/SWIMMING

*THIS IS SAILING (1) *Modern centre-board dinghy	58	29.99	IPC
*THIS IS SAILING (2) *More advanced techniques	29	29.99	IPC
*LEARNING TO SWIM	30	20.70	VSA
*SWIMMING STROKES	90	39.10	VSA
*DIVING *How to Dive	60	20.70	VSA
SKI (1) Search for Speed/Between Chaos and Beauty/Helix	60	29.99	IPC
SKI (2) Garmish '78/Just a Matter of Time	60	29.99	IPC
WHITEROCK music by Rick Wakeman	90	29.99	IPC
WORLD CUP SKIING 1980	25	29.99	IPC

BADMINTON/SQUASH/TENNIS

INTRODUCING BADMINTON	30	19.95	VIP
*SQUASH PART 1 *The basics of squash	60	32.20	VSA
*SQUASH PART 2 *The Game	60	32.20	VSA
*SQUASH RACKETS - 1 *Anthony Swift	26	19.95	RNK
*SQUASH RACKETS - 2 *Anthony Swift	26	19.95	RNK
1976 IRISH MASTERS SQUASH CHAMPIONSHIP	50	29.99	IPC
1978 BRITISH OPEN SQUASH CHAMPIONSHIP	46	29.99	IPC
*TABLE TENNIS - 1	25	19.95	RNK
*TABLE TENNIS - 2	25	19.95	RNK
*TENNIS WITH MARK COX - 1	28	19.95	RNK
*TENNIS WITH MARK COX - 2	28	19.95	RNK
TENNIS Borg, Connors	60	23.80	VCL
WIMBLEDON 1974	52	29.99	IPC
WIMBLEDON 1975	52	29.99	IPC
WIMBLEDON 1976	52	29.99	IPC
WIMBLEDON 1977	52	29.99	IPC
WIMBLEDON 1978	52	29.99	IPC
WIMBLEDON 1979	52	29.99	IPC

MISCELLANEOUS

CHESS Programmes 1 - 7	60	39.95	INT
DRESSAGE Individual and Grand Prix jumping	45	29.99	IPC
FERRIA DE ABRIL Masters of the bullring	30	19.55	VCL
GAMES OF THE XXIst OLYMPIAD, Montreal 1976	119	39.95	RNK
LENINGRAD ICE SHOW, THE World's leading ice skaters	60	19.95	JVC
MONTREAL OLYMPICS Equestrian 3-day event	52	29.99	IPC
MUHAMMAD ALI v ARCHIE MOORE	60	23.80	VCL
NIJINSKY	53	29.95	VTX
REARDON ON SNOOKER	27	28.95	GHV
RIDING TO WIN Champion jockey Willie Carson	55	27.75	MIR
SECRETS OF THE ALL BLACKS Bob Stuart, Jim Stewart	60	29.99	IPC
WILL TO WIN Surfing, karate, football, etc.	30	19.95	JVC

GENERAL INTEREST

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ACAPULCO, MEXICO/LAKE MEAD, NEVADA		60	39.95	INT
ADVENTURE IN VENTANA	Wild life conservation	60	23.80	VCL
AFRICA		120	24.95	VOV
AFRICAN WATERHOLE	Life at the "waterhole" Wildlife of Central Africa	25	19.95	JVC
ALASKA BULIK/DESCHUTES RIVER, OREGON		60	39.95	INT
ALIENS FROM SPACESHIP EARTH		87	34.74	INT
AMAZING YEARS OF THE EARLY CINEMA – 1	The magicians/The epics	50	30.00	PGV
AMAZING YEARS OF EARLY CINEMA – 2	The clowns/The cowboys	50	30.00	PGV
APOLLO 4/APOLLO 7		30	27.00	IST
APOLLO SERIES: 8 - 17	ten tapes	28 each	27.00 each	IST

BEST WAY TO WALK		120	39.95	JAG
BEFORE THE MONSOON	ATV documentary	135		BFI
BIG BILL-The story of a Heron/Speckle and Hide		56	29.99	IPC
BODY, THE	Documentary	108	39.50	EMI
BORN TO BUCK		60	23.80	VCL
BOTANIC MAN VOL 1	Progs 1-4 of TV series	104	39.50	EMI
CARNIVAL '80		60		JVC
CINDERELLA STORY, THE		27	26.00	IFC
CIVILISATION: episode 12	Kenneth Clark	50		BFI
CONQUEST OF EVEREST, THE	Successful ascent of 1953	76	37.50	EMI
COZUMEL, MEXICO/KAULA ROCK, HAWAII		60	39.95	INT
EARTH-SUN RELATIONSHIP	formation of sun and planets	6	15.00	IST
EARTHQUAKE BELOW		14	20.00	IST
ENTERTAINING ELECTRON, THE	Featuring: Frankie Howard	52	26.95	GHV
FLAMES OVER THE SAHARA		25	19.95	JVC
FLOWER ARRANGING	With Jean Taylor	65		RNK
FROM AFRICA WITH LOVE		60	23.80	VCL
GET SLIM - STAY SLIM	Angie Best	60	37.75	MIR
GOSHAWK	Based on T.H.White's book	52	29.99	IPC
GREAT ENGLISH GARDEN PARTY, THE	Peter Ustinov	50	29.99	IPC
GREAT LADY, A	Life of the Queen Mother	55	27.75	MIR
GROUPIES		90	5.95	INT
INCREDIBLE MAGIC OF MAGIC, THE (volume 1)		53	22.50	MAG
INTERNATIONAL GYMNASTICS	USSR display teams/ Coca-Cola championships	90	39.50	EMI
INTRODUCTION TO BASIC YOGA		60	24.95	JAG
JAGUAR STORY, THE		60	25.00	VTV
JOAN COLLINS VIDEO SPECIAL, THE	Inc interview with Parkinson	54		YPL
LANGUAGE COURSE – FRENCH		90	39.95	VVW
LANGUAGE COURSE – GERMAN		90	39.95	VVW
LANGUAGE COURSE – SPANISH		90	39.95	VVW
LANGUAGE COURSE – ITALIAN		90	39.95	VVW
LANGUAGE COURSE – ENGLISH		90	39.95	VVW
LEARNING TO LOVE	Marje Proops	60	37.75	MIR
LEGEND OF LOCH NESS	Fact or Fiction	90	29.90	VCL
LIFE?		14	20.00	IST
LIVING FORM		30	19.55	VCL
MAGNETIC EFFECTS IN SPACE		14	20.00	IST
MAGRITTE		50	29.99	IPC
MAKING MANAGEMENT TICK	John Garnett	45	110.00	IDS
MAKING OF STAR WARS, THE	Behind the scenes glimpse	47	22.50	MAG
MAKING TELEVISION DANCE	choreographer Twyla Tharp	58		BFI
MAKING YOUR OWN HOME COSY		60	19.95	MBH
MAN WHO LOVED BEARS, THE		60		JVC
MIGHTY MICRO		156	39.95	PRV
MYSTERIES FROM BEYOND EARTH	Probe into another dimension	90	29.90	VCL
NEGOTIATING SKILLS	training programme	23	149.00	IDS
NEW LIFE IN THE GARDEN		60	19.95	MBH
NEW VIEW OF SPACE	space programme survey	28	27.00	IST
OSPREY	The magnificent Osprey	50	29.99	IPC
PALESTINE: PROMISES	Thames TV documentary	90		BFI
PALESTINE: REBELLION	Thames TV	90		BFI
PALESTINE: ABDICATION	Thames TV	90		BFI
POLICE TAPES, THE	WNET 13, New York	88		BFI
POPE JOHN PAUL II IN IRELAND	The 1979 Papal visit	168	44.95	RNK
PRACTICAL ACTION FOR MANAGERS	– a commonsense approach	45	149.00	IDS
PREDATORS, THE		60		JVC
RINGMASTER 1967, THE/PAUSE FOR NOSTALGIA		57	29.99	IPC
ROGUE LION		60	23.80	VCL
ROLLERMANIA		90	29.90	VCL
SILENT WILDERNESS	Documentary exploring Alaska	90	29.90	VCL
67 DAYS – THE LIVING LEGEND OF THE PARTISANS		118	5.95	INT
SOMEONE BEHIND THE DOOR		90	34.95	VOV
STORY OF PRINCE CHARLES AND LADY DIANA	told by Huw Wheldon	60	29.50	MBH
SUMMER OF STEAM	Historic Commercial Vehicles	55	25.00	VTV
SWAN LAKE		125	39.50	EMI
25 YEARS	A look at the Queen's reign	74	42.60	JVC
THIS IS YOUR CAPTAIN SPEAKING		55	24.95	VOV
TIME OF APOLLO, THE	the apollo achievement	28	27.00	IST
UFO JOURNALS	Visitors from beyond the stars?		29.90	VCL
UNDER KILIMANJARO	Wildlife	26	19.95	JVC
VTV MAGAZINE EDS 1 – 3 (MOTORING)		60 each	25.00 each	VTV
WHAT SHALL WE GIVE THEM TO EAT?		60	19.95	MBH
WILD LIFE THE BABOONS/RUN CHEETAH RUN	Baboon colony/female cheetah	60	19.95	JVC
WINGS OF THE WIND/THEY OWN THE SKY	Hang-gliding/RAF Falcons	52	19.95	JVC
WORLD AT WAR, THE	Parts 1&2, A new Germany/ Distant War	104	39.50	EMI

SCIENCE FICTION

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ALIEN		111	39.95	MAG
ALIEN ATTACK		122	39.95	PRV
ALIEN ENCOUNTERS		90	29.90	VCL
ASTRO ZOMBIES	Berserk human transplants	78	39.95	MNT
ATTACK OF THE KILLER TOMATOES	Musical-disaster comedy	87	39.95	VPD
BARBARELLA	Jane Fonda	97	N/A	CIC
BATTLESTAR GALACTICA		125	N/A	CIC
BENEATH THE PLANET OF THE APES	Charlton Heston, James Franciscus	91	29.95	MAG
BLOB, THE	Steve McQueen	76	39.95	MNT
BODY STEALERS, THE	George Sanders, Maurice Evans	91	36.95	GHV
BOY AND HIS DOG, A	Jason Robards, Don Johnson	90	39.95	VPD
BUCK ROGERS IN THE 25TH CENTURY		89	39.95	CIC
BUCK ROGERS – REBELLION IN SPACE		57	29.95	MNT
BUCK ROGERS – SKY PATROL		57	29.95	MNT

