JUNE 1989

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TELEVISION

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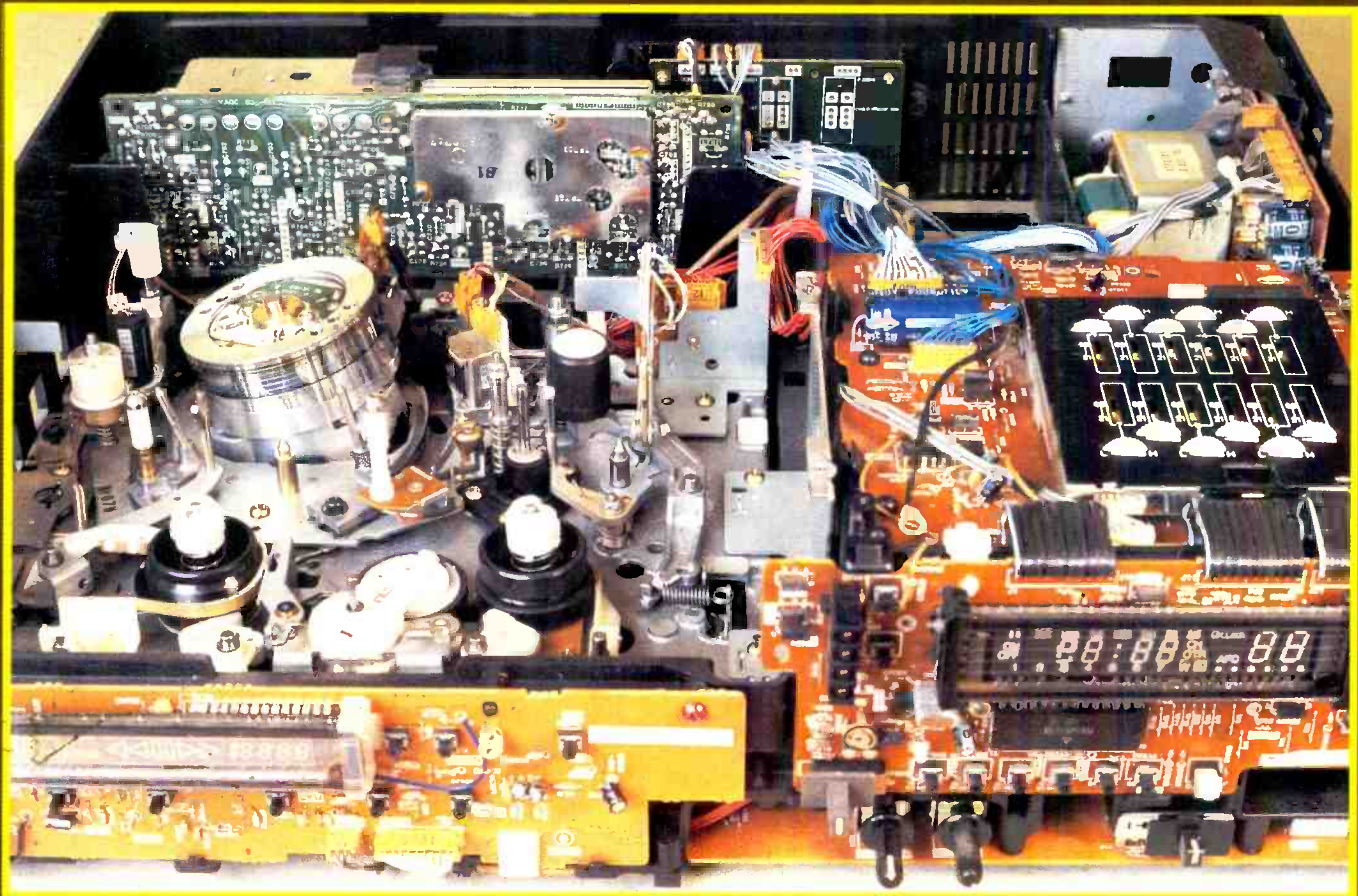

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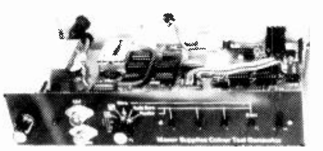
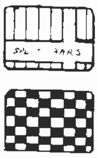
MKV PAL COLOUR TEST GENERATOR FOR DOMESTIC TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE





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- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
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- ★ Mains operated with stabilised power supply.
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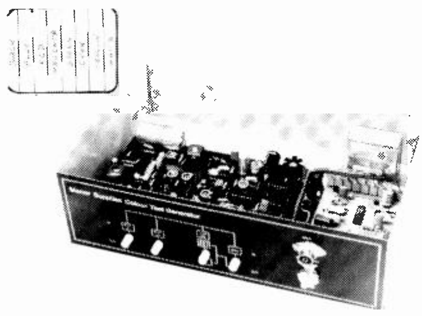

- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
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- ★ Backup service available.

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TELEVISION

June 1989

Vol. 39, No. 8
Issue 464

On sale May 17th

CORRESPONDENCE
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
Indexes to Vols. 36 and 37 are available at 80p each from the Editorial Office (address above).

SUBSCRIPTIONS
An annual subscription costs £20 in the UK, £24 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BACK NUMBERS
Subject to availability, copies of issues published during the last 12 months are available at £1·80 each from Television, Vouchcheck Services, Unit A6, Poplar Business Park, Prestons Road, London E14 9LR. Please make cheques/postal orders payable to IPC Magazines Ltd.

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. Correspondents should enclose a stamped addressed envelope.
Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

573 Leader

574 Still Video Systems — *George Cole*
Details of video systems put forward as an alternative to conventional photography. A world standard has been agreed using a floppy disc. There is also a digital system using a RAM store.

579 Long-distance Television — *Roger Bunney*
Reports on DX conditions and reception. There was a spectacular aurora and considerable F2 reception during March. Also a DIY approach to satellite TV.

582 TV Fault Finding
Reports from Philip Blundell, Eng. Tech., Paul Hardy, Hugh MacMullen, Ian Bowden, Nick Beer and J.R. Armagh.

584 Teletopics
News, comment and developments.

585 Here We Are Again! — *Les Lawry-Johns*
Still in business though activity is not what it has been in the past.

586 Practical Astra Installations — *D. J. Stephenson, B.A., I.Eng.*
A comprehensive, practical guide to the installation of Astra receiving equipment. It should encourage TV engineers to make the most of the new opportunities.

590 The Panasonic NV370/830/850 — *Nick Beer*
Servicing notes on the mechanical and electronic sections of these popular VCRs, with an extensive faults list.

594 Letters

596 Hum Problems — *George Wilding*
The causes of hum problems with various types of power supply. Also sound buzz problems.

598 Camcorder Servicing, Part 5 — *Steve Beeching, T.Eng.*
More on colour signal processing with solid-state image sensors.

599 Next Month in Television

600 The Philips CP90/CP110 Chassis — *Harold Peters*
An introduction to these chassis and some of the faults you may experience with them.

603 Product Review: Satellite TV Filter — *Roger Bunney*
An assessment of the Phantom IFP70 i.f. filter which can be used to obtain considerably improved satellite TV reception, particularly with weak signals.

606 VCR Clinic
Reports from Eugene Trundle, Alfred Damp, Ian Bowden, E.M. Beddow, Nick Beer, V.W. Cox and John C. Priest.

608 Vintage Scene: The Telectroscope — *Chas E. Miller*
While Baird was still an eight year old schoolboy Jan Szczepanik was developing TV systems using Nipkow discs and vibrating mirrors, with ingenious light modulators.

610 Servicing Compact Disc Players, Part 4 — *Joe Cieszynski*
The player's r.f. section, how to scope the r.f. waveform and what it will tell you.

613 Service Bureau

614 Test Case 318

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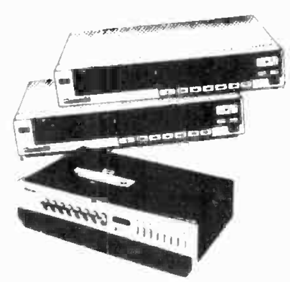

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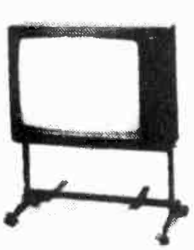

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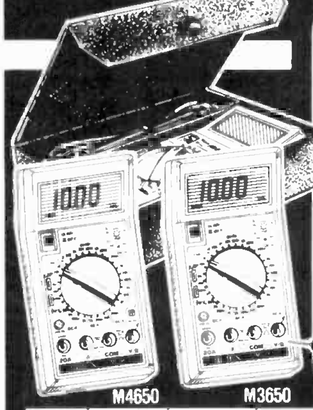

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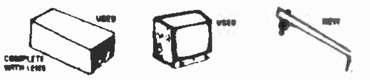

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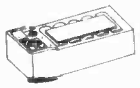

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CORRECTIONS

In Nick Beer's article on pages 512-3 last month the Panasonic NV-G21's "capstan motor" (VXP0777) should have read "capstan rotor". Salora Model 24K67 should have read 24L67.

COVER PHOTO

This month's cover photograph shows the Panasonic NV370 with the top and front covers removed to show the mechanism/internal layout. See article on pages 590-3.

Business Slows

Here we are at the beginning of the age of satellite TV broadcasting in the UK. Business should be booming, but isn't. Which is not to say that the TV trade didn't do well last year. In fact sales of colour sets rose to yet another record in 1988, up nine per cent at 4·4 million. But, as so often, there wasn't a lot of profit in it. For the first time, sales of small-screen sets overtook those of large-screen models, suggesting that the market is now primarily one for additional sets. And we all know the silly prices that are being asked for many of these small sets, with 14in. CTVs having been on offer for as little as £90. The chancellor's attempts to dampen demand through high interest rates have depressed sales this year. The silly prices seem to reflect an attempt to maintain turnover at the expense of profit margins. Perhaps this is inevitable when the large chain stores operate by placing massive orders with manufacturers. The stuff has to be kept moving somehow.

The public, having sated itself on CTVs and VCRs (2·3m in 1988, with market penetration now at 64 per cent of households), is not at present in the mood to invest in satellite TV equipment. Consumer research carried out by Ferguson has shown that only one per cent of those interviewed intended to buy a satellite TV receiver this year. Two per cent said they would probably buy, four per cent said they "might or might not" while a massive 85 per cent said they definitely wouldn't. Hardly a vote of confidence in the present offerings. In fact of course this reflects the present uncertain situation, with Sky seeking to establish itself on a shoestring and the advent of the BSB services in the autumn awaited. Sky gambled on getting in first. It must be getting worried as the summer slips by with so little consumer interest being apparent. All the signs are that a sizeable market won't develop until the two sets of services are in operation.

In the past Ferguson's market forecasting has been remarkably accurate. Its recent report on the consumer electronics market in the UK – from which the above figures have been taken – suggests that satellite TV will begin to take off in 1990 and 1991, when sales of 1·2m and 2m installations respectively are predicted. On the Sky/BSB battle, the report comments that "the system that wins the long-term battle will be the one that provides the best quality popular programming, and is sure to have little to do with technological advantages, manufacturers or retailers".

It's deeply unfortunate that satellite TV should have to be seen as yet another systems battle. But the two services require different technology, and although compatible units are possible and will doubtless come on offer they will tend to be expensive, calling for a steerable dish and wideband LNB plus duplicated decoding and descrambling circuitry. Possibly both systems will attract enough viewers to survive. But the problem is that satellite TV is basically an extra alternative to the already established and popular terrestrial services. Technically, Sky has proved to be a great success. BSB with its stronger signals should be equally easy to receive. It will, to say the least, be interesting to see how things develop.

Konosuke Matsushita

Konosuke Matsushita, founder of the world's largest manufacturer of consumer electrical/electronic products, known for its Panasonic, National and Technics brands, died in Osaka on April 27th, aged 94. Matsushita's father had lost heavily through speculating on rice futures and as a result Konosuke was forced to seek work at the age of nine. He started as an apprentice at a charcoal seller, then took a job in a bicycle shop. In 1910 he took up employment at the Osaka electrical utility. When, in 1918, his superiors showed no interest in his ideas for improving electrical sockets he left to start his own firm. That was the beginning of Matsushita Electric, as an electric light bulb manufacturer in a two-room apartment. Between the wars Matsushita became a pioneer in the mass production of consumer electrical products. The post-war story will be familar to readers, as National and Panasonic became internationally known brands. Konosuke retired in 1973.

It goes without saying that to have built up such an enterprise Konosuke must have been a remarkable man. Many facts and stories about him confirm this. Apparently during the great depression, when the government decreed belt-tightening and many manufacturers laid off staff, Matsushita put his staff on half-day working at full pay and urged his employees to sell the backlog of stock. Within three months the stock had been cleared and Matsushita had worked itself back to profitability. He was known for his writings, as an authority on management techniques, and also for his educational and cultural activities. He wrote that "the ultimate aim of production is to wipe out poverty and create prosperity . . . to make all products as inexhaustible and as cheap as tap water". In the post-war period he established first the PHP (Peace and Happiness through Prosperity) Institute and then, in 1983, the Science and Technology Foundation of Japan, to promote scientific research and development. He expected dedication and hard work, and was perhaps rather excessively nationalistic in regarding the 21st century as the time when the world would consist of a Japanese hegemony – the century of Japanese man. Be that as it may, the company he started with 200 yen had sales of 5·45 trillion yen in 1988 and employed some 180,000 people in approaching forty countries.

Still Video Systems

George Cole

Although the video camcorder has largely replaced the cine camera for home movie making, film is still used for conventional photography. A still video camera offers a number of useful features such as instant picture display via a TV set, a recording medium that's reusable and the possibility of picture transmission down a telephone line. Still video has yet to match the quality and price of film however. The gap between film and video is nevertheless narrowing, and at last year's Photokina exhibition a number of manufacturers demonstrated still video systems. Marketing of still video cameras (SVCs) in Europe may start this year.

The first electronic still-image video camera, called MAVICA (MAgnetic VIdeo CAmera), was unveiled by Sony in August 1981. The camera closely resembled a 35mm SLR camera in appearance, but a magnetic floppy disc rather than conventional chemical film was used to store the picture information.

The initial MAVICA system was a prototype which Sony used as a means of persuading other companies to join in, agree upon and develop a common still video recording system – it seems that someone had learnt something from the VHS/Beta video format war! In February 1983 twenty electronic, photographic and film companies formed the Electronic Still-Image Video Camera Committee and started work on establishing a world standard system. By May 1984 the committee had grown to 32 companies and agreement had been reached on a standard Video Floppy System (VFS). During the same year Sony's still video camera was demonstrated at the Los Angeles Olympics. A number of companies had in addition started to develop professional still video cameras which were used and assessed by newspaper photographers.

