

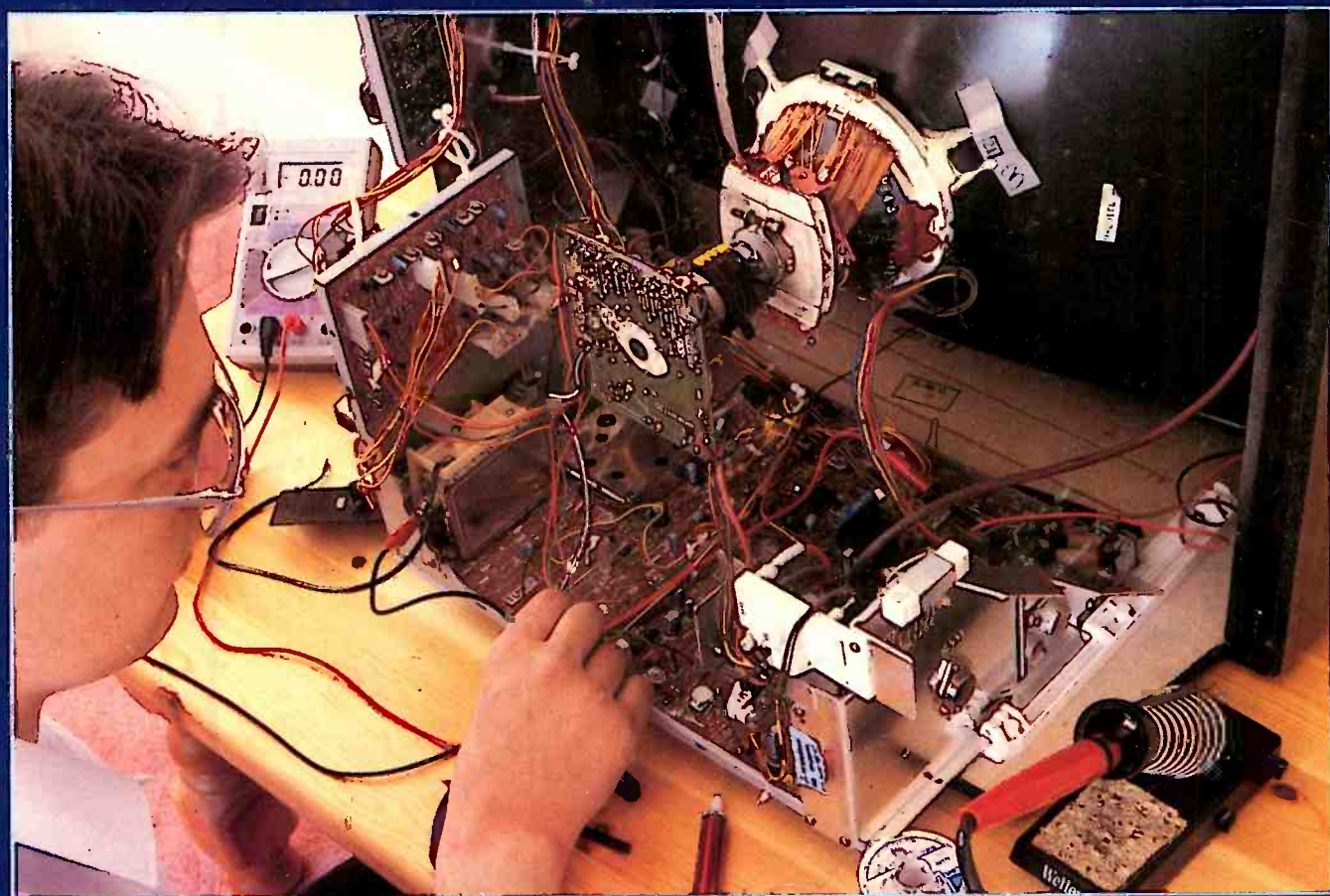
DECEMBER 1990

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TELEVISION

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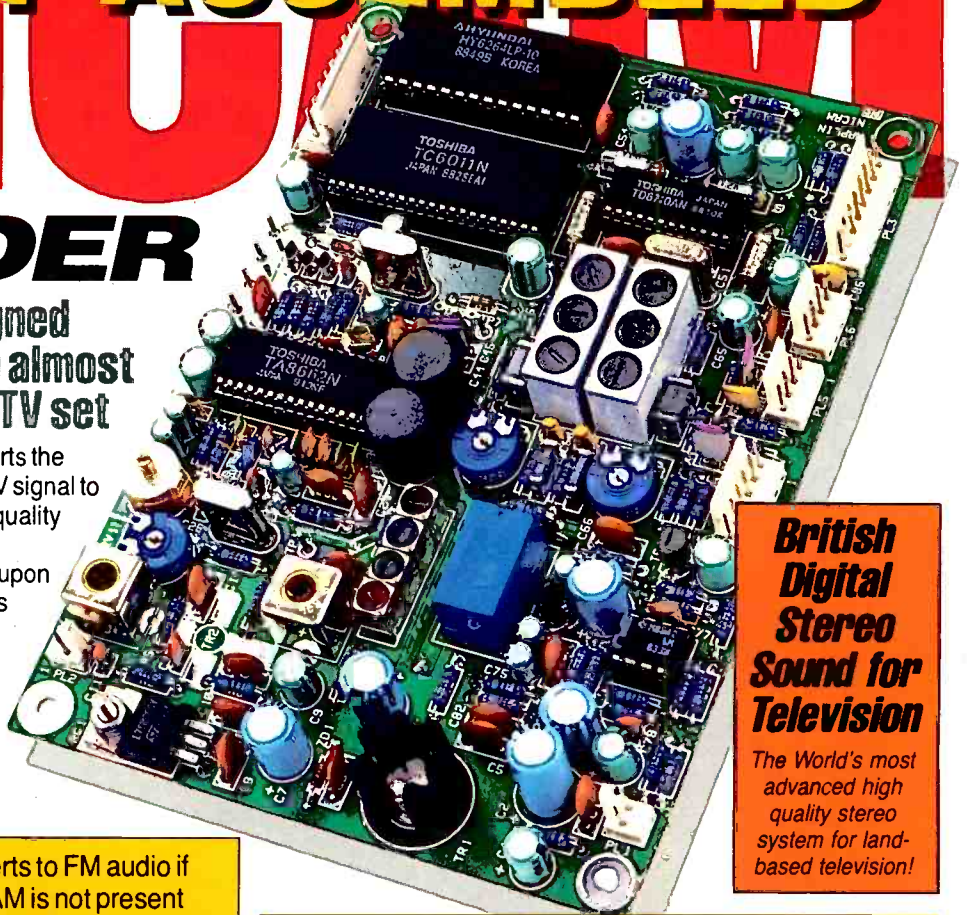
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TELEVISION

December
1990

Vol. 41, No. 2
Issue 482

On sale November 21st

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All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS.

INDEXES AND BINDERS

Indexes to Vols. 36, 37 and 38 are available at £1 each from the Editorial Office (address above).

Binders that hold twelve issues of *Television* are available for £4.50 from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques out to "Television Binders".

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BACK NUMBERS

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QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them.

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BE PUBLISHED ON DECEMBER 19

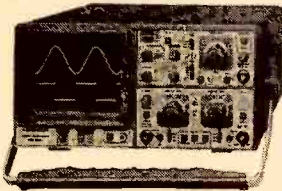
Table listing electronic components including resistors (AA119 to B243A), capacitors (B243A to B423A), diodes (AA119 to B423A), rectifiers (AA119 to B423A), transistors (AA119 to B423A), and integrated circuits (AA119 to B423A). Each entry includes a part number and its corresponding value or specification.

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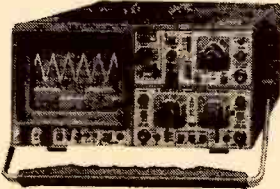
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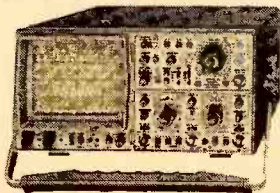
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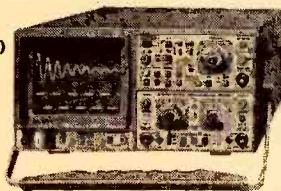


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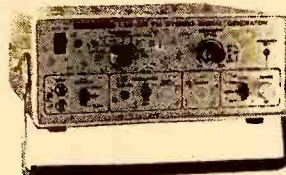
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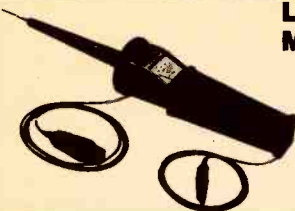
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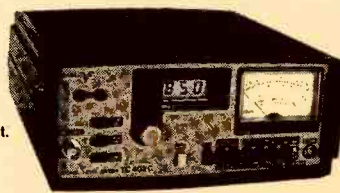
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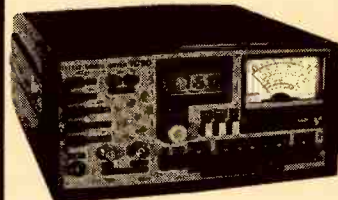


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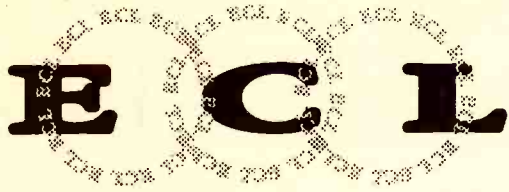
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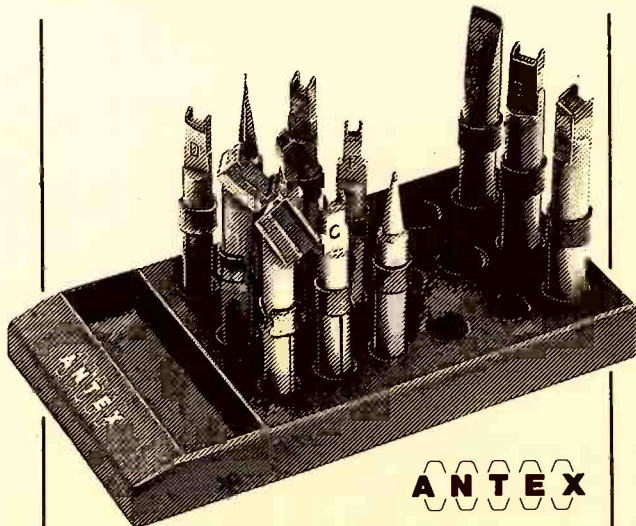
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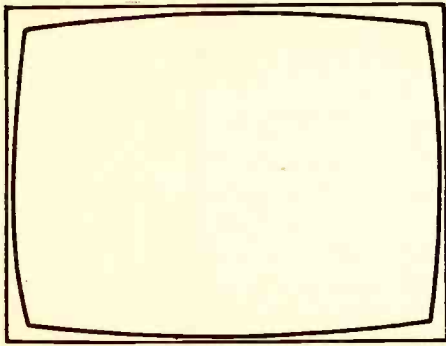
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TV2



TELEVISION

The Satellite TV Merger

Only a few months back, in our July leader (written in early June), we were commenting on "satellite success". As it turns out we were very wrong. But that is of course easier to see in hindsight. The economic squeeze that the government has been administering with its high interest rate policy suddenly began to have a really significant effect in the third quarter. Consumers have now lost confidence and are buying less. One of the first things you think twice about and decide to postpone is purchase of a fringe item such as a satellite TV receiver. In fact the increase in the number of satellite receiver installations in the past few months has been decidedly modest. Sales of Squarials in particular failed to rise above some 6,700 a week, which meant that British Satellite Broadcasting would have been hard put to see the number of installations for its service reach half the target figure of 400,000 by December. This would have made it difficult for BSB to draw on the loans agreed with its bankers.

Both British Satellite Broadcasting and Sky Television have been in an unenviable financial position in recent months, with the need to spend heavily on programmes and promotion in order to gain customers but little sign of any profits for years ahead. Sky's losses in the year to June 1990 were £95m. A leading media analyst has suggested that BSB's loss during the current year would have been around £330m. The two services were costing around £10m a day to run. Between them Sky and BSB had already spent over £1.25bn satellite on TV. With such a limited number of viewers this obviously couldn't go on indefinitely. It seems that, in great secrecy, talks between the two started back in July. At 3.10 a.m. on Saturday November 3rd a deal between Sky and BSB to merge their operations and form British Sky Broadcasting, trading as Sky Television, was signed.

I had originally thought to head this piece "collapse of BSB". But it hasn't, of course. It will own fifty per cent of the new BSB. What has collapsed is the system that BSB was running – its state of the art technology, high-power satellites and its commitment, under the IBA/ITC franchise awarded to it, to high-quality, varied programming. This is not to suggest that the quality of the new BSB's programming need necessarily be inferior – it still has to compete for viewers with the BBC, the ITV companies and other satellite TV broadcasters. But there was that guarantee given when its franchise was awarded, all of which suddenly seems to be a bit irrelevant. In fact what the whole business has shown is the curious position of the government and its appointed franchise awarding and supervising authority in this era of satellite broadcasting. While the IBA/ITC still has control over the 12GHz DBS band frequencies allocated to the UK for satellite TV broadcasting, it has no way of exercising control over anyone who wishes to point a satellite beam at the UK and use frequencies in the 11.5GHz FSS band.

To start with the new BSB services will use both Astra and the Marco Polo satellite. There will be five channels, the two film channels and one each for sport, news and entertainment. Since Sky has leased only four transponders on Astra 1A the fifth channel will probably have to use one of Marco Polo's transponders. This situation will change when Astra 1B comes into operation before long. The new BSB will then be able to concentrate on Astra, and the IBA/ITC will have even less control over the situation. It could strip BSB of its right to the DBS frequencies, but since no one else is likely to want to use them there would not be a great deal of point in doing this. The other consortia that applied for the DBS franchise must be contemplating their luck in not getting involved.

It's a great pity that an excellent technical innovation like MAC should end up like this. Its abandonment by the UK will hardly encourage anyone else to use it. In fact it seems clear that PAL will for the foreseeable future continue to predominate in Europe, both for terrestrial and satellite use. Should use of Marco Polo by the new BSB come to an end it's understood that those who have purchased Squarials and receiver/decoders will be offered free Astra replacements. There are at present some 150,000 installations. Those who will lose out will be the distributors/shops that hold stock – no one is likely to want a Squarial now – the appointed manufacturers and the chip makers.

There are other losers. Plans are to reduce the staff of the new BSB to less than half the combined staff of the old Sky and BSB. The programme makers will have fewer opportunities, and the cable companies will lose one of their main selling points – once the two Astra satellites are in operation at 19.2°E viewers will be able to receive a considerable variety of satellite TV offerings via a single dish.

In retrospect it all looks so inevitable. Satellite TV was always going to be something of a gamble. BSB did all the "right" things technically and officially, but as so often happens in human affairs its timing was wrong. Sky got in first, then the recession set in.

PRICE INCREASE

The cover price of *Television* will be £1.80 from the next issue dated January 1991. We regret the need for this increase, which has been made to cover our ever increasing costs.

INDEX TO VOLUME 38

The index to volume 38, covering issues of *Television* from November 1987 to October 1988, is now available. Copies can be obtained from the Editorial Office – see page 81 for details.

EDITOR

John A. Reddihough

Please note that the telephone numbers below are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 81.

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Our free gift on this month's cover has been supplied by Willow Vale Electronics Ltd., 11 Arkwright Road, Reading Berks RG2 0LU, telephone 0734 876 444 (head office). Willow Vale is the sole UK distributor for Grundig and Sharp spare parts and offers a wide range of genuine spare parts for many other manufacturers and brands.

COVER PHOTO

This month's cover photograph shows the Mitsubishi CT2227TX, the teletext version of the CT2227BX – see servicing article on pages 104-5.

Developments in CD Technology

George Cole

In an earlier article (*Television* April 1990) we looked at the official CD formats that conform to the red, green and yellow book specifications laid down by Philips and Sony. This article considers other systems that are designed to be compatible with existing compact discs and/or players. They fall roughly into two groups, those that put moving video pictures on a five-inch disc and discs that are recordable or both recordable and erasable.

We examined the compact disc video (CD-V) format in the previous article. It provides up to six minutes of moving pictures on a five-inch disc, with the video recorded in analogue form. We also looked at the compact disc interactive (CD-I) system. CD-I discs can store 65 minutes of video in digital form. There are several other video compact disc systems.

Compact Video Disc

The compact video disc (CVD, not to be confused with CD-V) was demonstrated at several European computer fairs a couple of years ago. Despite arousing much interest amongst computer companies the format does not appear to have been taken any further. CVD was developed by the US company SOCS Research and puts eighteen minutes of full-motion analogue video with digital sound on a five-inch compact disc. It achieves this by specially encoding the disc to enable it to store four times as much information as a standard CD.

According to patents filed by SOCS the system uses a crystal controlled sync signal generator to produce a series of reference signals that divide each revolution of the disc into a large number of sections known as references. The pits impressed on a CVD disc play a different role to those on CD or CD-V discs. With a standard compact disc the pits represent digital bits. With a CVD disc however the length and spacing of the pits represent the analogue video and digital audio signals. The pits coincide with the reference signals, each pit straddling a reference signal so that its leading and trailing edges each produce a video waveform sample (see Fig. 1). This doubles the recording density. Reference pits for sync purposes are also included on the disc – they are recorded during the vertical blanking interval.

Fig. 2 shows how data is written on to a CVD disc. The video source is a tape player that's controlled by the sync generator. Pulses from the latter are fed to the video processor which encodes the video signal with reference signals. The sync generator also controls the modulation timing and the write encoding on the disc by the laser head. Fig. 3 shows the demodulation system: the PLL demodulator locks to the frequency of the reference pits during each vertical blanking interval.

The demodulation process is outlined in Fig. 4. Line A shows the pits in relation to the reference signals. The pits modulate the light from the read laser, the light fluctuations being detected by an array of photodiodes that produce the signal shown at line B. Also shown here is the threshold reference voltage. The signal is squared, as shown at line C, and is fed to a sample-and-hold system which is controlled by the threshold crossover and the reference signals. The sample-and-hold system consists of a ramp generator followed by a hold circuit. A ramp is

started at the beginning of each pit, is restarted at each reference signal and is stopped at the end of each pit, producing the output shown at line D. The hold circuit samples the amplitude of each ramp and is also controlled by the reference signals, producing the waveform shown at line E. After filtering, the video waveform shown at line F is recovered.

CD4X System

CD4X is being developed by Nimbus Records. It uses smaller pits and data compression techniques to put at least an hour of moving video on a five-inch compact disc. With a conventional compact disc the width of the pits is 0.6 microns and the track pitch is 1.6 microns. These dimensions are halved with a CD4X disc, providing a four-fold increase in disc storage capacity from 600Mbytes to 2.4Gbytes. The major obstacle to this is the development of a low-cost, solid-state blue laser. The light output wavelength of a blue laser is shorter than that of the red lasers used in today's CD players.

Digital Video Interactive

Digital video interactive (DVI) isn't a CD format as such: it's a process that enables a compact disc to store about seventy minutes of moving digital video. Originally developed by RCA's David Sarnoff research laboratory, the technology was bought by chipmaker Intel in October 1988. A number of large computer manufacturers, including IBM, support the system.

DVI is a data compression system. When high-quality video pictures are converted to digital form a great deal of data is created: a five-inch disc can store less than a minute of uncompressed digital video of this type. There are many ways of compressing data – see Tom Ival's articles on

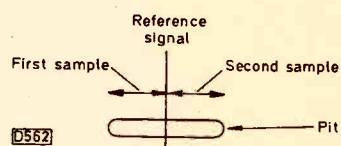


Fig. 1: Signal encoding on a CVD disc.

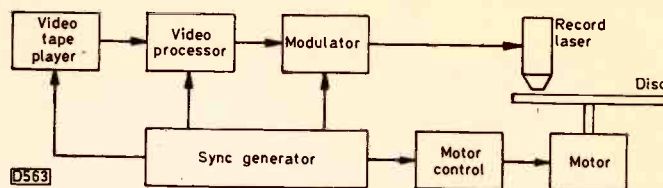


Fig. 2: CVD recording system.

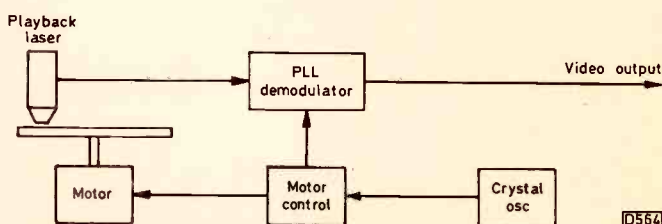


Fig. 3: CVD playback system.

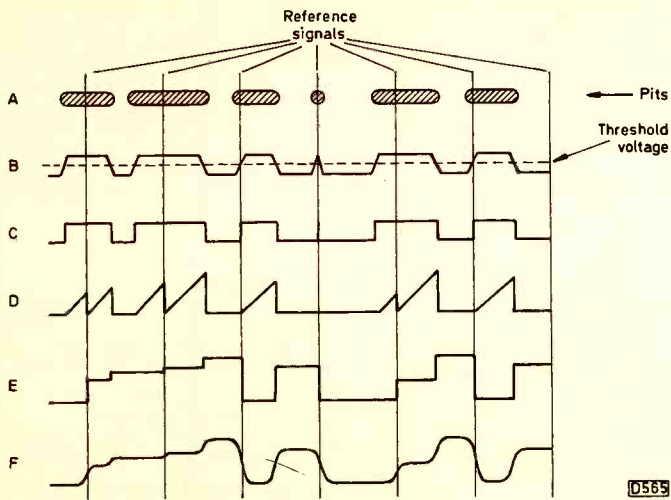
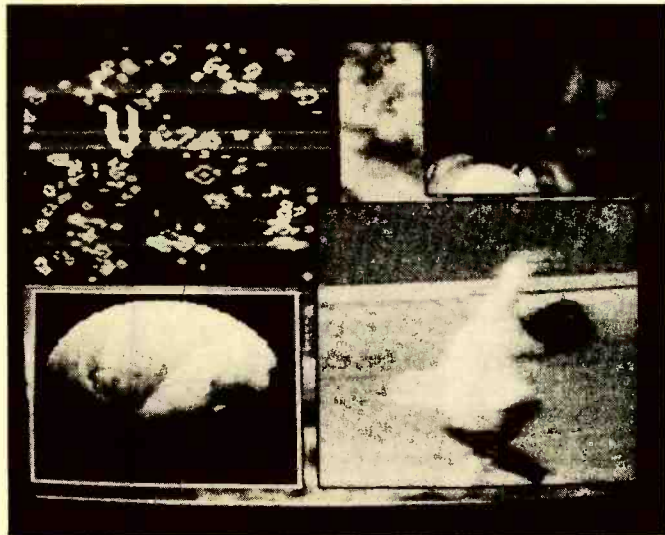


Fig. 4: Stages in the demodulation of the data recorded on a CVD disc.

bandwidth compression techniques in the December 1989 and January 1990 issues of *Television* – but basically the process works by discarding redundant or repetitive information. The key to this is the fact that there's usually very little difference in the content of successive TV fields. If you examine a typical TV picture you'll see that there's often a small amount of foreground movement while most of the background remains static. Furthermore the background contains a lot of repetitive information, for example a blue sky or a wall.

DVI uses data compression algorithms to compress a 600kbyte image to just 5kbytes. To give an idea of the magnitude of this compression, a standard personal computer would take half an hour to compress a single field, or twelve hours for a second of film. DVI uses transputer chips that take around thirty seconds to compress each field. While compression can be carried out overnight, expansion of the full-motion video must be done in real time. For this DVI uses a two-chip set that consists of a pixel processor and an output display processor. The pixel processor constructs the video image, working at the tremendous rate of 12.5 million instructions per second.

I've seen a number of DVI demonstrations and found the results fairly impressive. Picture quality is similar to standard VHS (pre-HQ processing). The screen can be



A DVI display with four separate pictures superimposed on a background picture.

split up into several sub-pictures, as the accompanying photograph shows. DVI's main drawback is the price of a system – around £10,000.

Moving Picture Experts Group

The Moving Picture Experts Group (MPEG) was set up in May 1988 by the International Standards Organisation (ISO) and the International Electrotechnical Commission (IEC) to develop an international standard for moving digital video. It proposes a system that, like DVI, converts the analogue video to digital form, compresses it in non-real time and expands it in real time. The two systems are not compatible however. MPEG's aim is to achieve a data transfer rate of 1.5Mbits per second to give high-quality digital video. Two standards have been developed to date. The first has a video transfer rate of 0.9Mbits/sec and a stereo sound transfer rate of 128kbits/sec. The second improves the picture quality at the expense of the sound quality. It has a video transfer rate of 1.15Mbits/sec and a stereo sound transfer rate of 32kbit/sec (64kbits/sec for mono sound).

Recordable and Erasable Discs

There are several types of recordable compact discs. Some, known as CD-R (compact disc recordable), can be used to make a single recording. Others, referred to as CD-E (compact disc erasable), can go through the record, read, erase and record cycle many times.

CD-R Discs

CD-R discs work on the same principle as the WORM (write once, read many times) discs used in the computer industry. WORM discs start out as blanks coated with a reflective alloy such as tellurium. A process called ablative coating burns pits on the disc's surface. In a typical system a 17mW laser beam is used for writing the data on to the disc. Heat from the laser melts the coating which, when cooled, has a series of raised edges (the "pits"). These are read by a low-power laser (around 2mW). Since the ablative process can't be repeated a recording can't be erased. There are two basic WORM disc sizes: 5.5in. discs store about 800Mbytes of data while the 12in. discs store 2Gbytes.

Several companies make CD-R discs. They include Yamaha, Fuji and Taiyo Yuden (who market a brand of audio cassettes called "That's"). One of the advantages of a digital system like CD is that provided the reading laser can discriminate between two states it doesn't matter how the binary information is recorded on the disc. The discs use different recording technology, but the end result is a CD-R disc that will play on most normal CD decks.

The Yamaha Disc

Yamaha's disc consists of a four-layer sandwich, see Fig. 5. There's a polycarbonate substrate, a reflective metal



Fig. 5 (left): Structure of Yamaha's CD-R disc.

Fig. 6 (right): Structure of Fuji's CD-R disc.

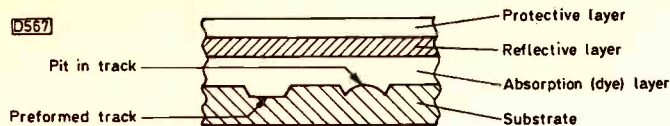


Fig. 7: Structure of the Taiyo Yuden CD-R disc.

layer, a non-reflective layer and a transparent protective coating. During the recording process a high-power laser burns holes in the non-reflective layer to expose parts of the reflective layer underneath.

The Fuji Disc

Fuji's disc – see Fig. 6 – has a triple layer of metals sandwiched between the polycarbonate substrate and the protective coating. Heat from the recording laser fuses the metals, forming an alloy that makes a dark spot on the disc.

The Taiyo Yuden Disc

The Taiyo Yuden CD-R disc has four main layers: a polycarbonate substrate, a photo-absorption layer composed of a green organic dye, a reflective layer made of gold (in most CDs this is aluminium) and a protective layer. A preformed spiral track is laid down during the injection moulding process to provide tracking for the recording laser: this is known as continuous composite recording. During the recording process a 6-9mW laser heats the dye to a temperature of over 250°C as a result of which it decomposes. At the same time conduction warms the polycarbonate layer which expands, pushing up into the dye to form a pit. Fig. 7 shows the idea.

Taiyo Yuden has suggested that the discs could also be used in CD-ROM/CD-R form, with an inner ROM area containing computer games etc. and an outer CD-R area used for recording the user's own data.