BUCK ROGERS – TOMORROW'S WORLD		57	29.95	MNT
BUCK ROGERS – WAR OF THE PLANETS		57	29.95	MNT
CAPRICORN ONE		123	39.95	PRV
DARK STAR	Dan O'Bannon	81	34.50	IFS
DAY OF THE TRIFFIDS		89	39.95	IPC
DAY THE EARTH CAUGHT FIRE, THE	Janet Munro, Leo McKern	95	37.50	EMI
DAY THE EARTH MOVED, THE	Jackie Cooper, Cleavon Little	74	36.95	GHV
DAY THE EARTH STOOD STILL, THE	Michael Rennie, Patricia Neal	92	29.95	MAG
DEATH DIMENSION	Jim Kelly, Aldo Ray	90	39.95	INT
DESTINATION MOONBASE ALPHA		96	29.95	PRV
DINOSAURUS		80	39.95	MNT
DOOMWATCH	Ian Bannen, Judy Geeson	92	36.95	GHV
DYING SEA, THE		44	29.95	MNT
DYNAMITE JOHNSON	the first bionic boy		39.95	MNT
END OF THE WORLD	Christopher Lee, Sue Lyon	88	39.95	INT
EYES BEHIND THE STARS	Robert Hoffman, Nathalie Delon	90	39.95	INT
FANTASTIC VOYAGE	Stephen Boyd, Raquel Welch	96	29.95	MAG
4D MAN		81	39.95	MNT
GIANT ANT INVASION, THE		44	29.95	MNT
GIANT SALAMANDER, THE		44	29.95	MNT
GODZILLA VS. THE COSMIC MONSTER		80	29.95	HOK
HAWK THE SLAYER	Jack Palance, John Terry	90	29.95	PRV
HUMAN DUPLICATORS, THE		80	39.95	HOK
INVADERS FROM MARS	Helena Carter, Arthur Franz	71	39.95	INT
ISLAND OF TERROR	Peter Cushing	89	39.95	DAV
ISLAND OF THE LOST	Richard Green	91	36.95	GHV
KINGDOM OF THE SPIDERS	William Shatner	91	39.95	INT
LASERBLAST	Kim Milford, Roddy McDowell	87	39.95	INT
LAST CHILD, THE	Michael Cole, Van Heflin	71		RNK
LOVE WAR, THE	Lloyd Bridges, Angie Dickinson	90	36.95	GHV
MAN WHO FELL TO EARTH, THE	David Bowie	134	39.50	EMI
MAN WITH THE SYNTHETIC BRAIN	John Carradine	70	39.95	MNT
MONSTERS FROM AN UNKOWN PLANET		80	39.95	DAV
NIGHT OF THE BIG HEAT	Christopher Lee	90	39.95	DAV
ONE MILLION YEARS BC	Raquel Welch, John Richardson	96	37.50	EMI
PLANET OF THE APES	Charlton Heston, Roddy McDowell	108	29.95	MAG
ROLLERBALL	Futuristic drama – James Caan	123	5.95	INT
SATURN 3		87	29.95	PRV
SHARK'S CAVE		83	39.95	HOK
STAR TREK – the motion picture		130	39.95	CIC
STAR TREK SHORE LEAVE	William Shatner, Leonard Nimoy	49	29.95	MNT
SUPERSONIC MAN	Michael Coby, Cameron Mitchell	90	39.95	INO
THING FROM ANOTHER WORLD, THE/STRANGER OF THE THIRD FLOOR	Classic sci-fi/Peter Lorre	165	39.95	KVD
THREE-HEADED DRAGON, THE	A spectreman movie	44	29.95	MNT
THUNDERBIRDS TO THE RESCUE	from puppet TV series		29.95	PRV
TRAPPED BENEATH THE SEA	Lee J Cobb, Paul Michael Glaser	96	36.95	GHV
UFO JOURNALS		90	31.81	VCL
WARNING, THE	Alien attack	96	36.95	GHV

WESTERNS

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ADIOS GRINGO	Guliano Gemma	100	39.95	INO
ANGEL AND THE BADMAN, THE	John Wayne, Gail Russell	120	29.95	MNT
BAD MAN'S RIVER	Lee Van Cleef	90	39.95	HVS
BANDITS	old fashioned western	88	39.95	INT
BLAZING SADDLES		90	39.95	WHV
BLOOD MONEY	Lee Van Cleef, Lo Lieh		34.50	LVC
BOLDEST JOB IN THE WEST, THE		100	5.95	INT
BORN TO BUCK	"truelife" exciting adventure	60	23.80	VCL
BOUNTY MAN, THE	Clint Walker	74	36.95	GHV
BUTCH CASSIDY AND THE SUNDANCE KID	Paul Newman, Robert Redford	106	29.95	MAG
CAPTAIN APACHE	Lee Van Cleef	94	39.95	HVS
CAPTAIN APACHE	Lee Van Cleef, Carroll Baker	90	29.90	VCL
CAN BE DONE AMIGO	Jack Palance	88	39.95	INT
CHARLEY ONE-EYE	A Negro on the run	96	39.95	INT
DEATH OF A GUNFIGHTER	Richard Widmark, Lena Horne		34.50	LVC
DJANGO	Franco Nero	85	39.95	INO
DRUMMER OF VENGEANCE	Ty Hardin	73	39.95	DAV
DUCHESS AND THE DIRTWATER FOX, THE	George Segal, Goldie Hawn	100	29.95	MAG
EAGLE'S WING	Martin Sheen, Sam Waterston	104		RNK
FOR A FEW BULLETS MORE		100	5.95	INT
GOOD THE BAD AND THE UGLY, THE	Clint Eastwood, Lee van Cleef	161	5.95	INT
GONE WITH THE WEST	Comedy western with James Caan	90	29.90	VCL
HANNIE CAULDER		85	39.95	HOK
HE WHO SHOOTS FIRST		90	5.95	INT
HOMBRE	Paul Newman, Frederic March	106	29.95	MAG
100 RIFLES	Jim Brown, Raquel Welch	105	29.95	MAG
I WILL FIGHT NO MORE FOREVER		105	38.95	GHV
LAST TRAIN FROM GUN HILL	Kirk Douglas, Anthony Quinn	91	29.95	MAG
LONGEST HUNT, THE	Brian Kelly, Keenan Wynn			IFS
MACHO CALLAHAN	David Janssen, Jean Seberg	96	29.95	MAG
MACKINTOSH & T J	Roy Rogers, Clay O'Brien	93		RNK
MASSACRE AT FORT HOLMAN	James Coburn, Telly Savalas	91	36.95	GHV
MY NAME IS NOBODY	Henry Fonda, Terrence Hill	115	39.95	INT
ONE SILVER DOLLAR	Guiliano Gemma	90	39.95	INO

PANCHO VILLA	Telly Savalas, Clint Walker	92	39.95	HVS
PANCHO VILLA	Telly Savalas, Clint Walker	90	29.90	VCL
RAW DEAL	Gerard Kennedy, Gus Mercurio	94	36.95	GHV
REASON TO LIVE/DIE, A	Telly Savalas, James Coburn			IFS
RIO BRAVO		138	39.95	WHV
SANTE FE TRAIL	Errol Flynn	107	39.95	MNT
SEARCHERS, THE	John Wayne	119	39.95	WHV
SHALAKO	Sean Connery	108	47.90	JVC
SHANE	Alan Ladd	117	39.95	CIC
SOLDIER BLUE	Candice Bergen, Peter Strauss	110	29.95	MAG
STARBIRD AND SWEET WILLIAM	Adventures of an Indian boy	90	29.90	VCL
TEXAS ADIOS	Franco Nero	85	39.95	INO
THEIR BREAKFAST MEANT LEAD		96	5.95	INT
THREE BULLETS FOR A LONG GUN		90	5.95	INT
THEY CALL ME LUCKY		103	39.95	HOK
TOWN CALLED BASTARD, A	Robert Shaw, Stella Stevens	97	39.95	HVS
TRACKERS, THE	Sammy Davis jnr,Ernest Borgnine	71		RNK
TRUE GRIT	John Wayne as Rooster Cogburn	128	N/A	CIC
UNDEFEATED, THE	John Wayne, Rock Hudson	114	29.95	MAG
VIOLENT BREED, THE		85	39.95	HOK
WHITE COMANCHE	Dramatic struggle for supremacy	98	39.95	INT
WILD BUNCH, THE		127	39.95	WHV
WILD WOMEN	Hugh O'Brien, Anne Francis	72		RNK
YUMA	Clint Walker	75	36.95	GHV
ZACHARIAH	Rock 'n roll western	92		RNK