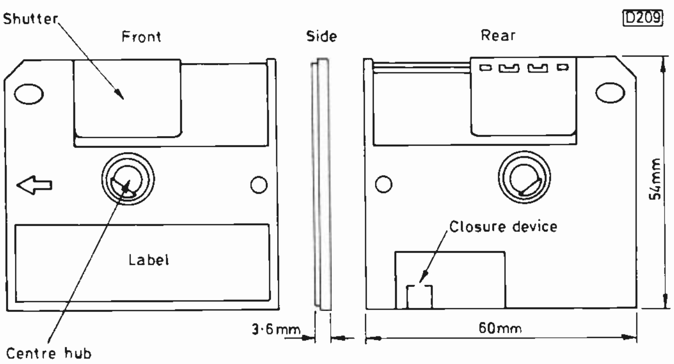


Fig. 1: Appearance of the disc jacket.

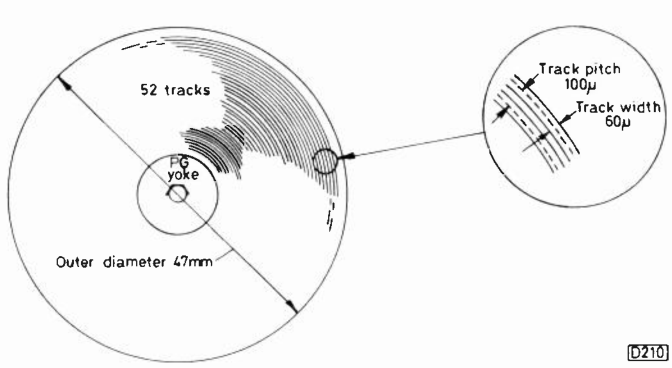


Fig. 2: The disc track arrangement

Fuji introduced the Fujix TV-Photo system in April 1985. In use the photographer shoots pictures on conventional film which is processed in the normal way. The images can then be transferred to a disc, inserted into a player and viewed on a TV screen. After viewing, the photographer can order the best shots for development on normal film.

In April 1986 the Electronic Still-Image Video Camera Committee, which by now had members from 42 companies, agreed to an optional method for recording sound with pictures. Then in July 1988 the committee agreed to a "hi-band" format for improved VFS picture quality.

The first domestic SVCs were unveiled at last year's Photokina and the first models went on sale in Japan late last year.

The Storage Disc

The committee decided to adopt a 47mm (two inch) single-sided floppy disc which looks like a miniature version of the standard 3·5in. computer floppy disc. The 47mm size allows up to 50 shots to be stored using a light, compact still video camera. The disc sits inside a hard plastic protective jacket whose dimensions are 60 × 54 × 3·6mm (see Fig. 1). Its weight is 8·7g.

Conventional computer floppy discs have a magnetic layer that's composed of ferric oxide. Instead, the video floppy disc has a coating of metal powder. This increases the coercivity and also gives a very high information packing density. The video floppy disc has a recording capacity of 1·5 Megabytes unformatted, 0·8 Mbytes formatted. Its recording density of 64KBPI (kilobits per inch) is way ahead of standard 3·5 and 5·25 inch computer discs, whose recording densities are around 9KBPI and 6KBPI respectively. The magnetic layer is four microns thick (the total disc thickness is 40 microns) with a coercivity of 1,250 Oersteds and remanence of 1,800 Gauss.

The disc can store a mix of audio, video and computer data as a series of concentric tracks (see Fig. 2). Each track is 60 microns wide, the track pitch being 100 microns. The disc holds a total of 52 tracks, but track 51 is not used. Fifty tracks store video images, audio signals and data while the 51st track (actually at track position 52), called the cue track, stores digital data. Each track has a 16Kbyte capacity. The recording radii of the main tracks are 15·1-20mm, the cue track radius being 14·9mm.

A fixed head that tracks across the disc's surface reads and writes the tracks. The head has two gaps, spaced 100 microns apart, to allow fast reading and writing of two tracks – the purpose of this arrangement will become apparent later.

Several features are incorporated in the disc and the drive unit to ensure that the head reads the correct track at the right point. First the disc hub contains a spring that holds the disc firmly to the drive spindle to prevent slippage. Stability is also ensured by incorporating a magnetic plate into the hub – it comes into contact with a magnet in the spindle. For accurate start positions when reading or writing the hub contains a pulse generator (PG) yoke and the drive a PG coil (see Fig. 3).

Recording

All SVCs use a solid-state CCD image sensor. This has an array of photodiodes that correspond to the image pixels (picture elements). Exposure to light charges the photodiodes. Horizontal and vertical CCD shift registers are used to scan the array, producing a sequential output signal. For more on solid-state image sensors see Steve Beeching's article last month. The image sensors used in most SVCs have some 400,000 pixels.

For PAL and SECAM systems the disc rotates at 3,000 r.p.m. while for NTSC the rotational speed is 3,600 r.p.m. These speeds correspond to one field period of the respective TV systems.

The video signal, see Fig. 4, consists of luminance and colour-difference (R − Y and B − Y) information. These three signals are frequency modulated and then multiplexed on to a single track. The deviation of the luminance carrier is 6-7·5MHz while the two chrominance signals have carriers with centre frequencies of 1·2MHz (R − Y) and 1·3MHz (B − Y). An alternate line chrominance recording system is used with the VFS format, i.e. the two chrominance signals are recorded on alternate lines. This method is similar to the SECAM TV system and helps to maintain picture quality during demodulation.

With the standard VFS format the horizontal resolution is around 360 lines, though with some cameras it may be possible to dispense with the chrominance carriers and extend the lower luminance sideband, producing monochrome images with slightly improved resolution.

SVC users can choose between two recording modes. In the field mode a single track is used to record the image, allowing up to fifty images to be stored on the disc. The penalty is a loss of vertical resolution. In the frame mode two tracks are used to record each picture. This halves the number of pictures recorded to twenty five. The two fields are recorded sequentially by the twin-gap head.

The VFS system has been designed to be very versatile.

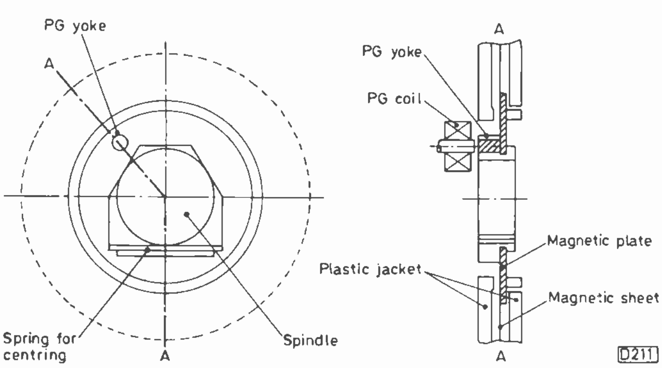


Fig. 3: The disc hub and drive spindle.

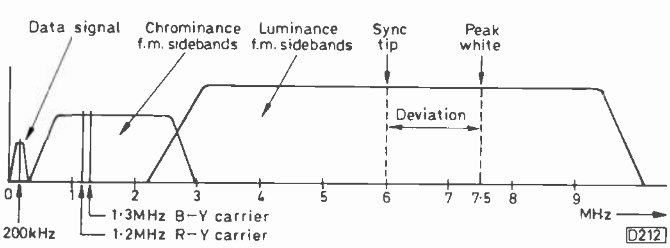


Fig. 4: Frequency spectrum of the recorded signals.

The Fujix ES-20 still video camera.

It's possible to record, erase and reuse specific tracks. Field and frame recordings can be mixed on the same disc.

Hi-band Format

The hi-band VFS system was developed to improve the picture quality and make the idea of still video more appealing to the discerning photographer. The frequency of the luminance carrier is increased and the deviation widened to 7·7-9·7MHz, increasing the horizontal resolution to 500 lines. As with the S-VHS system, hi-band cameras have dual-system capability, i.e. they will also store and reproduce pictures in the standard VFS format.

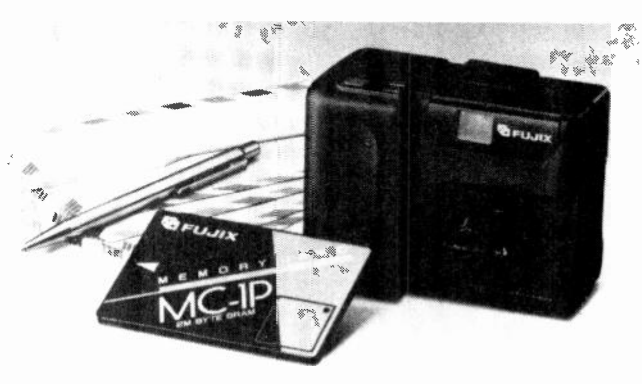
Several companies have produced hi-band still cameras using high-resolution image sensors with around a million pixels. Kodak recently announced the development of a four million pixel image sensor.

Unfortunately there's no agreed standard for making direct picture quality comparisons between still video and film. Electronic companies estimate that a colour 35mm photograph has a resolution equivalent to three million pixels while film companies put the figure at nearer twenty million pixels!

Multiplexed Data

It's possible to multiplex digital data on to the video track in addition to the composite video signal. As a result text or numerical information can be added to the video image. The data is recorded at the same time as the video signal.

Four groups of data can be added: (1) the track number; (2) the date of recording in year, month and day;



The Fujix DS-1P digital SVC, with storage card.

(3) field/frame identification; (4) user's specification. This latter information is at the discretion of the manufacturer and can include such things as the exposure value, shutter speed and whether the recording is standard or hi-band. Because this user data is not standardised a disc recorded by one maker's camera may not display some or all of the user information when reproduced via another maker's equipment.

The data stream modulates a 200kHz carrier (see Fig. 4). A form of differential phase shift keying (DPSK) is used. With this system each phase change represents a binary digit (bit) – the Nicam stereo sound system uses a variant of DPSK in which each phase change represents two bits.

Audio Recording

There's provision within the VFS system for short audio recordings, though not all SVCs will offer this facility. It enables users to accompany the video images with narration, music or sound effects. Since the video tracks are already hard pushed to accommodate the luminance and chrominance signals, and because of the possibility of interference, the audio signal is recorded on a separate track. This means that only up to twelve frame or twenty five field images can have sound accompaniment.

To make an audio recording in the time equivalent of one disc rotation, i.e. one fiftieth of a second with the PAL system, time compression has to be used. The recording process is shown in block diagram form in Fig. 5. The analogue audio signal is filtered and then passed through a 2:1 companding noise-reduction system. Time compression is then applied. The system works as follows. After analogue-to-digital conversion the signal is stored briefly in a random access memory, being read out at a faster rate. The difference between the read-in and read-out rates determines the compression ratio. A flag control code is added as a marker for the compression ratio. After digital-to-analogue conversion, pre-emphasis is applied and the signal is then fed to an f.m. modulator, the centre frequency being 6MHz. The output goes to the record amplifier and is then recorded on the disc. Quite a lot of technology here! The playback process is the reverse of course.

There are three specified compression ratios, though most SVCs that incorporate audio recording will offer only one. For the PAL system the agreed ratios are 1:272, 1:544 and 1:1,088. These give around five seconds of 10kHz sound, ten seconds of 5kHz sound and twenty seconds of 2·5kHz sound respectively. The NTSC ratios are 1:320, 1:640 and 1:1,280. Sony has a professional NTSC model that can replace the video tracks with 480 seconds of 5kHz sound.

Data Tracks

Storage of tracks of digital data is also written into the VFS specification. At present the only data-only track is the cue or data control track which is used to control the playback order, text or number superimposition, audio recording etc. Future models however may allow for a mixture of computer programs, video, text and sound on a VFS disc.

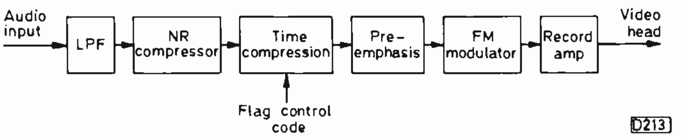


Fig. 5: Block diagram of the audio recording system.

Hardware

The features and specification offered by a particular SVC are, not surprisingly, determined by its price. Basic models have a fixed focus lens, auto white balance, auto exposure, auto flash and even field only recording. Playback is via a still video player or adaptor. Upmarket models may offer field/frame recording, a zoom lens (typically ×3), an auto timer, fast shutter and high-speed shooting operating at some 3-10 frames per second. Other possible features include sound and data recording and integrated modulators to allow instant playback via a TV set.

Most recorders and players will be equipped with a variety of sockets to allow interfacing with a number of items including a camera, TV/monitor, computer, printer, modem and VCR. TV/monitor socketry is likely to include provision for r.f., composite video, RGB and S-terminal.

Playback can vary from simple display to audio dubbing and digital effects such as multiple image display.

High-quality video printers are very expensive, the prices running into thousands of pounds. Thus SVC users are likely to take their discs to local dealers if they require hard copy print-outs.

There are several ways of printing video images. The sublimate dye thermal transfer line printing system brings ink paper and cartridge paper into contact with each other. Heat is then used to transfer the dye to the plain paper. The contact exposure system shines light from a fibre-optic tube on to photosensitive material to produce the image. Konica estimates that a single hard copy print should cost around Y100 (50p).

Digital System

At last year's Photokina Fuji produced a surprise in announcing a prototype SVC that didn't conform to the standard VFS format. The Fujix DS-1P is an all-electronic camera that uses a 16Mbit RAM card instead of a floppy disc. Thus the image is stored in digital rather than analogue form. The card can store ten field or five frame images, although Fuji says that compression techniques could increase this to forty frame images. More recently Fuji has announced a cartridge system that holds five RAM cards, giving 25 frame recordings or 50 recordings in the field mode.

The advantages of digital storage are many: no moving parts to wear out, no image deterioration during copying, and easy interfacing with personal computers and other electronic equipment. The snag is that the compression techniques required are expensive. Thus it may be years before consumer digital SVCs become viable. By that time the analogue SVC will probably be firmly established in the market. As the VHS/Beta/V2000 format battle clearly illustrated, it isn't always the most advanced technology that wins in the end.

Acknowledgements

My thanks are due to Mike Maclachlan, Technical Support Manager, and Gary Godfrey, Senior Product Engineer, of Sony UK for their assistance in the preparation of this article.

Long-distance Television

Roger Bunney

With the intense solar activity, one of the biggest auroras for many years was seen in March. There has naturally been good F2 reception, with a sprinkling of Sporadic E signals and a touch of tropospheric activity. Certainly a lively and interesting month. The winter/spring of 1989 has produced for us an active spell during a period that's normally quiet if not worse. The sunspot maximum for the present cycle is expected to be this December, with a smoothed estimated count of 190. So to the general log for the period.