Tests carried out by Taiyo Yuden show that with a 2.1mW reading laser there's no deterioration of the playback signal after 20,000 playback cycles. At 2.2mW however there's a sharp fall in the carrier-to-noise ratio and disc reflectivity, suggesting that spontaneous over recording occurs at this power level. Mike Leach, who contributes regularly to our CD Player Casebook feature, tells me that many of the older CD decks that he repairs, i.e. those at least four years old, have lasers rated in the 2.1-2.6mW region. This suggests that Taiyo Yuden's CD-R disc wouldn't play properly on them. There have also been reports suggesting that the Yamaha and Fuji CD-R discs have playback problems when used with some older and some budget-priced CD players and those that use a triple-beam laser playback system. So it seems that further work is required before a suitable CD-R disc becomes available for domestic use.

CD-E Discs

There are three basic erasable disc (CD-E) technologies – dye polymer, phase change and magneto-optical (MO). The dye-polymer system uses special dyes that are heated by a high-power laser to create bumps which represent the signal pits. With the phase-change system an alloy such as tellurium is heated so that it changes from a crystalline to an amorphous state: the two states have different reflective properties. The problem with these two systems is that they involve breaking down molecules and then rebuilding

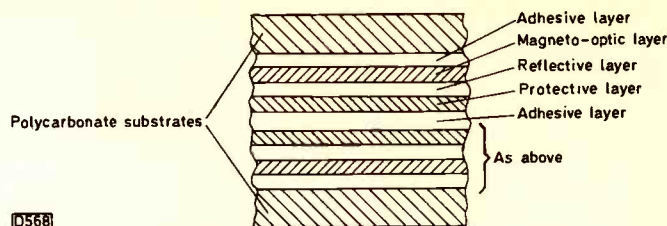


Fig. 8: Structure of the Hewlett-Packard CD-E disc.

them. There are limits to the number of times this can be done. Tests suggest that the number of acceptable record/playback cycles is 500-10,000 depending on the material used.

The Magneto-optical System

The MO system uses a disc that's coated with cobalt and a rare-earth metal such as gadolinium. Fig. 8 shows the composition of a Hewlett-Packard double-sided MO disc. Two magneto-optical films, each ten nanometres thick, are backed by reflective films and sandwiched between polycarbonate layers. Dielectric material and adhesive substances are used to separate and bond the layers. Around 650-1,000Mbytes can be stored on each side of the disc.

Digital information is stored on the disc in the form of a series of magnetic flux reversals in the magnetic material. With each bit the north pole faces either up, representing one, or down, representing zero. On a blank disc the north poles of all the bits face down. During the record process the disc sits above a drive magnet whose field surrounds the disc. At normal temperatures the magnet has no effect on the polarity of the bits. The high-power recording laser heats the area above each bit to 150°C for around 800 nanoseconds. This temperature is above the material's Curie point, allowing the drive magnet to change the bit's magnetic polarity. The modulated laser switches on and off as the disc rotates: it writes a one when the magnet is polarised north-pole up and a zero when the magnet's polarity is reversed.

MO playback technology uses the Kerr effect, which causes the reflected beam from a polarised light source (the laser) to twist either clockwise or anti-clockwise depending on the bit's magnetic polarity. The beam is intercepted by a polarising filter which either passes or blocks the beam depending on its state. Reuse of the disc involves erasing the existing data then writing in new data. For erasure the disc is rotated once with the laser switched on to write a series of zeros on the area to be reused. Re-recording involves a second pass during which the laser writes in the ones.

MO recordings are very stable. At room temperature it would require a two-ton magnet to alter any of the bits! Several companies are working on a second-generation of MO systems that would allow direct overwriting. With this system the laser is kept in a constant state while the magnetic field is modulated. Thus erasure and recording can be done during a single pass.

The problem with MO technology is its expense – each disc costs around £100. Because of this it's unlikely to appear in consumer products for a long time to come.

Acknowledgement

My thanks to Celia Watts and Jim Jonez of Hewlett-Packard for their help in the preparation of this article.

Letters

TOO OLD AT 38?

I'm discouraged by the attitude of prospective employers towards the fully-qualified service engineer who happens to be self-employed and 38 years old! I've been in the trade for 22 years and hold full C and G qualifications. But times are bad and, over the last few years, my takings have fallen greatly. So I'm looking for a job in the servicing field.

Companies send me application forms which I duly complete and send off. That's the last I hear! These firms cannot possibly form any conclusions about my character or abilities from the application form. From the very few replies I've had, and occasional phone calls to employers, I've come to the conclusion that the problem is my age and self-employment.

One firm I applied to was looking for engineers for a six-month contract. I filled in a form and heard no more. To my surprise the same advertisement appeared three months later. Now it doesn't take much thought to work out who the vacancies were aimed at. With only six months' work on offer, either out of work engineers or the self-employed, not someone who might move from permanent employment.

This is just the tip of the iceberg. I could mention other companies both large and small with this same attitude. What is the matter with employers in this country? I'm not over the hill at 38, and the experience I have to offer, gained over the years of self-employment, is vast. I would like to hear from anyone else who has come up against this problem.

*Paul Byrne, 87 Bro Deg,
Ruthin, Clwyd LL15 1XY.*

LOGIC SYMBOLS AND SAFETY

David Botto's introduction to the new logic symbols will I think be an invaluable reference to us all in the trade. Having said that, I'm back on my "horses for courses" soap-box again. I do hope that what David says in his opening paragraph, about the old symbols continuing to be used for simple gates, turns out to be so. As Figs. 6 and 7 clearly show, there's no advantage – in fact a positive disadvantage – in using the new symbols for standard gates and semi-complex functions.

Use of black-box symbols, though without functional notation, has been common practice for some time with computer equipment using such devices as PALs. Often there are Boolean tables to go with these devices, but one manufacturer with whom I've had dealings actually provides internal logic diagrams on a separate sheet. For all their complexity they are still easier to follow than the black boxes: they have a kind of logic of their own!

As a point of interest, it's quite common for US manufacturers in particular to show gates in digital logic circuits by function rather than true type. This means that a quarter of a 7400 chip can be shown as a nand gate in one part of a circuit diagram while another section of the same 7400 is shown as an or gate elsewhere. While this may seem to be confusing it is in fact a great aid to fault finding since time needn't be wasted working out how a gate has been configured when you find an unexpected signal at its output.

Changing the subject, I was pleased to see that Harry Todd has now received compensation for his back injury –

it's an all too common problem in the trade. His comment about the Telelift as an aid to avoid injury set me thinking however. The human being you see can be an awkward cuss. While Harry may have been the exception, I'm willing to bet that had the device been made widely available most engineers would have left it to collect dust in the back of their vans.

As evidence in support of this contention I'd cite the case of the portable isolation transformers that Rediffusion, a company well known for its safety-conscious engineering policies, provided for its engineers many years ago when I worked for the firm. Most engineers greeted them with cries of "we've enough to hump in and out of houses without these heavy things as well". This for a device designed to save one's life! What chance then for a device to prevent back injury? Sad as it is, I can't remember a single engineer who would use his transformer.

Finally, my thanks to J. LeJeune for taking the time and trouble to reply to my comments on the Ferguson FV30's switch-mode power supply. Points all noted!

*Geoff R. Darby, Proprietor Monitech,
Earls Barton, Northampton.*

SOLDERING IRON TIP

A neat way of greatly prolonging the life of workshop soldering iron elements is to fit a small torpedo line cord switch with a general-purpose diode across the contacts. Switching from 108V standby to the full 240V brings the iron to its working temperature in a surprisingly short time, and the element has only one bad thermal shock a day!

*G. Cox,
Bexhill-on-sea, East Sussex.*

THE GRUNDIG 1510

No mention was made of the 1510GB series, of which many different versions were produced, in David Botto's article (September) on Grundig colour sets. A major problem with the 1510GB series is dry-joints. There's also a common fault that crops up on the smaller portable models. It can fool anyone not used to this chassis. The problem occurs when the excess-current protection thyristor Ty604 goes short-circuit. The +A and +C h.t. lines then rise to around 300V instead of 255V and 250V respectively. If you find that the surge limiter R604 (9.1Ω, 17W) is open-circuit, measure the +A voltage after replacing it. You will almost certainly find that it's incorrect. A clue is the very sharp picture due to the increased h.t. On investigation you will probably find it necessary to replace the entire protection circuit consisting of Ty604, Tr612, Di614 etc. – especially if someone else has been at the set and has just replaced R604.

Another problem with the small cabinet sets is inadequate ventilation, which leads to disintegration of the PCB where all the droppers are mounted. Any remedy here will test your ingenuity as there is very little room inside the cabinet. Also Grundig inadvisedly left a series of holes in the back cover, some of which line up with presets – others just line up with live h.t. tracks. This causes problems with people who twiddle.

One set I'd sold came back with the complaint that it "just stopped". Of course it just stopped: the owner had tried adjusting a preset through one of the spare holes and had shorted out an h.t. rail, blowing the fuse and print everywhere! The customer denied knowing anything about it of course, so I cut my losses by giving him his money

back and later sold the set to a little old lady who had great trouble understanding the green-stripe tuning – it baffles many people.

If anyone has trouble obtaining line output stage thyristors for these sets Ochre Mill Technical Services can supply them (see classified advertisements, under lineage).

*L. Seeney,
Hexthorpe, Doncaster.*

TUBE TESTING ADAPTOR

Test Case 333 mentioned lack of a suitable tube base for use with a tube tester. I recently had the same problem and was "put right" by Manor Supplies when I enquired about a suitable base.

My tester has an extension lead that plugs into a B9A base. By using pin sockets that fit PCB pin connections, soldered to flying leads whose other ends are terminated by a B9A plug, almost anything can be tested. Clearly the leads must be properly marked, and a certain amount of care is required when setting up, but it does provide a solution.

*E.G. Kempshall,
Hove, East Sussex.*

MORE ON THE DAC90A

I've followed the many letters on vintage equipment with interest. It's nice to know that what at first seems to be an obscure and eccentric hobby is shared by so many people! Despite Chas E. Miller's comments, I remain worried about the possibility of the speaker grill on my Bush DAC90A becoming live – this would happen if Philip Lane's suggestion for adding negative feedback is followed. In any case I for one like to leave equipment in as near to the original condition as possible. This includes woolly sound, ten per cent distortion, crackles, hum, whistles and all! There's nothing very original about making a Fifties radio sound like a CD player or making its inside look like a computer. Unfortunately however reality rears its ugly head, and wax capacitors do have to be replaced if equipment is to continue to function. Paint all modern replacements with brown wax. It looks nicer. Mind you, maybe someone somewhere makes new wax capacitors – or should that be condensers?

I wonder if anyone else has noticed the number of DAC90As that appear on the box as props in war plays/films? This is historically incorrect of course, but maybe the props department can't find any Forties radios that have survived.

Finally, on the subject of video senders, I have one of these babies that draws a cool 150mA from a 12V battery, i.e. 1.8W! Many lower-power relays would be glad to use this amount of power. They must be immense fun in a tower block, eh?

*David C.J. Tilley,
Ashthomas, Nr. Tiverton, Devon.*

NOSTALGIA

I enjoyed Keith Hamer and Garry Smith's latest nostalgic look back at old BBC tuning captions. The only one I can remember is the grey scale shown in Fig. 12. With schools' broadcasts I recall the grey scale being shown for one minute followed by a large clock face with a second hand that would "count down" prior to programme commencement. Sometimes the music wasn't in time with the sequence, often ending ten seconds

before the clock completed its circle! Any chance of a feature in ITV lads?

It's interesting to know that I'm not the only one still using old sets. During a short stay in Balham recently I came across a shop in Bedford Hill full of the old sets that were around in my youth. A 9in. dual-standard Marconiphone set (950 chassis I think) looked very dated, not unlike a post-war design. There was a KB "Deep Scene" receiver, and plenty of the Thorn 11in. 405-line portables (980 chassis). None were in use, so I don't know whether any were workers, but it was such a joy to see a showroom full of sets that weren't horrible, dull grey FST types!

My thanks to S. Pearson for his explanation of "bright valves". Thorn 1400 chassis sets are very kind to their valves, especially the c.r.t.s which seem to last for ever. My pair still have their original tubes. Valve failures are mainly due to old age rather than poor circuit design.

*Brian Renforth,
Newcastle-Upon-Tyne.*

HELP WANTED

Can anyone supply a mains transformer for the Heathkit 10-18U oscilloscope?

*Brian Smith, Smiths Radio Ltd.,
91 Lewes Road, Brighton BN2 3HZ.
Telephone 0273 605 309.*

Could anyone supply a circuit diagram and/or service manual for a Hammond F3000 organ. Does Hammond still trade?

*M.A. Smallwood, 105 Davis Street, Stanley,
Falkland Islands, South Atlantic Ocean.*

Can anyone supply an M193-CB1 chip for the Hitachi CBP260 CTV?

*B. Battomy, 23 Dudley Drive,
South Ruislip, Middx HA4 6QN.
Telephone 081 845 5123.*

Could anyone supply a circuit diagram and mains transformer for the Scopex 4S6 oscilloscope?

*H.S. Downing, 16 Mayfield Crescent,
Lower Stondon, Henlow, Beds SG16 6LF.
Telephone 0462 850 244.*

Does anyone know of a source of the TMC1302 chip, or scrap Statesman telephones to take them from?

*Trevor Brook, Surrey Electronics Ltd., The Forge,
Lucks Green, Cranleigh, Surrey GU6 7BG.
Telephone 0483 275 997.*

Can anyone supply a circuit diagram for the Magnasonic Model 5100 CTV? The set is of Japanese origin. Does anyone know the manufacturer's address?

*Enock K. Cudjoe,
P.O. Box 8312, Accra, North Ghana.*

Can anyone supply a new pinch wheel for a Ferrograph 724 reel-to-reel audio recorder?

*E. Hazelhurst, 98 Moseley Street,
Southchurch, Southend-on-Sea, Essex SS2 4NN.
Telephone 0702 463 905.*

Could anyone supply the following – parts from scrapped sets would be o.k. First a TAA790 line generator chip for the B and O 3400/3235 series chassis. Secondly a tripler/h

decision based on the premise that a SMPS will inevitably be better regardless of circumstances. Alternatively it could be that a conventional mains transformer would have occupied too much space or caused radiated field problems. Some design subtleties are difficult to appreciate without information from those involved. It wouldn't be the first time that dimensional constraints for example have determined a major aspect of design – freight costs are affected by volume as well as weight.

In the fourteenth century the philosopher William of Occam commented "never use more to achieve what can be done just as effectively with less". This logical paring down is the origin of the phrase Occam's Razor. In these days of hi-tech and "technofear" I believe that we can

benefit from such thinking. By this I don't mean use a transistor radio instead of a hi-fi. Rather, apply the "horses for courses" rule more rigorously. Hi-fi in the living room, transistor radio in the kitchen. Likewise a SMPS in the TV set (to allow chassis isolation etc.) while using a linear PSU in the VCR.

Finally a comment on Keith Hamer and Garry Smith's nostalgic article on BBC tuning signals. As they say, Fig. 10 isn't accurate – in fact it's both upside down and back-to-front. To get it right, turn the page upside down and view Fig. 10 in a mirror. Surprising how much better it looks with the letters the right way up!

*Keith Cummins,
Holbury, Hants.*

Nikkai's Multistandard Sets

Gareth Foster

The Nikkai Models NT14 and NT20 have been available for a year or so now. Apart from the tube sizes (14 and 20in.) they are identical multistandard monitor-style sets. They are truly multistandard, being able to handle PAL, SECAM, standard 3.58MHz NTSC, modified 4.43MHz NTSC, 525-line pseudo-PAL as produced by the Panasonic NV-J35 playing an NTSC tape, 525-line pseudo-SECAM, and 625-line pseudo-NTSC produced by playing a PAL tape on an equivalent NTSC VCR. PAL signals with a 3.58MHz colour subcarrier (Brazilian PAL-M and Argentine PAL-N) can't be decoded. So much for the colour standards. The sets score equally well with TV transmission standards, being able to handle system B/G, I, D/K and M signals (i.e. sound carriers at 4.5, 5.5, 6 and 6.5MHz) but not the French system L. The specification gives the tuner's coverage as E2-12, R1-12, A2/3 and 6-13, E21-69 and A14-78. The sets I have cover 47-68MHz, 165-230MHz and u.h.f. however. So no R3-5, IC or A5/6. There are no facilities for direct AV inputs or outputs. The power supply can handle inputs of 90-270V a.c., 50/60Hz with auto-selection, the consumption being 80W maximum. When I tried a set with a variac I found that it would work with an input as low as 55V, but I wouldn't recommend running one like this for any length of time.

There are just six visible buttons at the front – on/off, channel up and down, volume up and down and call. When the call button is pressed the channel number and colour standard appear on the screen. To delete them the button has to be pressed again. The same information appears for a few seconds after every channel change. There are five rotary controls under a flap at the front – colour, brightness, contrast, NTSC tint and tone. Also five buttons for v.h.f. search, u.h.f. search, auto-preset, colour system select and manual fine tuning.

To get the set working all you have to do is to connect an aerial and the mains supply then press the auto-tune button. It then sweeps the bands, storing stations (maximum 16) as it goes. Standard selection is automatic. If you do this however you end up with distant relays and local stations stored in the order they come up. Individual preset tuning is very simple. Just press the u.h.f. or v.h.f. button and the set searches and auto stores: press the button again if you don't want a channel stored. Although manual fine tuning is available I found that I didn't need it, even when tuning in weak Band I DX signals. Colour system selection is automatic, but pressing the colour

system select button cycles the set sequentially through PAL, SECAM, NTSC 4.43, NTSC 3.58 then back to auto. There's also a remote control unit which has all the usual buttons for direct channel selection, channel up and down, colour, brightness, volume, mute, standby, granny button, call and an off timer.

Performance

I've tried these sets with different standard pattern generators, multistandard VCRs, local and DX off-air signals and various satellite TV signals. In every case they have performed very well. SECAM signals appear to have marginally more chroma noise than PAL or NTSC ones. The auto-selection works very well, the only problem being that when some VCRs play MESECAM system tapes they seem to fool the set into trying to decode the signal as though it was a PAL one. This seems to be a VCR problem: the same tape was o.k. when played via a different machine, but the problem continued with another machine of the same type (JVC HR7600MS). The problem was solved by selecting SECAM manually. When NTSC 3.58 was manually selected the set required a 4.5MHz audio subcarrier: when this standard was auto-selected however any of the audio subcarrier frequencies could be used. Any of the presets can be used for VCR playback. What this means in practice is that sparkly satellite TV signals are slightly more jittery than they might otherwise be, but this is only a minor gripe. It's a pity that the tuner doesn't cover the extended Band I channels IC, R3-5 and A5/6, particularly as the specification suggests that it does. Ideally a cable tuner should have been fitted. The upper u.h.f. channels, up to A83, are no longer used in North America, but AFN still uses A80 in Holland and this isn't covered.

Conclusion

Despite these small criticisms of the tuner these Turkish made sets are exceedingly good value for money at £139 trade for the NT14 and £169 trade for the NT20. These prices are exclusive of VAT. I've seen the NT14 for sale in the London area at £145 plus VAT retail. I originally had for review an NT14 and was sufficiently impressed with it to buy an NT20 soon afterwards. These sets show what can be done when manufacturers try. Availability might be a

problem – these are not the sort of sets you'll find in your local shopping centre. If you have difficulty I suggest you contact Nikkai Imports Ltd., 45 Byron Street, Leeds LS2

7QJ (telephone 0532 441 640) for the address of your nearest stockist.

CD Player Casebook

Reports from Mike Leach
and Philip Blundell, AMIEIE

Sony CDP-M20S

The problem with this machine was very distorted sound on both channels. On test I found that the distortion seemed to vary with the intensity of the music being played. As a first step the supplies were checked and found to be o.k. But it was getting late and I'd had a bad day – you know, phone ringing all the time, is this done, is that done, have you done Mrs Clatworth's handset and so on? So without further ado I ordered an LC3516AML-15 RAM chip as this device gives a certain amount of trouble (see *Television* March 1990, page 386, for example). It was fitted as soon as it arrived and cured the fault. Note that there can be different fault symptoms when this chip fails, i.e. no sound at all or very distorted sound. A faulty LC3516AML-15 normally affects both channels rather than one channel only.

M.L.

Marantz CD65 II

No turntable motor drive was traced to an open-circuit 10Ω resistor on the main panel. To get at it you have to remove the deck assembly and the main panel – a complete strip down in fact. I've had this type of resistor go before for no apparent reason.

M.L.

Rotel RCD820BX

This one caused me a bit of head scratching. It came in with the complaint "won't play disc" – a disc had been sent with it. I tried our test discs and the machine worked all right. I then tried other discs that don't work with certain players but again the machine was o.k. When the customer's disc was tried it went in, the TOC was read and 66 came up on the display. When play was pressed 34 came up on the display then the machine ground to a halt and just looked at me. Perhaps the disc was faulty? It played all right when tried in a Denon machine, which rather disappointed us! I should perhaps mention here that this Rotel player is very similar to the Philips CD160, the only real difference between the two being the power supply.

The customer's disc was all classical music. It was relatively long, with 31 tracks lasting in total for 66 minutes and 34 seconds. I inspected the disc only to find that there wasn't even a fingermark on it. There was a CD160 in the rack awaiting a new LCD display, so I decided to try using it to play the disc. Everything worked perfectly. Oh! With the disc back in the Rotel player 66 came up at TOC, 34 at play then stop.

I thought about this for a minute and tried to work out what was happening. Basically the TOC information wasn't being read correctly or was becoming jumbled so that the machine got confused. The player switched off because it was being told to play track 34 when the play key was pressed though there were only 31 tracks on the disc. The laser would scan the disc and as it couldn't find track 34 the machine would switch off.

A new CDM (laser plus servo) unit was tried but this made no difference. I then noticed one other difference between the Rotel machine and the CD160 – in the Rotel

player the decoder microcomputer chip is an MAB8441-T078 while in the CD160 it's an MAB8441-T082. When these chips were swapped over the fault showed up in the CD160. I breathed a sigh of relief and made a note to order a new chip.

The Philips CD160 service manual actually lists the "T078" chip in the parts list. It would be interesting to know if Philips had encountered the problem and updated the chip to cope with more information. Incidentally the disc that caused the problem is called *Piano Works by Poulenc*, Decca 417-438-2 – I think I'll buy one and use it as a test disc!

M.L.

Toshiba XR-Z70

The customer's complaint was that this player wouldn't eject the disc. I removed it by turning the tray motor by hand. When I switched on the sled motor tried to drive the sled off the end of its travel – investigation showed that the limit switch was dirty. Cleaning the switch was all that was required.

P.B.

Philips CD582

The complaint with this machine was "whistles". The disc played and the time was displayed but we had silence from one channel and only a constant tone from the other channel. Use of the scope enabled us to trace the tone back to the DAC chip, but prior to this it was difficult to know whether the data was correct or not. We then found that there was sometimes no sound from either channel when the machine was tried. In this state you could see that the data from the decoder to the filter had changed. A new SAA7210 decoder chip restored correct operation.

P.B.

Philips CD150

This machine had been to another dealer who'd fitted a new RAFOC unit. It didn't read the TOC though the focusing and disc speed seemed to be o.k. I checked the radial arm for free movement and found that it seemed to be stiff at the start of its travel. What had happened was that the flexiprint had been stuck down with Sellotape which had lifted, fouling the arm. When I'd removed the tape and glue I repositioned the plastic clip so that the flexiprint was out of the way of the arm – what should have been done in the first place.

P.B.

Philips Module 07660

There was no play and no TOC reading. The disc rotated but there was no output from the laser. When I dismantled the player a paper clip that had been wedged between the PCB and the plastic frame fell out! Oh no! What damage had it done? Voltage checks on the laser supply transistor 6527 showed that it was open-circuit base-to-emitter. A replacement was fitted and the laser current was checked. Fortunately nothing else was required.

P.B.

Servicing the Mitsubishi CT2227BM

John Coombes

This attractive 22in. set was on sale in the UK over the years 1983-1986. It's fitted with a 100° Mitsubishi Blue Diamond tube, type 560GEB22Q. Features include remote control and voltage-synthesis tuning. The main board is mounted horizontally at the base of the cabinet, with a mains transformer to the left of it (looking in from the rear). The class A RGB output stages are mounted on the c.r.t. base panel. There are several smaller panels on the upper left-hand side. These include the ETS panel, for remote control decoding and channel selection, and the optional vision and sound input/output panel. Our front cover photograph shows the teletext version of the set, Model CT2227TX. This differs in incorporating additional teletext decoder and interfacing panels, again on the left-hand side.

The Power Supply

The power supply system is straightforward, see Fig. 1. The mains transformer T991 has four secondary windings, one of which is not used. One winding supplies a half-wave rectifier (D7A0) on the ETS panel. A further winding supplies a bridge rectifier (D371-4) which produces 14.9V across C371 to power the audio amplifier/output chip IC351. The final winding supplies bridge rectifier D901-4 whose output is taken to the STR371 h.t. regulator chip IC991. The output from this, at TP91, is 115V (there's no preset control). A relay (K7A0) on the ETS panel controls the input to D901-4, giving standby operation. When the relay is energised diode D7Z2 on the channel indicator panel lights up.

The most common fault is no results. Check the 2AT mains fuses F911/2. If these have blown the on/of switch could be faulty or the mains transformer could have shorted turns.

If necessary go on to check the secondary fuse F901 (2AT). If it's open-circuit check C905 (470 μ F), D901-4 and the associated protection capacitors C901-3 for shorts. If the h.t. fuse F902 (800mA) has blown, check C907 (22 μ F) by replacement and IC991.

No 115V supply at TP91 could be due to R901 being open-circuit or a fault in IC991. For the small picture condition, i.e. lack of height and width, check whether R904 is open-circuit.

Line Timebase Faults

If the set is intermittently dead, check the 2SD870 line output transistor Q591 by replacement – it sometimes leaks intermittently – and that h.t. is reaching its collector. Absence of the h.t. supply at this point should lead to a check on the series resistor R581 (10 Ω , 10W) and on the continuity between pins 1 and 5 of the line output transformer T572.

Lack of drive to the line output transistor should lead to a check on the 2SC2482 line driver transistor Q571 which can go open-circuit. If there's no voltage at its collector check R571 (2.7k Ω , 2W) which could be open-circuit and the line driver transformer T571 which could be open-circuit or dry-jointed at its pins.

Dry-joints at the pins of the line driver transformer can result in a dead or an intermittently dead set. You may also

find that the set flicks on and off rapidly. If the dry-joints are present for any length of time a hole may be burnt in the panel.

The line output transformer T572 also suffers from dry-joints. These cause loss of sound or picture. A defective line output transformer can cause low brightness, a picture that balloons like low h.t., poor focusing or no e.h.t. Check it by replacement.

If the line output and driver stages are o.k. check the LA7800 sync/timebase generator chip IC401 by replacement.

Field Faults

There are several common causes of field collapse. Check for dry-joints on the scan coils, check the field output transistors Q402/3 which can go open- or short-circuit, and the field scan coupling capacitors C412/3 (both 330 μ F). Sometimes you'll get a complaint that the set smoked, but it seems to work all right on test. In this case replace C412 and C413. These capacitors can short or leak: they can also split wide open or sometimes blow in half. Another cause of field collapse is loss of the 115V supply to the field output stage as R415 (270 Ω , 10W) is open-circuit. In this event check whether C410 (22 μ F, 160V) is short-circuit. Note that several different types of field output transistor have been used – 2SC2073, 2SC2168, 2SD401 and 2SD386A.

Field collapse can also be caused by failure of the LA7800 timebase generator chip IC401 or an associated component.

Rolling can be caused by R410 (22k Ω) changing value but is more likely to be due to IC401.