HORROR FILMS

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ATTACK OF THE KILLER TOMATOES	Musical-Disaster comedy	87	39.95	VPD
BABY,THE	Anjanette Comer, Ruth Roman	85	39.95	HVS
BAT, THE	Vincent Price, Agnes Moorhead	78		RNK
BAT PEOPLE, THE	honeymoon turns to horror	91	39.95	INT
BEAST IN THE CELLAR		90	36.95	GHV
BLACKMAIL	Alfred Hitchcock	92	37.50	EMI
BLACK SABBATH	Boris Karloff		39.95	INO
BLOOD	Alan Bererdt, Hope Stanburg	57	26.00	IFS
BLOOD BEAST TERROR, THE	Victorian thriller	91	36.75	VDM
BLOOD ON SATAN'S CLAW		95	36.95	GHV
BLOODY ORGY OF THE SHE DEVILS	Sensational horror feature	73	29.90	VCL
BLOOD-SPATTERED BRIDE		95	39.95	MNT
BLOODSUCKERS	Patrick Macnee, Peter Cushing	76	39.95	INT
BODY STEALERS, THE	George Sanders, Maurice Evans	91	36.95	GHV
CANNIBAL MAN, THE	The mind of a murderer	98	39.95	INT
CARRIE	Sissy Spacek	98	5.95	INT
CARS THAT ATE PARIS, THE		90	5.95	INT
CAULDRON OF BLOOD	Boris Karloff	87	36.95	VDM
CHILDREN SHOULDN'T PLAY WITH DEAD THINGS	Witchcraft	90	39.95	INT
CITY OF THE DEAD	Witch-craft	78	39.95	INT
CORPSE GRINDERS	Bone crushing terror	90	29.90	VCL
CREEPING FLESH, THE	Peter Cushing	92	36.95	VDM
CRUCIBLE OF TERROR	Mike Raven, Mary Maude	90	39.95	HVS
CRYPT OF THE LIVING DEAD			34.50	LVC
CURSE OF THE CRIMSON ALTAR	H P Lovecraft classic story	84	36.95	VDM
DAMIEN OMEN 2	William Holden, Lee Grant		39.95	MAG
DEAD OF THE NIGHT	Back from the Dead	78	39.95	INT
DEATH TRAP	An electrifying feature	90	29.90	VCL
DEMONS, THE	Witchcraft and torture	90	39.95	GOV
DEVIL DOLL/THE CURSE OF SIMBA	Bryant Halliday, Yvonne Romaine/ Bryant Halliday, Dennis Price	165	39.95	KVD
DEVIL X FIVE		87	37.74	INT
DEVILS OF DARKNESS	William Sylvester	90	39.95	DAV
DEVIL'S HAIRPIN	Cornel Wilde, Jean Wallace			IFS
DEVIL'S MEN, THE	Donald Pleasence	93	29.95	MAG
DEVIL'S NIGHTMARE	erotic horror	90	39.95	GOV
DEVIL'S RAIN	William Shatner, Ernest Borgnine	82	34.50	IFS
DRACULA	Frank Langella	109	39.95	CIC
DRACULA – Andy Warhol			39.95	SML
DRACULA VERSUS FRANKENSTEIN		90	5.95	DAV
DRACULA'S VIRGIN LOVERS	Paul Nashy	76	34.50	IFS
DYING SEA, THE		44	29.95	INT
EXORCIST, THE		120	39.95	WHV
EYES WITHOUT A FACE		94	39.50	EMI
FACE OF FU MANCHU, THE	Christopher Lee	94	39.50	EMI
FEAR	Donald Pleasance	83	39.95	INT
FLESH AND BLOOD SHOW, THE	Horror classic	97	36.75	VDM
FRANKENSTEIN	Boris Karloff in 1931 original	71	N/A	CIC
FRIGHTMARE	Ruper Davies, Sheila Keith	95	39.95	HVS
GHOUL, THE		86	34.95	RNK
GIANT ANT INVASION, THE		44	29.95	VTX
GRAVE OF THE VAMPIRE		91	36.95	GHV
GRIP OF THE STRANGLER/FIEND WITHOUT A FACE	Boris Karloff/Marshall Thompson	165	39.95	KVD
HALLOWEEN	Donald Pleasence, Jamie Lee Curtis	92	39.95	VPD
HAUNTED HOUSE OF HORROR, THE	Frankie Avalon, Mark Wynter	91	36.95	VDM
HILLS HAVE EYES, THE	A Wes Craven film			JAG
HORROR EXPRESS		88	5.95	INT
HORROR HOSPITAL	Michael Gough	86	34.50	IFS
HOUSE OF THE LIVING DEAD	Shirley Anne Field	85	39.95	INT
HOUSE OF WHIPCORD	Barbara Markham, Ptrick Barr	103	39.95	HVS
HOUSE THAT WOULDN'T DIE, THE	Barbara Stanwyck	90	36.95	GHV
HUNCHBACK OF NOTRE DAME	Charles Laughton, Maureen O'Hara	112	37.50	EMI
INVASION OF THE BLOOD FARMERS		73	39.95	VTX
KING KONG	Fay Wray, Bruce Cabot	96	37.50	EMI
KING OF KONG ISLAND		90	39.95	INT
KISS OF THE TARANTULA, THE		84	39.95	HOK
KNIFE FOR THE LADIES	Ruth Roman, Jack Elam	51	26.00	IFS
LATE NIGHT TRAINS		89	29.95	WOV
LEGACY OF SATAN	Lisa Christian, Paul Barry	56	26.00	IFS

LEGEND OF THE WEREWOLF		88	34.95	RNK
LEMORA LADY DRACULA	William Witton, Leslie Gilb			IFS
MAGIC CURSE, THE		90	39.95	HOK
MALPERTIUS	Orson Welles, Susan Hampshire	89	39.95	INT
MARK OF THE DEVIL		90	39.95	INT
MIRRORS	psychological drama	88	39.95	INT
NIGHT STALKER, THE	Darren McGavin	73	36.95	GHV
NIGHT STRANGLER, THE	Darren McGavin	90	36.95	GHV
OCTAMAN	Kerwin Matthews	76	34.50	IFS
OMEN, THE		106	29.95	MAG
PERSECUTION		93	34.95	HIK
PHANTASM	corpses don't stay dead!		38.00	PTV
PHANTOM OF THE OPERA	Lon Chaney 1925	74	30.00	PGV
POSSESSION OF JOEL DELANEY, THE	Shirley Maclaine, Miriam Colon	104	29.95	PRV
PRISONER OF THE CANNIBAL GOD		96	39.95	INT
PSYCHIC KILLER		85	29.99	VIPC
PSYCHO	Hitchcock's masterpiece	108	N/A	CIC
PSYCHOMANIA	George Sanders, Beryl Reid	90	39.95	HVS
QUEEN OF SPADES	Anton Walbrook, Edith Evans	90	37.50	EMI
REPULSION	Catherine Deneuve, Patrick Wymark		36.95	VDM
SATAN'S CHEERLEADERS		88	34.50	DAV
SATAN'S SLAVE	Witchcraft	87	39.95	INT
SAVAGE WEEKEND		76	39.95	HOK
SCREAM BLOODY MURDER		90	39.95	INT
SHOCK	Italian horror		36.95	VDM
SHOCK CORRIDOR	Directed by Sam Fuller	101	39.95	VUL
SIMON, KING OF WITCHES	Black mass, black magic	84	34.50	IFS
SON OF KONG/YOU'LL FIND OUT	The monster classic/ Karloff, Lorre, Lugosi	165	39.95	KVD
STUDY IN TERROR, A	London's East End in the 1980s	95	39.95	INT
TASTE OF EVIL, A	Barbara Stanwyck, Barbara Parkins	90	36.95	GHV
VENOM	British horror suspense	84	34.50	IFS
VIRGIN WITCH	Witchcraft	93	39.95	INT
WHATEVER HAPPENED TO AUNT ALICE?		98	N/A	RNK
ZOMBIE FLESH EATERS		89	29.95	VIP

MARTIAL ARTS

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ANGRY DRAGON, THE	Cheung Lik	73	34.50	IFS
BLACK DRAGON REVENGES THE DEATH OF BRUCE LEE	Ron Van Cliff	90	39.95	INO
BOXER'S ADVENTURE, THE		100	15.00	ACE
BRAVE LION, THE			32.50	CEL
BRUCE AGAINST IRON HAND		89	39.95	INO
BRUCE AND DRAGON FIST	Bruce Le	85	34.95	ICV
BRUCE AND THE SHAOLIN BRONZE MEN			34.50	LVC
BRUCE & SHAO-LIN KUNG FU 1	Bruce Le	86	34.95	ICV
BRUCE AND SHAO-LIU KUNG FU	Bruce Le	83	34.95	ICV
BRUCE LEE'S GREATEST REVENGE		100	15.00	ACE
BRUCE LEE IN NEW GUINEA			32.50	CEL
BRUCE LEE AGAINST SUPERMEN	Bruce Li	80	39.95	INO
BRUCE'S FINGERS	Bruce Lee, Chan Wai Man	91	39.95	INT
BRUCE LEE, THE MAN, THE MYTH		91	39.95	DAV
CLEOPATRA WONG		90	39.95	MNT
CLONES OF BRUCE LEE, THE		85	39.95	HOK
CLUTCH OF POWER, THE	Web of Oriental intrique	90	29.90	VCL
CRYSTAL FIST		85	39.95	INO
DEADLY CHASE FOR JUSTICE		85	34.95	ICV
DEADLY REVENGE		90	39.95	INO
DRAGON DIES HARD	Bruce Li	77	39.95	INO
DRAGON LIVES AGAIN, THE	Bruce Lee	90	29.90	VCL
DRAGON'S CLAWS		100	15.00	ACE
DUEL WITH THE DEVILS		85	34.95	ICV
EAGLE FIST, THE		100	15.00	ACE
8 MASTERS, THE		100	15.00	ACE
18 RIDERS FOR JUSTICE	Chen Sheng, Wang Tao	85	34.95	ICV
ENTER THE DRAGON	Bruce Lee	86	34.95	WHV
EXIT THE DRAGON, ENTER THE TIGER	Bruce Li	84	39.95	INO
FEARLESS YOUNG BOXER	Peter Chen	83	34.95	ICV
FIERCE ONE, THE	Jimmy Nam	84	34.95	ICV
FISTS OF FURY 2		95	39.95	HOK
FIVE KUNG FU DAREDEVIL HEROES		85	34.95	ICV
FOUR SHAO-LIN CHALLENGERS		100	15.00	ACE
GENERAL STONE	Set in ancient China	90	29.90	VCL
GODFATHER OF HONG KONG	Yung & Kao after opium ring	89	39.95	INT
GOODBYE, BRUCE LEE	His last game of death	84	39.95	INT
HERO OF SHANGHAI		85	34.95	ICV
HERO OF THE TIME		85	34.95	ICV
INCREDIBLE KUNG FU MISSION		100	15.00	ACE
INVINCIBLE IRON PALM, THE	Feature	70	19.95	VIP
INVINCIBLE SUPER CHAN		90	39.95	INO
IRON MONKEY, THE		85	34.95	ICV
JAWS OF THE DRAGON		92	39.95	MNT
KILL THE GOLDEN GOOSE	hapkido karate	81	34.50	IFS
LADY KARATE	Chia Ling	86	34.95	ICV
LAMA AVENGER, THE		87	39.95	INO
LAND OF THE BRAVE			32.50	CEL
MARVELLOUS STUNTS OF KUNG FU		85	34.95	ICV
MATCH OF DRAGON AND TIGER	Yue Tin Lung	87	39.95	INO
MEN ON THE HOUR		85	34.95	ICV
MY KUNG FU 12 KICKS		100	15.00	ACE
MY NAME CALLED BRUCE	Bruce Le	85	34.95	ICV
MYSTERIOUS HEROES	Spectacular swordsmanship	90	29.90	VCL

NEEDLES OF DEATH		69	39.95	INO
REAL BRUCE LEE, THE	Bruce Lee, Dragon Lee	120	39.95	INT
RETURN OF BRUCE	Bruce Le	85	34.95	ICV
RETURN OF FIST OF FURY		84	34.95	ICV
RETURN OF THE DRAGON	Yue Tin Lung	90	39.95	INO
RETURN OF THE TIGER			32.50	CEL
RIVALS OF THE DRAGON			39.95	VUL
SHAO-LIN EX MONK, A		100	15.00	ACE
SHAOLIN IRON FINGER		85	34.95	ICV
SHAOLIN KUNG FU MASTER		85	34.95	ICV
SHAOLIN MASTER AND THE KID		85	34.95	ICV
SNAKE IN THE MONKEY'S SHADOW	John Chang	85	39.95	INO
SUN DRAGON		92	39.95	INO
SUPER DRAGON		90	39.95	HOK
TIGER STRIKES AGAIN, THE	Bruce Li, Carl Scott	85	39.95	INO
TREASURE OF BRUCE LEE	Bruce Le	85	34.95	ICV
TWO IN BLACK BELT	Murder and vengeance	90	29.90	VCL
WAY OF THE BLACK DRAGON		88	39.95	INO
WAYS OF KUNG FU, THE		100	15.00	ACE