5/3/89 F2 layer reception from Iran ch. E2, Malaysia. ZTV (Zimbabwe) ch. E2, GBC (Ghana) ch. E2, TSS (USSR) ch. R1 plus unidentified ch. E2 signals. Tropospheric reception produced signals from ORF (Austria) chs. E5 and E24, Switzerland chs. E6, 7 and 34 plus TDF (France), RTL+ (Luxembourg), Belgium and Holland in Band III and at u.h.f.

6/3/89 F2 reception from VOK (Kenya) ch. E2, Dubai E2, ZTV E2. SpE signals from YLE (Finland) in chs. E3 and 4.

7/3/89 F2 reception of TSS ch. R1 plus unidentified ch. E2 signals.

8/3/89 Unidentified F2 signals from the east in the early morning and the south at midday in ch. E2, plus TSS R1.

10/3/89 F2 reception from Dubai E2, VOK E2 and ZTV E2. SpE reception from TVE (Spain) chs. E2, 3 and 4. Improved tropospheric conditions with Band III and u.h.f. signals from TDF plus suspected Basque TV on ch. E35.

11/3/89 Tropospheric reception as on the 10th.

12/3/89 Unidentified F2 signal from the south east, ch. E2.

13/3/89 F2 reception from TSS R1 and VOK E2. Also major auroral event, see later.

14/3/89 Auroral event continues.

16/3/89 F2 reception from ZTV ch. E2.

17/3/89 Minor aurora with unidentified ch. E2/R1/E3 signals.

19/3/89 F2 reception from Iran ch. E2 midday.

20/3/89 F2 reception from Iran (IRIB) ch. E2 and Dubai ch. E2. Unidentified SpE signal in ch. E2.

22/3/89 F2 reception of PM5544/5534 test patterns floating/fighting, thought likely to be ZTV/VOK.

23/3/89 SpE reception from TVE E3 and RAI (Italy) ch. IA.

24/3/89 Unidentified ch. E2 and TSS R1 signals via F2 at 0700 GMT.

25/3/89 F2 reception from Dubai ch. E2.

30/3/89 Major tropospheric opening with signals from West and East Germany, TDF and the Benelux countries in Band III and at u.h.f. The new RTL+ ch. E36 outlet was well received in the south east.

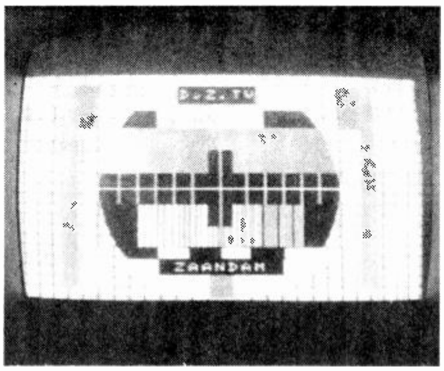
31/3/89 Tropospheric reception as on the 30th.

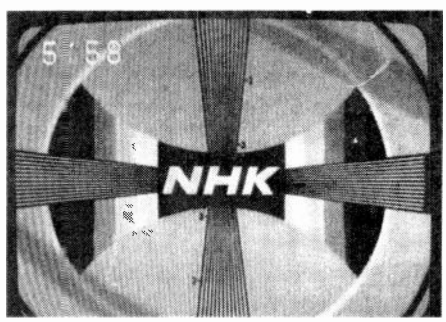
There was daytime F2 reception throughout the month starting from around 0800 GMT, with typically signals from the farther areas of Russia, then from Malaysia and Iran (often noted with the FUBK test pattern), Dubai with teletext pages, VOK with the PM5544 pattern and ZTV with the PM5534 pattern. It appears that a ch. E2 third network transmitter is in operation in Malaysia – Garry Smith noted a suspected caption on March 5th. Ghana ch. E2 was seen on the 4th with a "darkish" variation of the FUBK pattern, very distinctive.

The auroral event on the 13/14th was spectacular both visually and in terms of v.h.f. reception. One could see it with the naked eye even in the south. Simon Hamer (Powys) described it as a hillside fire in the sky. The v.h.f. results were extraordinary. For many enthusiasts simply aiming an aerial towards the north produced incredible levels of interference in Bands I and III, so much so that signals were often impossible to resolve. Radio effects extended throughout Band III and Ryn Muntjewerff (Holland) noted evidence of low-level signals at the lower Band IV frequencies. For the persistent, signals could be resolved. Simon Hamer identified TSS chs. R1, 4 and 7, RUV (Iceland) ch. E3, SVT-1 (Sweden) chs. E2, 3, 4 and 8, NRK (Norway) chs. E4 and 5, DR (Denmark) ch. E7, ARD (W. Germany) chs. E9 and 10, DDR (E. Germany) ch. E12, TVP (Poland) chs. R2 and 3, RTE (Ireland) chs. B, D, F, G, H, I and J. Many other signals were unidentified, including a 525-line one on ch. A2 (North American). The TV signals were fair/poor with much distortion and hum. Optimum reception was with the aerials pointing to the north east.

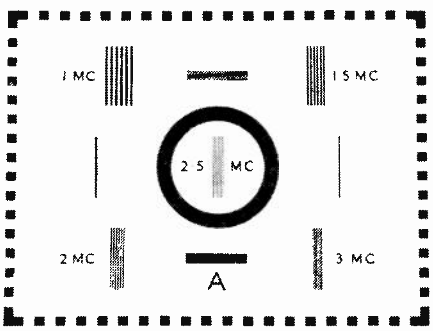
In Australia Anthony Mann (Perth) experienced the southern version of the aurora, which he describes as "spectacular" with the visual effects reaching to an elevation of 50-60° and to ±50° of due south. The event lasted from 1130-2130 GMT with a three-hour gap between the two phases (1300-1600). It was seen throughout New Zealand and as far north as Queensland, with many white vertical streamers. Garbled interference was noted in ch. R1 but there were otherwise no signals.

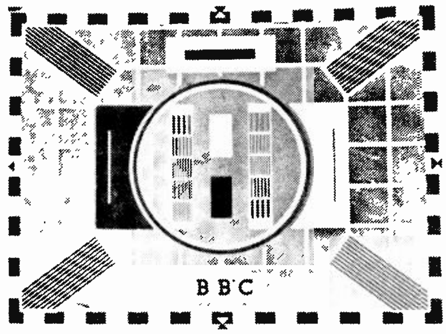
Cyril Willis (King's Lynn) comments that March was "the best I can remember", with F2 signals on most days. His most dramatic reception was a definite sighting of China chs. R1/C1 on the 5th at 0957 GMT, with athletics. He noted Malaysia ch. E2 and many other unidentified signals at this frequency – four separate E2 carriers were

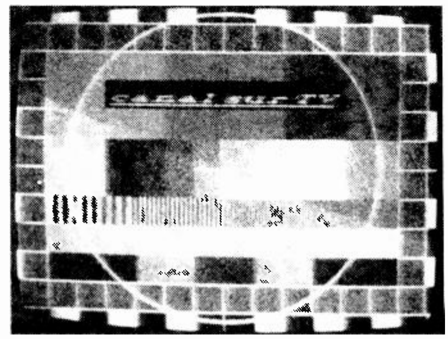




Left: Test pattern used by a Dutch pirate TV station, on ch. E2. Centre: Dortmund ch. E48 "Local TV" caption. Both photos courtesy Ryn Muntjewerff. Right: The Japanese NHK test card, courtesy Fred Robins, Stubbington, Hants.







Left: Vintage TV – Test Card A, the BBC's first one. Centre: Test Card C, used by the BBC from 1948-1964. Can anyone fill the gap by providing any information on Test Card B? Photos provided by HS Publications. Right: The Canal Sur TV test pattern seen in Gibraltar on ch. E65 originates from Mijas. Photo courtesy George Gaskin.

noted at one particular time. Robert Copeman in Australia (Victoria) also noted good F2 reception, with RTM (Malaysia) ch. E2 on the 18th. Nearby, Todd Emslie logged F2 reception on several days, with China chs. C1 and R1 (several transmitters) on the 15th and RTM/China on the 17/18th.

Mike Foubister (ZL3TIC) in New Zealand uses an upmarket receiving system consisting of a 22-element log-periodic aerial with integral GaAs f.e.t. tuned preamplifier covering 40-110MHz. He noted considerable Pacific/North American traffic in the low v.h.f. band. Of some importance to us is his list of the following transmitter offsets – essential for positive identification. Timaru TV2 (South Island) 45·24MHz vision, 50·74MHz sound. Wellington TV1 45·25MHz vision, 50·75MHz sound. TV2 Far North 45·26MHz vision, 50·76MHz sound. In addition ABC-TV Wagga Wagga (Australia) has 46·24MHz vision, 51·74MHz sound while TVQ0 (Brisbane) has 46·17MHz vision, 51·67MHz sound. Incidentally we've just heard that DDQ0 ch. 0 Queensland now has stereo sound on 51·91 and 51·67MHz – this corrects the details given in the April column.

All in all then an excellent month. The sunspot count was over 200 on the 20th, and despite the severe magnetic storms on the 13/14th F2 remained active. It all looks good for autumn F2!

It seems that Belgium may be testing for a new service, possibly Belgian Canal Plus – Anderlues has been seen testing with an identified ch. E58 test card on a 24-hour basis.

My thanks to the following for sending in reception reports: David Oliver (Birmingham), Peter Schubert (Rainham), Simon Hamer (Powys), Mark Baldwin (Rugby), Garry Smith (Derby), Tim Anderson (St. Leonards), Cyril Willis (King's Lynn), Roger Fussel (Torpoint) and Ryn Muntjewerff (Holland).

News Items

USA: A committee of ch. A2 broadcasters is being established. This particular channel suffers badly from SpE interference and the use by viewers of poor aerials. One proposed move is to tilt the transmitted beams below the horizon to reduce skywave radiation, and to seek FCC approval to lift transmitter powers by 3-4dB to compensate for the loss of signal quality in fringe areas. Discussions are also to be held with manufacturers of domestic aerials with a view to improving low-band performance.

The CIA sponsored Radio Marti service is intended for Cuba, operating in the medium-wave band. Thought is now being given to the start of a TV Marti service operating in ch. A7. The transmitter would be atop a captive balloon at 10,000ft, sited in the extreme south of Florida. US broadcasters are not too happy about the prospects of co-channel interference and have objected to the FCC.

West Germany: The BDXC reports that new transmitters are planned as follows: NDR-1 Hamburg ch. E26, 20kW e.r.p.; Niebull ch. E29, 100kW e.r.p. Both will carry the regional programme from Kiel.

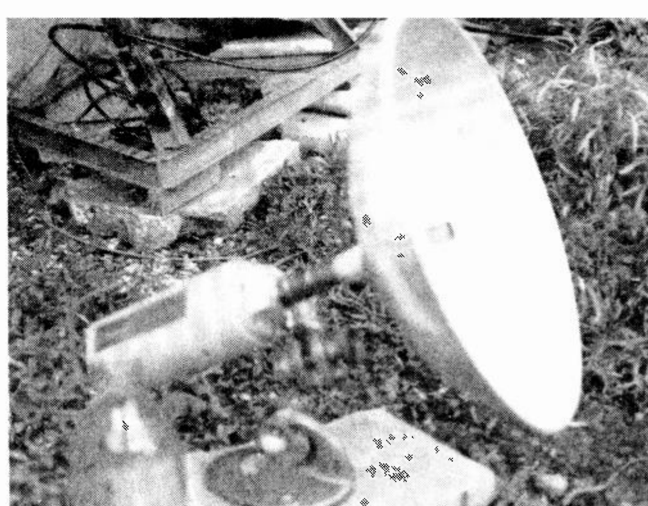
The satellite SAT-1 service is transmitted from Aachen on ch. E27 at 0·1kW. This station also transmits RTL+ on the adjacent ch. E26, at the same power.

Ireland: New information sheets are available free of charge from RTE, Reception Investigation, Donnybrook, Dublin 4. One sheet covers the RTE radio network transmitters while the other covers the community-owned TV schemes in operation at January 1st.

DIY Satellite TV

From time to time we receive letters describing quite remarkable reception obtained using novel equipment/techniques. Recently we received a long letter from Paul Matthews in Surrey describing, amongst other things, his 11GHz satellite TV reception using a 31cm Chinese wok lid and a system that includes water pipe, kitchen foil and plasticine. This has given him Astra signals and TDF-1 at 19°W. It's evident that we have a genius amonst us! Paul has been invited to contribute articles describing his equipment and we look forward to reading about it.

The Chinese wok lid, with wooden knob, was pur-



Paul Matthews' wok dish system brings in signals from Astra and TDF-1, the latter completely noise free.

chased for £2 in 1987 from Lee Fook Domestic Electrical Supplies, 25 Wardour Street, London W1. It has a diameter of 31cm, a focal point of 72mm, and was adapted for Cassegrain feed by means of a 22mm length of copper water pipe with a 40mm diameter disc suspended at one end using 16g copper wire. Plasticine was added to the disc, covered with aluminium foil, to form the reflector. Focus is adjusted by means of a 22mm water pipe coupler plus flange screwed to the back of the dish. A transition flange is made from a flattened coupler to provide a link to the LNB.

With a 1·6dB noise LNB and a home-constructed receiver with 18MHz i.f. bandwidth just sparklie-free signals are obtained from Astra, though saturated colours tend to be noisy. The 62dBW TDF-1 signals give completely noise-free reception, stable picture display with the MAC coding being obtained by means of a home built sync inserter. This is based on an SAA5020 sync divider and a 6MHz crystal, with varicap diode control.

Paul has seven dishes at his satellite receiving station. In addition to the wok there are ex-Jumbo Jet 75cm radar dishes, a home-made 5ft petal dish for Gorizont at 4GHz and others covering various bands.

One project we hope to feature uses a cheap u.h.f. TV tuner to downconvert Astra signals to 600-800MHz for distribution to up to six receivers, using cheap coaxial cable and simple i.c. technology. Briefly, the output from a 2·2dB noise LNB is downconverted using a BFY90 multivibrator and HP2800 Schottky diode. At the receiver a standard tuner (e.g. ELC1043) provides an output at 70MHz which, via a 22MHz bandpass filter, is fed to an MC10116 limiter/amplifier, MC1496 demodulator, 72733 video amplifier, NE564 clamp and then a PLL, sound demodulator etc. We look forward to hearing more about this.