The Signals Stages

It may be necessary to check a number of items for the no vision/snowy vision symptom. First check the lead at the back of the aerial socket and the socket's centre pin. Next check for shorts at the plug/socket connected to the tuner. The most common cause of this fault however is a low-gain tuner – check it by replacement. You can check whether the r.f. amplifier is at fault by injecting the signal at a later stage in the tuner. If this increases the gain it's best to replace the tuner. Other items you may need to check are the μ PC574J 33V stabiliser IC1A1 and the associated resistors R1A1 (12k Ω , 2W) and R1A2 (100 Ω).

The best course when the problem is a blank raster and no sound is to inject an i.f. signal at TP11. If this produces a disturbance on the screen check the tuner unit. If not, check the i.f. strip. Start by confirming that the 11.5V supply is present at pin 16 of the M5186P i.f. chip IC101. Its absence should lead to a check on R157 (120 Ω , 2W) which could be open-circuit. If this is o.k. check the 2SC1687 SAWF driver transistor Q101 and, by replacement, IC101.

For no brightness (loss of vision) again start at IC101. Check the d.c. conditions at the pins and the output at pin 14. Then check whether the 2SC2724 emitter-follower transistor Q103 or the luminance delay line DL201 is open-circuit. If necessary check the M51393AP PAL decoder chip IC601 by replacement.

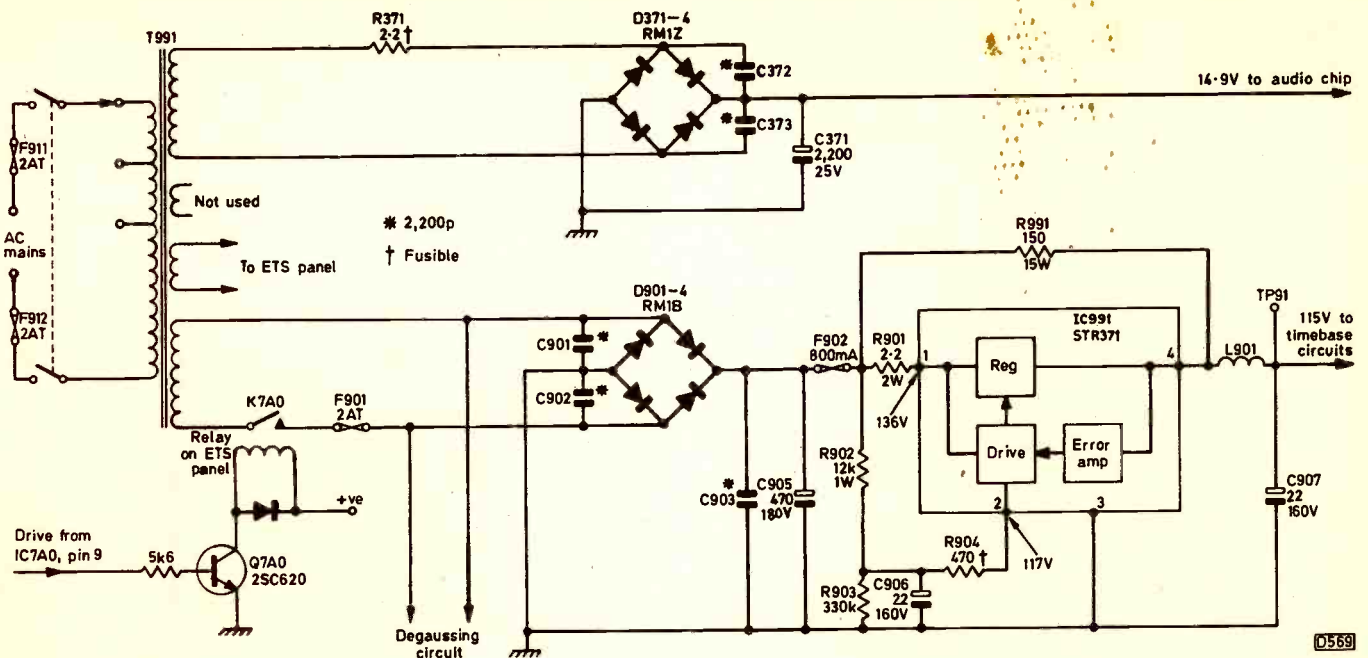


Fig. 1: The power supply circuitry used in the Mitsubishi CT2227BM.

It's possible for the transistors on the video/sound in/out panel to fail. The internal video signal is passed through the 2SC711A emitter-follower transistor Q2104 on this panel, the link being via connectors FD on the main panel and UP on the video/sound in/out panel. Video out is via transistors Q2154, Q2153, Q2155 and Q2151.

Tuning drift can be caused by the tuner (check by replacement) or the μ PC574J 33V stabiliser IC1A1. Monitor the 33V line carefully: if variation is noticed, change the stabiliser.

Colour and Associated Faults

Several things can cause the no colour symptom. The obvious item is the M51393AP PAL decoder chip IC601. Check it by replacement or check the d.c. conditions around it. The crystal X601 can be faulty or dry-jointed and the 10k Ω sub-colour control VR601 could be open-circuit - check the condition of its track as well. Another possibility is diodes D209, D208 and D211, all type 1S2076: check for reverse leakage or by replacement.

Various faults can develop on the tube base panel. The first thing that comes to mind is R669 (0.56 Ω , 2W) going open-circuit with the result that the tube's heaters don't light up - this can also be caused by an open-circuit winding on the line output transformer. Alternatively there may be an open-circuit within the c.r.t. itself, though this is very rare.

For loss of one colour check whether the relevant output transistor is open-circuit - Q652 green, Q651 red, Q653 blue. The output transistors are type 2SC2688. The 3.9k Ω flashover protection resistors R662 (green), R656 (red) and R668 (blue) also tend to go open-circuit. If necessary check the condition of the 5k Ω red, green and blue screen presets VR653, VR654 and VR655 and the 200 Ω red and blue drive presets VR651 and VR652. The cause of this fault could be in the M51393AP PAL decoder chip IC601 - also check for dry-joints around this chip.

If the raster is bright green, red or blue check the tube base socket by replacement - it can develop an internal short. The relevant output transistor can go short-circuit to cause the same symptom. Another thing to check is the spark gaps at pins 6 (green), 8 (red) and 11 (blue).

A bright white raster can be caused by failure of the M51393AP PAL decoder chip IC601.

If the contrast is low check the setting and condition of the 10k Ω sub-contrast control VR201. Again IC601 could be responsible - check it by replacement.

For flashing on the screen check the focus spark gap. Clean it or if necessary fit a replacement. The spark gap can also affect the focusing.

Sound and Remote Control Faults

Distorted sound can be the result of a faulty loudspeaker. For no sound check that the 14.9V supply is present at pin 5 of the μ PC2002 audio amplifier/output chip IC351. This supply will be missing if C358 (0.01 μ F) or C371 (2,200 μ F) is short-circuit. If necessary go on to check whether the jack socket is open-circuit, whether IC351 is faulty or the audio coupling capacitor C357 (470 μ F) is open-circuit. The intercarrier sound chip is IC301 (M5144P). This could be faulty.

There's also an M5144P chip (IC3101) on the video/sound in/out panel - it's used to provide d.c. volume control. Where this panel is fitted check the conditions around IC3101. There should be 11V at supply pin 5. Check R3118 (390 Ω) and C3108 (470 μ F) if this supply is missing. If necessary check IC3101 by replacement.

When switching on from standby you may hear a rushing sound for a short period followed by muting then normal sound. The cure for this is to change C3109 on the video/sound in/out panel to 10 μ F.

Various faults can occur in the remote control unit. The first thing to check is that the batteries are not low and that their connections are all right - no dry-joints or metal fatigue. Next check for dry-joints at crystal CFM01, for cracks on the board or dry-joints on the LEDs. The touch pads may need to be dismantled, cleaned and reassembled. If necessary replace the M50125P command encoder chip ICM01.

If the handset is all right but the range seems to be inadequate check the AN5020 remote control receiver preamplifier chip IC7U0 by replacement. It may be necessary to adjust coil L7U0 for optimum range with all functions.

Teletopics

BSB AND SKY MERGE

With losses mounting (over £1.25bn has so far been spent), a slower than expected viewer up-take and the prospect of profitability receding into the distant future BSB and Sky Television have agreed to merge. The new company will be known as British Sky Broadcasting and will trade as Sky Television. It will operate five channels. To start with transmissions will continue via the Astra and BSB satellites.

PHILIPS' NEW AUDIO TAPE FORMAT

A new audio tape format known as the digital compact cassette (DCC) has been announced by Philips. It's an extension of existing compact cassette technology, with the same size tapes and recording times. With DCC however a new coding technique called precision adaptive sub-band coding (PASC) puts digital audio on the tape. Philips claim that the sound quality is equivalent to that of the compact disc. DCC tapes will carry digital sound in sixteen narrow linear tracks across the tape width (eight for each stereo channel), and will be unplayable by a conventional cassette deck. A new generation of DCC decks will have analogue heads for playing conventional tapes and an extra segmented head for recording and playing DCC tapes. There is some uncertainty however as to whether DCC machines will be able to record in both the analogue and digital modes. Instead of flip-over operation, the system will use auto-reverse for faster access. Tape speed remains at 4.75cm/sec.

The whole system is made possible by the coding system, which uses fewer bits for quiet signals. New chips have made the system practical, at considerably less cost than DAT. Tandy, EMI, BMG, WEA and several Japanese companies are backing the DCC format. Hardware is expected to be available in early 1992, with the first machines selling for around £300.

THE DOMESTIC ELECTRONICS MARKET

The steadily increasing quantity of electronic equipment in the home is brought out by the preliminary results of the 1989 General Household Survey, carried out by the Office of Population Censuses and Surveys. Sixty per cent of households now have a VCR, almost twenty per cent have a home computer, fifteen per cent have a CD player and the number of households with a microwave oven increased from 39 to 47 per cent over the years 1988-89.

The latest Ferguson market report paints a rather more gloomy picture. It says that high interest rates, poll tax payments and low consumer confidence have slowed expenditure. The year-end forecast for large-screen CTVs (over 20in.) is 1.8m units, the lowest since 1981. Nicam set sales are reported to be increasing as the service spreads across the country. The year-end forecast for small-screen sets is 1.8m, excluding LCD TVs of which 50,000 were sold during the first six months. VCR sales are expected to reach 2.25m, a small decline from the peak reached two years ago. The average VCR price has risen just £2 to £333. 85 per cent of VCRs have programmable remote control, 39 per cent long-play and only eight per cent

NICAM. The camcorder market has grown by 50 per cent, the average price now being around £850. The Video-8 format has increased its share of the market to approximately 50 per cent. S-VHS machines account for eight per cent of sales. During January-July sales of satellite TV systems were estimated at 430,000 units, with BSB receivers accounting for around 40,000.

TV RECEIVER DEVELOPMENTS

Toshiba has launched the first TV sets in the UK to incorporate Dolby surround sound, Models 2505DB and 2805DB. The sets deliver 20W r.m.s. per channel, incorporate 100-channel automatic tuning and feature the new Toshiba Super C3 screen. The latter provides improved contrast and has a special anti-static coating to reduce dust build-up. A computer-controlled digital chassis is used. Toshiba point out that over 2,500 films have been recorded with Dolby Surround, the vast majority of which are available for rent or purchase. The major TV channels broadcast Dolby Surround.

The Japanese broadcasting corporation NHK has developed a 33in. colour plasma flat-panel (it's 6mm thick) display that's suitable for HD-TV use. The electrodes, laid down using thick-film printing, excite gas molecules in the plasma layer: when the molecules relax they emit ultra-violet light which in turn excites the red, green and blue phosphor dots seen by the viewer.

Philips has developed a 6in. full-colour liquid-crystal display panel that uses state-of-the-art D2R (double diode and reset) technology. Applications include pocket TV, portable TV/VCR combinations, video telephones and in-car entertainment.

Siliconix has developed a new wideband video switching chip, type DG894, that offers significant performance benefits and simplifies the integration of scart/I2C switching in a TV set. It's designed for use with the Philips-developed I2C bus and the internationally recommended scart interface. The circuit would be particularly useful with domestic TV installations where the TV set is used with a VCR, home computer, satellite and cable TV inputs and an audio hi-fi system. All these items can be left permanently connected and switched via remote control. Unlike previous arrangements with numbers of separate decoding and switching chips, the DG894 offers the switching, control and interface functions required in a single i.c. It incorporates 14 changeover switches arranged in two groups of four plus three groups of two, and can be used to switch both RGB and S-VHS YC signals.

A group of just three IIT chips will provide most functions in a digital TV chassis. The TVPO2065 is a combined controller, display processor and infra-red remote control decoder. It provides voltage synthesis tuning with an on-screen display so that no text processing unit is required. The other two chips are the VSP2860 video/sync processor and the VCU2133 video codec.

VIDEO NEWS

The Californian company C-Cube has developed a high-speed video-compression chip that makes it possible to store 72 minutes of full-motion video on a compact disc. It complies with the MPEG international standard for video compression. In Japan, Matsushita has developed a VCR that responds to spoken commands and answers with a synthesised human voice. It does not require pre-registering with the user's voice pattern.

Sony has launched what is claimed to be one of the

world's smallest and lightest camcorders, the CCDTR45, which weighs just 690g without battery and tape. The newly developed 1/2in. CCD image sensor is mounted directly on the camera block to achieve size reduction. Features include a "Mach" quick-start mechanism that goes from standby to record in 0.2 seconds, $\times 6$ zoom and three fast shutter speeds. The suggested price is £799.99. At just 790g the slightly larger CCDTR75 is intended for those who require better resolution and higher sound quality. It has a $\times 8$ power zoom with macro and the Mach start mechanism. The 1/2in. image sensor has 440,000 pixels. The TR75 is the first palm-sized model with AFM hi-fi stereo sound. A newly developed twin-unit, four-capsule stereo microphone is able to filter out background noise.

Sony is to introduce a metal powder (MP) tape for the Hi-8 format. It seems that the complex production technology has resulted in a shortage of metal evaporated (ME) tape. The new MP tape has a 40 per cent higher information packing density than conventional MP tape and can record wavelengths as small as 0.49 microns. Its thickness is 10.5 microns, its coercivity 1,500 Oersteds and its remanence 2,500 Gauss. The tape will be available with 30, 60 and 90 minute playing times. Launch date and price details have still to be announced.

Philips has announced a suggested price for the VKR9550 camcorder with still-picture mode mentioned last month - £2,300.

The Commodore CD-TV system mentioned in this column in August is expected to be available in the shops next Spring.

NICAM

Nicam transmissions have now started from the IBA's Sutton Coldfield, Pontop Pike and Dover transmitters.

Sachs Nicam GB Ltd., Suite 4, Belmont Lodge, London Road, Stanmore, Middx HA7 4NG (081 420 6311) has introduced a remote-controlled Nicam receiver at £149.94 including VAT. Called the Nicamizer, the receiver/decoder has been designed for use with a hi-fi system.

The latest range of Philips colour pattern generators provide multi-standard operation with Nicam test facilities. The PM5515TM and PM5518TM have teletext and Nicam: the PM5518TNI adds an IEEE-488 remote control interface. Multi-standard test facilities include CCIR/RTMA, PAL/NTSC and OIRT/SECAM. Separate YC and RGB outputs are available as an option.

SATELLITE TV

In-orbit tests of the first Eutelsat II satellite indicate that its performance is far higher than expected. Direct reception of radio and TV signals using a 90cm dish is possible in the area covered by the wide beam - from Madrid in the south to Stockholm in the north and Istanbul in the east. In the central area of the super beam coverage an e.i.r.p. of 52-53dBW has been measured, giving excellent quality TV reception with 80cm dishes throughout central and western Europe.

Satellite TV installation business seemed to be flat during September, the last month for which estimated figures have been released. A number of Sky trial installations have been disconnected.

Grundig has extended its range of Astra receiving equipment to include an integrated receiver/decoder, Model GIRD2000, that's available with either a 60 or an

80cm dark mesh oval dish. The suggested price is £399.99/£429.99 depending on dish size.

The Tabstrong Astra/BSB Doublevision dish is apparently now in production. It has two angled surfaces, each with an LNB, for reception from the two satellites.

OPTICAL FIBRE CABLE SYSTEM TRIAL

Up to 400 homes and businesses in Bishop's Stortford, Herts, are to take part in a two-year trial to demonstrate the feasibility of an optical fibre cable system developed at British Telecom's Research Laboratories at Martlesham Heath. Phone, 18-channel TV and videotext signals are being sent direct via hair-thin strands of ultra-pure glass as high-speed laser light pulses. The TV channels will include satellite and cable channels in addition to the four terrestrially broadcast ones: all will be free to viewers during the trial. British Telecom is running the system in conjunction with its partners BICC Cables, Fulcrum Communications and GPT.

TV SERVICING DATA

A common problem for those of us involved in the general side of TV repair work is finding service information for the less common models that come in. Macdonald used to publish an annual TV servicing book that I found invaluable. When publication ceased it looked as though the problem of service information would become extremely difficult.

U-View then stepped in with a TV circuit book, the first one being dated 1987-88. It actually consisted of three books in a giant plastic folder. The paper was good, with a shiny surface to help prevent finger and other unwanted marks. A video circuits book followed, in conventional bound form and A4 size with the pages opening out to A3 size. I've used my copies of both books regularly and they've paid for themselves several times over. I found a few mistakes in the circuits and some of the printing was not too good, but then the original circuits, especially with some of the cheaper brands, are often very poor and one or two minor errors seem to be present in almost every TV circuit diagram.

U-View has recently published the 1989-90 edition of *Television Servicing*. It's a much improved hard-back book that complements the *Video Servicing* book and the print quality is excellent. There are 98 separate circuit diagrams in the book, covering 749 models. Setting-up procedures, fault-finding trees and oscillograms are also included. The majority of brands are covered, including Matsui, Saisho, Hinari and Bush - all of which are regular visitors to our workshop. At £65 the book certainly represents value for money, with each circuit diagram averaging out at 70p (add £4 for postage and packing - there's no VAT).

I'm told that U-View is preparing the next edition of *Video Servicing*. It promises to be an improvement on the first edition, with a wider coverage of models, and is due for publication early next year. U-View hope to continue publishing these books in a similar manner to Macdonalds (and George Newnes Ltd. before).

Congratulations must go to technical editor Colin Barlow, B.A., for providing a service that's much needed. I hope he will continue with the good work! For more details and a colour leaflet apply to: U-View, 29 Warmsworth Road, Doncaster, South Yorkshire DN4 0RP - telephone 0302 855 017.

Mick Dutton.

VCR Clinic

*Reports from Philip Blundell, AMIEE,
Bob McClenning, R.J. Longhurst, Nick Beer,
Ed Rowland, Stephen Leatherbarrow and
Mick Dutton*

Philips VR6542

I recently had to sort out one of these VCRs for another local engineer who had tried to change the cam switch but had lost the gear alignment. The manual shows you how to align the gears using the triangular timing holes – the only snag is that the factory fitted gears don't always have them! Replacement gears do, thank goodness, so I cheated and fitted new ones.

If you have to change the cam switch and the triangular holes aren't present, mark the positions of the main and brake cams by scratching marks on the metal with a jewellers' screwdriver, through the small holes.

If one of these machines comes in with intermittent mechanical problems, to save time I change the loading belt, brake and master cams, and the cam switch. After doing this you should – as long as the reel idler is o.k. and the capstan motor hasn't got a dead spot – have covered the likely failure points. This has been my experience to date anyway. **P.B.**

Philips VR6290/1/3 and Clones

If the BUT11AF chopper transistor repeatedly fails in the customer's home but doesn't in the workshop, try fitting modification kit 4822 310 31817. Power supplies with a green label have already been modified. **P.B.**

Grundig VS200/220

If you look in the front of the service manual for these machines you'll see that there's a special function which allows you to put the machine in play without a tape. I tried this on several occasions and it didn't work. Then, while looking through Grundig's technical tips one day, I found out why – you have to lower the cassette tray first! Do this by pressing the cassette-in switch by hand for a few seconds. It isn't necessary with models such as the VS340 as with these the machine lowers the tray for you. **P.B.**

Grundig VS200

We've had several of these machines with a defective audio/control/erase head. The last one that came in had another problem – tape creasing when "back editing control" was working, prior to a recording being made. It seems to be essential to bend the leading roller on the threading ring backwards or forwards, despite perfect alignment of the ACE head, to ensure that the tape path is exactly central on this roller. Beware of this one. **B.McC.**

Logik VR955/Samsung VI711

No erase bias at all was caused by an internal fault in the bias oscillator coil unit L0504. It's perhaps worth noting that the Samsung unit is much cheaper. **R.J.L.**

Ferguson FV10B

The repair ticket said "dead", and the machine was very dead indeed, with no display and no functions. A check at pin 10 of the voltage regulator chip IC801 showed that the 13.2V which should have been present here was missing. A glance at the circuit diagram showed that there were

several possibilities for this. The culprit turned out to be R1 (10 Ω) which had gone open-circuit. A replacement brought the machine back to life. **E.R.**

Matsui VX3000/Saisho VR3400

A fault you sometimes get with these machines is loss of the playback picture, resembling head wear or failure. As often as not however the cause is poor head amplifier earthing, which is achieved via the screening can. The cure is to solder a short length of copper braid from the top of the screening can to the copper static discharge strip on the head drum. **E.R.**

Telefunken VR4935

The function LED wouldn't come on but the machine would accept a cassette. When play was selected the tape would lace up then immediately unlace. In the fast-forward and rewind modes the machine would run for a couple of seconds then stop. Having had this fault before we went straight for the STK5481 voltage regulator chip, which proved to be cause of the problem. **E.R.**

Ferguson 3V31

A recent case of no channel storage in this early search-tune machine was caused by loss of the -23V supply. It should be present at pin 9 of IC205, an MN1218A RAM. Q207 proved to be open-circuit. **S.L.**

Saisho VR1000

The fault with this machine was normal playback but no E-E video. C9, a 470 μ F, 10V electrolytic that couples the output from the i.f. section to the rest of the circuit, was leaky. As recently reported, this fault also occurs with the Amstrad VCR4600/4700 range. **S.L.**

Ferguson FV13H

This machine had been to two other companies before it was brought to us. The fault was very intermittent tape stopping, sometimes accompanied by some noises, with associated tape damage. We left the machine on test, partially dismantled, with a meter across the reel motor. Eventually we found what was causing the problem – intermittent no take-up. A fortunate guess on my part! The meter said that the supply continued to be present, so this left the motor itself or the idler/clutch assembly. As the motor didn't read open-circuit the whole assembly – the reel motor plus clutch – was removed and the idler was inspected. It appeared to be in almost new condition, but was very rough when turned by hand – particularly at one point. Separation of the unit into its two parts is easy. When this had been done the reason for the roughness was evident – a small piece of magnetic material was loose inside and would periodically jam, preventing movement. The internals were fortunately intact, and once the foreign body had been removed normal operation was restored. The material had presumably been there since the machine had been made, as the customer complained of the fault from new.

The drive system is ingenious – simple and effective. The idler/clutch has only two sections, with none of the usual felt pads, springs, washers, etc. Take up torque would appear to rely on the motor drive plus the magnetic flux/attraction between the two idler sections. Very neat.

Another of these nice machines came in with no capstan drive. The circuit is simple, with the microcomputer chip IC601 delivering capstan on/off commands via pins 52 and 53 to the M54644BL capstan drive chip IC604. IC601's outputs were present but there was no output from IC604. As a cross check IC604 and IC605 were interchanged – the reel drive chip IC605 is the same type. This proved the point by giving us capstan operation but no reel drive. S.L.

Logik VR950

The only problem with this machine was that it wouldn't switch off. Because Q3 (2SC815) was short-circuit collector-to-emitter the power supply was always on.

M.D.

Saisho VR3650

The complaint with this machine was noise bars on the screen. We found that the right-hand loading arm didn't locate fully in its V block. Further investigation showed that this arm was loose as the tension spring within its operating cog had broken. Incidentally the same mechanism is used in the Matsui VX850.

M.D.

Philips VR6462

The customer's complaint was that this machine would play but not record. This proved to be the case: when record was selected you couldn't tune in a station. As another machine was handy we swapped the tuner/i.f. panel P104. The first machine then worked all right. Access to this panel in situ is very poor, but after replacing the machine's own panel we managed to check the voltages at the tuner. This showed that there was no voltage on the tuning line to pin 7. We traced the source back to IC7401 where there was no still output, but connecting the meter to pin 8 of this chip restored the tuning. This pin is the 30V input from the regulator. We let the machine cool down then tried again. This time there was no voltage at pin 8 and on tracing back to the regulator we found that there was a 40V input but nothing from T7601 (BC556A). Replacing this transistor restored normal operation.

The second machine would jam a tape as it loaded. We found that the spring in the right-hand side of the cassette lift had come out. As a result the lift would jam half way down.

M.D.

Ferguson 3V29

There was no reel drive and no supply to the motor. We checked back through the junction PCB to the mechacon panel where there was no drive voltage output from the reel drive chip IC12. We soon found that there was no input supply at pin 10. This comes from regulator transistor Q1 via CP-20. The problem was that Q16, which turns Q1 on, was open-circuit.

M.D.

Panasonic NV333

The customer's complaint was that the machine would intermittently shut down during play or record. We ran several tapes through before the fault showed up. There was excessive tape tension – even with the back-tension

lever pulled off the tape tension was still high. A check revealed that the supply spool was stiff on its shaft. Stripping this down and greasing it provided a cure. M.D.

Saisho VR1200

This machine didn't always start – there would also be no clock display. Q2582 can cause the problem but this time the cause of the fault was dry-joints on the 6V regulator. It's mounted on the chassis, to the rear of the head drum.

M.D.

Panasonic NV-G40

This machine would accept a tape and half lace it correctly, but when asked to give the tape back it refused. We found that when the machine began to unlace and the mechanism reached the point where it has to click the solenoid to move to the next stage, i.e. half way between half lace and the entry to the cassette, the mechanism stopped as the solenoid didn't move. Despite the fact that the solenoid worked perfectly on the outward excursion it was the cause of the fault.

N.B.

Ferguson FV32L

The job card said "no r.f. output". Now dry-joints in the r.f. amplifier/modulator unit can cause this, and I was thinking about it when I picked up the job. But this time the cause of the trouble was quite different. There was no tuning as the pulse-width modulated drive from IT20 was missing. Furthermore the following BC558 transistor that supplies pin BT of the tuner was short-circuit all ways round. The tuner had a short to earth from pin BT and all three devices had to be replaced.

N.B.

Ferguson FV31R

The installer complained that this new machine was dead. On the bench that ever so nice power supply (see J. LeJeune's article in the July 1990 issue) pumped and whistled at me. With the covers removed I switched the machine back on at the mains and it started up correctly. My next fault-finding step may seem odd to those of you who don't know these VCRs: I tapped the tuner/i.f./signals PCB that sits across the top of the machine. It could then be made to stop and start. My experience has been that however strange the symptoms this is very often the area in which the cause of the fault lies. After looking at thousands of perfectly good joints I eventually found that there was an intermittent short in the tuner/r.f. amplifier. I should have looked there first of course.

N.B.

Logik/Triumph/Saisho

The problem I've had with various Logik, Triumph, Saisho etc. machines that use an Orion deck is no capstan rotation in play. In each case the cause has been a metal pin dropping out of the plastic arm that feeds through the deck just in front of the capstan. It usually falls out when you remove the bottom cover. You will need to glue it back in – the pin protrudes on the lower side of the arm.

N.B.

Help Wanted

Does anyone have a new or serviceable video head for the Philips VR2334? The part number is 4822 691 20195. Please write to Philip Blundell, AMIEIE, c/o the Editor at the editorial office.

IBC '90 Report

Geoff Lewis, B.A., M.Sc.

The International Broadcasting Convention and its associated Exhibition have been held at Brighton biennially since 1980. Having outgrown the space available the event is to be transferred to Amsterdam in 1992. It seems that the main driving force behind this move is the International Association of Broadcasting Manufacturers, whose organising committee consists largely of the representatives of many of the multi-national companies involved.