ROCK MUSIC

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ABBA MUSIC SHOW 1		30	39.95	INT
ABBA MUSIC SHOW 2		40	39.95	INT
AMANDA LEAR	Live	28	19.55	VCL
ANN MARGRET – FROM HOLLYWOOD WITH LOVE	with guest Dean Martin	52	23.80	VCL
AVERAGE WHITE BAND	Live on European tour	28	19.55	VCL
BEN SIDRAN		45	28.75	INT
BERT KAEMPFERT AND HIS ORCHESTRA		55	19.55	VCL
BEST OF JUDY GARLAND, THE		120	39.95	WOV
BLACK SABBATH	Live performance	60	23.80	VCL
BOBBY DARIN		60	23.80	VCL
BONEY M P1		60	29.99	IPC
BOOMTOWN RATS, THE	Live at Hammersmith Odeon	50	23.80	VCL
BROTHERS AND SISTERS	Concert, live in Chicago	60	23.80	VCL
BUDDY HOLLY SHOW, THE		110	39.95	HOK
DARRYL HALL & JOHN OATES		45	28.75	INT
DICK CLARK SHOWS	20 programmes	60	39.95	INT
DISCO DYNAMITE		79	39.95	HOK
EAT TO THE BEAT	Blondie	42	29.95	BWV
ELECTRIC LIGHT VOYAGE	Electronic fantasy	60	39.95	VPD
ELKIE BROOKS		45	28.75	INT
ELO LIVE IN CONCERT	Empire pool Wembley	60		VCL
ELTON JOHN IN CENTRAL PARK, NEW YORK		60		VCL
ELVIS IN HAWAII	Elvis Presley	56	29.95	MNT
ELVIS THE KING OF ROCK 'N ROLL		120	39.95	WOV
EVERY GIRL AN ENGLISH ROSE		25	15.00	AVM
FIFTH DIMENSION	with Dionne Warwick and the Carpenters	60	23.80	VCL
FILLMORE ROCK FESTIVAL	Santana, Jefferson Airplane	101	39.95	MNT
FLOWER OUT OF PLACE, A		50	29.95	VPD
FUN IN ACAPULCO	Johnny Cash, Linda Ronstadt & more Elvis Presley	93	29.95	MAG
GARY NUMAN		53	29.95	WHV
GREAT GOLDEN HITS OF THE MONKEES, THE		30	19.55	VCL
JAMES BROWN STORY		60		JVC
JAZZ FESTIVAL		60	23.80	VCL
JOHNNY CASH WORLD, AND HIS MUSIC		78	5.95	INT
KENNY BALL AND HIS JAZZMEN	Kenny Ball	30	19.55	VCL
KENNY EVERETT VIDEO SHOW		104	39.50	EMI
LEROY GOMEZ	Disco star of Santa Esmarelda	28	19.55	VCL
LOU RAWLS		60	23.80	VCL
LOVE MACHINE FROM THE USA	Seven beautiful girls	30	19.55	VCL
MANNFRED MANN'S EARTH BAND		30	28.75	INT
"MARY WILSON" AND THE SUPREMES	Live in London	30	19.55	VCL
MICHELLE LAURENN	Delightful voice, infectious	30	19.55	VCL
MINA LIVE	Italian singer and entertainer	45	23.80	VCL
MOVIES		43	28.75	INT
NANCY WILSON		60	23.80	VCL
NEW CENSATION	Vintage performance	60	23.80	VCL
NINA VON PALLANDT		30	19.55	VCL
ONE TOUCH OF VENUS		90	34.74	INT
OSMOND BROTHERS SPECIAL		80		JVC
PARADISE, HAWAIIAN STYLE	Elvis Presley	88	29.95	MAG
PHILLIP GOODHAND-TAIT	Sunshine on Ice	30	19.55	VCL
RANDY EDELMAN		30	19.55	VCL
RAQUEL		60	23.80	VCL
ROBERT GORDON WITH LINK WRAY		45	28.75	INT
ROCK AND ROLL REVIVAL		60	23.80	VCL
ROGER DALTRY – RIDE A ROCK HORSE		30	19.55	VCL
ROSE, THE	Bette Midler	129	39.95	MAG
SAD CAFE		52	19.55	VCL
SONNY AND CHER		60	23.80	VCL
SOUNDS OF THE SEVENTIES	Carlos Santana	52	19.55	VCL
STAMPING GROUND		91	39.95	INT
STARFIRE	Live in Europe	60	23.80	VCL
STATUS QUO – OFF THE ROAD	Offroading (motor sport) plus Quo in concert	30	19.55	VCL
STRANGE CASE OF ALICE COOPER			29.95	MAG
STREISAND - MY NAME IS BARBARA		120	39.95	WOV
SUSAN GEORGE - NATURALLY	Into the world of music	28	19.55	VCL
10 CC IN CONCERT LIVE		60	28.75	INT
THIN LIZZY		50	25.46	VCL
TINA TURNER	Live at Apollo, London	28	19.55	VCL
TOM JONES		60	23.80	VCL
TO RUSSIA WITH ELTON		74	29.95	PRV
WALDORF TRAVERS	Songs from "Night Blindness"	30	19.55	VCL
WOODSTOCK		173	39.95	WHV

CLASSICAL MUSIC

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
BEGGAR'S OPERA	Laurence Olivier	90	39.50	EMI
BIZET'S CARMEN	Carmen translated into dance	60	23.80	VCL
BRAHMS DOUBLE CONCERTO		70		JVC
CHRISTMAS CAROLS FROM CAMBRIDGE	King's College Choir	54	39.50	EMI
EVENING WITH THE ROYAL BALLET, AN	Rudolf Nuryev, Margot Fonteyn	85		RNK
FOUR SEASONS	I musici ensemble	50		JVC
GISELLE	Bolshoi Theatre in Moscow	85	19.95	JVC
GISELLE	Rudolf Nuryev, Monica Mason	77	29.95	PRV
HMS PINAFORE	D'Oyly Carte opera company	78		PRV
I AM A DANCER	Rudolf Nureyev, Margot Fonteyn	90	39.50	EMI
ISRAEL PHILHARMONIC 40th ANNIVERSARY		85		JVC
JAMES GALWAY AND KYUNG WAH CHUNG		70		JVC
LA TRAVIATA	Orchestra & Chorus Rome Opera House	113	39.95	RNK
LUCIA DI LAMMERMOOR	(two tapes)	60 each		JVC
MERRY WIVES OF WINDSOR, THE	The Zagreb Symphony Orchestra	97	39.95	RNK
MIKADO, THE	The D'Oyly Carte Opera Co	122	44.95	RNK
MOZART	Conductor, Isaac Stern	55	29.99	IPC
NEW YORK CITY BALLET, THE	Tchaikovsky, Bizet, Brahms	114	45.00	EMI
NUTCRACKER, THE		85		JVC
PACO DE LUCIA	Genius of Flamenco Guitar	30	19.55	VCL
TALES OF BEATRIX POTTER	Frederick Ashton ballet	86	39.50	EMI
YEOMAN OF THE GUARD		103	29.95	PRV

MUSICALS

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
BLUE HAWAII	Elvis Presley	97	29.95	MAG
BREAKING GLASS	Hazel O'Connor, Phil Daniels	104		PTV
BUGSY MALONE	Jodie Foster, Scott Baio	93	39.95	RNK
CABARET	Liza Minnelli, Michael York	123		RNK
CAN'T STOP THE MUSIC	The village people	120	39.50	EMI
CHITTY CHITTY BANG BANG	Dick Van Dyke, Lionel Jeffries	142	5.95	INT
DAMSEL IN DISTRESS/OLD MAN RHYTHM	Fred Astaire/George Burns/ Betty Grable, Johnny Mercer	165	39.95	KVD
DOCTOR DOLITTLE	Rex Harrison, Samantha Eggar	146	39.95	MAG
FIDDLER ON THE ROOF	Topol	169	5.95	INT
FOLLOW THAT DREAM	Elvis Presley		34.50	LVC
G I BLUES	Elvis Presley	100	29.95	MAG
GIRLS, GIRLS, GIRLS	Elvis Presley	102	29.95	MAG
GREASE	John Travolta, Olivia Newton-John	110	N/A	CIC
HAIR	'sixties peace musical	121	5.95	INT
HELLO DOLLY!	Barbra Streisand, Walter Matthau	140	39.95	MAG
JESUS CHRIST SUPERSTAR		107	N/A	CIC
KING AND I, THE	Deborah Kerr, Yul Brynner	128	39.95	MAG
KING CREOLE	Elvis Presley	110	29.95	MAG
ROLLER BOOGIE	Linda Blair	103	39.95	VPD
ROUSTABOUT	Elvis Presley	97	29.95	MAG
SKY'S THE LIMIT, THE/STEP LIVELY	Fred Astaire, Robert Ryan/ Frank Sinatra, George Murphy	165	39.95	KVD
SOUND OF MUSIC, THE	Julie Andrews	167	39.95	MAG
TOP HAT	Fred Astaire, Ginger Rogers	96	37.50	EMI
WEST SIDE STORY	Winner of ten Academy Awards	151	5.95	INT
YOUNG ONES, THE	Cliff Richard	104	37.50	EMI

ADULT

Title	Summary	Lngth mins	Price VHS/ Beta	Dist
ABDUCTION OF LORELEI		90	55	RIP
ADVENTURES OF ALISON I		60	40.25	VDX
ADVENTURES OF ALISON II	Peter Orlando, Jackie Roberts	60	40.25	VDX
AFFAIRS OF JANICE			39.95	VBP
AFRICA			24.95	VOV
AIN'T MISBEHAVIN'	Orig. and erotic extraordinary	93	39.95	INT
ALICE IN WONDERLAND	X-rated musical comedy	75	39.95	INT
ALLEY CATS	Adult	55	29.95	DAV
ALL THE SENATOR'S GIRLS		90	49.50	ADV
AMOROUS ADVENTURES OF A YOUNG POSTMAN		86	39.95	INT
ANGIE BABY		81	39.95	CVV
APHRODISIAC	An erotic fantasy	120	39.95	MNT
AU PAIR GIRLS	Four foreign lovelies		29.95	VDM
BABYFACE		85	39.50	TCX
BABY ROSEMARY	Sharon Thorpe	90	39.95	IPC
BED HOSTESSES	Adult	60	19.95	VIP
BEDMANIA	Bed tells the story of its life	80	39.95	INT
BEDSPREAD, THE	Young girl's life between sheets	65	39.95	HVS