EBU Transmitter Listings

France: Carcassonne TDF-6 (M6) ch. E43, 300kW; Auxerre TDF-6 (M6) ch. E49, 100kW; Sens TDF-3 (FR3) ch. E50, 20kW; Toulon TDF-5 (La 5) ch. E57 and TDF-6 (M6) ch. E60, both 50kW. Polarisation is horizontal in all cases.

Syria: Haddar (Ortas-1) ch. E4, 0·2kW horizontal – one for the optimists!

We understand that the Siedlce TVP-1 (Poland) service has been transferred from ch. R1 to ch. R52.

Satellite News

Things move quickly in the world of satellite TV. This unfortunately means that items we publish may be history by the time they are read. There are rumours that a new Intelsat craft is to be launched soon at 30°E, carrying several 11GHz downlinks. At 16°E ECS-F1 has been carrying ITC Stockholm tests at 11·47GHz horizontal, with programming from time to time. Italian outside broadcast links have been seen via ECS-F5 at 10°E and about 11GHz horizontal. The Intelsat craft at 27·5°W is at present transmitting a high-level blank carrier. This was formerly used by MTV and is shortly to be used for the new scrambled BBC European all-day service which you too can view at £270 for the first two years, including a new decoder. It seems that this service will not use the Sat-Save scrambling system.

PanAmSat at 45°W was seen carrying the 259th Mormon Conference from Salt Lake City live on April 1st, with 625-line PAL on the second of its three Ku band transponders. This transponder has previously had occasional use, e.g. for the US elections, generally with System M video. The Mormon Conference was broadcast with English sound on a 6·6MHz subcarrier and German sound on a 5·8MHz subcarrier.

Hugh Cocks reports from Portugal that the vertically polarised Astra transmissions are well received there using 1·5m dishes. The horizontally polarised transmissions are some 10dB down however, calling for a dish of 3m or more to provide adequate quality reception.

The Russian Ekran (window) satellite series is now providing two services. The original 714MHz (ch. 51) service is captioned "Orbita III" and provides time-shifted Moscow TV transmissions. It's intended for Siberia and the far north but can be received at good strength across most of India using appropriate Yagi aerials. In India, programme times are approximately 0500-1100 and 1400-2300. A new service at 754MHz (ch. 56) provides a further time shift to 0230-0900 and 1130-2100 Indian time. It's captioned "Orbita II" and carries the same programming, apparently intended for the extreme north east of the USSR. As a result signal levels in India are somewhat lower. Test transmissions lasted for a month until the service started at the end of February. Nanda Kumar (Madras) has seen reference to a "Global Antenna" that would bring Russian TV services to the farthest corners of the world. This was in a locally circulating Russian magazine, *Science and Technology* (February 1989 issue). The standard would be SECAM with a 6·5MHz sound subcarrier. Does anyone have further information on this proposed service? It seems that the Gorizont series will be carrying 11GHz Russian TV services to the USSR and Eastern Europe in due course: could this perhaps be the service referred to?

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Paul Hardy, Hugh MacMullen, Ian Bowden, Nick Beer and J.R. Armagh

ITT CVC1200 Series Chassis

For low h.t. at 90V instead of 145V check whether the pulse feedback transformer Tr712 in the switch-mode power supply is open-circuit. You get the same effect when the line output stage isn't working, for example if the line driver stage is inoperative because the h.t. feed resistor R744 is open-circuit. **P.B.**

Philips K35 Chassis

This set was dead with no 140V h.t. supply. The 12V feed to the power supply was low and was being dragged down by the wire connected to pin 3 of plug M2. This led us to the TRD4 panel where plugs V25 and V23 had accidentally been swapped over. . . Be careful to mark the plugs as you disconnect them — there are six white two-pin plugs that go to this module and it's easy to get them mixed up. **P.B.**

Philips 2A Chassis

This set was dead. On investigation we found that the protection thyristor 6727 had fired because the voltage at L5601 in the EW modulator circuit was too high. We noticed that C2608 (4·7μF) was missing, but a check on a few stock sets showed that this is not fitted in models that have 45AX tubes. All the flyback tuning components and supplies were o.k. Attention was then turned to the EW modulator, where the driver transistor Tr7599 (BD234) was found to be non-conductive. D.C. checks revealed that R3598 hadn't been pushed through the print at the factory. **P.B.**

Philips CTX-E Chassis

This chassis normally uses a TDA2577 as the sync/field generator chip. Don't try a TDA2577A in this position – you'll end up with excessive height. **P.B.**

Philips CP90 Chassis

For field collapse check whether R3623 (8·2Ω) is open-circuit. This removes the 163V supply to the base circuit of Tr7571 in the field output stage. R3623 is by the line output transformer. **P.B.**

Philips CTX-E Chassis

There was no picture – just a blank raster when the brightness control was turned up. The voltage at the TDA3560 colour decoder chip's contrast control pin 7 was low at 1V because C2565 (39nF) in the beam limiter circuit was open-circuit. **P.B.**

Grundig GSC100 Chassis

This set had horrible field linearity problems. A check revealed that the supply to the field timebase panel was low at about 11V, but changing the TDA1170 chip made no difference. Voltage checks in the line output stage showed that several of the supplies were a bit low, though not significantly. When the field module was powered by a separate 18V supply the scanning was correct, so the problem was a supply one. It eventually transpired that fuse Si627 had gone high-resistance, though not high enough to show on my initial meter check. This fuse is between rectifier diode Di627 and its reservoir capacitor C628 and was thus limiting the peak current into C628. **P.H.**

Toshiba C2085, C2090/Rank T24 Chassis

This set was actually a Toshiba C2090. The fault was intermittent colour. Changing the colour decoder chip IC501 made no difference and meter checks were inconclusive, so the scope was brought into action. This revealed that the line pulses at pin 4 of IC501 didn't look too healthy, though the manual doesn't show the waveform. On checking back to the source of the pulses I found that R229 (3·6kΩ) on the main panel was virtually open-circuit. For those of you who may be interested, the waveform would appear to be about 1·5V peak-to-peak with nice straight sides and tops! **P.H.**

Philips K40 Chassis

This set had field linearity problems at the top of the picture, with teletext lines visible. While investigating the cause of the trouble the TDA3650 field timebase chip blew up. After replacing it along with the safety resistor R3186 I powered up the set, having made a few more checks and sensing victory. You've guessed of course, the TDA3560 and R3186 both failed. After extensive checks in the field output section of the circuit I eventually found that C2107 (100μF, 63V) had gone low in value. Replacing this provided a complete cure. **P.H**

Philips 2A Chassis

This set would switch off after exactly twenty minutes and no amount of tapping would bring it back to life. When the fault was present there appeared to be a short between pin 17 of the line output transformer and chassis. A freezer test eventually showed that C2609 (9·1nF) was short-circuit when warm. Normally this capacitor cracks and goes black, giving a visible clue. **H.MacM.**

Panasonic TC261G

The problem with this set was very low h.t. We found that D812 (SV03) in the self-oscillating switch-mode power supply had gone very high-resistance while the d.c. amplifier transistor TR802 (2SA636) was short-circuit. **H.MacM.**

ITT CVC1210 Chassis

This set came in with very intermittent sound and vision. After a few minutes the fault disappeared and no amount of tapping would bring it back. The cause was eventually traced to glue on pin 32 of the tuner/i.f. module (CMR800/3). This glue is used in some quantity to secure

C1075 (2,200μF) in position and had spilt on to the contacts. **H.MacM.**

Salora M Series

This set was completely dead, with the 2AT mains fuse and the 2·2Ω, 5W surge limiter resistor RB701 both open-circuit. I spotted the cause of the breakdown as soon as the back cover was removed – CB705 (680pF) hadn't been fitted correctly during manufacture. Only one end was soldered through the board, the other end resting on the surface of the PCB. As this capacitor is part of the snubber network across the primary winding of the combi-transformer it wasn't surprising to find that the chopper transistor TB701 (BU603) was short-circuit, hence the blown fuse and surge limiter. Zener diode DB709 (12V) in TB701's base circuit had also failed. TB701 was in fact shorted between all its connections. When these various items had been replaced, with the capacitor fitted correctly, the set was restored to correct working order. **I.B.**

Panasonic TC2205 (U2 Chassis)

After several hours' use a dark area would appear across the bottom of the screen. The size of this area increased with time, moving upwards to obliterate more of the picture. If the contrast control was set to maximum the darkness would retreat back to the bottom again. Use of a hairdryer and freezer enabled us to prove that the field output chip IC401 (TDA1104SP) was the cause of the problem. **I.B.**

Salora J20 Series

At switch on this set would start up on channel one as normal. It couldn't be shifted by using either the remote control unit or the on-board buttons however. We found that if the standby button on the remote control unit was held down the channels could be changed normally. When this button was released the set stuck on the selected channel. The remote control decoder/set keypad encoder chip ICC9 (SAA1251) was suspected and when it was replaced the fault had cleared. **I.B.**

Tatung MQ7703

The problem with this monochrome portable was no results and a quick check on the 12V rail showed that the voltage was less than 5V. Checking the regulation and removing the loads proved fruitless. I eventually found that the line output transformer had a short-circuit winding. **N.B.**

B and O MX2000

A colleague was dealing with this set, the initial problem being severely reduced height. The cause was soon traced to IG01 (TDA4950) which was short-circuit internally and RL28 (1·5Ω) which had gone high in value. This situation is not unknown. Destruction of these devices is nearly always caused by dry-joints on the EW modulator diodes DG05/6. He attended to this and was rather distressed to switch on and find that there were severe EW distortion problems – the picture was bowed in significantly at either side and the correction controls had no effect. He rechecked the diodes and their joints, changed a resistor that had gone slightly high in value, then checked other likely items. Getting even more upset and being already harassed by a number of Pioneer compact disc players that wouldn't set up very well he asked me to take a look.

Bearing in mind my colleague's thorough and logical checks I took the view that the fault was probably due to something unusual. A scope check on the three relevant waveforms showed that they were all of excessive amplitude. So it seemed to me that the series coil LG02 had to be short-circuit or low-resistance, which proved to be the case. **N.B.**

Hitachi CPT1646 (NP84CQ Chassis)

This was a new set. When we tried to tune in the stations the raster would suddenly flash white and the video vanish as the correct tuning point was approached. The field blanking period would then roll down the screen and a moment later a normal picture would return. This effect pulsed on and off about once a second. Reducing the brightness and contrast control settings was not very helpful and it was impossible to store any station in order to make a detailed study of the a.g.c., a.f.c. etc. While attempting these latter two checks we got hum bars with wavy verticals and weak contrast between the bars. This effect disappeared as quickly as it came and didn't return.

Lengthy checks were made on the decoupling and we discovered that reducing the first anode voltage from 470V to 440V markedly improved matters, though the picture was then too dark. Flicking the contrast suddenly to fully up seemed to provoke the fault, while on low contrast scenes reducing the contrast and brightness way down cleared it. These things suggested a fault in the beam limiter circuit. Replacing D702 and D703 improved matters noticeably but didn't provide a complete cure. C718 (10μF, 50V) measured o.k. on the Avo but fitting a replacement finally cured the bother. **J.R.A.**

Philips KT3 Chassis

Odd symptoms with this set: when switched on from cold there was intermittent line failure, the "squegging" wriggle flashing down the middle, and tripping occurred. Everything was o.k. once the set had been persuaded to warm up. Not dampness nor corona. In fact two dry-joints on the degaussing posistor. When cold the posistor conducts hard, the pulsing load doing the rest. **J.R.A.**

Hitachi CPT2250/Salora J40 Series

This set's front controls worked all right but there was no remote control of the brightness. Also there was a marked irregular variation in the black level of not only the brightness (luminance) but also the red.

We took these two faults one at a time despite the temptation to assume that there was a single cause. Pin 11 of the video chip ICB200 showed no d.c. variation when the remote control was operated, nor did pin 2 of ICB9 on the control panel. Replacing ICB9 cured this fault.

The second fault was eventually found to be caused by dry-joints on the attachment legs of the metal screen in the video section, above the c.r.t. neck on the main chassis. This screen is in fact part of the link between the red black-level potentiometer and the other video resistors to chassis. Adding flux and solder cleared this one up. The arrangement in the Salora J40 is not quite the same but would be worth checking in the event of this type of trouble. **J.R.A.**

Teletopics

SATELLITE TV PROSPECTS

The findings on consumer interest in satellite TV contained in Ferguson's second annual report on the UK consumer electronics market created quite a stir in the industry. The report focused on satellite TV as the next major marketing opportunity. It found that 14 per cent of those interviewed were interested in receiving the new satellite TV channels (4 per cent very interested, 10 per cent fairly interested while 58 per cent were not at all interested). However only one per cent stated that they would buy a TVRO installation this year while two per cent said they would probably buy one. Forty four per cent of those with an Astra installation were likely to buy a VideoCrypt decoder for the Sky Movie channel.

The Ferguson research found that because of the two competing and incompatible systems most of those interviewed indicated that they intended to wait to see how the services developed. Ferguson concludes that the satellite TV market is unlikely to be as large this year as the broadcasters had predicted. A more optimistic view is held of the future: Ferguson points out that the prices of satellite TV equipment are comparatively low and suggests that the market should grow faster than video in its early days. Ferguson's satellite TV consumer offtake forecasts are 400,000 installations this year, 1·2m in 1990 and 2m in 1991.

Sky's own research shows that over 60,000 households are now receiving the Astra transmissions direct. The company has investigated the supply of dishes/receivers and believes that some 200,000 should be available by late May. As a result a national advertising campaign has been launched. On the advertising side the company has made almost half its sales staff redundant.

BSB intends to make available receiver kits for DIY installation. The kits will include a receiver, a Squarial and some aids for DIY installation. It's understood that the Squarial is somewhat less sensitive to alignment inaccuracies than an equivalent dish. People don't seem to be having all that much difficulty with dishes come to that – and there's a report that Stan Bacon, who runs a TV shop in Andover, Hants, has done what we all joked about, received Sky TV using a steel bin lid. For some information on the use of a wok, see Roger Bunney's long-distance TV column.

VIDEO NEWS

A CCD colour video camera module has been announced by Philips Components. It has an image sensor with 450,000 pixels and can operate satisfactorily at light levels down to 0·45 lux. Simply adding a lens, chassis and case should enable manufacturers to produce cameras to sell at around £400. The module weighs 150g and measures 195 × 42 × 48mm.

A new addition to the Philips range of VCRs, Model VR6182, is of interest in incorporating teletext and the ability to record subtitles. The suggested retail price is around £380.