The decade of Brighton IBCs coincided with a period during which rationalisation, privatisation and market forces have taken precedence over the other requirements of public service broadcasting. The new Broadcasting Bill will come into force shortly and in January the IBA's centre of technical engineering excellence at Crawley Court is to be further exposed to market forces when it becomes National Transcommunications Ltd. In addition the BBC is once more up against funding problems. Where public service broadcasting goes from here is anyone's guess.

HD-TV and Digital Processing

High-definition television has, during the period of the Brighton IBCs, developed from an engineers' solution to a communications problem into a practical proposition for marketing to the public. It was a major topic at the IBC, both in the technical papers and on the exhibition stands. This time it was widely featured by exhibitors instead of appearing on only a few large stands. But it was often to be seen in a darkened booth. From the viewers' standpoint it's a pity that the displays weren't presented in a manner more akin to the normal domestic conditions. It's also about time that the various systems in competition with one another were presented side-by-side, showing the same programme material under the same viewing conditions.

During this same period digital signal processing has progressively encroached into broadcasting. As the broadcasting and computer industries increasingly converge, so it was difficult to find an exhibition stand without the ubiquitous personal computer. This technology is becoming more important in all aspects of broadcasting, from programme origination through to signal processing in the receiver.

First UK 1250-line Set

The receiver that's claimed will be UK viewers' first opportunity to obtain a domestic quality wide-screen 1,250-line TV set was to be seen at the back of the Independent Television Association's stand, as though the ITA was reluctant to show a piece of domestic equipment amongst the display of professional gear. The extra lines are obtained by inter-line interpolation. Apparently the set will be available from Radio Rentals Ltd. at a retail price of around £3,000 from about April 1991. It was displayed with a Ferguson badge but is of Thomson manufacture, using French circuitry and an Italian tube. The 36in. diagonal 16:9 aspect ratio tube displays decoded PAL transmissions at double the normal line rate to provide

greatly improved picture quality. A control and zoom function enables the viewer to switch between the standard 4:3 aspect ratio and the wide-screen format to suit the transmitted signal. Additional features enable a second image to be displayed either as a picture-in-picture (PIP) or picture-outside-picture (POP). The scanning system can work to the current transmission standard and the future HD-MAC standard. A long strip of presets was readily accessible behind the lower front panel flap: this could be a knob-twiddler's delight that turns into a service technician's headache!

Sony Stand

The Sony stand was large and impressive, as is usually the case. The audio section featured a strong display of DAT equipment. Sony's professional DAT recorders use four heads to scan the tape helically: this is done to allow for the read-after-write operation that's necessary for confidence monitoring. Also on display was what is probably the most sophisticated training and servicing aid to date, the Interactive Knowledge System (IKS). It consists of a library of video discs that contain the data base and a personal computer with a touch-screen VDU. The data base is organised as a hierarchy of data levels arranged so that the user can search for the information required via a menu. Knowledge accumulated during the various stages of product development can be stored in the system for the benefit of service personnel. The system can be linked to an oscilloscope via an interface to provide a truly interactive diagnostic tool. If this technique ever reaches the stage where the data base can be made available on floppy discs IKS will become an important service bay tool.

Some viewers have criticised the bow-fronted optical distortion caused by the Sony Trinitron tube's flat vertical plane. This distortion is more noticeable with 16:9 wide-screen versions of the tube – horizontally moving objects become even more distorted as they cross the centre of the screen. I also noticed faint parallel horizontal lines with these wide-screen tubes, probably caused by the shadow-grille support structure. These lines are most obvious when text is displayed against a bright, pale-coloured background.

Offerings from Hitachi

In addition to all the promises of improved vision and sound quality Hitachi displayed two devices that promise early treats for the viewer. The device aptly nicknamed Lap Watch is a very small portable multi-standard TV receiver/VCR. It's a VHS machine with HQ circuitry, incorporating a 5in. LCD colour display system. An on-screen display is used for such information as channel number, tape count, battery status, clock and timer etc. The machine is available from shops now at a price just below £1,300. The Hitachi video printer was displayed alongside. It's about the size of an older standard VCR and is able to grab a frame of video from either PAL or RGB inputs, producing a colour print that costs about 40p a copy in about two minutes. The suggested high street price is just under £1,500 and it's expected to be in the shops before the end of the year.

PAL-PLUS

The PAL-PLUS group forcefully made the point, backed by demonstrations, that the PAL standard is not

ready to give way to another system, MAC or otherwise. The merits of several variants were propounded. These included improved-definition PAL (I-PAL), extended-definition PAL (E-PAL), quality PAL (Q-PAL) and I-PAL-M, a modified and phase-error compensated system. The BBC provided a convincing demonstration of a system described as Weston/Clean PAL. It uses technology developed for the MAC system within the Eureka-95 project. Clean PAL was said to make possible a further range of PAL enhancements.

The PAL-PLUS group and others reported on advances made with ghost-cancelling in the receiver. This would provide benefits for both picture and teletext reception.

Although the MAC system provides better quality pictures and can be easily adapted to provide high-definition TV the fact remains that a great deal of capital has been invested in the PAL system. It was this point that made the Americans think twice about adopting the Japanese HD-TV system.

Auto VCR Programming

A BBC development has enhanced automatic VCR programming. It solves the problem introduced by the fact that not all programmes start and stop at the advertised times. Digital labels that accompany and identify each programme are transmitted with the teletext signal. They occur about once a second while a programme is running. A VCR equipped for this stores a list of wanted labels, with the time window in which the programme is expected. The user enters the labels from a programme schedule listed in the teletext pages. When the VCR finds a match between the stored and transmitted labels it starts to make a recording: the VCR switches off when a change of programme is indicated by a change of label. Apparently use of the system would strictly speaking have been illegal before 1989, when a change in UK law allowed for time-shifting of broadcast programmes.

Cinema Surround Sound

To enhance cinema programmes Kodak has introduced a digital soundtrack that provides six channels of surround sound with CD quality. Current 35 or 70mm projectors can be adapted at relatively low cost. The film's digital soundtrack is error protected against dropouts that could be produced by dirt and/or scratches. A major advantage over previous sound film tracks is that the sound quality does not deteriorate with successive screenings.

Reflections

Since future IBCs will be held at Amsterdam, the 1990 event proved to be thought provoking. The decade of Brighton IBCs coincided with an increase in the influence of market forces and a decline in training and education within the UK. The technology has steadily advanced but research and development have been progressively taken over by organisations whose headquarters are outside the UK. Is the IBC move a part of this drift away from the UK, and might it add further to the UK's problems? Many young engineers and technicians from the smaller companies were able to spend only one day or even the Saturday or Sunday at the event. They will certainly be unable to bear the cost of a day trip to Amsterdam. These young, maturing engineers, and the industry, will be the poorer for a lack of exposure to the high technology that's featured at each IBC.

next month in

TELEVISION

FREE YEAR PLANNER

Our January issue will contain a separate Year Planner for 1991. Useful for noting events, meetings, spares orders and so on.

● **DEALING WITH SURFACE-MOUNTED COMPONENTS**

Advances in manufacturing methods have an unfortunate habit of making life more difficult for the service engineer. Surface-mounted component technology is the biggest change since the advent of the PCB. It first found application in portable video equipment, where there's a need to pack components densely into very limited space. Since setmakers found that it suited their manufacturing needs the technology has advanced into many other areas of consumer electronics. It calls for a different approach to servicing, in particular much greater care than with conventional PCB assemblies. Next month Eugene Trundle considers the problems and discusses operating procedures and tools. There will also be a couple of reviews of relevant servicing aids.

● **TEST JIG FOR LNBS**

MCES has invested in a sophisticated test set-up to enable LNBS to be checked and serviced. Steve Beeching takes a look at the equipment used.

● **VIDEO HEAD CLOGGING**

Video head clogging is a common problem that causes a lot of wasted time and money through not being properly understood. Nick Beer takes a detailed look at the subject, providing guidance on causes, what to look for and action to take.

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Servicing S-VHS Equipment

Steve Beeching, T.Eng.

One of the problems with specialised servicing of high-technology equipment is that the technology keeps changing. Keeping abreast of these changes involves considerable cost and effort.

Standard VHS and VHS-C camcorders present problems enough, one of which is video head replacement. Initially Panasonic equipment was fine, with no Q circuits to align. JVC camcorders however have to be spread out so that they look like the exploded view in the relevant manual, with a proliferation of extension leads between the various panels. All this just to align the four Q circuits. Experience taught us that in view of the time required to carry out alignment of the Q circuits in the preamplifiers and avoid picture wobble due to reverse tracking it's more effective to replace the whole drum assembly using the kit that consists of the lower drum motor, the video heads (all nicely balanced) and prealigned preamplifiers. The preamplifiers don't need to be replaced with Panasonic drum assemblies as no alignment is required. Perhaps I'd better explain reverse tracking: it's the ability of the video head drum to lock 180° out of phase so that none of the individual heads replays the tracks it has recorded. Later camcorders have anti-reverse tracking control circuits built in.

Problems with S-VHS Equipment

The introduction of S-VHS equipment brought more problems for those involved with servicing. For one thing it has been over-sold as "the poor man's broadcast standard" because of the Y channel's greater bandwidth. Owners of the equipment, particularly the "film your wedding" brigade, soon complain when they find that it doesn't match up to their idea of what the results should be.

Remember that S-VHS equipment, both camcorders and mains-operated machines, is still mass produced for the domestic market and is thus subject to tolerance spreads. These are acceptable as far as the manufacturer is concerned but give rise to phantom fault complaints such as "picture not up to spec" or "poor-quality copies". Such complaints are generally not valid, and there's further aggravation when the owner is told that his equipment is within specification.

Apart from this problem, very good test gear is required for setting up S-VHS equipment. The idea of checking S-VHS equipment with a pattern generator and Y/C splitter, despite this being part of the manufacturer's test kit, is not good enough. This is particularly so with a camcorder deck assembly. Even if the pattern generator, such as my Grundig VG1000, is to broadcast standard the Y/C splitter introduces a bandwidth restriction, not to mention the 4.43MHz notch in the Y output due to the colour filter's action.

More particularly, S-VHS circuits that have a wide bandwidth rather than using signal-enhancement techniques require a video sweep signal for correct equalisation setting. This is critical if spatial-flicker effects during playback are to be avoided.

The video heads in JVC S-VHS equipment cannot be changed without a sweep generator to set the Q circuits: this is done with an injector coil mounted on the drum,

which has to be prevented from whizzing around while the operation is carried out.

Servicing Equipment

Earlier this year I made enquiries about various pattern generators and eventually contacted Leader in Japan. They put me on to Thurlby-Thandar Ltd. A nice lady there knew nothing about special equipment but sent me a catalogue. Looking through this I discovered a new product - the Model 430P PAL sweep generator. For the adjustment and alignment of S-VHS equipment it said. Back to Thurlby who knew nothing about it.

Now put yourself in my place. The only thing anyone knew about the 430P was the specification printed in the catalogue. This looked impressive, but would the machine drive a JVC injection coil? It was going to cost me £1,240 plus £30 carriage plus VAT and a twelve-week delivery time from Japan to find out. One was ordered after I'd put back Elaine's new car by a few months - a very unpopular move! Three months later there was a "here's your **\$!88*! pattern generator" announcement along with a big box and lots of scowls. But I can take it!

Features of the Leader 430P

Anyway, what about the Leader 430P? Well, it has two basic signal-source sections. There's a colour pattern generator and a video sweep generator, to the PAL specification down to the last 0.75 cycle!

There are four colour patterns. First a multiburst consisting of seven sets of vertical resolution bars that increase in frequency across the screen. On the extreme

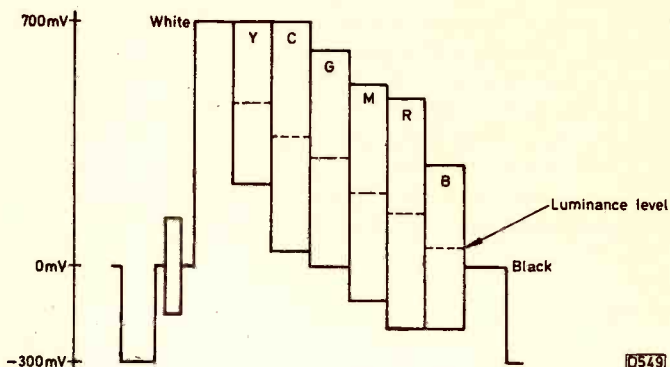


Fig. 1: The 430P's full-field colour bars.

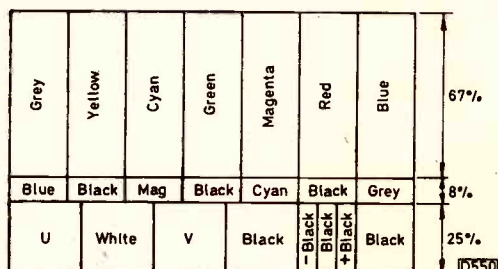


Fig. 2: The SMPTE test pattern provided by the 430P.

left there's a 100 per cent white reference. This is followed by 0.5, 1.25, 2, 4.43, 4.8, 5.8 and, on the right-hand side, 7MHz bars, with an 0.2dB level flatness.

The second pattern is full-field colour bars (see Fig. 1) and is self-explanatory. Next come SMPTE colour bars, see Fig. 2. This is a standard reference set made up of complementary colours, U and V and a selection of black levels. There are three black levels beneath the red bar, the variations either side of the standard black level being $\pm 25\text{mV}$. Not much good for camcorders and VCRs, but fine for setting up monitors.

The final pattern is a blank raster, not white but light grey. It's made up of R+B+G.

Six switches affect all these patterns. They enable red, green, blue, the colour burst and the chroma and luminance components of each pattern to be switched off independently. Thus the blank raster can be set to any of the primary colours and the colour bars can be converted to a grey scale.

The video sweep section runs from 100kHz to 10MHz (actually it's nearer 11MHz). There are three controls here, for the start and stop frequency setting and the amplitude level. The frequency controls enable the sweep to be varied over the range 100kHz to 10MHz. The amplitude control is also operational with the set of multiburst frequencies.

With a frequency sweep you need spot marker frequencies. The 430P doesn't fall short in this respect. There are five sets of markers as follows: (1) 0.1/1/2/3/4.43/4.8MHz; (2) 0.1/1/4/6MHz; (3) 0.1/5/7MHz; (4) 0.1/4.5/5.5MHz; and (5) 0.1/8/8.5/10MHz. As the five selector buttons are independent you can select any set or sets or the lot to give a complete band of markers.

Outputs

So much for the generator sections. What about the outputs? As you'd expect a BNC connector provides a composite video output. There's a variable control associated with this and a fixed-level preset switch that gives 1V peak-to-peak at 75 Ω . The S-VHS output provides Y and C signals via an S connector: Y is 1V peak-to-peak and C 300mV peak-to-peak, both at 75 Ω . Another BNC connector provides a trigger output for an oscilloscope: HD or VD pulses at 3V peak-to-peak can be selected – this should be enough to trigger any oscilloscope. The final front-panel BNC connector has a TTL output providing pulses which are coincident with the marker frequencies: you can use this to sync an oscilloscope to a marker or provide a second trace to indicate marker positions if they are not clear after the sweep has gone through a circuit.

All these controls and connectors are on the front panel. A BNC connector at the back provides a composite sync output. Oh yes, and there's an on/off button.

Video Preamp Alignment

After unpacking the generator the first relevant job I had was to align the video head preamplifier Q circuits in a JVC GRS707 – I'd replaced the lower drum assembly, which contains the preamplifiers. You fix a coil mounted on a bracket over heads SP1 and LP2 as a pair or alternatively over heads SP2 and LP1 on the opposite side of the drum. A fair amount of preparation is required – to disconnect the drum motor drives, power

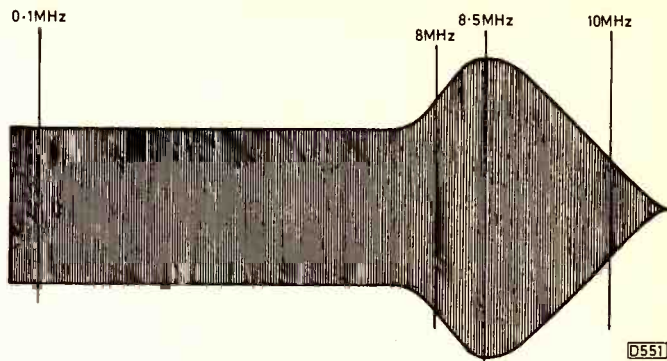


Fig. 3: JVC video head sweep.

the preamplifiers and apply logic switching to them so that they are in the playback mode. It's also necessary to select each of the four head preamplifier outputs in turn so that the R and C adjustments for each head can be set. Providing logic switching by soldering to test points or twisting wires together is difficult, so I built a test box with four pushbuttons and f.m. test points mounted on it. I connected it via a D connector and ribbon cable to the camcorder's PCB. The box is also useful with the GFS1000 and HRS5000, using different connector cables.

The peak of the waveform is set at 8.5MHz, so the 0.1-10MHz sweep was selected with marker set (5). The adjustable capacitor and damping resistor are used in conjunction to match the level of the outputs from heads SP1 and SP2 to each other and heads LP1 and LP2 likewise. If the adjustments aren't carried out correctly the result will be differential flicker in different parts of the playback picture.

Fig. 3 shows an example of the sweep – naturally the real signal looks more ragged and fuzzy. Table 1 shows the head switching logic. /SP is low for SP and high for LP selection – this determines the test point at which the sweep signal will appear (TP SP FM or TP LP FM). Individual heads are selected by taking the drum flip-flop signal high or low – low is 0V and high 5V.

General Use

I've fed the full bandwidth (subject to the matching cables) Y/C output signals into various JVC camcorder decks with great success, so my Y/C splitter box has become redundant. It's good not to have to rely on the camera for pictures when you are checking out the deck by using sweep signals or recording colour bars.

At first I had some difficulty with Panasonic MC6 and MC10 camcorders as I couldn't get chroma through in the E-E mode. I then discovered that the first chroma emitter-follower had no base bias as this is obtained from the camera section. As 5V is available on the connecting ribbon cable I added a couple of resistors to turn the transistor on and have had no further trouble here.

Table 1: GRS707 head switching logic

Head	SP	DFF	Test Point
SP1	L	L	SP FM
SP2	L	H	SP FM
LP1	H	H	LP FM
LP2	H	L	LP FM

As I write this the first faulty NV-MSC90 has come in for repair. Getting it apart was a nightmare – made worse by the fact that the service manual is not only wrong but misleading, so that one or two ribbon cables could be badly damaged. This camcorder uses connector cables of a different size, so here we go again in the matching lead construction business.

Conclusion

The 430P is very light at only 5kg. It's fairly wide at 426mm. Height is only 99mm and depth 300mm. Two

small retractable feet allow you to tilt the front up by 45mm.

At its price I wouldn't expect anyone simply to rush out and buy a Leader 430P. But for the specialist servicing I do the generator is very good value for money however you look at it. The address of Thurlby-Thandar Ltd. is 2 Glebe Road, Huntingdon, Cambs PE18 7DX. Telephone 0480 412 451, fax 0480 450 409.

I will shortly be reviewing some new Grundig test generators. As optional extras one has additional teletext test pages and a Nicam test generator – but at four grand or more it would have, wouldn't it?!

The Room at the Back

J. LeJeune

Things had been very quiet at Electronic Dreams in recent weeks. Terry Green paced the sales floor looking for missing customers. The cash register's drawer had opened but once so far this morning – at 8.45 when he'd prepared the small change float. People stopped and gazed at the window display. One or two had ventured in but departed without making a purchase. It seemed that people had little thought for things electric. At least the room at the back was more lively.

The service van rattled into the rear yard bearing Norman and Gareth back from another dish installation. "Satellite dishes are no problem at all to install" commented Norman, once inside. "BSB is even easier than Astra, especially with the installation screen. But it's best to do the final peaking with a meter, just to make sure."

Andy was quietly peering into a Ferguson HF17 with no record and bad playback hum on tape deck one.

Norman picked up a Philips CP90. They didn't get many of these, though they'd had a couple about a year back both suffering from lack of height due to a small-value resistor in the field output stage. This one was dead. When he'd taken the back off Norman checked the main h.t. line. Only 50V or thereabouts. No wonder there was no life. Being unfamiliar with the chassis Norman reached for his file on it.

By now Andy was almost inside the HF17 but had made no progress. He switched off his bench lamp and rubbed his eyes. "I think I'm going to need glasses" he said, "the print on some of these components gets smaller and fuzzier."

The problem on Gareth's bench was an old Fidelity colour set – ZX3000 chassis. It was dead and Gareth found that the 2A mains fuse was blackened and the bridge rectifier was short-circuit, all four diodes being faulty. Norman, who was looking on and had experience of these sets from some time back, advised him to replace them with something better – like the big BY127s.

Norman had diagnosed a faulty line output transformer in the CP90. His file had offered this advice and his tests had provided confirmation. He was busy ordering a replacement when Gareth's ZX3000 sprang to life. Andy had also met with success. He retreated to his stool with a look of satisfaction. "Well" said Norman, "what was it then?"

"The play/record head switching is done by transistors which get their supply from a 9V source via a diode" Andy replied. "The diode was open-circuit, hence no 9V. And as none of the switching transistors were switched on the

circuit from the head to the record/play circuits was open. The absence of a load on the inputs produced the loud hum. Simple as that!"

Norman looked at the Hitachi CTP2650 that now occupied most of his bench. It was by now a fairly old set. The sound was o.k., but there was no picture on the screen. He started to poke around. The picture suddenly appeared but was not very good. Norman began to check the grey scale, only to lose the picture again. He reached for the manual and began to set up the c.r.t. voltages correctly as a preliminary to going through the grey-scale procedure. Back came the picture, but the grey scale was wrong and every time he attempted to improve it the picture disappeared. Then he remembered. The grey-scale settings with this particular set had to be right or the result was no picture for a long time. The tube was so poor that acceptable settings of the grey-scale controls couldn't be obtained. He picked up the phone to ring the customer.

An old Panasonic TC48G was Norman's next patient. He looked at the screen intently. "Good programme?" commented Gareth. "I'm watching the raster" Norman replied, "not the picture. Apparently the trouble is line drift that appears when the set has warmed up".

"Ours at home does that" said Gareth, "after running continuously for about five hours. I've been meaning to take a look but the family won't let me touch it when a programme is on."

"Are you suggesting that I'll have to wait five hours for this set to play up?" Norman replied. He turned away from the Panasonic and switched a Ferguson set on – a TX10. The fault report said that the picture faded off and on at random. Sound was o.k., and the picture was good when it was present. Norman eased off the back cover and took a look inside. Everything seemed to be normal – there was no smell of overheating. He took the set to the soak bench to let it run awhile, then looked around for something else to do. As he was looking round the TX10's picture began to fade away, over a three-second period. Simultaneously the Panasonic receiver began to show the line drift complained about, at the top of the picture.

"Trust them both to go at the same time" commented Gareth. He went over to the TX10 and peered inside. "Line's still running – I can hear it – but the tube's heaters have gone out. Probably a dry-joint on the chopper transformer."

Norman, now gazing intently at the Panasonic TC48G, mumbled something back about Gareth attending to that if he liked. He moved the TC48G circuit diagram under his bench light.

Andy's problem was with a Ferguson TX90 whose field scan amplitude varied at the bottom. Tapping the PCB in the area of the field output stage would restore full height but it wouldn't stay like that. A few moments later it would flicker up and down again. He disconnected the mains supply and took a soldering iron to the field output transistors. The emitter connection of one of them was held in by crystalline solder. When he'd put that right and switched on again the full height had been restored on a permanent basis.

Norman was waving a can of freezer about. "Found it!" he exclaimed. "It was C505, the capacitor that couples line flyback pulses to the flywheel sync discriminator circuit." He stalked off to the stores for a replacement. "I'm going to fit a paper one in place of that electrolytic - it should last a lot longer."

Gareth's current problem was with a teletext set. The page showed increasing amounts of errors towards the right-hand side of the screen. Obviously the text data was being decoded more accurately the closer it was to the clock run-in signal at the start of a row. It could only be the 6.9MHz clock coil out of adjustment, but Gareth couldn't

get any improvement by slight adjustment. He called over Andy, who was on to the problem quickly. "You have to re-dial the page, Gareth, to clock in fresh data." The clock-cracker was paged and results were soon corrected.

Andy went back to his Panasonic NV7000 - it had no E-E sound. After sundry scope checks he pulled the bench Avo across to check the logic level on the mute line. It was high, the cause being a defective nand gate in IC6010.

Service manager Sid appeared from the stores where he'd been carrying out an inventory - and trying to establish how much of the older stuff could be cleared out. A Ferguson TX90 with no colour had just been brought in. He was in the mood to have a go at it. With the back off, the process of chasing around the few components associated with the μ PC1365 colour decoder chip began. At five o'clock he was still chasing. Gareth was close by with the broom. "It's probably the delay line" he whispered.

When Sid looked up from his bench the rest of them had gone. It was dark outside and out front the shop was deserted. It had been the delay line. He pulled the big switch and set off for home.

Panasonic Bar Scanners

Nick Beer

We've had a few problems with Panasonic combined scanner/remote control units. They are used with various VCRs including the NV-L20/5/8, NV-F70/65 and NV-J30/5. An interesting symptom occurs when the four HP16 batteries get towards the end of their life. The scanner red light output is still present and the unit still transmits but there's no LC display. On many occasions I've had these units returned for repair when the only fault has been low batteries.

If the complaint is that the scanner doesn't read the data from the card the most likely cause is a blocked hole in the nozzle that surrounds the pen-section transducer. The nozzle can be twisted off - a quarter turn - and cleaned. Earlier versions came complete with a little brush and instructions. This is no longer the case but the brush is available as a spare part so that any customer who has difficulty in cleaning the hole can be supplied with one.

I've also had a faulty chip cause the above faults. Another cause of the no display symptom, or of incorrect/missing display segments, is that the contact rubber cushions under the LCD sandwich are dirty or worn out. Reassemble by placing the LCD into the upper half of the case followed by the two cushions in the case slots then finally screw down the PCB on top. This ensures correct placing of the cushions. A faulty chip can cause identical symptoms.

When fault finding with these units it's best to remove the PCB from the case and power it from an external d.c. supply. But beware: symptoms that are present when batteries are used can simply disappear when a mains-derived power supply is used. A set of batteries in a holder, soldered or clipped to the PCB via leads, is better.

Excessive battery drain is usually due to a faulty chip or scan transducer switching transistor, as a result of which the red LED doesn't switch off after a short period of inactivity as it should.

The battery contacts and the cases don't stand up to rough use. All case parts are available as spares. Panasonic

can supply the complete set of case components as a kit for scanner-only units. If you don't open the case correctly (see my article on repairing remote control handsets in the September 1989 issue) it may break and not go back together. If someone steps on the sliding cursor over the scanner section, something that quite often happens, it will crack. To replace, slide it to the bottom of the unit and then off where there are cutouts for the notches in its runners, otherwise it will damage the upper half of the case.

Reference and type numbers of the components vary from unit to unit. So be precise when ordering parts.

The main problem with older units in which the scanner and remote control sections are separate is dry-joints on the crystal resonator. The result is no or intermittent operation. A faulty chip can cause all sorts of faults, but again the usual one is no go. Intermittent operation can also be caused by weak or dirty battery contacts. Duracell batteries give trouble due to the shape of their end terminals.

After some use the cases of the older units often look tatty. As they are reasonably priced it's worth considering replacement when a machine is overhauled. You may find that the battery cover clip is weak. Some earlier top half cases that were supplied as spares have an incorrect moulding for the battery contacts, the result being that you can't fit a battery. All that's required is a sharp knife applied to the appropriate place.

Ordering Replacements

When ordering remote control units and scanners make sure that you quote the exact part number for the VCR concerned. As the difference can be only a single button it's easy to supply the wrong one: it can be a costly mistake. The only times we've had to order and supply replacements have been when spillage or loss has been involved.