BEHIND THE GREEN DOOR	Marilyn Chambers	75	39.50	TCX
BELOW THE BELT		93	39.50	TCX
BIG BAD WOLF, THE			24.95	VOV
BILL MARILYN BOB AND LAURA	Bill Page, Denise Horlor	60	40.25	VDX
BILLY THE KID TRAPPED			24.95	VOV
BITCH, THE	Joan Collins, Michael Coby	90	39.95	IPC
BLACK DECAMERON	five erotic tales from Africa	90	39.95	INT
BLACK DEEP THROAT	Ajita, Ivan Staccioli	90	39.95	INT
BLACK EMANUELLE, WHITE EMANUELLE	Laura Gemser	90	39.95	DAV
BLACKENSTEIN				VPD
BLONDE VELVET	International sexual blackmail	80	39.95	ITC
BLOOD & BLACK LACE	Cameron Mitchell, Eva Bartok	80	34.50	IFS
BLOW CUT		133	5.95	INT
BLUE FANTASIES		72	39.95	HOK
BRITT BLAZER		60	24.95	KLV
BRUTES AND SAVAGES	Factual report, not for the nervy	85	39.95	DAV
BURNING PASSION		78	34.95	VOV
BURNING PASSIONS			34.95	VOV
BUTTERFLIES	A country girl in the Big City	90	55.00	RIP
BUTTERFLY		90	49.50	ADV
BUTTERFLY			39.95	VBP
CAGED WOMEN	Adult	60	19.95	VIP
CALIGULA EROTICA		75	39.95	INO
CANDIDO EROTICO		95	39.95	CVD
CANDY GOES TO HOLLYWOOD			39.95	VBP
CAN YOU KEEP IT UP FOR A WEEK	Hilarious sex comedy	94	39.95	INT
CAR HOPS	Drive in - you want to come again	120	39.95	MNT
CARNAL GAMES			39.95	VBP
CASTING COUCH		60	24.95	KLV
CATCH #9	Adults only-2's company, 3's..	65	39.95	HVS
CAUGHT IN THE CAN		60	24.95	KLV
CENTREFOLD GIRLS	Most beautiful girls in the world	92	39.95	INT
CHAMPAGNE FOR BREAKFAST	Leslie Bovee, John Holmes		39.95	SML
CHANDIDO EROTICA	Lilli Carati, Marcha Carven	95	39.95	INO
CHERRY AND MELANIE	Sindy Young, 'Sooty' Blair	60	40.25	VDX
CHERRY PICKER, THE	Lulu, Spike Milligan	79	34.50	IFS
CHERRY TRUCKERS		90	49.50	ADV
CHINA DE SADE		90	49.50	ADV
CHINA LUST		90	49.50	ADV
CHRISTY		60	50.00	RIP
CO-ED FEVER			39.95	VBP
COME PLAY WITH ME		93	39.95	HOK
COMING OF ANGELS, A		86	39.50	TCX
COMPUTER GAME	Dating service you'll never forget	63	39.95	HVS
CONFESSIONS FROM THE DAVID GALAXY AFFAIR		95	39.95	HOK
CONFESSIONS OF A FRUSTRATED HOUSEWIFE	Carol Baker, Adolfo Celi	82	34.50	IFS
CONFESSIONS OF A MOVIE STAR		89	39.95	INT
CONFESSIONS OF AN AMERICAN HOUSEWIFE	Daughter tells mom free love's fun	120	39.95	MNT
CONFESSIONS OF A SEXY PHOTOGRAPHER		72	34.50	IFS
CONFESSIONS OF THE SEX SLAVES		70	29.95	HOK
COOL IT CAROL	Robin Askwith, Janet Lynn	101	39.95	HVS
COUPLES	June Day, Steven Powers	60	40.25	VDX
CROCODILE	Dat Puvanai, Tany Tim	83	39.95	INT
CRUEL PASSION	Koo Starr, Lydia Lisle	92	39.95	INT
CRY UNCLE	Super dick enjoys sex on the job	120	39.95	MNT
DAUGHTER OF EMANUELLE		84	39.95	HOK
DEATHHEAD VIRGIN, THE	Jock Gaynor, Larry Ward	90	39.95	INT
DEATH OF A HOOKER	Adult action-thriller	86	39.95	INT
DEBBIE DOES DALLAS			39.95	VBP
DEEP THROAT			39.95	VBP
DEFIANCE		90	49.50	ADV
DELINQUENT COLLEGE GIRL		60	29.95	DPV
DELINQUENT COLLEGE GIRLS	Three men on the run	60	23.80	VCL
DESIRES WITHIN YOUNG GIRLS			39.95	VBP
DEVIL IN MISS JONES			39.95	VBP
DEVIL INSIDE HER, THE	Set in 1826	90	55.00	RIP
DEVIL'S GARDEN, THE		81	39.95	CVV
DEVIL'S NIGHTMARE	erotic horror	90	39.95	GOV
DEVIL'S PLAYGROUND		90	49.50	ADV
DIAL A GUY	Mark Jenson, Andrew Bailey	60	40.25	VDX
DIE SCREAMING MARIANNE	Susan George, Barry Evans	100	39.95	HVS
DINGLE DANGLE		84	39.50	TCX
DIRTY EVENING	Bernard Manning	60	37.00	VDC
DIRTY LILY		90	39.95	CVD
DIRTY MIND OF YOUNG SALLY, THE	A beautiful but bored secretary	96	39.50	TCX
DIRTY WESTERN, A		90	49.50	ADV
DIVORCE – Italian style			34.95	VOV
DOCUMENTARY OF A MADAME		60	24.95	KLV
DR MINX		90	34.95	VOV
DOGGIE BAG	She loves to love, doggie style	65	39.95	HVS
EASY	Jessie St James	83	49.50	CVV
ECSTASY GIRLS			39.95	VBP
ELECTROSEX		60	50.00	RIP
ELECTRIC BLUE 001	Fiona Richmond	60	31.00	SCG
ELECTRIC BLUE 002	Marilyn Chambers, Joanna Lumley	60	31.00	SCG
ELECTRIC BLUE 003	Britt Ekland, Marilyn Monroe	60	31.00	SGC
ELECTRIC BLUE 004		60	31.00	SCG
ELECTRIC BLUE 005	It's all sex!	60	31.00	SCG
EMILY	Koo Stark, Sarah Brackett	95	39.95	HVS
EMANUELLE AND FRIENDS	Encounters guaranteed to please	60	19.95	MNT
EROTIC ADVENTURES OF CANDY, THE			39.95	VBP
EROTIC IMAGES I		60	40.25	VDX
EROTIC IMAGES II		60	40.25	VDX
EROTIC INFERNO		82	39.95	HOK
ERUPTION	Leslie Bovee, John Holmes	78	49.50	CVV
ESCORT GIRLS	Helen Christie, Marika Mann	90	39.95	INT
ESKIMO NELL	Based on fewd ballad same name	120	39.95	MNT
EXPENSIVE TASTE		90	49.50	ADV
EXPERIMENT,THE	Original un-cut version	60	29.90	CVL
FANTASY		90	49.50	ADV
FEMALE RESPONSE	Lib'd women discuss and display	120	39.95	MNT
FILTHIEST SHOW IN TOWN	"Judge for yourself on obscenity"	120	39.95	MNT
FILTHIEST SHOW IN TOWN, THE		74	39.95	MNT
FINAL TEST		90	49.50	ADV
FINISHING SCHOOL		90	49.50	ADV
FIONA ON FIRE		90	49.50	ADV
FLESH GORDON				VPD
FOR MEN ONLY	David Kernan, Andrea Allen	61	39.95	HVS
FRAT HOUSE		90	49.50	ADV
FREE CLINIC		60	50.00	RIP
FRENCH LOVERS, THE	2 French soldiers on vacation	84	39.95	INO
FRESH, YOUNG AND SEXY		60	24.95	KRY
GAMES THAT ADULTS PLAY	Joanna Lumley, Penny Brahms	90	29.90	VCL
GETTING OFF		90	49.50	ADV
GIRLS COME FIRST		60	30.00	OPP
GIRLS FOR RENT	Georgina Spelvin, Susan McIver	86	39.95	INT
GIRL GO ROUND	Adult	55	29.95	DAV