Panasonic has released a Super VHS-C camcorder equipped with hi-fi sound. Model NV-MS50B has a suggested price of £1,400. Its other features include a ½in. 420,000 pixel image sensor, a piezo auto focus system with three-zone select, three-speed fast shutter operation, audio dubbing, insert edit, VISS marking, a self-timer and interval record.

Sanyo is to launch a Hi-band Video 8 camcorder this November. Model VMH100P has a claimed horizontal resolution of over 400 lines, which compares with 270 lines for standard Video 8 equipment. Other features will include stereo f.m. sound, a ½in. 390,000 pixel CCD image sensor, three-speed fast shutter operation and a stereo microphone. The price is expected to be around £1,300.

Mitsubishi is to invest £7·5m on increasing the output capacity at its VCR plant in Livingston, Scotland. About 200 jobs will be created. The aim is to increase the output capacity to 500,000 machines a year by 1992.

40 YEARS OF THE BATC

This year is the fortieth anniversary of the British Amateur Television Club. It's publication *CQ-TV* first appeared in October 1949, when the circulation was 25 copies. The club now has several thousand members and is very active. Membership is only £6 a year and includes the excellent *CQ-TV* magazine. Anyone interested can obtain details from Dave Lawton, G0ANO. "Greenhurst", Pinewood Road, High Wycombe, Bucks HP12 4DD. Our best wishes to the club for its next forty years!

LATEST TV SETS

Models using the new G90 chassis have been announced by Philips and Pye. This chassis is being produced initially in Italy and is of particular interest in making extensive use of surface-mounted components. The first models have 19 and 21in. tubes, on-screen display functions and a sleep timer facility which enables the viewer to programme the set to switch itself off within a ninety minute time block, in fifteen minute segments. There are text and non-text versions. Sets with 15 and 17in. tubes are to follow and in the autumn sets fitted with the 110° version of the chassis (the G110) will be introduced.

Sanyo has released advanced details of its 32in. Model CBP3272. Features will include a Dolby Pro-logic decoder for surround sound effects, a Nicam decoder, five speakers, a flicker-free picture, fastext, multistandard (PAL/SECAM/NTSC) operation, twin scart sockets, an S terminal and an auto switch-off timer. The launch date is January 1990 and the provisional price is £2,300.

THIRD IRISH TV SERVICE

The go-ahead for a third TV network, TV3, has been given by the Irish Independent Radio and Television Commission. The service will be based mainly on cable networks and local microwave transmissions and will be operated by the Windmill Hill consortium. TVS Entertainment and Ulster Television are involved in the project. The service is expected to start next spring and will be financed by advertising.

The Irish government is shortly expected to announce the first microwave TV service, broadcasting eleven channels to an area with a radius of thirty miles.

NEW PRODUCTS

P.D. Systems International Ltd., Estate House, Pool Close, West Molesey, Surrey KT8 0RN has introduced the LineLok, which enables individual TV lines to be reliably displayed on an oscilloscope. By means of thumbwheel switches one of up to 1,250 possible lines in the display (interlaced or non-interlaced) can be selected. The unit works by providing a pulse for the scope's external trigger input. The unit is battery powered for portability and uses PLL circuitry to eliminate jitter. Price is £340 plus VAT.

Rendar Ltd., Durban Road, South Bersted, Bognor Regis, West Sussex PO22 9RL has introduced a comprehensive range of quality BNC, TNC, F and MIL-specification N connectors manufactured in Japan by Marushin. The firm also has a large selection of adaptors to make cross-connection between different types of connector easy.

Litesold has introduced the Project ETC-5 range of soldering stations with electronic temperature control. There are three models, Viper (20W), Cobra (50W) and Mamba (80). Each has its own dedicated soldering iron with the 5-pin DIN plugs differently wired to prevent damage from wrong insertion. All control units are housed in similar enamelled steel cases that provide full screening and earthing. For further details apply to Light Soldering Developments Ltd., Spencer Place, 97/99 Gloucester Road, Croydon CR0 2DN.

Schlumberger has introduced a new signal generator for testing D-MAC and D2-MAC packet transmission paths and reception equipment. The SI7765 provides comprehensive test patterns and signals to EBU specifications to simplify installation and maintenance of DBS equipment. The price is £4,300-£5,950 depending on the facilities incorporated. A colour brochure is available. For further details apply to Schlumberger Technologies, Instruments Division, Victoria Road, Farnborough, Hants GU14 7PW.

Here We Are Again!

Les Lawry-Johns

Yes, we're still here, but I wonder for how long?

It's thirty five years since I wrote my first article for *Practical Television*, as this magazine was then called. It was the first one in the "Servicing TV Receivers" series. Seems only yesterday, honest. Many of my articles over the years have appeared under pen-names, such as S. Simon. Did you get the joke I wonder? Simple Simon you see! When I read some of those articles now I'm quite surprised. Did I really know all that? There was also Peter Gaymead Frazer and, going back to earlier days, N. Mead. So I must have been a clever fellow, though I didn't realise it.

There must be many of you who can write a lot better than I can and haven't yet reached the winding down stage. You will though. It seems that in my case I've done so much earlier than most people do. I find myself doing daft things but there have been no complaints so far – except from that lady who is going to sue me for chucking out her set after she told me she didn't want it done as it was going to cost thirty quid to replace the tripler etc. and then left it for some time in the shop. She still hasn't returned the set I gave her in exchange and I do wish her solicitor would stop writing to me. I've told him I'm trying to get a white portable, Thorn 9900 chassis, with remote control sticking out the front, but they seem to be a bit thin on the ground. Frankly I'd thought it was the 9000 chassis, but Keith and Alex put me right about that – they popped up from Portsmouth the other day. I've not been right for a long time, which is perhaps why I've not yet sold this shop though I've bought a bungalow and am now in debt to the bank because of a bridging loan. Not for long, I hope.

Sets still come in, though there are very few of them. I never got around to taking in videos for repair. The family's videos, including our own, are taken to Geoff's at Moon Lane for repair. Geoff isn't upset by this as he too is short of TV repairs. I suspect that there are a lot of you in this situation, what with all these imported sets being sold with guarantees that last for years. They'll start to give trouble eventually, but will it be worth repairing them when spares and data are expensive and difficult to obtain?

Be that as it may, perhaps I can briefly return to those early days thirty five years ago. The editor then wasn't our John. It was F.J. Camm, the magazine's founder, who had his name up front. F.J.'s brother was Sir Sidney Camm of Hawker aircraft fame – he designed the Hurricane, the Fury and all the other famous Hawker aircraft made before and during the second World War. I could give you a long list as aircraft were my all consuming hobby at that time – I can remember giving lectures on aircraft recognition when I was in the Fleet Air Arm – but this interest began to wane as I worked on the aircraft in this country, Gibraltar and Alexandria (just past the stinking tannery). I still have photographs taken at the time and the memories keep flooding back, more so than of what happened yesterday but I dare say there are lots of you like that.

The Fidelity CTV14R

We had another Fidelity CTV14R (ZX2000 chassis) in the other day. I expected to have to fit a new line output transformer but this wasn't necessary. The complaint was that the picture kept rolling and going off. After a while I discovered that the focus control was damaged. This was no problem since we keep having to remove the focus control in these sets, together with the first anode control, when fitting the ZX3000 series line output transformer. A new focus control was fitted in no time and the picture no longer rolled and hopped on and off. I then noticed the matchstick in the on/off switch. When this was pulled out the switch no longer worked. So in went another, complete with the remote contacts.

I phoned the owner and she agreed to pay what I asked (none of your business!). Anyway she came in later and handed me a twenty pound note and I handed her a fiver.

Colour Changeover

I'm sorry about the set that changed its colours. Should have realised it was the degaussing unit. But honestly the changeover was so complete I didn't think it could be that. The set lives over the road so I'll hear about it if it mucks about again, and so will you.

That's all for now. Anyone want to buy a famed store in a prestige position? Mr. Fayed from Alexandria perhaps?

Practical Astra Installations

D.J. Stephenson, B.A., I.Eng.

There have been widespread rumours and horrendous tales about the alleged difficulties of setting up dishes for reception from the Astra satellite. I suspect that many of these stories are intended to scare off competition from TV technicians intruding into the domain of the aerial rigger. In reality the job is simplicity itself, provided the right equipment is to hand. The purpose of this article is to pass on practical experience gained by carrying out many such installations, for the benefit of those who are contemplating whether or not to enter this potentially lucrative business. We won't delve into the theory of satellite TV reception: many books and articles have been published on this subject.

It's unlikely that the general public will have much success with DIY satellite dish installation simply because of the alignment accuracy required. To try to find the satellite by trial and error or by following the manufacturer's instructions is likely to lead to many hours of frustration followed by a call to a TV technician/aerial rigger for help. The DIY enthusiast also has to contend with the fact that the flat pack systems obtained from major retail outlets come without cable, F connectors and mounting hardware such as wall plugs, screws etc. Fig. 1 shows an Astra receiving system in simplified block diagram form.

Ladders

If you are going to go into this business, perhaps the most important things you will require are a roof rack and a set of ladders. A good ladder size is 28ft double, which extends a few feet above the gutter height of the average semi-detached house. Since you will not be carrying heavy loads up it a class 3 domestic ladder is quite adequate and is considerably cheaper than say the type of ladder used by builders. A 15ft roof ladder may be an advantage for pole mounting where a suitable wall is not available. In my experience however this has not been necessary. Many modern houses have a flat garage roof adjoining a south-facing wall. This calls for an additional single ladder or a step ladder. In such cases I've found that a two-way single/step ladder is the most versatile type.

Planning Permission

At the time of writing planning permission has to be obtained when a dish is mounted above roof height. Permission may also be required under other circumstances, e.g. a conservation area. Check with the local council planning department.

Tools and Fixings

You will need to keep a selection of fixings in the van. Experience shows that 2·5in. No. 12 galvanised or blacked screws and 8 and 10mm Rawbolts are the most commonly specified fixings. The appropriate plastic wall plugs and masonry drills will also be needed. Fixing should be into bricks, not the mortar course, so it's vital that a powerful professional hammer-drill with a half-inch chuck is purchased. The small domestic type will soon burn out with punishing work such as this. A 40m extension lead drum is recommended, terminated with a residual earth circuit-breaker plug.

Other more mundane tools required are a large screwdriver, claw hammer, spirit level, set of metric ring or combination spanners and a pair of mole grips. A metric socket set is also an asset. A tool belt saves a lot of footwork when working up ladders.

For drilling the coaxial cable entry holes into wooden window frames a five sixteenth inch auger bit and hand-brace does the neatest job. Where plastic double glazing is encountered it's better to drill the wall at the corner of the window frame, using a long 8mm masonry bit. This long bit is also needed in a small number of cases to drill dividing walls.

Something that's often omitted from the tool-box on the first job is 7mm round section cable clips – or 10mm if extra polariser leads are involved (see later). An adequate supply of F connectors and coaxial plugs should also be carried. Finally, silicone rubber compound is needed to encapsulate the connection to the LNB (low-noise block) to ensure that it's waterproof.

Instrumentation

Perhaps the most important single instrument required is a compass. The cheap Christmas cracker variety is definitely out. A good sighting compass can be purchased for about £27. The Silva ranger type 15T is a particularly useful one. It includes a mirror, sighting lines and 360° bearing graduations and can be purchased from camping/sports shops. An inclinometer is useful for elevation measurement, but most manufacturers stamp elevation scales on the mounting brackets. Unless the wall to which the dish is to be mounted is truly vertical however these are not too accurate. Care is required in using an inclinometer with an offset focus dish as the offset angle has to be taken into account.

A satellite signal strength meter is a boon for optimising picture quality. The small Connexions satellite signal strength meter can be obtained from HRS Electronics plc (11 Garretts Green Lane, Garretts Green, Birmingham B33 0UE) for just £45 plus VAT (trade only). This wideband unit is simply connected in series with the LNB-receiver coaxial cable, using F connectors, and is thus powered by the LNB voltage feed. It enables the f.m. first i.f. output from the LNB, at approximately 950-1,750MHz, to be monitored.

Site Survey

The purpose of the rather pretentiously named "site survey" is to check the lie of the land and offer the customer the maximum amount of choice as to dish location. Some customers like the dish to be unobtrusive while others like to advertise the fact that they have one.

It's important to ensure that no tall buildings or trees are in the direct line of site. If this situation cannot be avoided the customer should be told that reception will be either degraded or impossible. A site survey may involve running up and down ladders at various locations on a south- or east-facing wall, checking the line of sight. Since dishes can be rotated through 90° an east-facing wall can be used for Astra as a last resort.

Four items of information are relevant to the choice of site. They are best calculated before you arrive at the customer's address. A programmable scientific calculator with continuous memory or a computer will help here.

(1) The satellite's geostationary position. For Astra this is above the equator over Zaire, at 19·2° east of south of the Greenwich meridian.

(2) Elevation. This is the angle of inclination from the horizontal to the satellite's line of sight. It's given by:

Elevation = Arc tan [(cos C − 0·151269)/sin C]
where C = Arc cos [cos (Ls − Lr) × cos B]
Ls = longtitude of satellite
Lr = longitude of receiving site
B = latitude of receiving site.

For example Astra from the Wirral peninsular, Merseyside, longitude 3°W, latitude 53·33°N, gives the elevation as 25·74°.

(3) Azimuth. This is the bearing of the satellite depending on the location of the receiving site and is given by:

Azimuth = Arc tan [tan (Ls − Lr)/sin B].

For the Wirral, Merseyside the true azimuth is 153·03°.

(4) The local magnetic variation. True south can be 3-7° to the right of magnetic south depending on the location of the receiving site and varies by nine minutes or so a year. Current information can be obtained from the latest edition of the Ordnance Survey Landranger series of maps for your area.

As an example the magnetic variation for the Wirral, Merseyside is 5·5°, therefore the corrected azimuth or compass reading is 158·53° or 21·47° east of south.

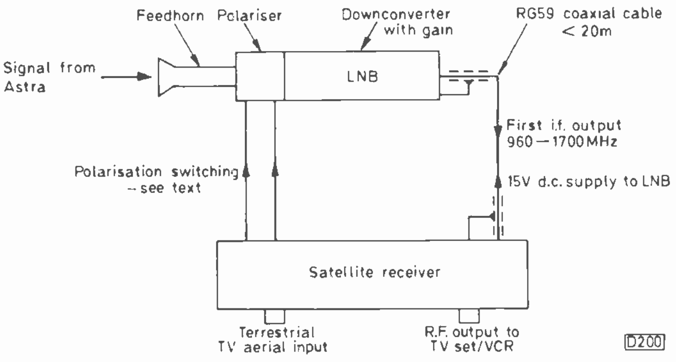


Fig. 1: Simplified block diagram of a receiver system for Astra transmissions.