Long-distance Television

Roger Bunney

As we approach the end of the 1990 Sporadic E season it's clear that this has not been a good one. Conditions during September cannot be described as anything other than quiet. The month often brings good tropospheric conditions, with slow-moving anticyclonic pressure systems predominating, but apart from a brief uplift on the 28th, tropospheric propagation was sadly lacking. The following SpE log tells all!

4/9/90 TVE (Spain) chs. E3, 4.
5/9/90 TVE E4; RTP (Portugal) E3.
6/9/90 TVE E2, 3.
7/9/90 TVE E2; NRK (Norway) E2; SVT (Sweden) E3.
8/9/90 +PTT (Switzerland) E2.
9/9/90 TVE E2, 3, 4.
10/9/90 NRK E3; DR (Denmark) E3.
14/9/90 TVE E2, 3; RAI (Italy) IA; NRK E3.
17/9/90 TVE E2, 3, 4.
20/9/90 RUV (Iceland) E4; RAI IA.
21/9/90 NRK E2; CST (Czechoslovakia) R1; SVT E2, 4; YLE (Finland) E3, 4.
22/9/90 ARD (W. Germany) E2; RAI IA, B; +PTT E2; TVE E2.
27/9/90 RAI IA; TVE E3.
29/9/90 JRT (Yugoslavia) R1; RAI IA; NRK E3.
30/9/90 DR E3; SVT E2; TVP (Poland) R1; MTV (Hungary) R1; TVE E3; ARD E3.

Simon Hamer received a weak F2 layer signal at 1000 BST on the 25th with unidentified programmes. The only other event worthy of note was the short lived but intense tropospheric opening on the 28th. There was extensive reception of v.h.f. and u.h.f. signals from France, Luxembourg, Holland, Belgium and W. Germany. DFF-1 (E. Germany - now united with the west of course) signals were received on chs. E6/7/8/11/12 and DFF-2 signals on ch. E34.

My thanks to Simon Hamer (Powys), Iain Menzies (Aberdeen), Roger Fussell (Torpoint) and Bill Cotterill (Tipton) for sending in reception reports.

During early October I was working in France some two miles from the Rouen transmitting mast, an impressive red-painted tubular steel construction with terrestrial microwave link dishes at 25m or so. Signs of the times atop

the building itself were two dishes aimed, one must suppose, at Telecom 1C at 5°W and Telecom 1A at 8°W, satellites that provide downlinks for the main TV network offerings.

News Items

Germany: DFF is facing severe financial difficulties which could lead to the collapse of the E. German TV network. It's at present seeking a 15 per cent programme schedule within the ARD network.

Japan: NHK is to start digital radio broadcasting via the BS 3A satellite. It will be the first subscriber-based digital radio service in the world. NHK is also to start two pay-TV channels via the same satellite.

UK: The BBC is to exploit its downtime (i.e. night) network facilities by transmitting scrambled programming. The intention is to transmit programmes for professional and minority groups and specialist leisure interests. The service, to be known as BBC Select, is due to start in September 1991. VideoCrypt scrambling will be used.

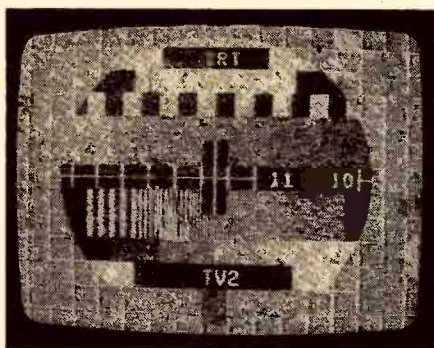
Pakistan: The new PTN (People's Television Network) channel which started on May 26th in Islamabad has been a great success. The service is at present on-air from 1900-2300, on ch. E12. An agreement has been reached to use CNN material.

Italy: New laws will restrict advertisements to seven minutes an hour over RAI and eleven minutes an hour over private channels. News programmes must be screened on all channels, with 40 per cent European content. No 18 rated films are to be shown and those rated 14 can be screened only after 2230 local time.

Gibraltar: George Gaskin reports that RTL is considering purchase of the financially ailing GBC. The main objective could be access to the regions along the Spanish coast. He's received two new commercial stations, TVT Television Tropical from Almunecar on ch. E52 and TVM Telemotril from Motril on ch. E54. Signals were weak, the distances being over 175km.

USA: An interesting transmission technique called high-speed audio transmission (HSAT) is being tested in the States. It enables an hour's audio material to be compressed and transmitted in just twelve frames of video. The "Fast-Trax Technology" also enables other digital data to be inserted into video frames for rapid transmission.

France: The new 7th TV network, Canal Enfants, is to be transmitted at u.h.f. in Lille, Lens, St. Quentin, Amiens, Caen, Paris, Le Mans, Orleans, Tours, Angers, Nantes, La Rochelle, Angouleme, Bordeaux, Bayonne, Toulouse, Montpellier, Nimes, Avignon, Toulon, Grenoble, Clermont-Ferrand and Montlucon. Coverage should



Left: Reception of amateur TV at 435MHz by Ryn Muntjewerff in Holland from G4UAM near Norwich. Centre: C band reception of the Turkish Network-2 test pattern by Ian Waller in Lincoln, via Intelsat at 60°E. Right: An NTSC System M test pattern received during the Finnish summit talks in early September, via Eutelsat I F4 at 13°E.

approach eleven million viewers. Channel M6 now has 75 per cent coverage.

Radio Amateurs: The use of vertical aerials, now permitted, will increase interest in 50MHz mobile operation. Up to 400W c.w. and s.s.b. is to be allowed.

New EBU Listings

Spain: Almonaster ch. E28 (Canal Sur) 21kW; Valencia E38 (Antenna 3), E41 (Tele 5) and E44 (Canal Plus), all 50kW; Torrente E43 (Antenna 3) and E46 (Canal Plus) both 91kW. All with horizontal polarisation.

There is increasing collaboration between the EBU and the East European organisation OIRT and a single authority is expected to be formed. Several E. European countries, including Czechoslovakia and Poland, have joined the EBU.

Satellite TV News

Eutelsat II F1 is now in position at 13°E and has taken over most of the services previously carried by the I F4 satellite at the same position. Teleclub has departed from 13°E however and is now to be seen only via Astra 1A.

The French "Sport 2-3" service is expected to come on air next summer via the TDF satellites, with programme backing from the A2 and FR3 networks.

Ted Turner's CNN network is to launch a general entertainment and news channel intended for the Caribbean and Central/South America.

The Spanish commercial channel Teleconco, transmitted via Eutelsat I F2 at 7°E, claims viewing figures greatly in excess of TVE-1.

The elderly Intelsat satellite VA F11 at 27.5°W is now co-located with the VI F4 satellite. Enthusiasts may have noted the improved EBU news feed signal strengths. If you tune carefully to the EBU vertical signal at 11.471GHz, then switch to horizontal, you will if your cross-polar rejection is good see another weak test pattern consisting of vertical frequency response bars. Its origin is unknown, but the signal is an NTSC, 525-line one.

On certain nights an interesting Technology Channel can be seen via the Discovery Channel transponder at 27.7°W.

A monthly newsletter called *Transponder* is to be published with news, views and information on the satellite scene. The initial, experimental edition can be obtained from PO Box 112, Crewe CW2 7DS. Send a self-addressed, stamped foolscap envelope.

The SatView Bandwidth Filter

Many TV enthusiasts are installing trackable dishes that can pull in signals from across the satellite arc. Unfortunately however many of the available signals are intended for reception using relatively large dishes. Few of us can call upon a 2m or larger dish, most of us having to do with one of 1m or less diameter. Fortunately LNBS with a noise figure as low as 0.9dB are becoming commonly available, though at a price. If you are operating with a trackable 90cm dish this is the quality of LNB to aim for.

Even with such low-noise operation many signals will be sparkly or marginal at best. It's possible to achieve improved weak signal reception by using a variable bandwidth i.f. filter to extend the receiver's threshold. Many earlier satellite TV receivers made the 70MHz i.f. signal available at the rear so that a filter could be added. Few current receivers incorporate this facility, but it's easy to include a filter by breaking the 70MHz i.f. feed between

AERIAL TECHNIQUES



The Galaxy 25

- 10" Picture tube with 78° deflection and smoked screen filter.
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- 12/24V or 240/220V operation from mains or battery.
- 39 Programme storage tuning.
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- Headphone socket for private listening.
- Extension speaker socket.
- Built in aerial.
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- Features direct channel entry.
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● Built in Peritel socket allows this unit to be used with a variety of other AV equipment.

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the final down-conversion and the main receiver PCB. The signal to the main PCB usually comes from a small metal-encased unit via thin coaxial cable that can be extended/broken, using free sockets for looping as required.

Electron Electronics, Unit 14-16, Singer Way, Woburn Road Industrial Estate, Kempston, Bedford MK42 7AE (telephone 0234 841 174) has recently introduced in the UK the SatView unit which can be used to reduce the bandwidth progressively from 30MHz to 12MHz. Reducing the bandwidth reduces the noise window, with the result that a weak signal becomes much clearer. There's also the advantage of improved selectivity.

The unit is housed in an attractive black metal case, with input/output F sockets at the rear. It requires a 240V a.c. supply. One useful feature is that when the unit is switched off an internal relay switches the in/out to bypass so that signals still pass through to the receiver – the alternative Phantom IFP-70 unit has to be powered whether switched on or off.

The front panel controls are obvious – gain and bandwidth. When the unit is switched on a warm red glow is seen from beneath the front panel. Operation is simple. Excessive bandwidth reduction can cause sync tripping and colour distortion, the latter being apparent on saturated colours, e.g. red, as an intense frying noise effect. If you are seeking a weak signal at noise level however it may be necessary to use maximum bandwidth reduction.

I was impressed with the unit and can recommend it highly. The retail price is £79.95 inclusive of VAT. If ordered by post add £2.50. Trade enquiries are welcomed. My thanks to Electron Electronics for making the filter unit available for assessment.

Interconnecting Video Equipment

James N. Slater*

Satellite TV has made many people aware for the first time of the difficulties that can arise when the domestic TV set is used as a display device for various items of equipment. The basic problem is that the vast majority of TV sets have only one signal input point, the aerial socket. Some more recent models are fitted with a scart connector, but they generally have only one of these. Taking things in historical sequence, we'll consider first the use of the aerial socket for interconnecting equipment.

Being assigned to other purposes, channels 35-38 have never been used for broadcasting in the UK. So to avoid interference with off-air TV transmissions the modulators in items such as home computers and VCRs are tuned to a frequency within this range.

For most people a VCR was the first item to be connected to the TV set. Since VCRs are designed to act as a feedthrough device, connecting the aerial to the VCR and the VCR's u.h.f. output to the TV set's aerial input socket is usually perfectly satisfactory. The VCR's output can be divided so that one or more receivers can be used for off-air reception while other(s) are used for off-tape viewing on say ch. 36. The only problems arise in a limited number of areas close to airports, where radar signals on ch. 36 can interfere with off-tape signals. Adjustment of the modulator's tuning usually overcomes this problem – modulators can generally be tuned over a limited range of say ch. 31-40, though a wider tuning range will probably be provided in future.

Adding Astra

As with VCRs, Astra satellite TV receivers usually have a modulator that provides an output at around ch. 36 for connection to the aerial socket of a domestic TV set. They also usually have a u.h.f. aerial input socket so that there's a through path for u.h.f. signals. Where an Astra receiver and a VCR are used with the domestic TV set the usual method of connection, assuming that the set doesn't have a scart socket, is as shown in Fig. 1. This arrangement provides considerable flexibility – either the satellite or u.h.f. TV broadcasts can be recorded, while different TV sets can display satellite TV, terrestrial TV or off-tape programmes simultaneously.

There are potential problems however. The u.h.f. outputs from the two modulators will tend to interfere with each other, and perhaps with the incoming terrestrial u.h.f. signals. The frequencies used by the two modulators need to be carefully adjusted to minimise interference, which usually takes the form of patterning on the pictures. In areas where the local off-air transmissions are on channels close to those used by the modulators it can often be difficult to tune the modulators to frequencies that don't result in patterning on some of the pictures obtained. To add to these difficulties, for economic reasons the modulators provide double-sideband outputs which of course occupy a greater amount of spectrum space than a standard off-air transmission.

Two Satellite TV Inputs

Things start to get more tricky when a second satellite TV receiver, say for the BSB transmissions, is added. Real

problems can arise when all the interconnections are at r.f. As with Astra receivers, those for BSB are equipped with a u.h.f. input socket as well as the socket for the input from the dish. So many people will simply connect a BSB receiver in series with their Astra receiver, VCR and domestic TV set. This can work, and enables any of the incoming signals to be recorded while any of the others is/are being viewed. But the fact that there is now a third r.f. modulator makes it more difficult to find channels that are free from mutual interference. Thus patterning is a very real possibility. It's not only co-channel signals that can cause interference: signals on adjacent channels and on channels that are spaced five and nine channels away from the wanted signals can also cause problems, so the use of these "taboo" channels must also be avoided.

Additional Equipment

Interference problems soon become intolerable as more equipment is added to the system in this way. Once Channel 5 transmissions start, using channels 35 and 37, the situation will become even more difficult. One has also to remember that when a TV signal is passed through any piece of equipment noise is inevitably added – passing a signal through several units in series will further increase the noise seen in the picture.

Alternative Solutions

For all these reasons it's better to adopt techniques that avoid the use of so many different modulator frequencies. There are two main alternatives: to switch the r.f. signals or to switch baseband video signals.

Fig. 2 shows a simple r.f. switching arrangement. The various u.h.f. inputs to the main receiver are fed via a multi-way switch, which must be a high-quality device with good isolation between the various inputs to avoid breakthrough interference. The same channel, say 36, can be used for the various non-terrestrial TV inputs so that the TV set remains tuned to this channel for the "extra" inputs. For a VCR to be able to record one programme while another one is being viewed a second r.f. switch is required, and each of the incoming feeds must be split into two to provide signals for the receiver and the VCR. This can result in a fairly complex wiring arrangement.

Fig. 3 shows an idea that could be useful where the TV set has only a u.h.f. input socket. The adaptor box receives say six baseband video inputs from the scart sockets of satellite TV receivers and other equipment. Any of these inputs can be selected by the switch and applied to the PAL u.h.f. modulator. It's not at present possible to buy an adaptor to this sort.

Video Interconnection

A better arrangement is to avoid r.f. interconnections, making use instead of the video outputs available from VCRs and satellite TV receivers.

The use of scart sockets provides a very satisfactory method of connecting a VCR and a couple of satellite TV

* The author is with the Independent Broadcasting Authority.

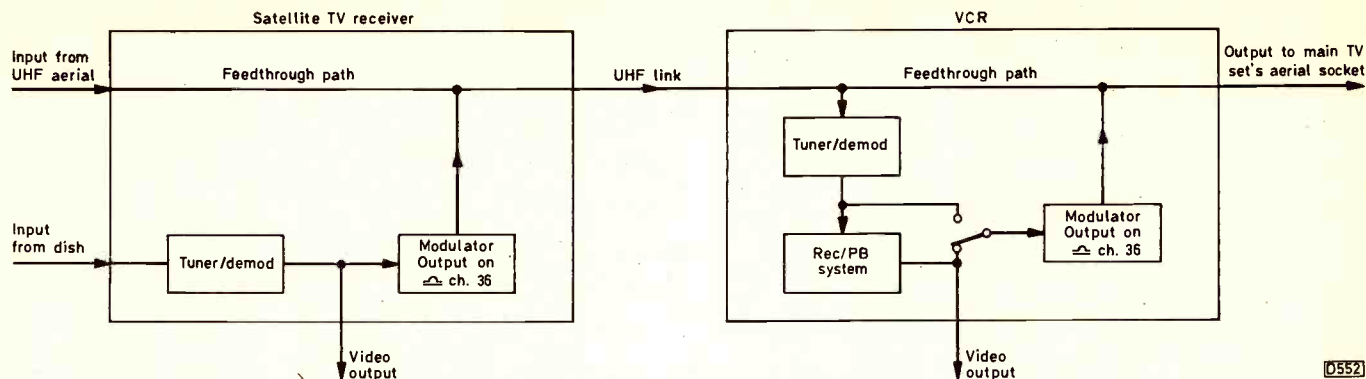


Fig. 1: A satellite TV receiver, VCR and domestic TV set connected in series at r.f.

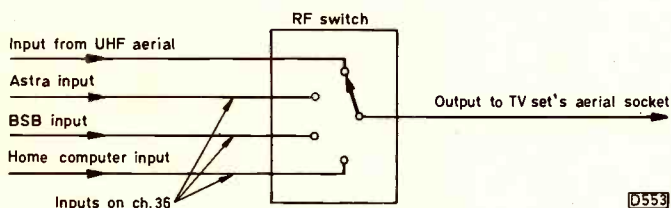


Fig. 2: A simple r.f. switching arrangement.

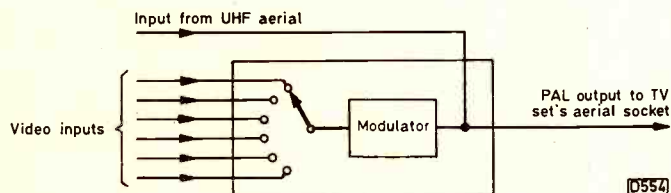


Fig. 3: A baseband video to r.f. switching box.

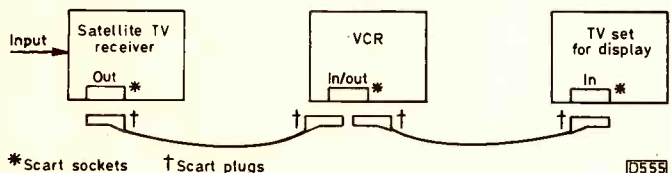


Fig. 4: Use of scart connectors to link a satellite TV receiver, a VCR and a domestic TV set.

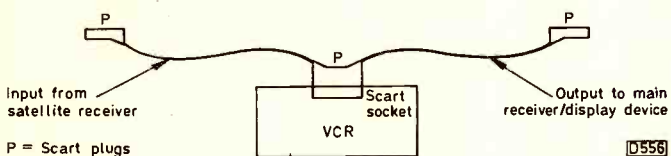


Fig. 5: Use of a special three scart connector lead.

receivers to a main receiver fitted with one of these sockets. Composite PAL video is used with a VCR and an Astra receiver, separate RGB outputs with a BSB MAC receiver – along with the associated sound of course. Direct video connection avoids the use of modulators and thus removes the possibility of r.f. interference. Since a modulator must introduce some slight distortion the signal quality should also in theory be better, but in practice there's little difference with PAL signals. With a MAC transmission however the colour and luminance signals are kept separate: thus video connection provides noticeably cleaner and sharper pictures than when the BSB signal is converted to PAL form to modulate a u.h.f. carrier.

Interconnection with scart connectors is simple. The 21-core cable can carry composite video (PAL) and RGB video signals. A problem arises when a VCR is included, see Fig. 4. Since the 21-core scart connection carries both

input and output signals, once the satellite receiver is linked to the VCR's single scart socket there's no way of getting an output from the VCR to the TV set. Ideally two scart connectors are required, but only a few VCRs and TV sets have two. One way round this problem is to use a special lead with three scart plugs, one at each end and another in the centre. This is shown in Fig. 5. Unfortunately such leads are difficult to obtain.

Connection is simplest where the receiver and VCR have two scart sockets. In this case the required input can usually be selected by a remote control system. To overcome the problems that arise when receivers and VCRs have only one scart socket a range of scart adaptor boxes and switching units is available, enabling almost any interconnection scheme to be achieved. This type of arrangement is much to be preferred to serial r.f. interconnection. Even so, such mechanical switching can be complex and clumsy. The solution being developed by setmakers is the D2B (domestic digital bus) system. It will enable various items to be interlinked via scart connectors with switching between units effected by sending logic signals over two of the interconnecting wires, under remote control. This will remove much of the difficulty of wiring up systems, but for those who object to having large quantities of interconnecting leads in their living rooms it still seems far from perfect – and is several years away.

Scart Problem

Problems can arise even when a satellite receiver is connected to the main TV set via a scart link. I recently came across a BSB receiver connected in this way to a large-screen set but the cross-colour patterning visible in areas of fine detail showed quite clearly that a PAL picture was being displayed. The problem is that the connector carries RGB and composite PAL signals on different pins and the receiver will switch to RGB input only when the appropriate voltages are applied to pins 8 and 16. Some scart leads don't have all the cores connected, and some early scart-socket TV sets don't have provision for RGB inputs.

Other Developments

Some of the latest TV sets also have an S input socket to enable the component (separate chrominance and luminance) video from an S-VHS VCR to be plugged in directly.

The ultimate solution would appear to be to have the two satellite TV receivers built into the VCR, or to have the whole lot built into the TV set – but even this leaves no scope for connecting next year's technological wonder!

TV Fault Finding

*Reports from Philip Blundell, AMIEE,
John C. Priest, John Hopkins, Ed Rowland,
Steve Cannon, Stephen Leatherbarrow and
Mick Dutton*

Grundig CUC4620 Chassis

There was no raster and no sound while a screaming noise came from the line output transformer – the BU508A was getting very hot. Disconnecting the tripler had no effect so the scan coil plug was disconnected to remove the h.t. supply to the line output stage. Scope checks on the TDA8410 line driver chip IC500 then showed that the output at pin 1 was very low while the input at pin 7 was about a quarter of its normal amplitude. The input returned to normal amplitude when pin 7 was lifted. The TDA8140 was faulty.

P.B.

Philips KT3 Chassis Edition II

For intermittent volume, brightness or colour changes try moving the cables on the remote control decoder board. There are two high-wattage resistors on this board and there are quite often dry-joints on the plug next to them.

P.B.

Philips G90AE Chassis

A previous engineer had got in a right mess with this one – from an inspection of the PCB I could see from the soldering that someone had had a long and meaningful relationship with the power supply, the tuning and the teletext sections of the set. After a check for missing parts or chips fitted the wrong way round I switched on. The set was tripping. I disconnected the supply to the line output stage and connected a dummy load. The set still tripped, but this stopped when the set-h.t. control was turned down. In fact the supply could be set to 95V as normal. Reconnecting the supply to the line output stage brought the set back to life but there was no sound and just a blank raster, though the on-screen channel display worked. When a signal was injected into the TDA5850 video switching chip there was activity on the screen, but there was no output from the TDA8341 i.f. chip. Resistance checks then showed that the crystal filter 1030 was short-circuit to chassis – there was a solder whisker across two of the pins! A touch with the soldering iron and all was well.

P.B.

Hinari CT15 etc (ST200 Chassis)

Loss of sync can be misleading with these sets. Don't dive in and replace the TDA4505 i.f./sync/audio/timebase generator chip IC201. Instead look first for the sandcastle pulse (8V peak-peak) at pin 27. If it's present the TDA4505 is probably o.k., so look next for positive-going line pulses (0.5V peak-peak) at pin 25 – waveform 11 if you have the manual. If these pulses are missing or of very low amplitude turn to the teletext panel, first checking the ribbon cables and connectors CN901 and CN902. The line pulses come from pin 1 of the SAA5231 chip IC901, via R952 and pin 4 of CN901. If the pulses are still missing check the 12V supply to the panel. It comes via the small twin red/white lead and CN903 on the main panel. These items are near the rear edge of the boards to your left when the back cover is removed. The 12V supply should be present at pin 2 of the plug and goes straight to a 4.7Ω fusible resistor (R949) which on several occasions we've found to be open-circuit for no apparent reason.

Replacement cures the fault. As the resistor is so readily accessible when the back cover has been removed I now make this my first check in cases of no sync.

If the problem persists it's worth checking whether there's a video signal at pin 27 of IC901, since the sync pulses are derived from this. There's a three-stage amplifier (Q903/4/5) between pin 2 of CN901 and the chip. I've had no trouble with the transistors but the coupling capacitors C920 and C924 can give problems.

Loss of sync makes it difficult if not impossible to tune in the channels. The situation can be clarified by feeding in a composite video signal via the AV phono socket – otherwise it may not be obvious that the actual fault is loss of sync.

J.C.P

Amstrad SRX200

This unit was brought in with the complaint "no signals" and a comment from the rigger that there was no supply at the LNB. Our first check was of course on F503 (1A) which was found to be intact – and the original. After a quick cold check for any obvious shorts we powered the unit up and checked the voltage at the centre pin of the F connector. Instead of the 13V or 17V normally present here there was only about 2.5V, which did however vary by about 0.25V when the polarisation button was toggled.

The transistors in the 13/17V regulator circuit were all o.k. There was 22.5V at the emitter of Q506, but only just over 2V at its collector. Since we'd already established that the H/V circuit was toggling it was probable that Q513 and the setting potentiometers VR503/4 were all right. So attention was turned to the error amplifier – half the LA6358S chip IC501. Replacing this restored the LNB supply voltage. A quick tweak of VR503 and VR504 to set the 13V and 17V lines exactly completed the repair.

J.C.P.

Triumph CTV8620

The customer phoned and said "my set's making a funny noise – would you like to hear it?". She held the receiver out and shouted "switch it on Jack". Even over the phone I could hear the e.h.t. arcing, so I said "switch it off quick". When I got to the set it was obvious that the tripler had suffered. A replacement from NEC put things right.

J.H.

Hinari TV1A

This 14in. portable caused a bit of trouble. The fault was no sound, picture o.k. I told the customer it would be no problem and took off the back. The speaker proved to be o.k., as did the earphone socket and all the connections. At this point I decided to take the set back to the shop.

As I didn't have a circuit diagram I traced the signal path from the speaker via the earphone socket and the sound output transformer to a pair of output transistors, Q602 (npn) and Q608 (pnp). My theory was that if the collector of one was at 12V its emitter should be at about 6V. All connections read about 12V however, so I suspected an open-circuit resistance path to chassis, especially as both transistors checked out o.k. and there was a nice fat audio signal at the driver transistor Q601. Tracing the line back from the collector of Q608 showed no faulty components

that could cause the fault. There were only a few capacitors, which we ignored, and a diode (D810) that was fed from the chopper transformer. This diode had 34V at its cathode and 12V at its anode (collector of Q608). Very careful examination of the board showed that there was a hairline crack across this track and several close ones. A few strips of fine bridging wire gave us 12V across D810, 1-2V at the collector of Q608 and good sound. **J.H.**

Tatung Early Bird

Here's a postscript to my earlier article on satellite TV systems (March 1990). There's now an official modification to the Tatung Early Bird. To fit a VideoCrypt decoder, remove the lead from pin 15 of the scart socket and discard it. Disconnect the lead from pin 19 and reconnect it to pin 15. Link pin 10 to pin 13. C213 should be changed to 1,000 μ F, 16V, part no. 14-3846-8. It's available from Tatung at no charge. This modification is not necessary with Models TRX1801/22, TRX1802, DRX1851/22 and DRX1852.