GLASS TABLE ORGY, THE	Louise Reading, Sindy Young	60	40.25	VDX
GODSON, THE	Orgies, killing prostitution	93	39.50	TCX
GOLDEN GATE PAY-OFF		60	29.95	DPV
GOOD GIRLS OF GODIVA HIGH		90	49.50	ADV
GREEK CONNECTION, THE	Athens dope trade	77	35.95	ITC
GROUPIE GIRL	Groupie sexual initiation test	120	39.95	MNT
GROUP MARRIAGE	Group sex	88	39.95	INT
GUESS WHAT WE LEARNED IN SCHOOL TODAY	Richard Carballo, Devin Goldenbrg	87	39.95	INT
GUMS	'Jaws' & 'Deep Throat' combo	120	39.95	MNT
HAPPY HOLIDAY		90	55.00	RIP
HAPPY HOOKER, THE	Lynn Redgrave, J.P.Aumont	87	39.95	INT
HAPPY HOOKER GOES TO WASHINGTON, THE	Joey Heatherton	86	39.95	INT
HARD STUFF	Harry Reems	59	31.95	ITC
HAREM HANG-UPS		60	29.95	DPV
HOT ONE, THE		81	39.95	CVV
HOT RACKETS		81	39.95	CVV
HOT SEX IN BANGKOK	Adult	60	19.95	VIP
HOT TIMES	American Graffiti with sex	120	39.95	MNT
HOUSE OF HOOKERS		60	29.95	DPV
HOUSE OF PERVERSITY		90	39.95	GOV
HOUSEWIFE ORGY		60	24.95	KRY
HOW TO SUCCEED WITH SEX	Zack Taylor, Mary Jane Carpenter	75	39.95	INT
HUSBANDS, WIVES AND OTHER STRANGERS		60	50.00	RIP
I FEEL IT RISING	Jennifer Welles, John Leslie	79	35.95	ITC
IMMORAL		83	39.95	VIP
I'M NOT FEELING MYSELF TONIGHT		62	29.95	JAG
INCREDIBLE CHESTY MORGAN AND HER DEADLY WEAPONS		74	39.95	INT
INTERNATIONAL RED TAPE	Int by Keith Allen		29.95	RTP
INTIMATE GAMES	Students' fantasies		29.95	VDM
INTIMATE RELATIONS		84	39.95	INO
IS THERE SEX AFTER DEATH?	Buck Henry, Holly Woodlawn	85	39.95	INT
JAMBOREE	Girl Guides at summer camp	12	25.00	TAB
JOE	Dennis Patrick, Peter Boyle	107	39.95	INT
JOHNNY WADD	John Holmes	60	50.00	RIP
JOLLY HOCKEY STICKS/TEENAGE SEX		45	45.00	TAB
JOY OF FEELING AROUND		90	39.95	CVV
JOY OF LETTING GO		60	29.95	DPV
JOYS OF GEORGETTE	Strange puzzling Georgette	64	39.95	HVS
KING DICK	adult cartoon	66	39.95	INT
KNOCKOUTS		60	29.95	DPV
LADIES' DOCTOR	Paola Senatore	93	39.95	INO
LADIES NIGHT		84	39.50	TCX
LADY IS A WHORE, THE	Anna Fonsou, Christos Nomikos	79	39.95	INT
LANDING SPRING			24.95	VOV
LAST TANGO IN PARIS	Marlon Brando	129	5.95	INT
LAURA		60	24.95	KLV
LIFETAKER, THE	Terence Morgan	82	39.95	INT
LIKE MOTHER LIKE DAUGHTER			49.50	ADV
LITTLE GIRL..BIG TEASE	Multisexual adventures	83	39.95	INT
LITTLE GIRLS BLUE		90	49.50	ADV
LIVE SHOW		30	21.95	KRY
LIVING FORM	Eternal qualities of woman	30	19.55	VCL
LOOK		30	14.95	PPL
LOOK - NO STAPLES VOLUME 1	Dana Gillespie	60	29.90	CLV
LOOK - NO STAPLES VOLUME 2	Dana Gillespie	60	29.90	CLV
LOVE AND KISSES	Hot moments in cold climates	99	39.95	ITC
LOVE BOX, THE	Classified ads for strange tastes	120	39.95	MNT
LOVE BUTCHER, THE	Erik Stern, Kay Neer	90	39.95	INT
LOVE CLINIC	Place for flagging lovers	93	39.95	INO
LOVE FOR SALE		60	50.00	RIP
LOVE GAMBLER		60	29.95	DPV
LOVE IN A WOMAN'S PRISON		60	24.95	KRY
LOVE IN FOUR EASY LESSONS	Ursula Andress, Barbara Bouchet	80	39.95	INT
LOVE IN HOT PANTS	Her love made him pant for more	64	39.95	HVS
LOVE SWEDISH STYLE	Adventure of Swedish au-pair	120	39.95	MNT
LOVE THY NEIGHBOR	They played musical beds	61	39.95	HVS
LUST FOR REVENGE	Kidnap, rape and suicide	85	39.95	INT
LUSTFUL VICAR, THE	Jarl Borssen, Margit Carlquist	82	39.95	INT
MADAME ZENOBIA	Erotic tale of voodoo lust	120	39.95	MNT
MAID IN SWEDEN	Kristina Lindberg, Monika Ekman	90	39.95	INT
MAN OF VIOLENCE	Michael Latimer, Luan Peters	107	39.95	HVS
MAN WHO COULDN'T GET ENOUGH, THE	Roger Lloyd Pack, Vicki Hodge	81	39.95	INT
MASH'D			39.95	VBP
MASSAGE PARLOUR WIFE	Series of sex romps with Melonie	84	39.50	TCX
MEATBALL		90	49.50	ADV
MELODY IN LOVE	Melody O'Brien, Sascha Hein	96	39.95	INO
MIDNIGHT BLUE	Michael Coby		38.95	JUB
MIRAGE		60	29.95	PPL
MIRAGE – ISSUE ONE	Video magazine	60	31.00	EEL
MIRAGE – ISSUE TWO	adult videoscene	60	29.95	PPL
MISTRESS, THE	Senta Berger	81	39.95	INO
MONDO EROTICO		70	29.95	HOK
MONIQUE	Sultry au pair		29.95	VDM
MORE THAN SISTERS			39.95	VBP
MYRA BRECKINRIDGE		90	29.95	MAG
MY SWEDISH COUSINS	They weren't kissin cousins	63	39.95	HVS
NAKED AFTERNOON	Abigail Clayton	82	49.50	CVV
NAUGHTY	Frank revelation of erotica etc	120	39.95	MNT
NAUGHTY SCHOOLGIRLS	...wanting to graduate with a bang	120	39.95	MNT
NEGATIVES		90	5.95	INT
NEVER ON FRIDAY	Erotic Robinson Crusoe	78	39.95	INT
NEW ADVENTURES OF SNOW WHITE, THE	Sexy bedtime story	120	39.95	MNT
NEW BLACK EMANUELLE	Emanuelle Nera	85	39.95	INO
NEW GIRL	Lynsay Honey, Sharon Daniels	60	40.25	VDX
NIGHT OF THE ANIMALS		60	29.95	DPV
NIGHTS AND LOVE OF DON JUAN		91	39.95	INO
NINE AGES OF NAKEDNESS	Sex comedy	89	39.95	DAV
NO MERCY MAN, THE	Tough men terrorize small town	91	39.95	INT
NORTHVILLE CEMETERY MASSACRE, THE	David Hyry, Craig Collicott	86	39.95	INT
NOTORIOUS CLEOPATRA, THE	Orgies and intrigue	88	39.50	TCX
NOT TONIGHT, DARLING		93	34.50	DAV
O FOR MEN		60	24.95	KRY
OH! CALCUTTA		95	39.95	HOK
ONCE UPON A TIME			24.95	VOV
ONE ON TOP OF THE OTHER		99	39.95	INO
ON THE GAME	Pictorial history of prostitution	120	39.95	MNT
OPEN AIR BEDROOM	She parked it in any park	64	39.95	HVS
OPENING OF MISTY BEETHOVEN, THE		90	39.95	HVS
ORAL LUST	Unfaithful Tim	12	25.00	TAB
ORGY MACHINE, THE	mad professor	60	50.00	RIP
ORGY TIME		30	21.95	PPL
ORIENTAL BLUE	Peonies Jong, Kim Pope	76	35.95	ITC

ORIENTAL SEX KITTEN	John Holmes	60	50.00	RIP	SEXSLAVE	Sue Bassett, Richard Voight	60	40.25	VDX
OTHER SIDE OF JULIE, THE	John Leslie, Susannah French	83	49.50	CVV	SEX THIEF, THE	Luscious investigator Judy		29.95	VDM
					SEX WORLD		90	49.50	ADV
PARK AVENUE		30	19.95	PPL	SEXY EMMANUELLE		60	24.95	KRY
PENELOPE'S EDUCATION		60	24.95	KLV	SEXY SISTERS		75	34.95	VOV
PENTHOUSE PET OF THE YEAR		110	39.95	INT	SHARON		90	49.50	ADV
PERMISSIVE	Exploits of Suzie		29.95	VDM	SHE'LL FOLLOW YOU ANYWHERE	Keith Barron, Kenneth Cope	96	39.95	HVS
PETS	Ed Bishop, Joan Blackman	91	39.95	INT	SHE'LL FOLLOW YOU ANYWHERE	Keith Barron, Kenneth Cope	98	39.95	INT
PHANTASY	New Video spectacular	60	39.95	INT	SILENT NIGHT, BLOODY NIGHT	Patrick O'Neal, James Paterson	84	39.95	INT
PHYSICAL ASSAULT	Mako, Peter Hooten	82	34.50	IFS	SKI ON THE SKY			24.95	VOV
PIG KEEPER'S DAUGHTER, THE	Hilarious sexual encounters	94	39.50	TCX	SLITHIS				VPD
PLATO'S			39.95	SML	SLUMBER PARTY '57	Recalling 1st love experiences	83	39.95	INT
PLAYBIRDS, THE		94	39.95	HOK	SNOW WHITE			24.95	VOV
POOR ALBERT & LITTLE ANNIE	Zooey Hall, Geri Reischl	82	39.95	INT	SNOW WHITE AND ROSE RED			24.95	VOV
PORNO MODEL		30	21.95	KRY	SOME OF MY BEST FRIENDS ARE		120	39.95	JAG
PORTRAIT OF SEDUCTION	Vicy Lion	90	39.95	CVD	SOMEONE BEHIND THE DOOR			34.95	VOV
POSSESSED		90	49.50	ADV	SOMETIME SWEET SUSAN		82	39.50	JAG
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PROVOCATION	Udo Kier, Helena Nathaniel	99	39.95	ITC			each	each	
					SWEET & SEXY	Adult	80	19.95	VIP
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ADV A.V.C. 95 Charing Cross Road, London WC1
BFI British Film Institute, 81 Dean Street, London W1V 6AA
BWV Brent Walker Video, 9 Chesterfield Street, London W1
CEL Charles Second Entertainments Ltd., 60-66 Wardour Street, London W1
CIC CIC Video UK, 1 Great Pulteney Street, London W1R 3FW
CLV Club Video, 120 Marylebone Lane, London W1
CVD Carnaby Video, 26 Carnaby Street, London W1
CVV Cal Vista Video, see Probe Publications
DAV Derann Audio Visual, High Street, Dudley, West Midlands
DER DER/Radio Rentals – see your local dealer
DPV Dapon Video, see Probe Publications Ltd
EEL Eve Electric Ltd., 248 Walton Road, East Molesey, Surrey
EMI EMI Videogram Productions Ltd., 5 Dean Street, London W1
GHV Guild Home Video, Woodston House, Oundle Road, Peterborough PE2 9PZ
GPL Genevieve Promotions Ltd., 14 Pall Mall, London SW1Y 5LU
HIK Hikon Video, No 2 Chichester Rents, Chancery Lane, London WC2
HOK Hokushin, 2 Ambleside Ave., London SW16
HVS Home Video Supplies Ltd., 13 Shepherd Market, London W1
ICV Inter-Continental Video, Stanley Aarons, 147 Wardour Street, London W1
IDS Publications Department, The Industrial Society, Peter Runge House, 3 Carlton Terrace, London SW1Y 5DG
IFS Iver Film Services, Pinewood Studios, Iver, Bucks SL0 0NH
IMG Imagination Video, Suite 411, London International Press Centre, 76 Shoe Lane, London EC4A JJB
INO Inter-Ocean, 29 Great Pulteney Street, London W1, Distributed by VPD
INT Intervision Video Ltd., Unit 1, McKay Trading Estate, Kensal Road, London W10
IPC IPC/Video, Surrey House, Throwley Way, Sutton, Surrey
IST Istead Audio Visual, 38 The Tything, Worcester
ITC Intercity Video, see Probe Publications
JAG Jaguar Video, Distributed by Oppidans
JVC JVC Ltd., Eldonwall Trading Estate, Staples Corner, London NW2
KLV KLV Video, see Probe Publications Ltd.
KRY Krypton Video, see Probe Publications Ltd.
KVD Kingston Video, 34 Windmill Street, London W1
MAG Magnetic Video UK, Perivale Industrial Park, Greenford, Middlesex
MBH Michael Barratt Home Video, 108 Park Street, London W1
MIR Mirrorvision, Videospace Ltd., 31 Eveline Road, Mitcham, Surrey CR4 3LE
MNT Mountain Video, 45 New Oxford Street, London WC1
OPP Oppidans, 2 Broadstone Place, Blandford Street, London W1
PPL Probe Publications, 15 Rich Industrial Estate, Crimscott Street, London SE1
PRV Precision Video Ltd., 19 Upper Brook Street, London W1
PTV Picture Time Video, distributed by VCL
RIP Rippledale Ltd., 55 Old Compton Street, London W1
RNK Rank Audio-Visual, PO Box 70, Great West Road, Brentford, Middlesex
RON RONCO Film & Video Productions, Dharama House, 59 Northwood Way, Northwood, Middlesex
RTP Red Tape Productions Ltd., 5 Avery Row, London W1
SCG Scripglow Ltd., 41 Paddington Street, London W1
STN Stanmore Video Services, 91-93 High Street, Edgware, Middlesex
TAB Taboo Films International, 37 Berwick Street, London W1
TCX Tele Cine X, 294 Ilford Lane, Ilford, Essex
VBP Valentine Products, Hermit Place, 252 Belsize Road, London NW6
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VDM Videomedia, 68-70 Wardour Street, London W1
VDX Videx, 14 Palmerston Road, Sutton, Surrey
VID Videospace Limited, 32 Eveline Road, Mitcham, Surrey CR4 3LE
VIP VIPC, 9 Sentinel House, Sentinel Square, Brent Street, London NW4
VOV Vision on Video, see Probe Publications Ltd.
VPD Video Programme Distributors, 29 Great Pulteney Street, London W1R 3DD
VSA Video Sport for All, Marvic House, Bishop's Road, London SW6
VTV Vintage Television Ltd., 35 Petergate, Bradford, West Yorkshire
VTX Vertex Video Distributors, 76 The Old Village, Huntingdon, York YO3 9RB
VUL Video Unlimited, 24 New Road, Northbourne, Bournemouth, Dorset BH10 7DS
VVW Videoview, 68-70 Wardour Street, London W1
WHV Warner Home Video, Distributed by WEA Records Ltd., PO Box 59, Alperton Lane Wembley, Middlesex
WOV World of Video 2000, Maine House, 15 Lyon Road, London SW19 2SB
WSK Woodstock Video, 41 Carshalton Road, Sutton, Surrey
YPL Yellowbill Productions Limited, 11 Cross Keys Close, London W1M 5FY