These calculations may seem a bit tedious to perform for each installation, but in the long run they do save time. If, as is often the case, work is confined to a small geographical area the figures obtained will not vary significantly.

Computer Program

The calculations for any geographical location and any satellite can be performed in a fraction of a second by computer. An Acorn Electron or BBC B computer system can now be bought very cheaply second-hand and is ideal for calculations such as these. A suitable program that will perform all the necessary calculations is listed in Table 1.

When using this program it's important to remember that longitudes west of Greenwich (0°) are entered as negative values. For example the Wirral, Merseyside is 3°

west and is thus entered as −3. Grossly ridiculous inputs will not be accepted.

When the program is run the first prompt asks for the longitude of the satellite. Astra is 19·2° east of south and is therefore a positive value. Enter 19·2.

The second prompt asks for the longitude of the site. For the Wirral, Merseyside this is 3°W and is thus entered as −3.

The third prompt is for the latitude of the site. For the Wirral this is 53·33°N, so enter 53·33.

The prompt for local magnetic variation is finally displayed. From Ordnance Survey maps this is 5·5° for the Wirral, so enter 5·5.

The program will calculate the elevation, true azimuth, compass bearing and path distance. With the data fed in we get 25·74°, 153·03°, 158·53° and 39,001·1km respectively. Simply type RUN to repeat the program. A printout can be obtained by pressing the CTRL and B keys simultaneously prior to typing RUN CTRL C disables the printer again. Anyone with a working knowledge of the BASIC computer language should find it easy to transpose the program for use with other machines.

Cables

There appears to be no standardisation with regard to the cable requirements for various manufacturers' dishes. Amstrad/Fidelity use single coaxial cable. The i.f. signal from the LNB is fed down the cable and a d.c. voltage from the receiver is fed up it to power the LNB. This d.c. voltage can be threshold varied to switch the solid-state polariser. Grundig use coaxial cable with an additional polariser lead to switch the polariser's polarity. The 15V supply for the LNB is fed up the coaxial cable and a further 12V supply lead is used to switch the polariser – 0V for vertical polarisation, 12V for horizontal polarisation. The earth return is via the coaxial braid. Tatung use coaxial cable with two separate polariser leads.

The special coaxial cable with one or two additional polariser leads is very costly at the time of writing – about £125 for a 250m drum. An alternative solution is to run up a separate cheap cable for the polariser requirements and use cheaper coaxial cable.

There are many grades of 75Ω low-loss cable. With short runs, say less than ten metres, ordinary u.h.f. low-loss coaxial cable can at a pinch be used with no appreciable picture quality degradation. Better quality cable such as RG59, at about £69 for a 250m drum, should be used for longer runs. This cable has a loss figure of 27dB per 100m. For a really professional job you can, provided the customer is willing to pay the extra at about 75p per metre, use Pope H100 cable. This is available from HRS and has a loss figure of 13dB per 100m. In practice however RG59 is an adequate, inexpensive general-purpose cable. With really long cable runs line amplifiers need to be inserted at every 20-30m or so.

The Installation

An installation team should consist of a technician and someone skilled in ladder agility. Public liability insurance cover should be taken out along with employee liability. This costs about £250 for a turnover of less than £45,000 a year. Further insurance against personal injury is advisable due to the potentially dangerous nature of the work.

Once all the groundwork has been completed the easy part is erecting the wall-mounted dish. For drilling the dish mounting holes some manufacturers supply a template on the back of the flatpack. A slight breeze up a ladder with a large flapping piece of cardboard in one hand and a hammer-drill in the other has to be seen to be believed! Throw it away. Drill and temporarily fix one point first, put a spirit level on it, then mark out the other holes.

The light-weight dish and LNB are best assembled at ground level and taken up the ladder in one piece for offering up to the mounting bracket. Be careful not to knock the feedhorn/LNB assembly – this is a precision unit manufactured to the highest standards and any dent could make the whole assembly useless.

Fit the F connector to the LNB temporarily, fit polariser leads as necessary, and tack up the cable(s) to the receiver. Never bend the coaxial cable at a sharper angle than about ten times its diameter otherwise significant signal attenuation will occur.

Table 1: BBC computer program for satellite dish alignment.

```
>
>LIST
   10REM★★★★★★★★★★★★★★★★★★★★
   20REM★                                    ★
   30REM★  EUROPEAN SATELLITE FINDER         ★
   40REM★                                    ★
   50REM★        DJ Stephenson 1989          ★
   60REM★                                    ★
   70REM★★★★★★★★★★★★★★★★★★★★
   80MODE 7
   90PROCline:PRINT"EUROPEAN SATELLITE
   FINDER":PRINT TAB(20)"DJ Stephenson
   1989":PROCline
  100PRINT"Enter Longitude of Satellites/Sites WEST of
  Greenwich as NEGATIVE Values"
  110PRINT:PRINT"Enter Longitude of Satellite
  (deg)":LS=FNip(-90,90)
  120PRINT"Enter Longitude of Site
  (deg)":LR=FNip(-90,90)
  130PRINT"Enter Latitude of Site (deg)":SL=FNip(30,80)
  140PRINT"Enter Local Magnetic Variation
  (deg)":var=FNip(2,8)
  150A=LS-LR:sign=SGN(A):A=ABS(A)
  160A=RAD(A):B=RAD(SL)
  170C=ACS(COS(A)*COS(B))
  180Elev=ATN((COS(C)-0.151269) /SIN(C))
  190IF Elev<0 THEN PRINT"Satellite over horizon":GOTO
  290
  200Azimuth=ATN(TAN(A)/SIN(B))
  210Azimuth=180-sign*FNround(DEG(Azimuth))
  220Pathdist=(42164*SIN(C))/COS(Elev)
  230PROCline
  240PRINT"Elevation = ";FNround(DEG(Elev))" degrees"
  250PRINT"True Azimuth = ";Azimuth" degrees"
  260PRINT"Compass bearing = ";Azimuth+var" degrees"
  270PRINT"Path Distance = "; FNround(Pathdist)" Km"
  280PRINT:PRINT"Type 'RUN' to repeat program ";
  290END
  300
  310DEFPROCline
  320PRINT STRING$(39,"_"):ENDPROC
  330
  340DEF FNip(min, max)
  350REPEAT
  360INPUT A$:A=VAL(A$)
  370IF A=0 AND A$>"0" THEN A$=""
  380UNTIL A>=min AND A<=max AND A$<>""
  390=A
  400
  410DEF FNround(N):N=INT(N*10^2+0.5)/10^2:=N
```

Next tune in the TV set or VCR to the satellite receiver's output. Most receivers provide a test pattern tuned to channel 38 – this may need to be retuned if there is interference from local terrestrial transmissions. With receivers that don't provided a test signal, f.m. noise as opposed to a.m. noise should be detectable from the LNB when the tuning is correct.

The BSI and the CAI strongly advise that the dish assembly metalwork is earthed via an approved clamp to an earthing point or buried rod. The minimum earthing wire thickness is specified as 1·5mm. This also applies to aerials for the reception of terrestrial transmissions, but I must admit that I've never seen it done in practice. Although at present not a legal requirement, the reason for doing it is to discharge to earth static build-ups to prevent damage to tuners and the possibility of a customer receiving a static shock. The high failure rate of r.f. amplifier transistors in video r.f. splitters and TV tuners is blamed on omission of this safety precaution.

Adjustments

We come now to the dish adjustments. Proceed as follows.

(1) Tighten all elevation and azimuth adjusters. Take up any slack but do not tighten so much that the dish cannot be moved with moderate effort.

(2) Stand directly below the dish with a sighting compass and note some landmark, such as a roof apex, at the calculated magnetic bearing.

(3) Climb up the ladder and sight the boom to the chosen landmark.

(4) Set the elevation adjuster, using either the manufacturer's stamped graduations or an inclinometer. With Grundig dishes a ruler will be needed to set this.

(5) Since satellite TV receivers are pretuned at the factory, Astra reception should now be possible. If your calculations are correct you will get reasonable picture quality immediately without need to use a signal strength meter.

(6) Switch off the receiver to disable the 15V LNB supply. Note that any temporary shorts in the cable connections can blow fuses in the receiver! – a multimeter check for shorts is a good idea before switching on. Connect the signal strength meter in series with the coaxial cable to the LNB, with a short stub. Switch on the receiver and trim the elevation and azimuth adjustments for maximum signal strength.

Some dishes, such as the Grundig ones, have a skew adjustment which also needs to be optimised. Skew is the rotary adjustment of the feedhorn/LNB assembly.

Finally, tighten the adjusters fully, thread the coaxial cable through the boom, and refit the F connector. Ensure that there are no sharp kinks in the cable.

(7) Check the received picture quality. If o.k., encase the whole LNB F connector with weatherproof silicone rubber compound.

(8) Mark or scratch lines on the adjusters so that dish realignment is easy if, at a later date, wind moves the dish.

(9) Seal the coaxial cable entry hole in the wall or window frame with putty or silicone rubber compound.

Guarantees

It's customary to guarantee your work for a period of at least a year against wind altering the dish alignment or water penetrating the coaxial cable etc. Point out to the customer that this doesn't cover vandalism or freak weather conditions such as the Force 10 hurricanes experienced in late 1987. It's the customer's responsibility to insure against such risks.

Repairs

It's normally not advisable to attempt to repair the LNB assembly or the tuner unit in the receiver. These items employ a lot of surface-mounted technology and, at the frequencies involved, component layout is critical. The units are best replaced if necessary, and it's hoped that manufacturers will introduce an exchange service for them.

Repair of the other sections of the receiver should be a comparatively easy task for a TV or video technician. There's a complication however. Since the various manufacturers use so many different standards and polarising arrangements servicing can be difficult unless you have available the relevant dish. The idea of having ten or so dishes on the workshop wall seems ludicrous. Fortunately the problem can be overcome by building a separate unit to supply the various voltage feeds required by the chosen workshop dish installation. The first i.f., which appears to be standard, can then be fed into any make of receiver via isolation capacitors to block any d.c. sent up the cable from the receiver being repaired. I hope to provide details of such a unit shortly.

In Conclusion

It's hoped that this article will persuade many TV technicians to enter this new field, which is expected to be an expanding one until at least 1996 when it's estimated that twenty million receivers for the Astra transmissions will have been installed in the UK. There should be sufficient work for large numbers of installation crews to make a good living, provided the trade sticks to a reasonable installation charge and doesn't advertise "free installation" in order to shift over-ordered stock. The larger retail outlets are the most likely to offend in this respect.

The Panasonic NV370/830/850

Nick Beer

The Panasonic NV370 is a "basic" model that was introduced as a replacement for the NV333. It incorporated several firsts including front loading, standby OTR (one-touch timer record operation), a picture sharpness control and a large multi-function fluorescent display. It has cord-linked remote control, a one event/14 day timer and a two-head drum (VEH0218). The NV830 came later and is basically a hi-fi sound version, its drum (VEH0266) incorporating two audio heads. Further features were added with the NV850, in particular an eight event/14 day timer and a third video head in the drum (VEH0231) for perfect stills and general improvement in the trick modes. In addition to the two drum-mounted audio heads the two hi-fi machines have a single mono linear audio head. The absence of a stereo linear sound track facility gave rise to a certain amount of criticism, due to the number of stereo (not hi-fi) library tapes available. The hi-fi machines both have a comprehensive infra-red remote control system, though you can't use it to set the timer. These two machines have black cases whereas the NV370 is in silver. From the servicing point of view the differences between these machines are minimal. We'll mention them as they arise.

The function display is separate from the clock/channel display, being mounted above the deck function selectors. The electronic counter is a four-digit type with electronic memory. Dew warning is given by the counter display's far right-hand digit changing to "d", something that might not be immediately obvious. Addition of standby to the OTR function already seen on some previous models allows the OTR start to be delayed by up to two hours in thirty minute steps. The NV850 has memory back-up when the mains supply is interrupted – this feature is not present on the two cheaper machines.

The mechanism is very quiet in operation – welcome after the NV7200 series! One point about its operation that I personally find annoying is that it returns to the stop position during mode selection. For example if you make a test recording then push stop and immediately after select play it won't, as with the NV7200s, go straight into play. It will unlace and relace.

Dismantling

To remove the top cover, undo the four silver screws at the sides of the unit and pull the top upwards, gradually pulling the front edge away. The bottom cover is held by nine brass-coloured screws. It covers the entire bottom area of the machine. Later decks have just a plate over the mechanism.

The bottom, main PCB covers part of the mechanism and for a lot of work has to be unhinged. To do this you have to remove the front, operation PCB which is hinged on it. This is a similar idea to the NV333/NV366 series, but only the small operation PCB is attached, not the timer/presetter as well, previously a single unit. First remove the cabinet front by undoing the three red screws, one at each clip across the top of the front, then undoing each of these clips and the three across the bottom. After removing the two red screws in the top two corners the operation PCB can be hinged out. The main PCB can be released by undoing the eight red screws and two clips which, with the machine stood on its back, are one third and two thirds of the way down on the right-hand side. The whole assembly can be hinged towards the back of the machine, but you will need to unsolder the earth wire to the front left-hand side of the mechanism.

The screening can over the head drum is removed by loosening the five red securing screws and then moving the can across and up to allow the screw heads to pass through the larger holes in the plate.

The capstan brake is countersprung and is mounted on the capstan flywheel support bracket.

The Mechanism

The mechanism in all three machines is similar to the D1 type, with only minor modifications. The drum is a typical Panasonic direct-drive unit, of slightly more compact design to those previously used. There's a direct-drive capstan which also provides the kick idler drive, via the capstan belt (VDV0149). A separate motor is used for tape loading, via a loading belt (VDV0148). This is significantly smaller than the two-belt system used in the NV7000 and NV333 series machines. Front loading is performed by a carriage-mounted motor and belt (VDV0074). Mechanism state detection for the syscon is carried out by a linear mode switch (VES0246 for Models NV370/NV850, VSS0091 Model NV830) which is somewhat different in appearance from those previously used. It has a skeleton-style look, the leads being soldered directly to the contacts rather than to a PCB.

Whereas in previous models the drum static discharge angle was fitted at the top of the drum, this time it's fitted to the bottom – part no. VXS0059. Since the bracket construction is different the earlier type cannot be used. The new type rarely fails however.

Moving back up to the top of the mechanism we come to the thing that most people will probably associate with this deck for ever more, the reel idler (VXP0521). There can't be many people who didn't have to change one during the first twelve months because of tape chewing. The answer is to fit the modified type, which is far more reliable and has the length of life you'd expect. The old type is plain white while the modified type is black and white. A machine came in quite recently with the old type still fitted. It was working all right but we nevertheless changed it, as you always should – don't tempt fate!