If the picture appears to be washed out try the de-emphasis switch at the back of the decoder. **J.H.**

Saisho CT141

This set would sometimes fail to start, but once running it was o.k. for the rest of the day. Replacing C508 (4.7 μ F) provided a complete cure. **E.R.**

Philips K40 Chassis

This set came in dead with the h.t. feed pin on the line output transformer partially burnt away. After repairing and refitting the transformer the set still failed to work. Further investigation showed that the line driver transistor's 680 Ω feed resistor R3192 was open-circuit. Fitting a replacement restored the set to life. **E.R.**

Philips KT3 Chassis

This one caused quite a bit of head scratching. When the set had been on for about half an hour it would begin to trip occasionally. The fault became progressively worse as the set warmed up. We eventually found that the cause of the trouble was a dry-joint on the posistor in the degaussing circuit. **E.R.**

Panasonic TXC2480 (Alpha 1 Chassis)

This particular set had been in about a fortnight ago, when we'd replaced the line driver transformer. Well, here it was again with exactly the same symptoms – no sound or picture, with the power supply squealing. The line driver transistor was short-circuit and the transformer was again faulty. Things were beginning to look bad, then I just happened to notice a spark from the copper side of the line driver stage. On investigation I found that one of the lugs of the black metal heatsink was arcing to part of the print around the line driver transformer. Since we bent the lug away from the print the set has worked perfectly. The heatsink lugs are all over the board, so other intermittent faults could develop due to this. **S.C.**

Sony KV2062

The h.t. appeared for a second then the power supply shut down and the set went completely dead. With a dummy

load connected the power supply ran perfectly, so it seemed likely that there was a line output stage fault. We wound the set up via a variac, and at about 80V the set tried to start. It was squealing however and R855 began to burn up. We concluded that one of the e.h.t. rectifiers in the line output transformer was faulty and fitted a replacement. To our dismay this didn't cure the fault. Now one of the differences with the Trinitron system is that the e.h.t. lead from the line output transformer doesn't go to the tube directly: it goes to the H stat unit. When this item was unplugged from the transformer the set started up. A replacement put matters right. We've had this fault on a couple of occasions now. **S.C.**

Philips CP90 Chassis

This set had apparently been struck by lightning. The symptoms we had were no output from the power supply and a corrupt channel indicator display. The 5V supply to IC7840 was present, but we judged the device to be a little too hot for comfort. Replacement brought the set back to life with good colour pictures and sound. On test we found that the 1.5V back-up battery 1901 didn't hold its charge, as a result of which there was memory loss of the analogue functions. IC7840, type TMP47C432AP-8188, is available from Willow Vale. Be sure to order the 8188 numbered device as this denotes programming specifically for this set. **S.L.**

Ferguson TX10 Chassis

The complaint was of hum on sound and a dark picture. We suspected the 12V regulator but this proved to be o.k. Lots of time was spent looking for hum getting into the sound and wrong voltages on the supply lines. By sheer luck we noticed that one of the RGB output transistors on the tube's base panel was bent over and dry-jointed. Resoldering it cured the problem, but don't ask us why! **M.D.**

Philips NC3 Chassis

The problem with this set was no colour. Checks around the colour decoder chip revealed that the voltage from the colour control was slightly low at 0.6V. We checked the control, the 10k Ω series resistor and the 10 μ F decoupling capacitor. As we were getting nowhere we decided to consult the manual. To set up the reference oscillator frequency you link pins 5 and 1 of the chip. This supplies 12V to the colour control pin to disable the colour killer. When we did this the cause of the problem became obvious – the reference oscillator was slightly off frequency. A tweak to R635 was all that was required. The moral is that if you come across a set you've not met before it pays to read the book and think before you dive in! **M.D.**

Sony KV2096

The problem with this set was field foldover at the bottom of the screen. There was excessive height at the top of the screen and the bright-up at the bottom was about 2in. high. The voltages around the field output chip were more or less correct except for that at pin 4 which was low. This is associated with the linearity feedback between the output and generator chips. An investigation of this circuit revealed a heavy leak in C527 (470 μ F). Replacement provided a complete cure. **M.D.**

Stereo AM Radio Systems

J. LeJeune

One of the changes brought about by the Broadcasting Bill will be a new Radio Authority. To make way for more services in the medium-wave band, notably the new community stations, the BBC has relinquished some of its m.w. allocations, concentrating its services in the v.h.f./f.m. and l.w. bands. One notable development will be the introduction of compatible stereo transmissions for the m.w. independent radio services. Motorola's CQUAM system has been adopted for this purpose.

Compatibility

Compatible stereo means that a conventional mono receiver using an envelope detector will be able to produce an undistorted mono output from the stereo transmission. While compatibility is a basic requirement, equally important from the broadcaster's point of view is that stereo operation should not significantly reduce a transmitter's service area. The success of commercial radio depends on the number of people it can reach. So the station must be "loud". One of the tricks used to give greater "punch" is over-modulation. The stereo system should therefore be tolerant of this practice.

The compatibility requirement means that amplitude modulation must be used, in conjunction with other techniques, for the new m.w. stereo services. The main problem with m.w. broadcasting stems from the very large number of transmissions within a band just over 1MHz wide. A 9kHz channel spacing permits an audio bandwidth of barely 5kHz to be used. So a stereo subcarrier is out of the question. There is also the problem that sky-wave propagation improves rapidly after dark, when the absorbent D layer vanishes to follow the sun. This results in the nightly cacophony of whistles and sideband splash.

AM Radio Limitations

The use by most self-contained transportable a.m. radio receivers of inadequate loudspeakers and small acoustic chambers to house them, also power output/battery economy considerations, further contribute to the inferior results obtained. It's only with in-car systems, for which people seem to be prepared to spend a lot of money, that acceptable l.f. audio performance is now commonplace. The ferrite-rod aerial is another limiting factor with transportable receivers. It has excellent directional properties, but often makes receiver siting a compromise.

In addition the ferrite rod is affected by the harmonics of the higher frequencies in the audio circuits. This gives rise to audio distortion unless the receiver's h.f. performance is rolled off. The roll-off reduces the intensity of the night-time whistles, but further widens the performance gap between v.h.f./f.m. and m.w./a.m. systems. In-car receivers and those intended for incorporation in a domestic audio installation, using a long-wire aerial, avoid these latter drawbacks and can be expected to comprise the bulk of the target market for a.m.-stereo.

Amplitude modulation does have some advantages however. It's the most efficient method for narrow bandwidth use and is independent of noise. With an a.m. receiver the background noise remains the same whether or not modulation is present. With phase and frequency modulation systems however noise that isn't present with an unmodulated carrier arises when modulation is present.

Stereo AM Principles

Most of the work on compatible stereo-a.m. systems has been carried out in the USA. In addition to Motorola's CQUAM system, Belar, Harris, Hazeltine-Kahn and Magnavox have developed systems. All transmit L + R and L - R signals that are matrixed in the receiver to obtain the original L and R audio signals (for mono operation L + R is used, the L - R stereo-difference signal being ignored). The L + R signal amplitude modulates the carrier which is also phase or frequency modulated by the L - R signal. In addition some systems use quadrature modulation techniques. Most systems don't allow negative-going modulation peaks to go over 100 per cent (the condition when the modulation is equal to the amplitude of the unmodulated carrier) because momentary disappearance of the carrier stops the stereo decoding and produces bursts of noise. The problem here is that a lot of mean sideband power is lost when the modulation is held below 100 per cent, with the result that the transmitter's service area is reduced.

A further requirement is the right "tuning feel" with behaviour similar to an f.m. stereo receiver. This calls for a high-gain, critically damped a.g.c. system. The traditionally "loose" feel of a.m. tuning would result in stereo image shift as the user tunes through a transmission. Other factors that have to be taken into account are adjacent channel interference, differential fading and signal-to-noise ratio penalties.

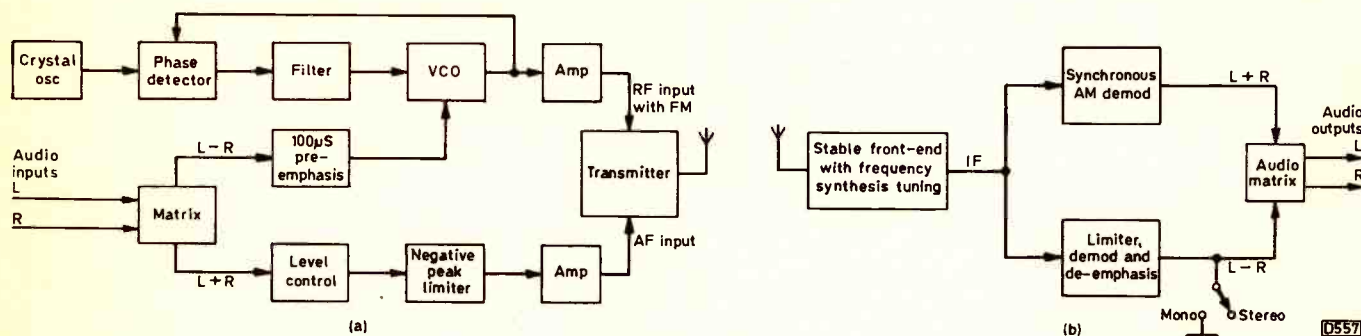


Fig. 1: The Belar system. (a) Block diagram of the transmitter. (b) Block diagram of the receiver.

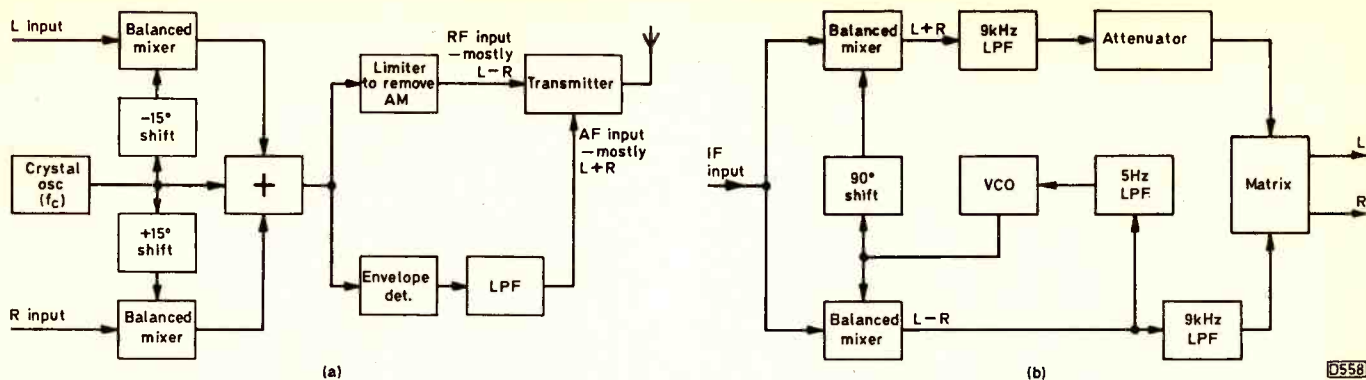


Fig. 2: The Harris CPM system. (a) Block diagram of the transmitter. (b) Stereo decoder block diagram.

Out of interest we'll take a brief look at the alternative systems proposed before dealing with the Motorola CQUAM system in greater detail.

Belar System

The Belar system serves as a simple introduction. Fig. 1(a) shows the arrangement used at the transmitter. The left and right audio inputs are first matrixed to obtain $L + R$ and $L - R$ signals. Compatibility is ensured by using the $L + R$ signal to amplitude modulate the carrier. The same carrier is frequency modulated by the $L - R$ signal, which is subjected to $100\mu\text{sec}$ pre-emphasis and used to provide a peak deviation of $\pm 1.25\text{kHz}$. Negative-going audio peaks are limited to prevent the modulation depth exceeding 90-95 per cent: positive peaks are not limited, permitting the carrier to reach maximum output so that the compatible system can compete in audibility terms with its mono neighbours.

Unless it's poorly aligned, a receiver's envelope detector will ignore the frequency modulation and will demodulate the a.m. signal component in the normal way. As shown in Fig. 1(b) the receiver has two i.f. systems, one for the a.m. and the other for the f.m. component of the received signal. A matrix is used to recover the original L and R signals.

Harris CPM System

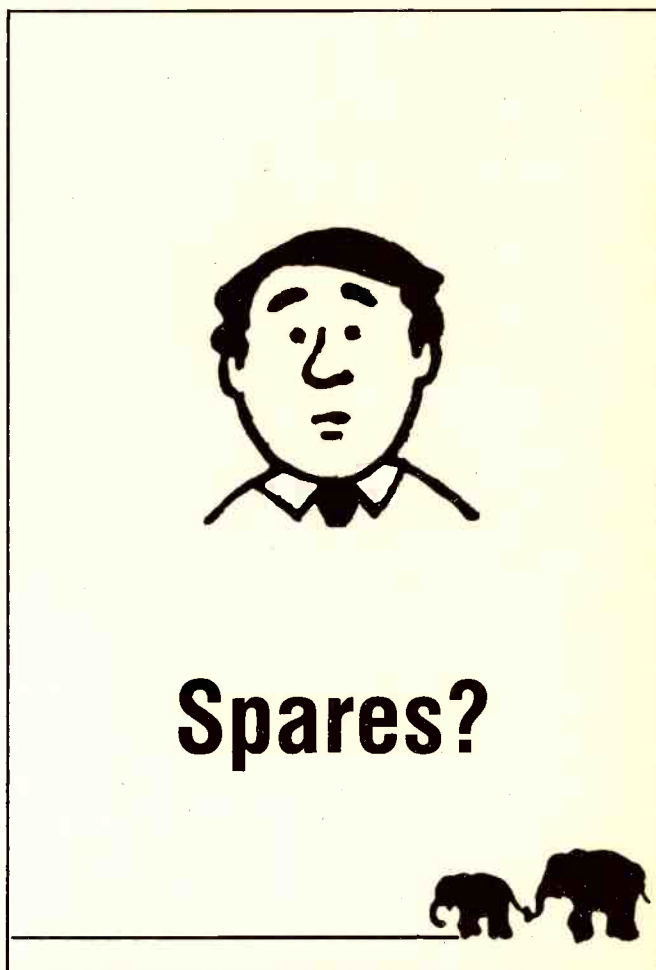
In the Harris compatible phase multiplex (CPM) system the left and right audio signals amplitude modulate two carriers at the same frequency but with a phase difference of 30° , see Fig. 2(a). The carriers are then added to produce a mono signal with sidebands that contain, at a much lower level because of the 30° phase difference, the $L - R$ signal. This is known as a modified quadrature system which in some respects resembles the technique used in NTSC and PAL TV receivers for the two transmitted colour-difference signals. Phase modulation is carried out by the two balanced mixers, with carrier insertion at the following adder. The adder's output follows two paths. In one it's limited to remove all a.m. The limiter's output forms the transmitter's carrier, with phase modulation that consists mainly of the $L - R$ information. The other path is via an envelope detector and a low-pass filter whose output, mostly $L + R$, amplitude modulates the carrier.

The i.f. amplifier in a stereo receiver feeds two balanced mixers - see Fig. 2(b) - which are also supplied with an unmodulated carrier. This carrier is obtained from a PLL that uses the incoming i.f. as a reference signal - the 5Hz low-pass filter effectively removes any modulation. The VCO's output is 90° out of phase with the incoming i.f.

signal and can be used for demodulation of the $L - R$ signal directly: for demodulation of the $L + R$ signal the VCO's output is passed through a 90° phase shifter. Audio matrixing is then carried out, an attenuator in one feed to the matrix providing gain equalisation.

Hazeltine-Kahn ISB System

The Hazeltine-Kahn independent sideband (ISB) system generates a lower sideband that contains the left stereo information and an upper sideband that contains the right information. A mono receiver tuned to the carrier centre will demodulate $L + R$. At the transmitter the L and R signals are matrixed to produce $L + R$ and $L - R$ signals which are then fed through phase shifters, -45° in the case of the $L + R$ signal and $+45^\circ$ in the case of the $L - R$ signal. The $L + R$ signal amplitude modulates the carrier while the $L - R$ signal is used to phase modulate



the carrier. Right channel components add in the upper sidebands produced by the system and cancel in the lower: similarly the left channel information cancels in the upper sidebands and adds in the lower sidebands. Because of the system's limited stereo separation, a separation enhancement system is used at the transmitter.

Two separate receivers can be used for stereo reception, with the left one tuned slightly below the carrier frequency and the right one tuned slightly above. A stereo receiver designed for optimum use of the system uses an envelope detector to demodulate the $L + R$ signal with a more complex channel including a PLL, an amplitude modulator and a product detector to provide an $L - R$ output. Phase shifting ($\pm 45^\circ$) is required before the $L - R$ and $L + R$ signals are matrixed to yield L and R .

Magnavox System

The Magnavox system again uses a.m. for the $L + R$ signal and phase modulation for $L - R$. The transmitter uses a frequency synthesiser that's phase modulated by the $L - R$ signal. The output from this, see Fig. 3, is fed to a mixer whose other input is obtained from a crystal oscillator. A low-pass filter is included in the mixer's output, which consists of a carrier containing the $L - R$ information in the form of phase modulation. This carrier is amplitude modulated by the $L + R$ signal. The receiver employs a full envelope detector for $L + R$ and a limiter and PLL-controlled phase detector for $L - R$. A $16\mu\text{sec}$ delay is required in the $L + R$ channel.

Motorola CQUAM System

In the Motorola CQUAM system the $L + R$ and $L - R$ signals amplitude modulate two carriers in quadrature, i.e. with a 90° phase difference between them. This is the same basic technique that's used for the $B - Y$ and $R - Y$ colour-difference signals in the NTSC and PAL systems. Fig. 4 shows the arrangement used at the transmitter. The $L + R$ and $L - R$ outputs from the L/R matrix are fed to a pair of balanced modulators. One receives an in-phase (I) carrier input from the master oscillator and the other a 90° shifted (Q - quadrature) carrier input. Double-sideband, suppressed-carrier outputs are obtained from the modulators. These are added, together with an in-phase carrier, the result being a perfect a.m. quadrature signal. This is heavily limited to remove all a.m., the output from the limiter being a carrier that contains the $L + R$ and $L - R$ information in the form of phase modulation. To provide a compatible signal the carrier is, as in the other systems, amplitude modulated by the $L + R$ signal.

The use of quadrature amplitude modulation allows a second carrier to be added without a noise penalty. Because both carriers have the same frequency and carry f.m., the two components of the signal suffer identical attenuation and distortion under difficult reception conditions. As in an NTSC or PAL colour receiver, two synchronous demodulators using reference signals with a 90° phase difference can be used to detect the $L + R$ and $L - R$ signals separately.

Decoding CQUAM

In a practical CQUAM receiver decoder an envelope detector is used to demodulate the $L + R$ signal while synchronous detection is used to extract the $L - R$ information. Fig. 5 shows a basic arrangement. The incoming i.f. signal is fed to an envelope detector and, via a

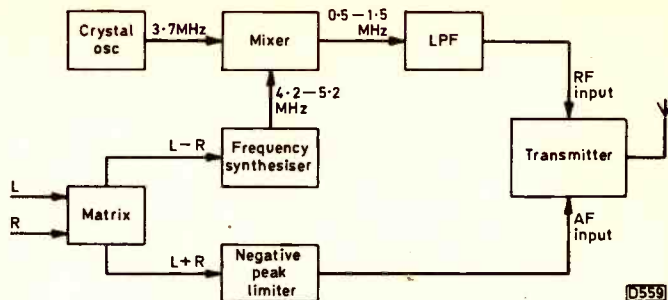


Fig. 3: Block diagram of the transmitter arrangement with the Magnavox system.

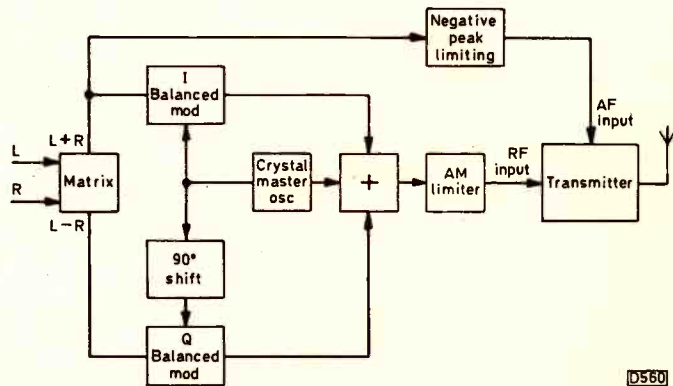


Fig. 4: Block diagram of the transmitter arrangement with the Motorola CQUAM system.

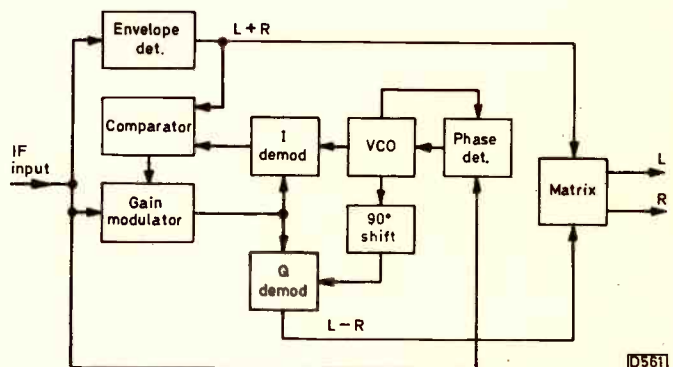


Fig. 5: Block diagram of a stereo decoder for the Motorola CQUAM system.

gain modulator that acts as a kind of fast a.g.c. system, to the two synchronous demodulators I and Q . With a mono signal the a.m. and I signals are identical and there is no output from the comparator. Normal envelope detection produces an $L + R$ output. In the presence of a stereo signal the a.m. and I signals differ and the comparator develops an output that controls the gain modulator. The action of the gain modulator ensures that a perfect quadrature signal is applied to the I and Q demodulators so that the output from the Q demodulator is an accurate $L - R$ stereo-difference signal. $L + R$ from the envelope detector and $L - R$ from the Q demodulator are then matrixed in the usual way to obtain the L and R audio signals. The VCO is incorporated in a PLL.

Heavy modulation of the carrier is necessary to obtain maximum output from a stereo-a.m. transmitter. This can result in small bursts of noise from the stereo information part of the system. An advantage of the CQUAM system is that when the carrier level is momentarily reduced to a very small value by the modulation the output from the envelope detector similarly falls to a very low level. This produces an error voltage from the comparator. Thus the

comparator and gain modulator reduce the i.f. input to the I and Q demodulators so that their outputs are also very low, drastically reducing the effect of the noise bursts.

CQUAM Receivers

The remainder of the receiver is conventional apart from the fact that the i.f. bandwidth is increased to around 6kHz and screening of the audio power sections has to be improved to prevent coupling into the ferrite-rod or slab aerial. These measures improve the receiver's audio performance but reception may suffer in the usual way after sunset. Inclusion of a 9kHz rejector to eliminate adjacent channel whistle is virtually mandatory – note that stereo a.m. receivers made for the American market will

have a 10kHz filter, making them unsuitable for use here without modification.

With CQUAM the burden of good audio quality is placed firmly on the receiver. When a.m. stereo models begin to appear on the market the old adage "you get what you pay for" will be true. The nature of the CQUAM Q signal is such that a variety of methods can be used to decode it, giving various levels of performance. Stereo separation, signal-to-noise ratio and tolerance to overmodulation are the key factors. Without radical l.w. and m.w. broadcasting practice changes that would render existing receivers obsolete we are left with a.m. for the foreseeable future. What stereo a.m. means in terms of extras in the receiver will probably amount to just one chip and a few associated components.

Steve's Camcorner

Steve Beeching, T. Eng.

I've commented before on fault symptoms being caused by a component in an apparently unrelated part of the circuitry. Recently I had another classic example, a weird fault with a JVC GRC7 camcorder. In fact I was caught out twice by this one.

The fault report was "no tracking control – possibly dirty heads". On test I found that the picture was o.k. but a bit grainy and noisy because the heads were slightly off track. The tracking control had no effect.

Checks were made around the servo chip IC101. There was a tracking ramp waveform at pin 18, to which the tracking control is connected. When the control was adjusted the ramp's rise-time period varied – this confirmed that the tracking circuit monostable was working. Much time was then spent checking the rest of the capstan servo. I found that nothing else, from the pulse width outputs of the digital servo to the motor drive, varied when the tracking control was adjusted.

Now the only times when the tracking circuit is inoperative are when the camcorder is in the record or assembly edit mode. In these modes switching within the chip controls the tracking, but there's no way of checking the situation externally. The camcorder was clearly not in the record mode. Perhaps it was stuck in assembly edit? Checks on the control logic and various voltages and waveforms confirmed that the machine was in the playback mode. It seemed therefore that the chip was faulty. A replacement was fitted and, as you've probably guessed, there was no change.

More time was spent cross-checking around the chip, but I still couldn't find any reason for the lack of servo control. The switched 5V line was correct so there was nothing wrong with the supply to the chip. There was no ripple on the supply. In fact there was no reason for the fault condition.

The only logical course left was to swap the main PCB temporarily with one from another GRC7. When this had been done the fault was still present. I then found that the main board worked fine in the other machine. So the main PCB, which contains the entire control system, the power supplies, the servo electronics and tracking system was without fault.

There followed a frenzy of uncontrolled board swapping, just to narrow the fault down to one PCB or

the chassis. The breakthrough came when the operation panel was changed. This cleared the fault, with full tracking restored. I then noticed that the LC display on the panel was blank – there was no voltage across it. Now comes the fun bit.

The operation microcomputer chip and serial interface are supplied by an always-5V line, AL5BV. The same line supplies the display, via three small series diodes to provide a voltage drop. C6 decouples the output from the diode droppers. It was short-circuit and as a result the AL5BV line, which comes from a regulator, was low at just over 4V. Strangely, when C6 had been replaced the servo tracking fault had cleared.

So a shorted capacitor that decouples a different 5V supply to the one used by the servo circuitry caused a servo fault! The only explanation I can think of is that the low voltage to the operation microcomputer chip

Panasonic

NIKKAI NEC

FIDELITY

PHILIPS

S&C

KUNIG

THORN

and many others



resulted in it producing serial data which the servo chip interpreted as "assembly edit/play". As a result the tracking control circuit was disconnected.

I was caught out twice because I went for the obvious possibility of dirty or faulty video heads first and didn't spot the fact that the tiny LC display wasn't working. It won't get me again – or will it?

TEST CASE

336

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

Now that the long dark evenings are back we've noticed a welcome increase in people's interest in home entertainment gear, particularly satellite TV receivers. BSB equipment has not been selling as well as we'd hoped here, but there's a steady demand for Astra gear.

The present set-up is that Stick-Em-Up install the dishes – with the aid, when necessary, of a newly fitted spotlight on top of their van – then our Doc Colin follows up with the receiver installation. Thus Mr. Judge joined the happy band of Astra watchers. But he wasn't so happy, as he told us in a phone call the following day. His pictures were spoilt by the dreaded sparklies – darklies as well (black sparklies!). They were present on all channels, but worse with transponders 2, 6, 10 and 14 whose power is lower in the UK. Rain made them worse still – the weather had been good on the day that the receiver was installed.

Dylan was duly sent to check things out. He made sure that the tuning was spot on, and that the cables looked o.k. Then he measured the LNB's supply voltage, which was correct. Concluding that the dish alignment must be wrong he got the service manager to arrange with Stick-Em-Up to return to the site and double-check the accuracy of the dish pointing. This was arranged for 12 noon next day.

At 12.30 the aerial man rang the workshop. He said that the dish had been correctly aligned, so the fault had to be elsewhere. Questioned on his methods, he told us that he used a battery-powered dish-peaking meter which he connected to the LNB directly. Fair enough. Just after lunch the exasperated Mr. Judge arrived at the workshop with the satellite receiver, demanding a replacement.

We hooked his receiver to the workshop dish and TV set and immediately got good, clear pictures that were vitally free of sparklies despite the fact that there was a steady drizzle at the time. Mr. Judge was then given the replacement he insisted upon. Within the hour he was back on the phone to tell us that it performed just as

badly as the original receiver. By this stage his problem was occupying most of the resources of two companies, the aerial contractor and ourselves.

A senior engineer went off to the site with a replacement LNB in one hand, a bank of cable in the other and a determined look in his eye. From the top of the ladder he'd borrowed from Mr. Judge he surveyed the sky and saw nothing but the clouds. He checked the cable with a battery at one end and a torchbulb at the other, a more reliable test in his view than the use of an ohmmeter. Finally he fitted the new LNB assembly and climbed down, certain that the problem had been solved.

It hadn't! Back in the lounge he was confronted with the same impaired picture as before. It was just acceptable on most channels if not viewed too critically, but sure to deteriorate in poor weather and with any slight mistuning.