GLOSSARY

Audio: Sound, particularly recording and reproduction. Electronic systems handling frequencies within the range of hearing.

AFC: Automatic Frequency Control; a feature found in tuners fitted to TVs and VCRs to ease station tuning and stability.

AGC: Automatic Gain Control; an electronic feature in TVs, cameras and VCRs which corrects for discrepancies in signal level.

ALC: Automatic Light Control; *AGC* (see above) applied particularly to video cameras to match their sensitivity to the scene light level.

Assemble Edit: A technique whereby separate scenes are electronically 'spliced' together to make a TV programme.

Amplitude: Level, or value, usually of an electrical signal.

AM: Amplitude Modulation; the normal method of broadcasting TV pictures as well as low quality TV sound.

Auto Assemble Edit: A video recorder feature which simplifies the joining together of separate sections or scenes in programme production.

Aperture (of a lens): See *Relative Aperture*.

Backspace Edit: See *Auto Assembly Edit* above.

Bandwidth: The range of electrical frequencies over which a system responds without significant loss.

Betamax: The brand name of Sony's current home VCR system.

Black Level: The value of the television signal that corresponds to black in the picture.

Blanking: The period of the TV signal during which the scanning spot of the display tube flies back from right to left and from bottom to top of the picture.

BNC plug: A small bayonet type connector commonly used in TV equipment.

Brightness Control: In a TV display, that which adjusts the overall light output of both light and dark parts of the scene, as opposed to *Contrast* (see separately).

Burn: Of a camera tube; the spots and blemishes that remain permanently visible after exposure to excessively bright light.

Capstan: The motor-driven metal spindle which pulls the video or audio tape through the machine.

Caption: Lettering or other graphic material used in television.

Cassette: A plastic housing containing the magnetic tape and two spools, for use in video and audio cassette recorders.

Chroma: Chrominance; That part of the television signal that carries the colour information.

Colour Bars: A television test signal which contains the Red, Blue and Green primaries, and their three complementaries, Cyan, Magenta and Yellow.

Cosvicon: The trade name for the camera tube made by Matsushita in Japan for their single tube colour cameras.

Colour Temperature: We perceive the colour of objects as if independent of the incident light; *eg* this paper is white in candle or sunlight, whereas the film or electronic camera responds according to the character of the incident light as measured by its colour temperaure.

Composite Video: The composite video signal consists of four separate elements: the luminance, the chrominance, the sync and the colour sync signals.

Compressor: A device which reduces the loudness range, or dynamic range of an audio signal in order to make recording or transmission possible.

Contrast: The difference in brightness between the lightest and darkest parts of an image. In television this is limited to about 50 to 1.

Control Track: The string of pulses recorded by the VCR onto the magnetic tape in order to synchronise the rotating video heads on playback.

Convergence (of a colour TV display): The degree to which the red, green and blue images coincide to produce sharp black and white (monochrome) detail.

Cut: From film traditions; the instantaneous change from one camera or scene to the next.

Decibel: The unit of measurement of relative intensity of sound or electrical signals.

Dolly: The triangular base with wheels, supporting the camera tripod, to allow smooth lateral camera movements.

Dropout: The short-term loss of video signal on VCR playback, resulting from dirt or other tape imperfections. Hence *Dropout Compensator:* an electrical device for concealing the visual effects of dropouts.

Dub: Copy from one video recorder to another.

EVR: Electronic Video Recording; the first commercial attempt at providing a video player system for institutional and possible home use.

Editing: The putting together of separate sequences to make up a programme. Videotape editing is done by transfer between two machines.

EFP: Electronic Field Production; the technique of making television programmes outside the studio by single camera recording and subsequent videotape editing.

ENG: Electronic News Gathering; applying the techniques of *EFP* (above) for television news.

EHT: Extra High Tension; the high voltage power needed by the cathode ray tube, the display device used in all TVs so far. Hence *EHT Stability*, the lack of which causes the picture to enlarge and defocus with high scene brightness.

Flutter: The short-term speed variations in a recording machine.

Frame: A single film or television image, the latter being composed of two interleaved scans, or *Fields*. Hence applied to video recorder's *Freeze-Frame* and *Still-Frame* features.

FM: Frequency Modulation; the transmission/recording technique used stereo radio (VHF/FM) and magnetic video recording.

Gain: The amplification of electrical signals expressed as a factor (*eg* 10 times), or as a ratio in decibels.

Genlock: The technique used for synchronising professional video equipment, particularly cameras.

Grill: A criss-cross pattern electronically generated and used to align the three separate colour images of a TV display.

Head: For recording; the device used for imposing the magnetic pattern onto the video or audio tape.

Helical Scan: The recording system used for all domestic VCRs, whereby two rotating video heads make diagonal contact with the video tape, by moving the latter over a cylindrical drum following a path which is part of a helix.

Hertz: The unit of periodic movement or frequency.

High Energy Tape: The term coined by the 3M company for a recording tape with more powerful magnetic properties; hence Sony's term High Density Tape. The proper term for both is High Coercivity tape.

Hue: The unique attribute of a colour, *eg* red or blue, whereas red and pink are the same hue, but differ in intensity or *Saturation*.

Iris: The adjustable aperture used to regulate the amount of light passing through the camera lens.

Jack: The term for a family of single prong connectors originated by the Post Office but also used in consumer audio equipment.

LVR: Longitudinal Video Recorder; a fixed head recorder first tried in the 1950s. More recently this has appeared in versions by both BASF in Germany and Toshiba in Japan; neither have so far been successful.

Lag: The retention of moving objects, also known as *image stick*, which characterises low cost colour cameras.

LCD: Liquid Crystal Display; found in some home VCRs and TVs, for timers and tape counters. Of possible future use in flat TV screens.
Leaders: The separate section of clear tape at the start and finish of a videocassette.
LED: Light Emitting Diode; the modern solid state replacement for the incandescant indicator lamp, generally red. Also used for timer and other numerical displays.
Lens: The collection of glass discs used to gather light and focus it onto the photo-sensitive surface of the TV camera tube(s).
Limiter: The electrical circuit that restricts the maximum level of an audio or video signal.
Luminance *(Luma)*: The brightness of a scene. The part of the TV signal conveying the brightness information, as opposed to the sync or the colour information.
Lux: The unit of illumination.
Monitor: For audio, a high quality loudspeaker; for video, a display screen.
Monochrome: Black and white (television).
Ni-Cad: Nickel Cadmium Battery. An alternative re-chargeable type which has a longer life than the cheaper lead-acid design.
Noise: The electrical disturbance which is perceived as a hiss on sound recording and a random pattern of 'snow' or 'grain' on TV pictures.
NTSC: The initials denoting the colour television standard used principally in the USA and Japan.
OB: Outside Broadcast. The multi-camera technique of the TV studio used outdoors, *eg* for major spectator sports.
Plumbicon: Trade name for the camera tube developed by Philips, used mainly in broadcasting.
Portapack: A portable, battery operated VTR and camera.
Quadraplex VTR: The large, high quality video recording system used in broadcasting.
Quartz Light: Short for Quartz Iodine Light, but now also used for Tungsten-Halogen and other types designed for TV and Photography.
Relative Aperture: Of a lens; in technical terms the ratio of its focal length to the aperture, the result being expressed as f/n or f number. Practically, it indicates the ability of the lens to gather light: an f2 lens will gather twice the light, *ie* will be twice as sensitive as an f2.8 lens.
Resolution: The ability of a TV system to 'resolve' fine detail in the scene.
Registration: The degree to which the three colour images in the TV camera overlap to give clear black and white detail; equivalent to Convergence in TV displays.
Saticon: Trade name for the Japanese camera tube used in industrial and certain broadcast cameras.
Scanner: The American term for the head-drum in the VCR; see *Helical Scan*.
SECAM: The initials for the colour standard adopted by the French.
Sensitivity: Of a camera; its ability to produce useable pictures at low levels of light.
Servo: The electronic system controlling the rotating video heads in the VCR.
Shading: The variations of output or colour across the camera's field of view.
Skew: Bending of verticals in the reproduced VCR signal, as a result of variations in the tension of the magnetic tape.
Still Frame: see *frame*.
Sync: Short for *synchronisation*; the pulses included in the TV signal to ensure that the scanning beam in the playback monitor (and various other intermediate equipment) keeps in step with the original scans of the camera.
Telecine: The device for converting cine film into television signals.
Timebase Corrector (TBC): An expensive electronic device used by professionals to broadcast from or copy between video recordings.
Tracking Control: In a VTR, the manual adjustment provided for precise alignment of the path of the moving playback head with the fine magnetic pattern recorded on the tape.
Tri Electrode Vidicon: The system used by Hitachi in their camera tubes to make simple, single tube colour cameras.
Trinicon: Another trading name for a simplified colour camera tube, this time originating from Sony.
U-Matic: The trade name – again originally from Sony – for the industrial VCR system using ¾ inch tape.
Trinitron: Sony's trade name for their colour TV display tube.
V-2000: The trade name for the Philips/Grundig 8 hour home VCR system.
VCR: *Video Cassette Recorder;* also the trade name for Philips' two earlier home video recorder systems, the *N/1500* and the *N/1700*.
Vectorscope: Short for *Vector Oscilloscope*; a device for displaying the characteristics of the colour component of the TV signal in a form suitable for accurate analysis.
Vertical Interval: The gap (in time) between the bottom of one TV picture and the top of the next.
VHS: *Video Home System;* The home VCR system developed by JVC in Japan, and now adopted by many Japanese manufacturers.
Vidicon: The lowest cost TV camera tube in common use.
Viewfinder: The optical, or preferably the electronic, 'eye-piece' used in TV cameras.
Vision Mixer: A control box enabling television pictures from several sources, generally cameras, to be selected and combined.
VLP: *Video Long Playing Record*; the video disc system invented by Philips.
VTR: *Video Tape Recorder*; the generic term for both open reel VTRs and home cassette VCRs.
VU: *Volume Unit*; the unit of sound level used in low cost audio level meters.
Wow: The slow variations in speed of a recording mechanism.
Zoom Lens: A lens with variable magnification, or viewing angle.
Zoom Ratio/Range: The range of magnification of a zoom lens, usually expressed as range of focal lengths – *eg* a zoom range of 12.5 to 75 millimetres is a zoom ratio of 6:1.