Mechanical Service

The majority of the jobs on the top of the deck, for example reel idler or brake band replacement, require removal of the cassette carriage. The reel idler can be replaced without doing this, but is then a more difficult operation. To remove the carriage, undo the four red bolts at each corner of the top plate, remove the multi-pin plug (P1507) on the small PCB at the rear right-hand side, then lift the carriage out. This assumes that you've already removed the screening can from the head drum, as it mounts over the front lip of the carriage.

Idler replacement is straightforward. Unhook the spring that runs over its back edge then remove the slit washer from the shaft to allow the idler to slip up over the pivot. When fitting the replacement ensure that it is completely bedded down and mating with its drive surface. To do this, push the idler wheel towards the back of the machine against its spring while pushing it home, then fit the slit washer again. You don't get a replacement washer now with each new idler, though one comes with the maintenance kit for this series (kit part no. VUD4092, see Ian Bowden's article in the October 1988 issue of *Television*). Refit the spring and check the review torque (see later).

The brake bands are beginning to suffer from the usual Panasonic ailment: the glue on the pad dries out and the pad drops off. The result of course is virtually no back tension, the symptom looking as though one video head has failed. Replacement is marginally easier than with other Panasonic decks as the band is fixed to the back-tension lever by means of a moulded plastic spring clip instead of a second circlip. The lever will usually have to be removed to undo the old unit, but sometimes it can be pulled out from above. To fit the replacement, simply push it through the hole. Set up the back tension afterwards (see later).

Head Drum Replacement

This was the first series of Panasonic decks to have the pin-connection style head drum instead of the flexible leads previously used. It saves a lot of time, fiddling about, and burnt fingers. The two things to watch are first that all the arrowed connections on the PCB are free after unsoldering – otherwise you'll end up with broken connections to the rotary transformer and will then need a new DD unit. Don't unsolder any connections other than those arrowed: unsolder all those arrowed even if there appear to be too many. The head section is held to the DD unit by the usual two screws. To prevent any nasty experiences, always remove them as the last job before the head and refit them first after replacement, before resoldering the pins. This is to ensure that the upper and lower drum sections are fully mated – if you solder then tighten the bolts and the head drum moves you'll crack the head PCB or damage the DD unit. The other point to note is that since there's no lead colour coding the head can be fitted the wrong way round. To prevent this, half the PCB in the drum is coloured white and there's a white mark on the DD unit: these should, not surprisingly, be matched up.

With the NV850 the DD unit is covered by the stator not present on the other two models. This has to be removed to enable the head drum to be replaced. The stator angle is held on by two bolts, one in each rear corner. There's also a multi-pin connector (P4501) which has to be removed. Underneath there's the rotor base, again held by two bolts. With this removed you'll find that the head drum (VEH0231) is secured by the usual two screws. To reinstall the stator assembly after replacing the drum calls for the stator angle adjustment jig (part no. VFK0268) to ensure correct positioning.

Pinch and Impedance Rollers

Pinch roller replacement is straightforward. Remove the bolt that holds the dew sensor bracket, then the single circlip that holds the pinch-roller arm. Pull it off, at the same time releasing the counterspring.

One final point about the top of the deck. With the hi-fi models when you replace the impedance roller (VDP0908) on the left-hand side, beside the erase head, or carry out any tape path adjustment, ensure very careful alignment while looking at the audio f.m. envelope. A very slight discrepancy that might not affect the picture adversely can have a dramatic effect on the audio f.m. envelope. This roller is part of the maintenance kit and should be changed at the appropriate time – no skimping!

The Belts

The mechanism has three belts. The loading belt (VDV0148) simply slips over its two pulleys. The capstan belt (VDV0149) does the same but the support bracket over the bottom of the capstan motor has to be moved out of the way. It's not necessary to undo all three bolts: remove the two at the rearmost end and loosen the other one to enable the belt to be manoeuvred over it. The third belt is on the carriage and can be slipped off both its pulleys in alternate directions. Thus there's no need to remove any motors or brackets. The belts rarely fail but they do get to be tired looking and, being part of the 1,000 hour kit, should be changed.

Mode Switches

The mode switches are less reliable than those on the earlier machines and are in turn more reliable than the very similar looking ones on the later NV230/NV430 series machines. Faults range from no drum rotation to being stuck in the laced-up state – in general, any weird mechanical happenings (see also the fault list). Always disconnect the deck from the mains supply before working on the mode switch, otherwise you'll end up with a retiming job. A single bolt holds the switch and should be changed along with the switch. The old switch gives you a useful guide to the positioning of the new one. You'll see a clean area around the slot, inset in the blackened, corroded area. This is where the old bolt head was located. Fit the new switch in the same way, ensuring that the white peg is correctly located on the main lever, and you won't go far wrong. Remember to write down the wiring connections to the switch. A note in the manual is worthwhile, but I've seen more than one set of wire colours.

Take-up Torque

The take-up torque should be within the following limits for each mode. Play 105-145g/cm, fast forward and rewind over 400g/cm, review 200g/cm ± 10 per cent. If there's a large discrepancy the drive systems should be investigated (look for worn idlers etc.). Adjustment is by altering the notch to which the left-hand side of the spring is attached. This is the spring across the rear half of the reel idler.

Back Tension

The back tension should be between 25-30g. You will very often find that the best performance, especially for searches, is with the back tension set at 30g. This figure should not be exceeded. Adjustment is by altering the position of the back-tension spring mounting bracket. This assumes that you've not changed the brake band and upset the level. If so, the back tension should be aligned with the brake band set as shown in Fig. 1.

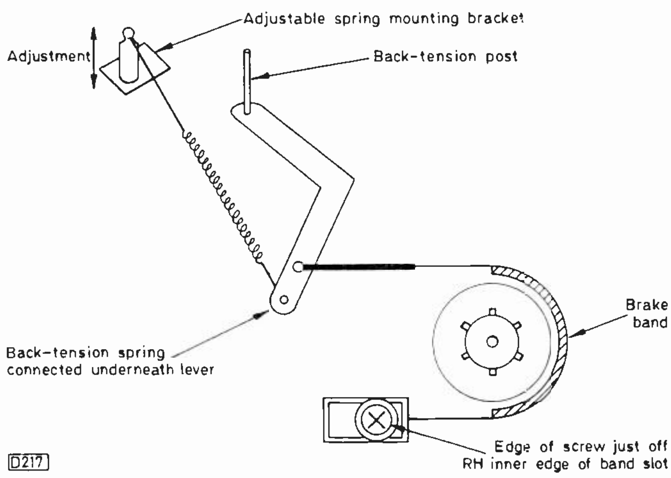


Fig. 1: The back-tension arrangement

The position of the brake band, and thus the falling range of the back-tension lever, should be set using the adjustment plate (part no. VFK0187). A few machines will not warrant this, so the diagram can be used as a guide.

Electronic Features

In this section we'll briefly consider the circuits that are likely to require attention.

The syscon is designed around a microcomputer chip, circuit reference IC6001 as always. All three machines use the same device (MN15342VGC-3). An optosensor under the take-up reel provides detection of rotation and pulses for the electronic counter. The troublesome cassette up and down switches are mounted on the right-hand side of the carriage – see fault list. There is also an insert switch (VSM0047) in the middle of the top of the carriage.

A larger number of chips are used in the servos than in the previous models and a manual will usually be required for any in-depth fault finding.

The power supply is simple. Fig. 2 shows the mains transformer/rectifier board circuit which should help if you don't have the manual – there's a tendency with these machines for the fusible resistors to go open-circuit randomly.

There are obviously various differences in the timer/presetter arrangements used in the different models. The basic NV370 has a step up/down selection system with presets for its 16 channels, a single M54836AP chip (IC7503) being used for control. The NV850 on the other hand uses the single thumbwheel and store system that was to become familiar on later machines. It also has a back-up system for memory when there's no mains input. This takes the form of three 3·3F, 2·3V gold capacitors, as in the NV366. They suffer the same fate!

The hi-fi circuits are on two boards situated around and over the presetter PCB.

Remote Control

The NV370's cord-linked remote control unit, part no. VSQ0330, gives control over only the basic functions play, rewind, fast forward, record and search. It works on the same switched resistance principle as the system used with the NV333/NV366. The single-screened lead is terminated with a 2·5mm two-pole plug.

The IR unit used with the hi-fi models, part no. VSQ0338, gives control over virtually everything apart from the timer and hi-fi selection functions. There are no real stock faults. Spillage is the most common cause of trouble – it can corrode the contacts of the rubber mat. The buttons tend to wear so we replace them when a machine is in for service to keep up the appearance of the unit.

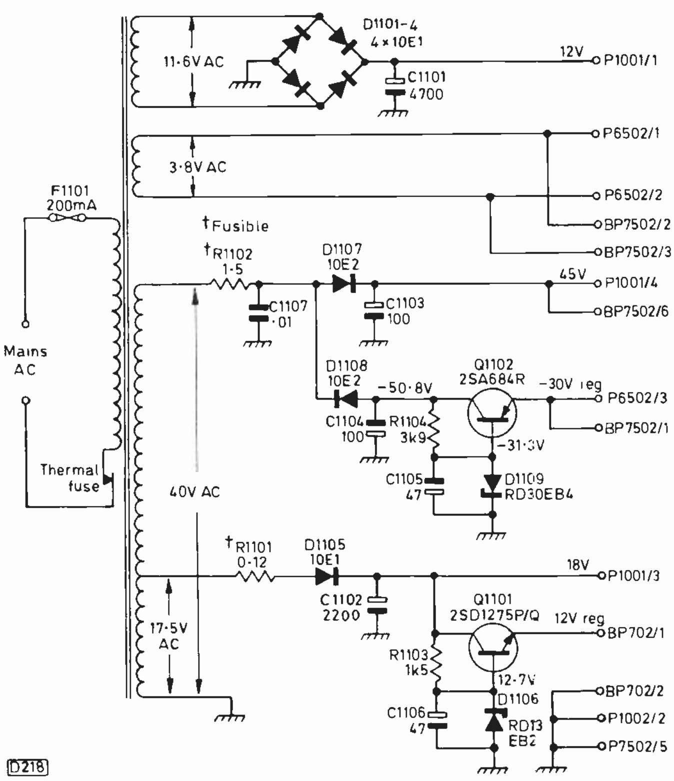


Fig. 2: The mains transformer/rectifier PCB circuit, Model NV370.

Fault List

Here's a list of some of the more common faults we've experienced with these machines.

(1) No or slow rewind/fast forward and/or chewing tapes. Usually caused by a worn reel idler, especially if the plain white type is still fitted (see earlier remarks).

(2) Cassette will not stay in. Cassette up/down switches on carriage faulty. See earlier comments.

(3) No results. 5V rail missing as D1002 (3·9V zener diode) short-circuit and R1001 (0·39Ω) open-circuit.

(4) Hum on sound and vision. C1102 (2,200μF) leaky or open-circuit. This is the reservoir capacitor for the unregulated 18V supply.

(5) Incorrect function selection – fast forward instead of play and rewind instead of record. C6011 (0·18μF) in key scan two line faulty.

(6) Capstan speed incorrect and will not set correctly. Can be caused by IC2001 (AN6359N) or IC2002 (MN6168VIF) – sometimes both fail together.

(7) Drum motor does not rotate. If the outputs at pins 1, 2 and 23 of IC2005 (AN6387) are absent or "pulsing" suspect this i.c.

(8) Function display not working. Check D6504 (RD75EB) and IC6501 (MN1450BUF2). The display (VSL0030) might have an open-circuit heater.

(9) No or incorrect colour in record and playback. IC8001 (VEFC007) faulty. It's on the folded FPC.

(10) No 5V supply to capstan servo, causing shunting fore and back. Q1104 (2SD1275) in the power supply faulty.

(11) Capstan and kick idler shunting. R1101 in power supply open-circuit, usually for no apparent reason though Q1101 (2SD1275) and D1105 (10E1) may be short-circuit.

(12) Machine goes off after about three seconds. Note if when switched on the characteristic loading "shuffle" occurs. If not check the loading motor drive chip IC6003 (BA6209) as it will probably have an internal short.

(13) Horizontal picture twitch. Impedance roller (VDP0908) sticky. Replace along with its insert (VMX0541). Note previous remarks about precise adjustment with hi-fi machines.

(14) Dew indicator stays on. Try resetting the microcomputer chip IC6001 (MN15342VGC-3) by disconnecting the mains supply for a minute or so then switching back on. If this fails to cure the problem and the machine is not damp IC6001 is suspect.

(15) Capstan does not rotate. Assuming that all the supplies are present, as opposed to being excessively loaded, suspect IC2004 (AN3821K) and check the continuity of the capstan stator (VEK2038).

(16) When play is selected the machine laces but the drum doesn't rotate, the machine won't unlace then switches itself off. Suspect dirty contacts on the mode switch.

(17) Machine switches off as soon as review is selected. Mode switch faulty.

(18) Machine cuts out after a few seconds in review and the left-hand reel is slow to turn or doesn't turn at all. Replace worn reel idler.

(19) Machine cuts out after a few seconds in play, a slightly shorter time in rewind or fast forward. Check whether the electronic counter works before the machine cuts out. If not, check for reel pulses at pin 19 of IC6001. If these are not present and the supply to the optosensor (type ON2160) is present, suspect a faulty sensor. Otherwise suspect IC6001. Both items have been known to cause this fault.

(20) Grainy, black and white playback picture. Video heads worn or drum fitted wrong way round (see earlier remarks).

(21) Knocking noise, particularly noticeable in play. Check for dents in idler wheel VXP0521 and its clutch gear VDG0147 – shadow of BSR turntables! In nine cases out of ten however clutch VXP0523, under the clutch gear, is responsible. This fault will very often not be reported but will nevertheless be very evident.

(22) Mis-operation of the hi-fi channel indicator LEDs, not corresponding with switch selected. In order of probability, check QR4306 (DTC124A), QR4304 (DTC144A) and QR4301 (DTA114A).

(23) No front panel selection of play etc. possible with Model NV370. Check that the remote control unit is not plugged in, then suspect that the remote control socket is faulty.

(24) No remote control operation, front panel controls o.k., Model NV370. Suspect that the remote control unit's lead is open-circuit, particularly the screen connection. It can be replaced with normal single-screened lead if you remember to save the cable gland/strain from the old lead.