There was no point in investigating the TV set, which was virtually the only item that hadn't been checked: the "sparkly" effect produced by poor carrier-to-noise ratio with an f.m. system is quite unlike the on-screen effects produced by problems downstream from the satellite TV receiver itself. The set provided perfectly good BBC and ITV pictures.

Our man returned to the workshop with a definite diagnosis that had nothing to do with the satellite receiver or the TV set. What was it? See next month for the answer.

ANSWER TO TEST CASE 335 – page 48 last month –

Our first-time encounter with a GoldStar VCR resulted in an incorrect diagnosis that the reel-rotation sensor was faulty. You'll recall that the sensor's output pulses were noisy, of low amplitude and misshapen. Very close examination of the scope trace, though we could hardly have realised it at the time, would have shown that there was a regular repeat pattern in groups of four consecutive pulses. Had we noticed that and thought about it we would have come up with a brilliant, cast-iron diagnosis of the sort we all dream about.

The system used in this machine for reel-rotation sensing is that an infra-red LED under the take-up spool shines upwards on to a series of four radial, shiny silver segments printed on the underside of the spool carrier. Each time one of these reflective strips comes into the view of the optocoupler the IR light is reflected back on to the photodiode mounted beside the LED, producing a chopped photodiode current waveform.

For the system to work the segments must be bright and shiny. In this case they were dirty and contaminated with a black, oily substance that also coated the optocoupler's active face. All that was required was a clean and a polish of both surfaces. After this the pulse amplitude was restored to 4V peak-peak and the machine worked beautifully. It seemed likely that on some past occasion there'd been a squeak and the shaft had been splatted with oil which gradually blackened as it picked up debris.

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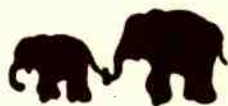
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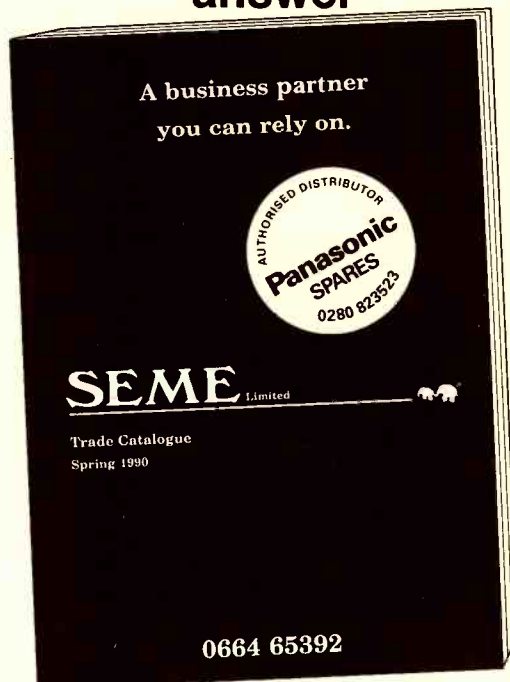
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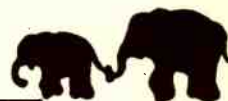
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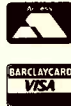
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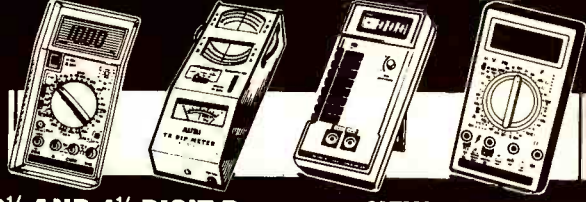
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AN7169 £3.50	HA11714 £3.50	LA7016 £2.50	MC14093B £1.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520P £2.50	TD42700 £2.00	UC3895 £2.00	2SC2672 £1.60
AN7171K £8.00	HA11715 £3.20	LA7096 £4.00	MC14262P £2.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520Q £2.50	TD42700 £2.00	UC3895 £2.00	2SC2673 £1.60
AN7205 £1.95	HA11747A £12.75	LA7210 £3.10	MC14429P £2.20	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520R £2.50	TD42700 £2.00	UC3895 £2.00	2SC2674 £1.60
AN7213 £1.10	HA11749 £7.00	LA7305 £5.90	MC14497P £5.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520S £2.50	TD42700 £2.00	UC3895 £2.00	2SC2675 £1.60
AN7218 £1.20	HA11750 £5.10	LA7309 £3.75	MC14518BOP £2.00	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520T £2.50	TD42700 £2.00	UC3895 £2.00	2SC2676 £1.60
AN7220 £1.90	HA12005 £3.80	LA7507 £4.00	MC14518BOP £2.00	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520U £2.50	TD42700 £2.00	UC3895 £2.00	2SC2677 £1.60
AN7222 £2.10	HA12017 £3.20	LA7520 £3.25	MC1458UPC1458 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520V £2.50	TD42700 £2.00	UC3895 £2.00	2SC2678 £1.60
AN7224 £1.60	HA2413 £1.20	LA7801 £1.50	MC1458UPC1458 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520W £2.50	TD42700 £2.00	UC3895 £2.00	2SC2679 £1.60
AN7225 £1.90	HA3001 £1.80	LA7820 £1.50	MC1458UPC1458 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520X £2.50	TD42700 £2.00	UC3895 £2.00	2SC2680 £1.60
AN7273 £2.00	HA3402 £8.20	LA7830 £1.50	MC1458UPC1458 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520Y £2.50	TD42700 £2.00	UC3895 £2.00	2SC2681 £1.60
AN7310 £1.10	HA3403 £4.00	LA7813 £1.30	MC1458UPC1458 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520Z £2.50	TD42700 £2.00	UC3895 £2.00	2SC2682 £1.60
AN7311 £1.75	HA3590 £3.00	LM1011N £2.00	ME42050 £4.00	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AA £2.50	TD42700 £2.00	UC3895 £2.00	2SC2683 £1.60
AN7315 £1.75	HA3566W £2.65	LM1017M/19281 £3.00	ME42901 £3.60	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AB £2.50	TD42700 £2.00	UC3895 £2.00	2SC2684 £1.60
AN7324 £4.50	HA1368R £2.55	LM1035 £2.30	MH27316 £3.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AC £2.50	TD42700 £2.00	UC3895 £2.00	2SC2685 £1.60
AN7410 £2.10	HA1374 £5.00	LM1036N £3.70	ML2328 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AD £2.50	TD42700 £2.00	UC3895 £2.00	2SC2686 £1.60
AN7415 £1.40	HA1377 £2.00	LM11036N £3.70	ML2328 (BT160) £3.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AE £2.50	TD42700 £2.00	UC3895 £2.00	2SC2687 £1.60
AN7420 £3.20	HA1388 £4.00	LM1112CN £3.70	M1237 £7.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AF £2.50	TD42700 £2.00	UC3895 £2.00	2SC2688 £1.60
AN7816P £1.00	HA1392 £3.00	LM1286 £5.00	M238 £7.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AG £2.50	TD42700 £2.00	UC3895 £2.00	2SC2689 £1.60
BA1303 £1.00	HA1394 £4.00	LM1866N £1.50	M293 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AH £2.50	TD42700 £2.00	UC3895 £2.00	2SC2690 £1.60
BA1320 £1.50	HA1397 £5.40	LM1894N £5.75	M323 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AI £2.50	TD42700 £2.00	UC3895 £2.00	2SC2691 £1.60
BA1332 £1.00	HA1398 £3.50	LM317T £1.00	M3230P £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AJ £2.50	TD42700 £2.00	UC3895 £2.00	2SC2692 £1.60
BA3018 £1.50	HA1406 £2.00	LM3324 £0.80	M326 £4.50	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AK £2.50	TD42700 £2.00	UC3895 £2.00	2SC2693 £1.60
BA318 £2.50	HA1409 £2.00	LM3339 £1.75	M341API £1.75	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AL £2.50	TD42700 £2.00	UC3895 £2.00	2SC2694 £1.60
BA328 £2.00	HA14219 £2.70	LM3339 £1.75	MMS3108N £1.25	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AM £2.50	TD42700 £2.00	UC3895 £2.00	2SC2695 £1.60
BA3306 £2.10	HD14081 £0.25	LM384 £1.00	MMS387 £2.90	SA1505-01 £9.50	STK5492 £5.20	TA7335 £1.50	TD41520AN £2.50	TD42700 £2.00	UC3895 £2.00	2SC2696 £1.60
BA333 £1.40	HD4539 £0.70	LM386N £2.80	MMS4							

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Stock items despatched by return

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TRANSISTORS

BC184	£0.09	BC244	£0.30	BU406	£0.90
BC212	£0.09	BC244C	£0.30	BU406D	£1.50
BC213	£0.09	BD278A	£0.80	BU407	£0.50
BC214A	£0.07	BD434	£0.80	BU426A	£0.75
BC214B	£0.07	BD508	£0.90	BU500	£0.95
BC214L	£0.09	BF195	£0.07	BU508A	£0.90
BC237	£0.07	BF196	£0.15	BU508AF	£1.70
BC238	£0.07	BF197	£0.15	BU508AP	£1.50
BC307	£0.12	BF198	£0.07	BU508D	£0.95
BC308B	£0.07	BF199	£0.14	BU806	£0.75
BC327-25	£0.07	BF244	£0.40	BU807	£0.75
BC328-40	£0.05	BF259	£0.22	BU111	£0.75
BC337	£0.07	BF422	£0.15	BU111AF	£1.95
BC372	£0.95	BF458	£0.22	BUW84	£1.55
BC392	£1.50	BF459	£0.22	BUW84	£0.60
BC441	£1.25	BF469/BF471	£0.25	SD12659	£0.75
BC461	£0.25	BF471	£0.25	T9053V	£0.75
BC547	£0.07	BF472	£0.25	T9064V	£2.28
BC548	£0.07	BF70/BF472	£0.25	TI10	£2.45
BC557	£0.30	BU108	£0.75	TI112	£0.45
BC559B	£0.07	BU126	£0.70	TI29	£0.30
BC639	£0.18	BU126	£0.70	TI30	£0.45
BC640	£0.30	BU208	£0.90	TI31	£0.30
BD131	£0.50	BU208A	£0.90	TI32	£0.30
BD8D132	£0.40	BU210	£0.90	TI41	£1.10
BD137	£0.35	BU208T	£0.95	TI42	£0.25
BD237	£0.22	BU208T	£0.95	TI42C	£0.40
BD238	£0.22	(TOSHIBA)		TI47	£0.98
BD243B	£0.30	BU326A	£0.95	ZTR604	£0.55
BD243C	£0.30	BU326A	£0.95	ZTR650	£0.70

DIODES AND THYRISTORS

BA157	£0.07	BY206 (BY9696)	0A91	£0.20
BR100	£0.20		OT112	£2.20
BR101	£1.40	BY210/800/BYV96	RGPI15G	£0.55
BR103	£0.75	BY227	RGPI15J	£0.55
BR303	£1.50	BY227	RGPI15K	£3.35
BR556	£0.75	BY228	RGPK30K	£0.70
BT116	£2.50	BY229	RH1	£1.30
BT128P	£4.50	BY299	RM11C	£0.45
BT129P	£4.50	BY960	SC264	£8.50
BT151/800R		BYV96D	SKB02	£0.60
BY126	£1.75	BYW96E	SKB08	£0.90
BY127	£0.08	BYX10	SKB20/2	£0.60
BY133	£0.20	BYX55/600	SKE102	£1.10
BY164	£0.90	F82506	SKE1M15	£0.65
BY164/SKB202		IN4001	SKE2G202	£0.75
BY189	£3.00	IN4002	SK22G304	£1.30
BY179	£1.10	IN4004	SK4F104	£0.45
BY179/SK208		IN4005	SK4F106	£0.45
	£1.10	IN4006	SKESF310	£2.20
BY184	£0.65	IN4007	SR2M	£0.75
BY189	£2.00	IN4148	SR2M	£1.40
BY190	£2.00	IN4508	T9053V	£1.40
BY223	£2.00	KBL08	TK155	£1.40

ASK FOR SEMICONDUCTORS NOT LISTED

VIDEO HEADS

AMSTRAD			
3HSSR-VCR7000 (Saisho/Orion)		£21.50	
PSF1-VCR4500, 5200, 9000		£18.00	
PSF2-VCR4600, 4700		£18.50	
PSF3-VCR6000		£27.00	
FERGUSON			
3HSSV-2 Head universal		£9.95	
3HSSVA-3V42, 44, 45, 46 etc		£22.00	
3HSSVA-3V32/HR7655		£33.00	
3HSSAVC-3V48/HRD565		£37.00	
3V48, 58, 59, 65, FV10, 11, 12, 13, 14, 20, 21, 26			
And most other Ferguson		POA	
HITACHI			
3HSSHA-VT8000, 9000 series		£19.00	
3HSSHB-VT11, 33 etc		£19.00	
10082-VT120, 220		£41.00	
10081-VT130, 135		£33.50	
PANASONIC			
3HSSN-2 Head universal		£9.95	
3HSSUN-NV100, 370, 380/Philips VR6460		£16.00	
3HSSUN-NV230, 470, 480, G9, 10, 11, 15PX		£30.60	
3HSSUN-NV430, 460		£21.50	
3HSS3N-NV77, 330		£21.50	
3HSS4NB-NV730		£30.80	
3HSS4NA-NV366		£30.80	
NV300, 33, 40, 45, 46, 130 & most others Panasonics		POA	
SANYO			
3HSSSY-VHR1100, 1110, 1300		£26.50	
3HSSSY-VHR1500		£30.80	
SHARP			
3HSSSP-VCR3000, 9500, 9700, 381, 481, 482, 483, 486 etc		£21.00	
3HSSSPB-VCR581, 583, 651, 670 etc		£21.00	
VC7000, 8000 series (Brass)		£42.00	

OTHER MAKES

Alpha 4000, Goldstar 8000, Sentra 8000, Solovox 1000		£25.50
Fisher FVHP510, 520, 530, 615, 710 etc		£21.00
Fisher VBS7000, 9000 etc		£33.75
Hinari VXL2, 4, 3, 20, 25		£21.50
Hinari VXL5, 6, 20H		£18.50
Mitsubishi HS306, 710		£37.00
Orion VC150, 180, VHT, 2, 3 etc		£23.00
Saisho VR160, 605, 705, 805, 905		£23.00
Samsung Universal 2 Head		£24.25
T o s h i b a		
V71, 73, 74, 75, 81, 82, 83, 84, 85, 85, 87		£25.50
Toshiba V93		£25.50

ASK FOR VIDEO HEADS NOT LISTED

The above heads are new and replacements.

BELT KITS

AKAI			
VS1,2,5		1.20	
VS4,6,9,15		1.10	
VS9300,9500,9800		1.60	

AMSTRAD

7000		1.00	
VCR4600,5200		1.90	
VCR4500,9000		2.00	

FERGUSON/JVC

3V00/16/22 Mechanical Models		1.60	
3V23		1.00	
3V29/30		1.20	
3V29/30 Loading Belt		0.35	
3V31/32		1.00	
3V35/36/38/39		1.10	
3V42/43/44/45/48/54/55		1.00	
3V58/59/64/65/8950/51/FV10/11/12/13/14		1.60	

FISHER

FVHP520/530		1.70	
FVHP615/710/715/716/722/725/830		1.00	
FVHP905/906/907/908/910/911/915/916		1.20	

HITACHI

VT11/14/17/19/33/34/35/38/39/88		1.30	
VT52/61/62/63/64/65/85/86		2.10	
VT100/110/111/113/115/118/120/125/130/135/145/150/175		2.50	
VT8000/8500		1.70	
VT9300/9500/9700		1.50	

PANASONIC

NV230/250/280/370/380/430/450/460/465/485/630/810/830/850/870/890		1.90	
NV300/333/340/366		1.60	
NV600/777/788		1.50	
NV2000/3000		1.50	
NV7000/7200/7500/7800		1.40	
NV8600		2.20	
NV730		0.60	

PHILIPS

VR6367/6467/6561/6751/6760/68B84		2.00	
VR6460/6920/6520		2.40	
VR6580/6581		2.50	
VR6362/6367/6470/6467		2.25	
VR6542/6843		2.00	

SANYO

VTC5000/6500		0.65	
VTC5300/5350		1.00	
VHR1100/1300/1500		1.00	
VHR2300/2500/2700		2.90	

SHARP

VCF3/VC402/500/571/581/582/583/584/585		1.10	
VC6F3/6V3/VC600/651/681/682/683/684/685/693/700/7832.10		2.10	
VC200/381/384/385/386/390/9300/9500/9700		1.95	
VC300/387/388/481/483/486/488/496		1.20	
VC7300/7700/7750		1.95	
VC8000/8300		1.95	

TOSHIBA

V8600/8700/9600		1.05	
V55/57		1.10	
V66/67		2.80	
V31/33		2.30	
V73/81/83/85		2.30	

Belt kits for Funai, GEC, Goldstar, Grundig, Hinari, ITT, Mitsubishi, NEC, Orion, Saisho, Samsung, Schneider, Sony and Tensai also available.

LINE OUTPUT TRANSFORMERS

Decca 100	9.50
ITT CVC20	12.50
ITT CVC25/30/32	9.50
ITT Compact 80 Series 110	16.75
ITT Compact 80 Series 90	19.75
ITT CVC45	18.00
ITT 1109F	14.00
ITT CVC1204	11.50
ITT CVC800/1/3	21.50
ITT CVC1100	16.50
ITT CVC1150/1175	20.00
ITT 6325	18.50
ITT 3546	18.50
ITT 1200/1	20.00

Other ITT transformers available

Fidelity all models up to 20" ZX3000	10.50
Fidelity Panel for ZX2000	1.00
Fidelity 22" ZX3000	24.50
Hinari CT4/5 & TVA1	16.75
Philips KT3	12.95
Rank Bush T20A	11.50
Thorn 1615	8.00
Thorn TX100 Green Spot 110	17.25
Thorn TX90 Mains Trans	18.85
Ferguson 3V35/36 Mains Transformer	23.00
Ferguson 3V44/44/45 Mains Transformer	18.85
Sony - Please state model for price	
Universal Tripler	4.75
Universal Tripler with focus unit	9.50
Decca 120/130 series tripler	8.50
Thorn TX10 Focus Unit Kit	9.00

VIDEO MOTORS

REEL MOTORS			
Ferguson 3V29/30		£20.00	
Ferguson 3V58, 59, 65, FV10, 11, 12, 13, 14, 20, 21, 22		£17.25	
Ferguson FV26D		£14.50	
Hitachi 8000, 8300, 8500		£8.50	
Sanyo VTC5000, 5150, 5400, 5300, 6500		£7.50	
Sharp VCR3000, 9500 etc. Original		£15.90	
Panasonic NV333, 366 Original		£13.20	
All other Panasonics		POA	
DRUM MOTORS			
Ferguson/JVC (Mechanical models)		£23.00	
Sharp 7000 series Original		£24.63	
All Panasonic Original		POA	
CAPSTAN MOTORS			
Ferguson 3V35, 36 Original		£20.00	
Ferguson/JVC (Mechanical models)		£20.00	
Hitachi VT11 Original		£30.00	
Hitachi VT33 Original		£32.00	
Hitachi VT64 Original		£19.75	
Hitachi VT8000 series Original		£34.50	
Hitachi VT9000 series Original		£34.50	
Sharp VC7000 series Original		£30.50	
MODE CONTROL MOTORS			
Ferguson 3V42, 43, 44, 45, 48, 49, 52, 53		£6.00	
Ferguson 3V58, 59, 65, FV10, 11, 12, 13, 14, 20, 21, 22, 26		£4.50	

IDLER ASSEMBLIES

FERGUSON			
Take up Clutch (Mechanical models)		£5.00	
3V29/30 Take up Idler		£2.00	
3V29/30 Take up Clutch		£2.85	
3V29/30 Reel Idler		£3.00	
3V35 Reel Idler		£3.85	
3V35, 36, 38, 39 Take up Clutch		£2.85	
3V58, 59, 64, 65, FV10, 11, 12, 13, 14 Idler Arm		£1.80	
Clutch Assembly			
3V44, 45, 48, 49, 52, 53, 54, 55		£14.00	
Clutch Assembly 3V42, 43		£14.00	
FISHER			
FVHP515, 905, 910, Idler Assembly Original		£5.00	
FVHP515 Gear Idler Assembly		£4.35	
FVHP905, 910 Gear Idler Assembly		£5.00	
FVHP520, 530 Idler		£3.00	
FVHP520, 530 Pulley		£0.70	
HITACHI			
VT11, 33 etc. Original Idler Arm		£2.50	
VT11, 33 etc. Idler Arm Replacement		£1.75	
VT9300, 9500 etc. Play Idler		£3.65	

VT9300, 9500 etc. F/F Idler	£2.95		
VT9300, 9500 etc. Idler	£2.95		
VT8000, 8500 etc. F/F Rew Idler	£2.95		
VT8000, 8500 etc. Play Idler Assembly	£3.00		
VT8000, 8500 etc. FF/Rew Pulley	£0.70		
VT11, 33 etc. Clutch Assembly	£8.00		
PHILIPS			
VR6460 6920 Idler Arm (original)		£3.00	
DV464, 6462, 6463, 650 etc. Idler Mod. Kit		£4.50	
VR6542, 6843 Reel Idler		£6.50	
VR6542 Reel Drive Pulley		£7.75	
VR6843 Reel Drive Pulley		£8.50	
PANASONIC (All Original)			
NV370 Idler Arm Unit VXP0521 Gen.		£3.00	
NV8600, 8610 Play Idler VXP0243		£0.95	
NV332, 777, 788 Idler Unit VXP0463		£3.00	
NV600, 688 Idler VXP0515		£3.00	
NV333, 356 Idler Arm 2 Unit VXL0997		£10.50	
NV8400, 8600, 8610 etc. VXP0245		£0.80	
NV333, 366 etc. Idler VXP0401-NV700, 7200, 7800 Idler VXP0344		£0.80	
NV2000, 3000 Play Idler VXP0331-NV2000, 3000 Idler Unit VXP0329		£0.95	
Back Tension Bands		From £1.50	
All Panasonic Maintenance Kits		POA	
QUOTE PANASONIC PART No. FOR PARTS NOT LISTED			

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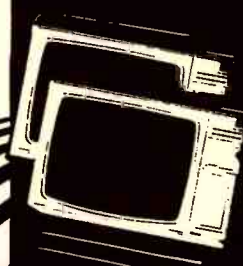
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- Decca 100 **£8.50**
- Hinari CT4-5 Lopt with PCB **£18.75**
- ITT 4515-01-61 **£10.25**
- ITT 4515-03-01 **£19.50**
- ITT 4515-03-19 **£16.50**
- ITT 4515-03-24 **£16.50**
- ITT 4515-03-22 **£18.50**
- Grundig 7100 FAT 3761
- Grundig 6100 FAT 3759

Midi Systems

- New Condition Working Double Tape Deck High Speed Recording

From £40



Ex Rental TV's

ALL WORKING STOCK

- Doric Mk3 Basic **£15**
- Doric Mk4 Basic **£25**
- Rediffusion Mk4 Text **£45**
- Japanese Panasonic, Toshiba from **£30**
- Thorn TX9/TX10 Text **£50**
- Thorn TX9/TX10 Stereo Teletext **£70**
- Portables Various makes from **£45**

Ex Rental Videos

ALL WORKING STOCK

- Amstrad VCR/7000 **£50**
- Ferguson 3V29/30 Thorn 8930 **£55**
- Ferguson 3V31 Thorn 8941 **£80**
- Ferguson 3V32 Thorn 8942 **£95**
- Ferguson 3V35 Thorn 8944 **£80**
- Ferguson 3V43 Long Play HiFi **£155**
- Hitachi 8000/8300/8500 **£50**
- Orion VXL3 **£75**

Capstan Motors

- Akai VS4 **£15.00**
- Akai VS2 **£15.00**
- Ferguson 3V35/8944/HRD120 **£16.50**
- Ferguson 3V16/8909 (PV47987M-Z) **£15.00**
- Hitachi VT11/17 **£26.50**
- Hitachi VT33 **£26.75**
- Hitachi VT61/62 **£29.50**
- Hitachi 5000 **£15.00**
- Mitsubishi H5306B (288 P05401) **£16.50**
- Osaki/Goldstar (414-029A) VCR32/GHV12321 **£19.50**

VIDEO TAPES from £1.20 Box 50

Postage and Packing Extra
All prices exclude remote controls and VAT. Stock subject to availability.



LOADS OF SPARES FOR FERG/THORN VIDEOS 3V00, 3V16, 3V22 PHONE FOR DETAILS

Here is our choice selection of spares. 100's of others not listed. Telephone for Price.