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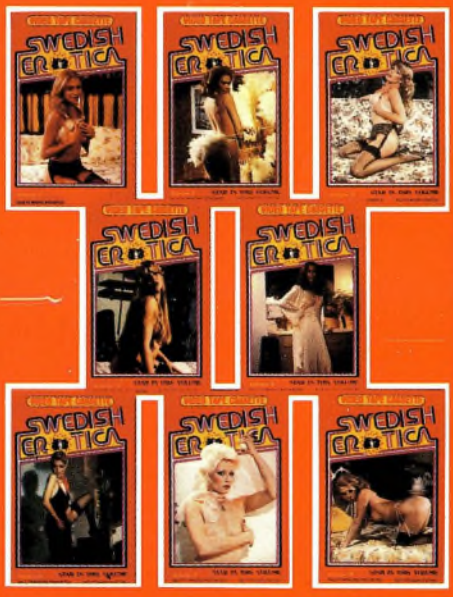

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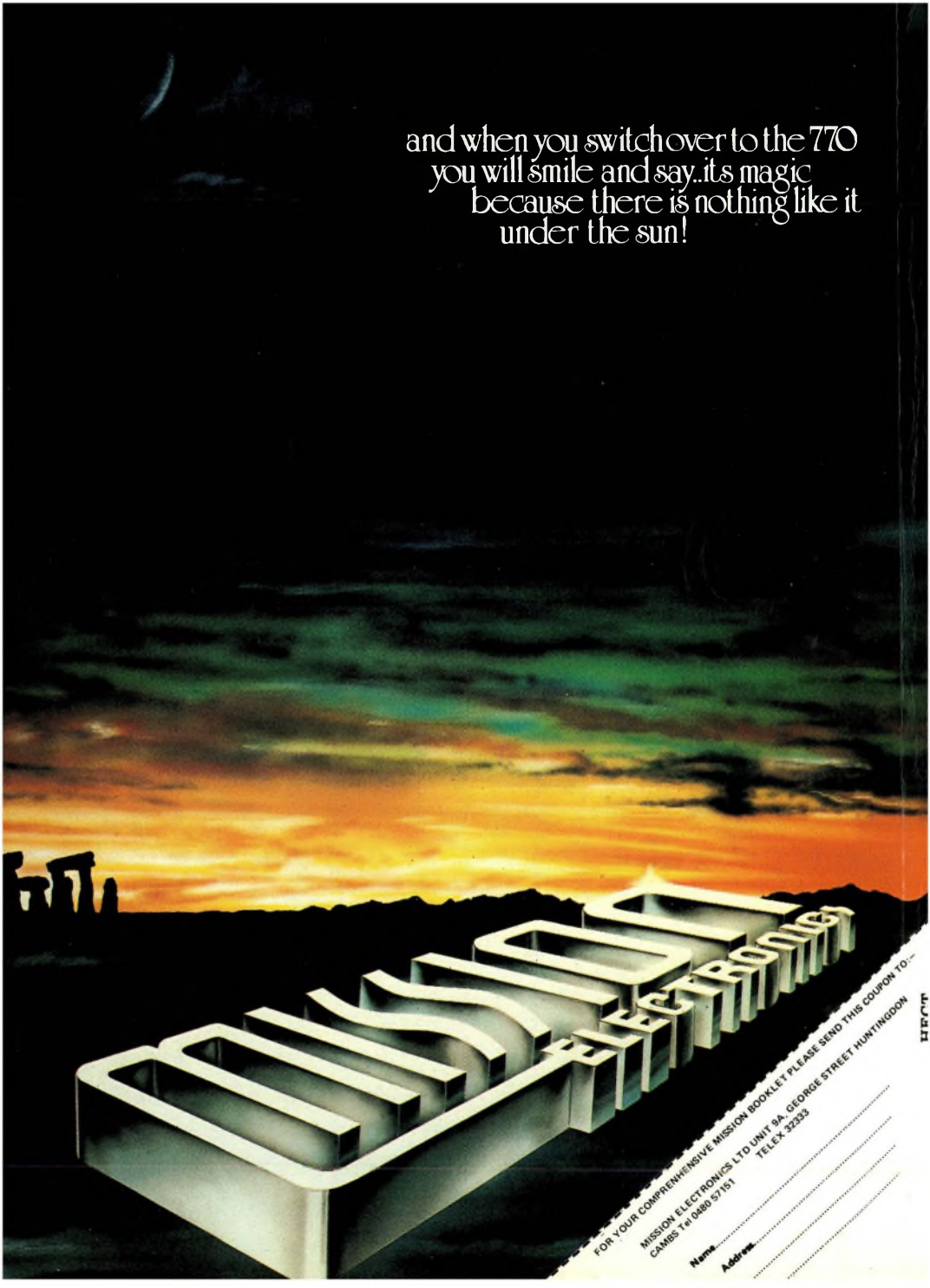
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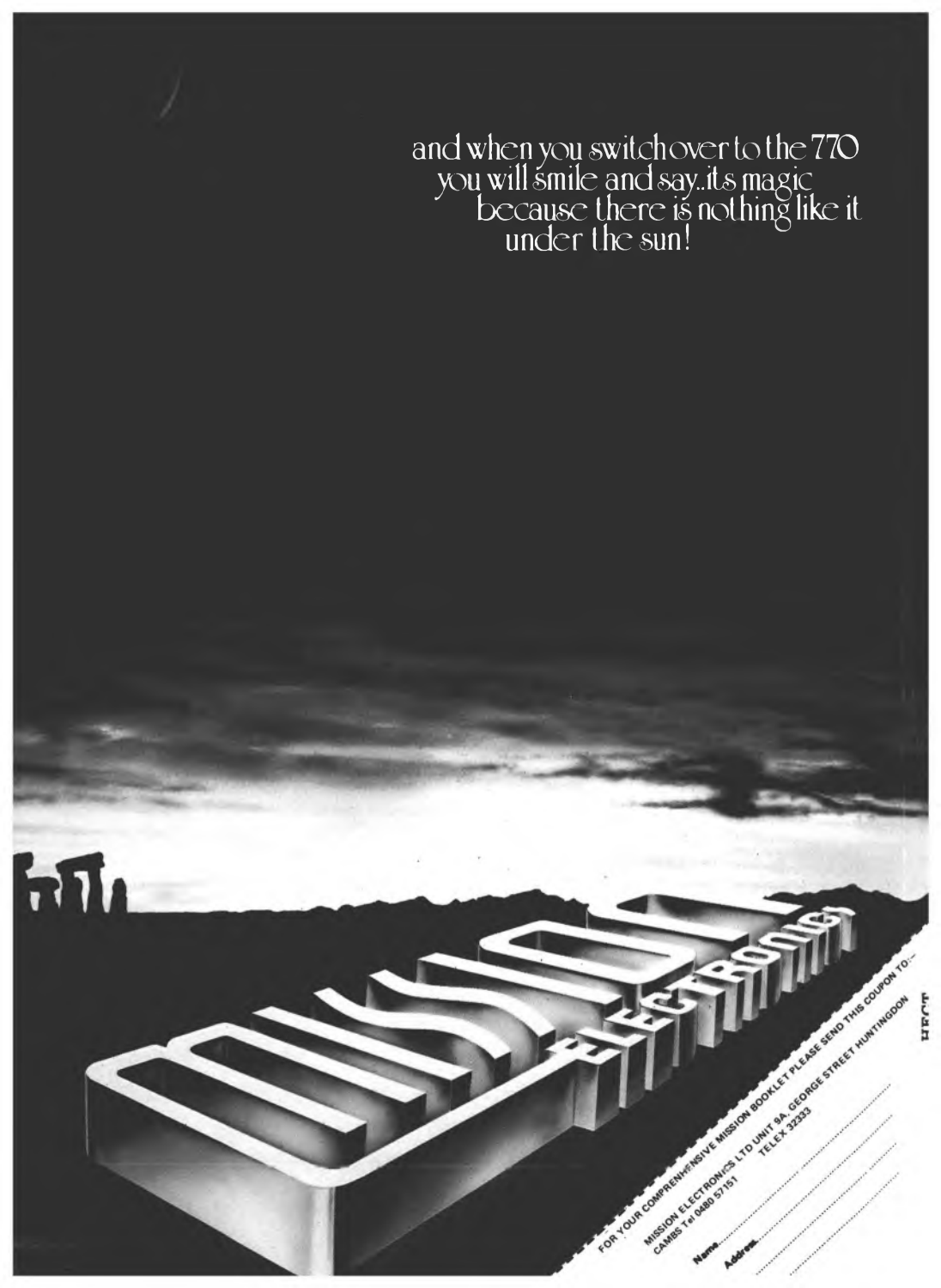
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