IC's

- AN316 **£1.00**
- BA5406 **£1.50**
- BA853 **£2.50**
- BA7007 **£1.00**
- HA11107 **£1.50**
- HA12072 **£1.50**
- LA4440 **£2.00**
- LA4520 **£1.50**
- MB88401-206M **£2.50**
- ML237B **£0.50**
- MC5192 **£1.00**
- MC1451 **£1.50**
- MC1453BCP **£1.00**
- SAAS020 **£2.00**
- SAAS040B **£2.00**
- SN75498N **£1.00**
- SN76131N **£1.00**
- SN7417N **£1.00**
- STK5421 **£5.75**
- STK5332 **£2.75**
- STK5481 **£6.85**
- STK5314 **£5.75**
- STK4121 MK.II **£6.25**
- STR440 **£4.95**
- STR4090 **£5.75**
- STR4211 **£4.50**
- STR5412 **£4.75**
- STR50103A **£4.50**
- TDA2576A **£2.00**
- TDA2540 **£1.00**
- TDA3654 **£2.00**
- TDA4600 **£2.75**
- TDA4505B **£3.50**
- UPC1365C **£3.25**
- UPA2004C **£1.00**
- UAA1008A **£1.00**

Original Replacement Video Heads

- Akai VS4 **£19.50**
- Amstrad 7000 **£17.50**
- Amstrad 4600 **£17.50**
- Amstrad 4600 MK2 **£14.00**
- Ferg. 3V43 **£36.75**
- Ferg. 3V32 4 heads **£27.00**
- Ferg. 3V42/44/45 **£14.75**
- Fisher FVM510-722 **£14.75**
- Fisher FVH516/520/530/615/622/710/715/720 **£16.00**
- Hitachi VT11/33 **£15.00**
- Osaki/Goldstar VCR 32/GHV12321 (413-048A) **£24.50**
- Panasonic NV366 **£24.00**

MANY MORE

New Video Boards

- Ferg 3V29 Audio Y/C Board **£15.00**
- Ferg. 3V29 MDA **£10.00**
- Ferg. 3V29/30 Top Cover **£5.00**
- Ferg. 3V23 T/T board **£15.00**
- Ferg. 3V23 Mechan Board **£15.00**
- Ferg. 3V23 Front Facia Board **£15.00**

Cassette Housings

- Akai VS4 **£10.00**
- Akai VS2 **£10.00**
- Ferg. 3V35 **£19.50**
- Ferg. 3V42/4 **£19.50**
- Ferg. 3V29130 (PUS26140C) **£10.00**
- Mitsubishi HS304 **£10.00**
- Siemens FM391/761 **£19.50**
- Sharp VC9100 (CHLDX 3014GE44) **£18.50**

Reel Motors

- Hitachi VT9300 (5577291) **£12.00**
- Sharp VC9100/9300 **£12.50**
- Sharp VC 481/482 **£13.50**

VHF-UHF TELEVERTERS £12.50

(Require) 15 volts supply

Drum Motors

- Sharp VC3800 (Pt No RM0TP10/9GEZZ) **£16.50**
- Sharp VC9100 (RMO TP1010GEZZ) **£16.50**

Loading Motors

- Sharp VC9100 (RMO TM1017GEZZ) **£12.00**
- Funai VCR4000 (8000-05-305) **£10.00**

Camera Spares

- Saticon Tube Ferg. 3V34 Compact Camera **£45**
- Saticon Tube Ferg. 3V41 Camcorder **£45**

UCR Service Manuals

- Ferg. 3V58, Ferg/Thorn 3V32/8942, Ferg/Thorn 3V35-6/8943-44, Ferg/Thorn 3V31/8941, Loewe P17 **All £4 each**

- Fluorescent display for Ferg./Thorn 3V30/8930 **£2.00**
- Thorn 8945 **£2.00**

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from **£65**

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AND GET ONE FREE**

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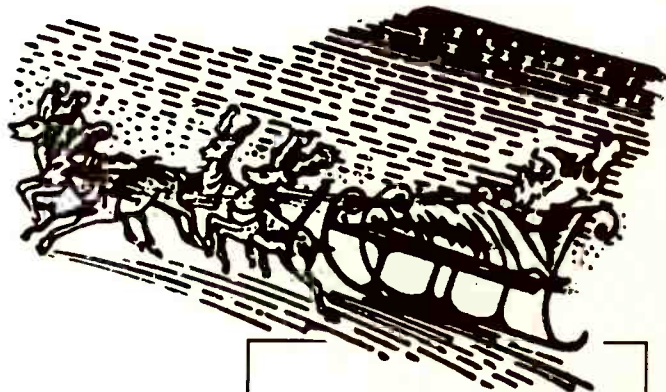
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 Teletext from £25
 100's of VCR's T/L from £45
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 14" COLOUR TV WITH
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 Tel: 0204 384 868

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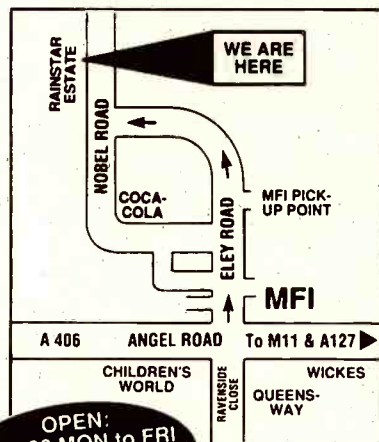
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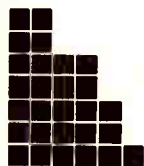
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9038	DETACHEBEL STEREO RADIO CASSETTE	£36.50
9044	DIGITAL STEREO RADIO CASSETTE	£43.00
5034	SNOOZY CLOCK RADIO	£6.75
6015	CLOCK RADIO WITH CASSETTE PLAYER	£14.75
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BEETA 100	CAR STEREO AM/FM	£12.50
BEETA 101	CAR STEREO NIGHT ILLUMINATION	£19.75
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12012	AUTO REVERSE CAR STEREO	£35.75
12013	CAR STEREO PRELUDE	£29.75
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BEETA 400	AUTO REVERSE FREQUENCY SYNTHASISER	£57.50
E-S 100	3 WAYS 50 W SPEAKERS	£8.00
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PORTABLE
£125**

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FROM £55**

**21" F.S.T. £200
NEW**

TXT VCR £200

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NEW

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ALL PRICES ARE SUBJECT TO 15% VAT & BASED ON QUALITY



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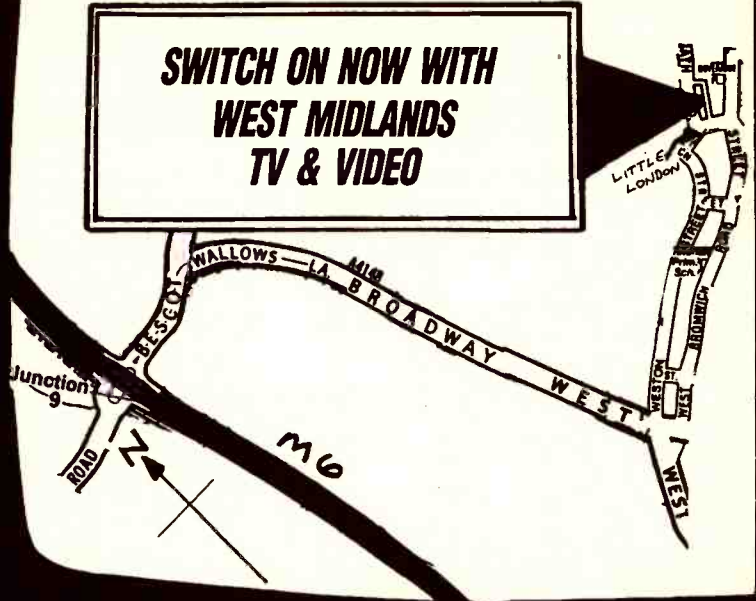
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10 WORKING TX TEXT ONLY £500

10 WORKING 3V29/30 VIDEOS ONLY £600

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IF	Converger	Decoder	Line scan	Power	Frame
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T26 X	5	16	20	17	X
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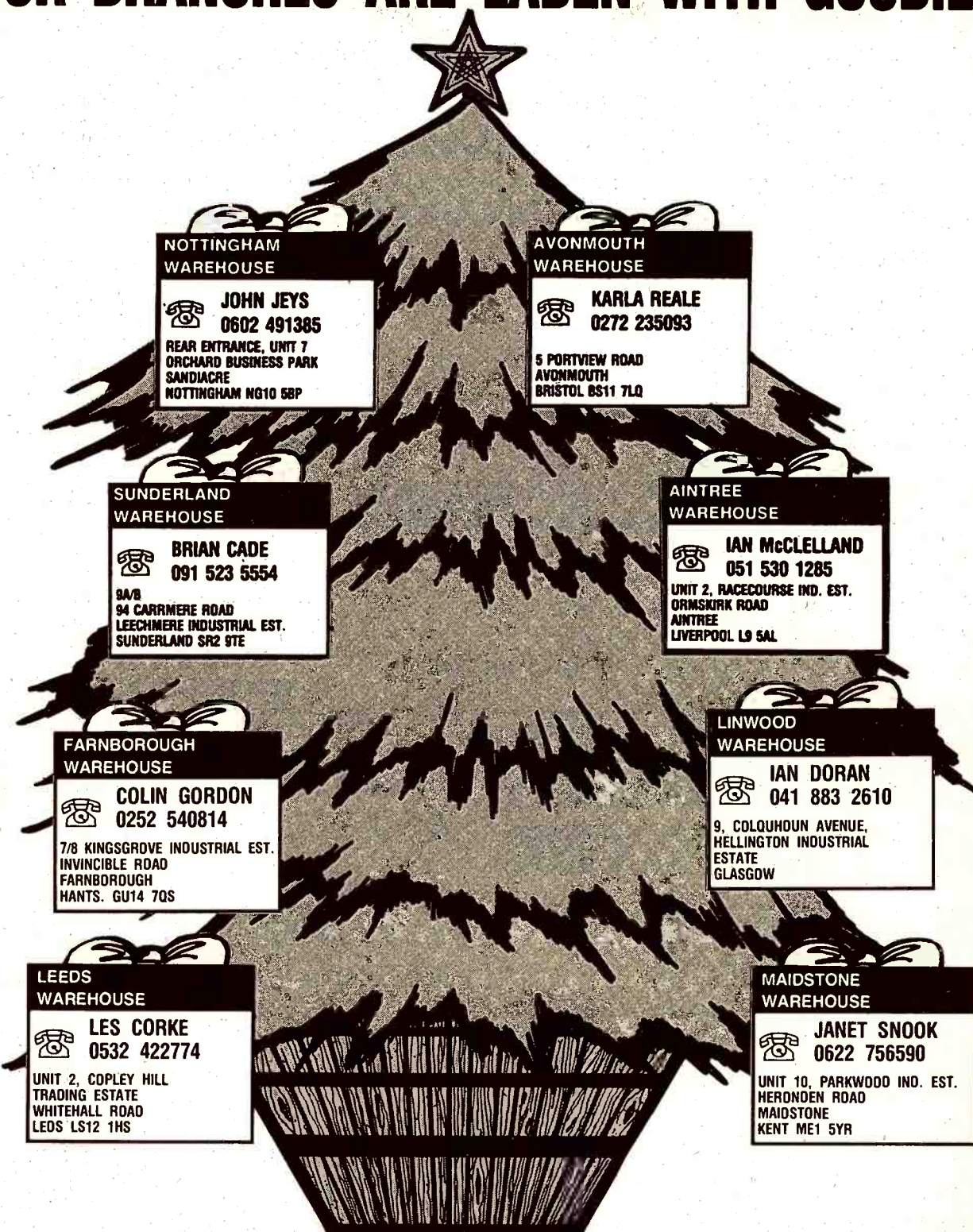
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MULTIVISION

TELEVISION WHOLESALERS

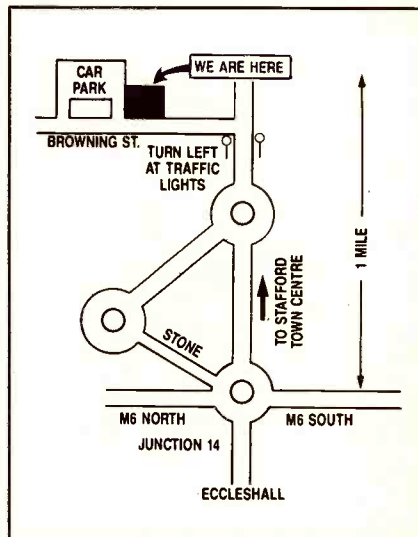
WORKING TELEVISIONS

Decca (Various models)	£15	Rediffusion Mk4	£28
Finlandia CTVs	from £12	Rediffusion Mk3 cable	£5
Ferguson TX10	£20	Toshiba	from £15
GEC Starline (some remote)	£15	Nat Pan T/Text	£60
ITT Trimline	£25	Philips KT3 + K30 T/Text	£60
Nat Pan remote	£30	Philips G11 T/Text	£45
Philips/Pye	£15	Rediffusion Mk4 T/Text	£60
Philips KT3 + K30	£28	B/W TVs	£5
Rediffusion Mk3	£12		

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		B/W TV's (off the pile)	£2

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COLOUR TV

PIL	FROM £15 WORKING
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TVS FROM ONLY £15 **VCR FROM ONLY £40**

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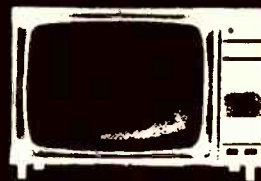
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9200/9600/9900/MK. 4 BASIC/G11	20	15
TX9 BASIC/KT30 BASIC/ITT TRIMLINE	30	25
ANY REMOTE TV's from	35	30
ANY TEXT from.....	55	47
STEREO TEXT	70	60
FST Etc from.....	100	80

★ VIDEO'S ★ ALL SERVICED

ANY TOP LOADER FROM	55	48
3V23	65	55
3V35/3v31	85	75
3V32/VT19 LONG PLAY	100	85
3V44/3V48.....	110	95
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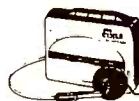
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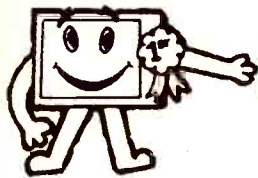
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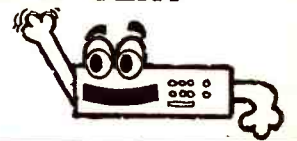


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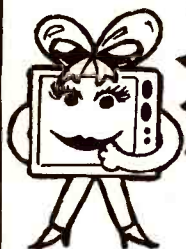
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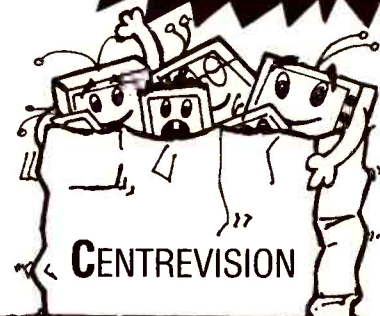
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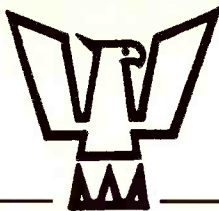
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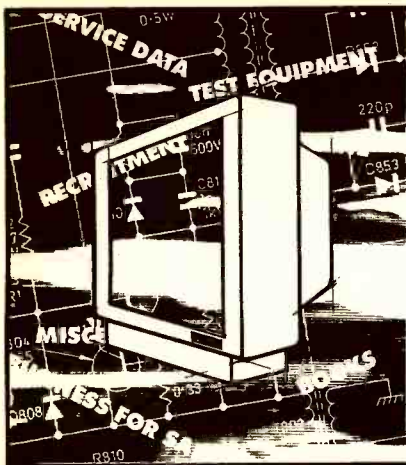
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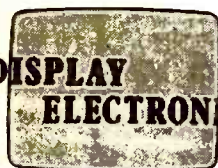
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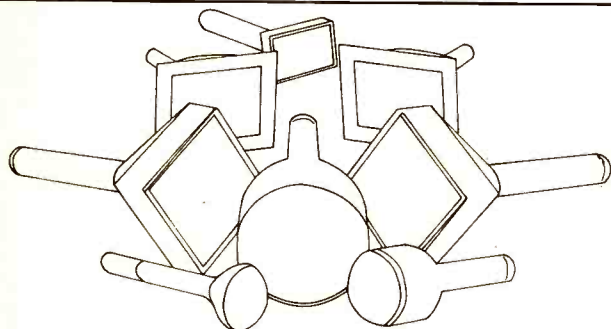


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KT3-K30-K4-K40 CTX ETC Mains Switch 75p each G8 LOPTS PHILIPS £6.00 G11 LOPTS £3.00 PHILIPS DESK TYPE Dual Power Calculator SBC1704 £7.00 K40 FOCUS POT £1.00 4.7µ KT3 W/W 10 for £1.00 FOCUS POT HDK TPA6006 £2.00 KT3 Triplers K3 Tex Front Panels with I.C.s (SAA302/7PSAB301V HO448328) £6.00 G8 100K Pots on Panel & Lead for 6 Push Button Unit £5.00 K30 Mains Switch remote £1.00 K35 Mains Switch remote 75p K35 Aerial Socket and Plug in Lead to Tuner £1.50 KT3-K30 Slider Pots 4.7ku 20p each		Philips SBC3050 Stereo Condenser Electric Microphone £11.00 Philips SBC3040 Mono Uni Directional Condenser Microphone £9.00 Microphone Philip Dynamic £6.00 10mm THICKNESS SOLAR POWER RADIO WITH EARPHONES £2.00 TX100 FRONT PANEL £5 WITH REMOTE		PHILIPS Desk Calculator £7.00 CVC 40 Cabinets £10.00 NEW IN — ITT BOXES Post £5.00 LINE TRANSFORMER Philips TX 12" and 14" Portable £12.00 WANDER PHONES Key Pad and Hand Set. No Case £1.00 PHILIPS UNIVERSAL BATTERY TESTER SBC 1695 £5.00 DX-TUNER VHF/UHF SEND FOR DATA 50p TUNER 75p GEC 20AX POWER SUPPLY Mark 2 £10.00 THORN 9000 4.7m 400V 40p G8 TUNER V/CAP on Panel £3.50 G8 SPEAKER 75p ONE I.C. K35 Decoder £7.00 K30 IF/K35 IF £5.00 THORN Lopt 8500-8800 £4.00 TX9 THORN Tuner Panel with ICS Pots & Mains trans. £3.00 THORN 1600 Rec & Anode Cap 50p KT3-KT30 Slider Pots 4.7k £1.00 for 10 K35 20 Turn Pots 6p each HITACHI & GEC 20k Pots and 100K and 69K Philips 20 for £1.00 100K POT & 20k v/cap type with band switch 5p KT3 K30 Speaker 30p K30 Push Button Switch 6 Way £1.00 K35 Spung On/P Panel Plug in and KT3 sound o/p £3.00 K35 12 way Push Button Unit £1.50 G8 6 Button Unit. New Type £2.00 6 off LED DISPLAYS, Mixed £1.00 HAND SET TESTER, Infra Red £3.00 AERIAL SPLITTER with filter £1.00 UNI DIRECTIONAL, Dynamic Microphone £2.00 20 TURN POTS with Band Switch 10p PUSH BUTTON Mains Switch with Screw Holes Fixing 4 for £1.00 PYE 731 Line Trans £3.50 PYE 731 New Power Supply £4.00 800v DIODES at 3 amps, Glass Beads 6p each, 20 for £1.00 KT3 Line Output Transformer £5.00 THORN 8500 Time Base £3.00 7 SEG DISPLAYS 4 Bank Displays Z-6042T 25p SPLIT DIODE FBS1245AR £5.00 GEC TEXT PANEL PC895A7 £10.00 SEND FOR LIST OF VIDEO SPARES £13 to £46 HEADS		TV AERIAL/VIDEO Combiner Switch and Sockets Lead 50p THORN RECEIVER PANEL 564/314 564/323 M293B1 SAA 5012 HCF4556BE MC14493P TX100 £6	
LARGE Foacs Pots. Fits Pye, GEC, ITT, Decca 75p 8 PUSH BUTTON UNIT for CTX Chassis £1.50 GR Power Supply Panel £4.00 EX DECCA 85-100 Decoder £5.00 EX DECCA 80-100 Frame £5.00 THORN 8000-8500-8800 Decoder £6.00 GLASS BEADS Diodes 200v/1.2A 50 for £1.00		PHILIPS NEW TYPE U/V HAND SET £10		THORN VIDEO HEADS 3HSSV £9.00 G11 470 MFD 250v IC-35 BRIDGES RECTIFIER BR-31 50V 2 Amp 8 for £1.00 TX90 THORN 20" chassis £25.00 TX90 MOD 3714B The Super Tuning System TX9139/001 £8.00 T6070V TX9 Transistor £1.00 TX9 90D4-106-004 £1.00 TX9 90D4-089-001 £1.00 Chopper Transformer £1.00 TX9-08D4-025-001 Choke £1.00 TX9-90D4-093-001-OIG £1.00			
G11 Typ Switch £20.00 G11 IF Panel £8.00 G11 Decoder Panel £8.00 G11 Condenser 470/250V ITT £2.00 G9 Power Panel £3.50 G8 Transductor £1.25 G8 Push Button Unit £2.00 G8 Con/Panel New Back Type £4.00		MIXED TOSHIBA HAND SETS FIVE FOR £12		TX100 FRONT PANEL £5 8 Button			
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MAINS TRANSFORMER 240v in/240v £1.00 GREEN FLAT, NEC. LED's 3p each 100 for £2 15V015V 1 Amp Print Type £1.00 12+12V 2.8VA Print 1"x1" 75p 8+8V 1 Amp Print 75p ET596 UHF V/CAP Tuner, small £2.50 FIDELITY Panels with I.C. £5.00 FIDELITY LOPT Split Diode AT2076/80 £3.00 AT 2076/80 MULLARD TEL-TEX DECODER Type VM6113 £7.00 WE HAVE OVER 1,000 6 DIODE TRIPLER AT £1 EACH TX10 8 way button unit £8.00 THORN TX90 Remote chassis £12.00 PHILIPS VHS Tape 180 £2.25		TX90 TX925 TX100 Mains Switch with Stand-by and Lead 3 for £1 or 50p each		UNIVERSAL VIDEO-RECORD KIT STEREO This kit may also be used to connect a mono to stereo. £10.			
2432984 2432971 2432901 2435016 2433952 2434393 2432211 TM48A DSTK89243 TFB3909D K4 L.O.P.T. K35 L.O.P.T. K40 TX9 L.O.P.T. 2432101-2		SPLIT - DIODE TX100 Green Spot £15.00 TX100 Blue Spot £15.00 TX100 Yellow Spot £10.00 L.O.P.T. £10.00 TX90 White Spot £10.00 L.O.P.T. £20.00 Split Diode 110" £12.50 Orion 65-3M £12.50 GEC C85-9793-6 £10.00		CTK Lopt 36212 33651 36072 36362 36383 36482 36761 36831 36832 36833 36921/79 36922/79		TRANSFORMERS AT2076/01 £1.00 AT2084/11 £1.00 AT2085 £1.00 AT2076/03 £1.00 AT2076/03 £1.00 AT2076/51 £1.00 CVC 820 £1.00 CVC 800 £1.00 3112-338-30942 £1.00 3112-338-30033 £1.00 3111-268-30050 £1.00 3112-338-98894 £1.00 3112-338-30634 £2.00 3112-338-96844 £1.00 3122-138-53861 £1.00 3122-138-98894 £1.75	
ITT TUNER CAN CMR 800/3 £20.00 Decca 100 Lopt Panel and Frame £5.00 WITH DATA Min with co-ax socket UHF v/cap tuner 40dB gain £1.50 or 10 for £10 Can be adapted for video ITT PANEL CMC 301 CMC 113 CMC302 £5.00 CMC 115 CMC 303 CMC306/2		I.C. Holders DIL — DIL £1.00 40 Pin x 4 £1.00 42 Pin x 5 £1.00 28 Pin x 5 80p 16 Pin x 10 70p 24 Pin x 5 75p 14 Pin x 10 70p 18 Pin x 10 80p DIL — QIL £1.00 16 Pin x 10 £1.00 18 Pin x 10 £1.00 28 Pin x 4 £1.00 All Mains Switch u/v 30p 1000 off for £10.00 FN4001-31 Amp		L.O.P.T. SPLIT-DIODE PHILIPS £10 EACH SHARP MS1HC190 TX9 LOPT £10 EACH 0044-235 (0241)			
CMR 800 Power Supply Switch Mode £5.00 SEL ITT IPB254F/2 Front Panel £15.00 DECCA — GEC — ITT 6 push button — £5.00 100 BC-BF Transistor £1.00		SEND FOR LIST BRITISH MADE V.H.S. VIDEO HEADS from £8.20 TO £60. SEND FOR PRICE LIST. V3HSS V, V3HSSV-L £8.20. SEND FOR LIST OF VIDEO SPARES, VIDEO LEAD AND BELTS 12V/1 AMP POWER SUPPLY WITH MAINS PLUG £4 PHILIPS HALOGEN LIGHT. NEW. NO ON/OFF SWITCH. NO HANDLE WITH CORD. BLACK IN COLOUR £5 PHILIPS HAND SET GII TEXT ULTRASONIC £10 GII TEXT IN RED HAND SET £12.50 GII HAND SET ULTRASONIC £10 PHILIPS RC5 EASY CONTROL £10 TVR3 Amstrad Cassette Mechanisms. New £35 with heads. Amstrad Television Tuner UHF. Small. Fits most Amstrads. £6. SENDZ COMPONENTS, 63 BISHOPSTEIGNTON, SHOEBURYNNESS, ESSEX SS3 8AF. SAME DAY SERVICE All items subject to availability. No Accounts. No Credit Cards. Postal Order/Cheque with 10% p.c. Add 15% VAT, then £1 Postage. Add Postage for Overseas. Callers: To shop at 212 LONDON ROAD, SOUTHEAST. Tel. 0702-332992. Fax 0702 338805 Open 9-12/2.30-6. GVMT + school orders accepted on official headings. Add 10% handling charge.					

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Min. UHF Tuner 40dB gain	£1.50
2 x 112 x 1/2	
AMSTRAD Tuner	
Thorn TX10 Export V/Cap UHF	£3.00
VHF	£3.00
V/Cap Rank UHF Z7767/Unit	£6.00
V/Cap Rank VHF Z7737/Unit	£5.00
NEW G8 Tuner V/Cap	£3.50
T21 6 Push Button Unit	£7.00
ELC2000 on Panel	£2.50
GEC 2100 V/Cap	£6.00
ELC1042 NEW	£6.00
ELC1043 (Ex Panel)	£3.75
ELC2001	NEW £4.00
ELC2003	£4.00
GEC Tuner V/Cap Hitachi After	£8.00
1979 ETS4K, ETS47, ETS41B	£6.00
ETS46	£6.00
UE33-B01 Amstrad UHF Tuner	£5.00
VHF/UHF EG522F	£5.00
ASTEC UM183	£10.00
V314 (VHF)	£5.00
V334	£4.00
U321	£6.00
U322	£8.00
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U342 (UHF)	£5.00
U343 Phono	£5.00
U343C	£6.00
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U410	£8.00
U.V. 411 Tuner	£8.00
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U743 Tuner	£7.00
Fidelity/Amstrad 2000 V/Cap Tuner	£5.00
Small V/Cap Mitsumi	£4.00
UHF	£4.00
VHF	£3.00
VHF & UHF ETS98P Tuner	£6.00
Portable & rotary Tuners Sanyo & Mitsumi	£5.00
UHF	£8.00
Mosfi UHF/VHF (new type)	£8.00
UE2-B31 Fidelity V/Cap T/Unit	£6.00
UHF/VHF V/Caps on panel	£3.00
HITACHI 20 Turn Pot	£6.00
U321 on panel	40p
Tuner unit VHS Sylvania GTR Video	£2.50
MTS 901	£2.50
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video tape recorders, TV cameras, video	
games, closed circuit TV, C.C.T.V.	
system. Data supplied.	£10.00
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TXS 250 AC mains filter 0.1 + (0.0x2) 11"	£2.50
leader & earth clip	25p
NEW U31 Mullard	£4.00

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Astec UM1286	£4.00	
Video Conversion Kit		
1 UHF/VHF small tuner with IF		
5.5 MHz & modulator 5.5 (very		
small)	£10.00	
UHF/VHF Tuner EGG13F		£6.00
ENV-5746S2 VHF/UHF	£5.00	
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TX90M02 37141B		
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TX9 139X01	£8.00	
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& Philips	5p	
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New	75p	
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HW2011	50p	
HW2013	50p	
SW453	50p	
SW150	£1.00	
HW2013	50p	
HW2015	50p	
RW303	50p	
SY2153	50p	
HW2011	50p	
HW2013	50p	
SW453	50p	
SW150	£1.00	
HW2013	50p	
HW2015	50p	
RW303	50p	
SY2153	50p	
HC368	10p	
BC369	10p	
BC384	15p	
BC394	10p	
HC413	15p	
BC414	10p	
BC416	10p	
HC440	30p	
BC454	30p	
BC455	30p	
BC456	10p	
BC460	25p	
BC462	30p	
BC463	10p	
BC478	10p	
BC527	10p	
BC532	10p	
BC546	10p	
BC547	10p	
BC548	10p	
BC556	10p	
BC557	10p	
BC558	10p	
BC559	10p	
BC635	10p	
BC636	10p	
BCX31	25p	
BCX32	25p	
BD116	25p	
BD124	25p	
BD124 (metal)	10p	
BD130Y	25p	
BD131	25p	
BD132	25p	
BD133	25p	
BD136	25p	
BD138	30p	
BD140	30p	
BD176	25p	
BD182	10p	
BD183	10p	
BD202	70p	
BD204	60p	
BD207	60p	
BD221	30p	
BD222	30p	
BD228	30p	
BD226	20p	
BD233	30p	
BD234	30p	
BD235	30p	
BD238	30p	
BD239	15p	
BD240	50p	
BD243c	50p	
BD244	50p	
BD250H	50p	
BD257	20p	
BD258	20p	
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BD312	20p	
BD313b	20p	
BD416	25p	
BD433	25p	
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BD999	30p	
BD1000	30p	

Thorn ML926	£1.00
MAB844B-C	£2.00
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MAB844I	£2.00
MAB844J	£2.00
MAB844K	£2.00
MAB844L	£2.00
MAB844M	£2.00
MAB844N	£2.00
MAB844O	£2.00
MAB844P	£2.00
MAB844Q	£2.00
MAB844R	£2.00
MAB844S	£2.00
MAB844T	£2.00
MAB844U	£2.00
MAB844V	£2.00
MAB844W	£2.00
MAB844X	£2.00
MAB844Y	£2.00
MAB844Z	£2.00
MM551	£1.00
MM552	£1.00
MM553	£1.00
MM554	£1.00
MM555	£1.00
MM556	£1.00
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MM569	£1.00
MM570	£1.00
MM571	£1.00
MM572	£1.00
MM573	£1.00
MM574	£1.00
MM575	£1.00
MM576	£1.00
MM577	£1.00
MM578	£1.00
MM579	£1.00
MM580	£1.