In Conclusion

In this article we've taken a basic look at the mechanical set up and operation of these machines, the electrical make-up of the circuits that tend to give trouble and listed the more common faults. These VCRs are not old – the majority just require a mechanical overhaul and a few are now being swapped over on rental. They can be rerented or sold for a very respectable price, and after a service can be expected to work well for the foreseeable future. Head wear is particularly good, but only when the back tension is set correctly. If you don't have a Panasonic account you'll find that spares are available from many advertisers in *Television*. Should replacement heads be necessary I particularly recommend those available from MCES.

1.N. 450 IC3 Pin 3 – pin 1 + 2.2µ – Pin 7 + of Cap

Letters

THE SPARES BUSINESS

We would like to comment on some of the points raised in your leader in the April issue. As specialist spares distributors we've been "knocking on the doors" of various setmakers for some time to be allowed to stock and sell their components. Some doors have been opened but others remain firmly closed. How long will it take for some manufacturers to realise that many customers do not want to or are unable to take their equipment back to the dealer from whom they bought it and therefore want a repair to be done by someone else? If the second dealer doesn't have an account with the manufacturer and spares are not available through distributors it can take weeks to get the part required. This delay reflects badly on the service department and also on the brand name. What will the customer think next time he makes a purchase? It would be so much better if all parts were available through distributors, thereby ensuring engineer and customer satisfaction.

Your point about smaller customers who require individual parts is one we understand all too well. As a result we have always supplied trade customers with whatever quantity they want, no matter how small the order. In the belief that offering a good service means just that, we have no minimum order level and no small order handling charges other than postage. This, along with the fact that we have a department that specialises in obtaining out of the ordinary components, means that we are doing our part in filling the gaps left by others.

Our job here at Wizard Distribution is to supply spares to the trade. Some manufacturers have other, understandable priorities. Why not let us all do what we do best, thus ensuring all-round customer satisfaction?
R.T. Blyth, Managing Director, Wizard Distributors, Empress Street, Manchester M16 9EN.

NICAM TRANSMISSIONS

Andrew Sykes' letter (May) suggests that the Nicam decoder chips being used in current TV sets and VCRs may not be able to handle future ITV and Channel 4 Nicam broadcasts satisfactorily. From our experience gained since starting Nicam test transmissions from the Crystal Palace and Emley Moor transmitters in February we do not believe this to be the case. It's important to realise that the broadcasts currently taking place are test transmissions which are intended to allow dealers and the public to hear demonstrations of the capabilities of the new service, also to enable us to gain practical experience and sort out any teething troubles with the equipment we are using before the start of scheduled programmes in September.

In the very early days of our tests we did discover incompatibility between one receiver chip and our transmissions. This gave rise to distortion on low-level sound. Although our transmissions complied with the published Nicam specification it was fortunately possible to solve this problem by making a minor change to the transmitted data within the specification.

We have also found that manufacturers have applied different logic to the interpretation of the use of the C4 control bit. C4 set to zero indicates that the Nicam signal and the conventional f.m. sound have different audio content. In this mode some Nicam receivers can reproduce only the f.m. audio. Conversely with C4 set to one some sets can receive only the digital sound. We are therefore carrying out test transmissions with C4 set to zero. C4 will be set to one when the scheduled service starts. Other sets allow the user to make the selection whatever the setting of C4, as do VCRs. We consider this to be the best arrangement.

When the full service starts the digital sound will of course be the preferred option where available. There have also been some Nicam VCR users who have apparently not realised that while the Nicam trade tests have been recorded on hi-fi sound tracks the f.m. programme sound has also been recorded on the conventional linear sound track. They can be selected by means of a switch.

The clicks Andrew Sykes mentioned are one of the teething troubles we have encountered since starting the test transmissions. We have chosen to encode the sound signals in the Nicam format in the studios, carrying them over the links to the transmitter in this form to modulate the new Nicam sound carrier. In this way the audio remains in the same digital form all the way from the studio to the viewer's receiver. The clicks have been caused by data errors occurring between the studio and the transmitter. These errors should not occur. We have investigated the problem and intend to make some changes to the equipment shortly to eliminate them.

We remain confident that once the system is fully operational Nicam digital stereo will provide very high quality sound from all existing and future Nicam receivers.
Paul Gardiner, Principal Engineering Information Officer, Independent Broadcasting Authority, Winchester.

CURING FIELD JUDDER

I was interested in John de Rivaz's suggestion for curing field judder (April) and would like to point out that a simpler way of implementing this good idea is to use an exclusive-or gate as shown in Fig. 1. The time-constant of the resistor and capacitor is the same as with John's circuit, but because a 4030's input impedance is so high we can use a higher resistance value and a lower capacitance value. Incidentally, if you want to invert the output another section of the 4030 can be used – an exclusive-or gate can invert the output or not by being wired as shown in Fig. 2.
Keith Cummins,
Holbury, Hants.

NOISY NV333 BEARINGS

In the November 1988 issue of *Television* Nick Beer, writing about the Panasonic NV333/NV366 VCRs, mentioned the problem of noisy bearings in the lower drum assembly. In view of the prohibitive cost of replacing the entire drum assembly I decided to examine the possibility of replacing the bearings, and have done this successfully on eight of these machines since August 1988.

It's necessary to remove the complete drum assembly from the VCR, then to dismantle it in the following sequence: remove the drum flywheel, stator assembly, mica washer, brass collar, spring washer and brass washer, then separate the upper and lower drum assembly by pulling them apart, thus exposing the bearings. See Fig. 3.

It's very important to make a reference mark on each of the following components as the unit is being broken down: (1) the end of the main shaft where it projects below the drum flywheel; (2) the drum flywheel; (3) the stator assembly; (4) the brass collar. Each mark must bear a direct relation to the next one. If this is not done carefully it won't be possible to get the head switching point aligned correctly. When reassembling the unit pay special attention to the correct sequence of replacing the brass washer and spring washer. The two screws that secure the flywheel should be tightened with a torque screwdriver – a little more than hand tight pressure will suffice.

The bearings cost £IR5 each here and are available from my local bearings distributor, the identification number on them being SSR-1560ZZ. The complete job takes one hour.

Pearce Heffernan, Madden TV,
Cork, Ireland.

CHEQUE CARD WARNING

The following experience with bank cheque guarantee cards might serve as a warning to others. I recently sold a second-hand TV set for £85, taking two cheques for it, one for £35 and one for £50. These were dated April 1st and 2nd respectively. I realise that the banks restrict the use of these cards to one cheque per purchase per day. But as everyone knows, £50 is not nowadays a realistic amount and rather than lose sales one is forced to break the rules.

On this occasion things went wrong. A "customer" rang us up on Tuesday to enquire about our opening times, asking "are you open at the weekends?". I replied that we are open on Saturday but not Sunday and the caller rang off. On the Friday the £50 cheque was returned, stating "not drawn in accordance with cheque card criteria". I phoned the bank – Nat-West at St Budeaux, Plymouth –

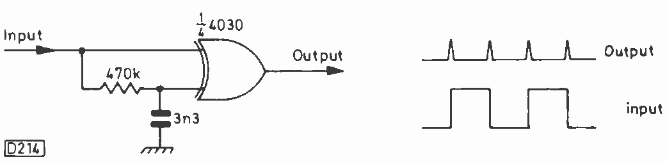


Fig. 1: Use of an exclusive-or gate to obtain substitute field sync pulses from the head switching waveform in a VCR.

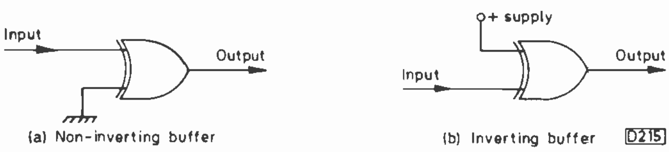


Fig. 2: An exclusive-or gate can be used as a non-inverting buffer (a) or an inverting buffer (b) depending on the way in which it is wired.

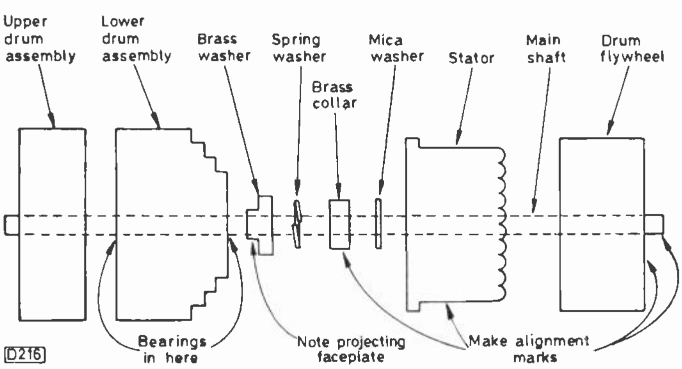


Fig. 3: The various items that comprise the drum assembly in the Panasonic NV333 VCR.

to ask about this and was told that as April 2nd was a Sunday they wouldn't honour the cheque. When I asked what this had to do with it I was told "you close on Sunday, we rang to find out". I was flabbergasted in discovering that a bank would phone anonymously to check on opening times and use this as a reason for not clearing a check, and have lost the money. The moral is obviously not to use Sunday's date on cheques.

S. Woodbridge-Smith, Proprietor Argyle TV & Video, Peverell, Plymouth.

HELP WANTED

Can anyone supply a line output transformer and/or a service manual for an Elizabethan T12 monochrome portable? It uses a Toshiba chassis and components (not to be confused with the Indesit model with the same number!).

Phil Nichols, 19 Kendal Avenue,
Copnor, Portsmouth PO3 5AX.

SOUND FROM NTSC TAPES

Being interested in life extension and cryonic suspension I have obtained from various American societies NTSC cassettes on their activities. The problem is that conversion costs are way beyond economic good sense. Much if not all the information that may be required is however usually available on the sound track.

If you play an NTSC cassette on a PAL VCR the sound runs slow because the machine tries to lock the 60Hz fields as though they were at 50Hz. If you use the double-speed feature the sound is too fast. I got round the problem by modifying an old audio cassette recorder to run at variable speed. This was done by fitting a front panel control in place of the speed control preset. The VCR was then run in the fast mode while the audio cassette recorder was used to record the sound, running faster than its usual speed. It was then used for playback with the speed adjusted so that the speech sounded normal.

I would advise turning the video monitor or TV set off rather than applying out-of-lock 525-line signals for any length of time. A computer monitor with the timebases adjusted for 525 lines shows part of the picture, but the VCR's head circuits have the wrong timing to display it all. Any information on how to get a PAL VCR to produce a locked 525-line picture in monochrome would be appreciated, also which old models would be easiest to convert.

John de Rivaz, B.Sc. (Eng.), A.M.I.E.E.,
Truro, Cornwall.

PHILIPS V2000 VCRs

B. Ross's article on the Philips VR2021 (February) mentioned the use of components from scrap machines.

With VR2020s, to overcome failure of the capstan pressure roller to engage correctly as a result of stretching/wear of the threading cord and pulleys, the easiest "fix" is to replace the small pulley at the left front with a medium size pulley. The pulleys are simply eased off and pushed home. Although there's a tensioning arm this has a limited range of adjustment. I suspect that larger adjustments can be made by separating the left rear pulley assembly and then refitting with the location peg in a different hole, but I've not tried this.

One cause of no deck functions is failure (short-circuit) of a cell in the ni-cad battery. This is likely to become increasingly prevalent.

J.C. Sparks,
Maghull, Merseyside.

VCR TIP

It may be useful to other readers to known that the idler in the Granada VHSCC1 is almost exactly the same as that in the Orion VHL3. After removing the cassette carriage to change the idler you have to press eject before refitting the carriage. Otherwise when the cassette is loaded the loading arms move into the play position and the power light flashes in the fault mode. I found this out when working on one of those machines without the help of a manual, not knowing whose design the machine is based on. After successfully placing the carriage back in I found that there's a mode switch on the carriage.

I'm looking for a power-luminance-chrominance PCB for a Panasonic NV333 to replace one damaged by water. If anyone has a working board at a reasonable price please write to the address below.

C. Taylor, 8 Echo Barn Hill,
Kendal, Cumbria LA9 5NA.

Hum Problems

George Wilding

Particularly with older TV sets, where a hum bar's severity has gradually increased over a period of time, with possibly some slight reduction in picture size, the most common cause is partial drying up of an h.t. reservoir electrolytic capacitor, since the capacitor has to be able to take sufficient charge during rectifier conduction to maintain the sets's full current demand. Where there's no significant reduction in picture size or in the h.t. voltage, but usually with field timebase tripping, a smoothing electrolytic is generally at fault. The simplest and surest way to check on these possibilities is to shunt a known good electrolytic across the suspects – the value of the test capacitor need be only a fraction of that of the suspect. The test capacitor should be temporarily soldered in circuit, not held across the suspect: this will avoid damaging surges and sparking.

Particularly when the electrolytic concerned is a multiple type, check the soldering at the earth connection. Where a series resistor has been replaced, check that its value is not less than that of the original.

Where the h.t. or l.t. supply is derived from a bridge rectifier and the hum bar has developed suddenly the usual cause is an open-circuit rectifier diode. When checking remember that unless the transformer's secondary winding can be isolated from the rectifier diodes by plug removal or disconnection the pairs of diodes will, from the d.c. point of view, be in parallel. Thus – see Fig. 1 – when testing D1 the ohmmeter is also across D2. When the diodes aren't isolated from the transformer's secondary winding the only evidence of an open-circuit diode will consist of an increased forward resistance compared to that of the other pair in the bridge.

Similar conditions apply where a conventional two-diode full-wave rectifier circuit is used, as in many portables (see Fig. 2). Unless the transformer's secondary winding is isolated, if one diode goes open-circuit this will be masked by the other one, ohmmeter application to them in situ seeming to indicate that they are both o.k.

Then in some models two series-connected transformer windings are used instead of a single centre-tapped winding, to simplify manufacture. It's not unknown for one of these windings in a replacement transformer to be connected in the wrong phase, so that only half-wave rectification is provided. This can be a misleading cause of hum and hum bars.

Where a series regulator transistor or i.c. is used and the severity of the hum bar tends to increase as the working temperature rises, leakage within the transistor or chip is very likely.

Some sets use an active ripple filter. The basic circuit is shown in Fig. 3. The great advantage of this arrangement is that the small base current required by the transistor can be provided ripple-free from a relatively large-value resistor in series with a small electrolytic capacitor. The output at the transistor's emitter should thus be ripple free (the value of the electrolytic capacitor in the transistor's base circuit is in effect multiplied by the transistor's d.c. gain). If collector-base leakage develops however the ripple present at the transistor's collector will be partially impressed on the base, producing ripple at the emitter output by normal transistor amplifying action.

The regulator transistor in a series regulator circuit (see Fig. 4) may be driven by one or two low-power types. One of these senses the output, the idea being to maintain the output voltage at a preset figure and in addition provide active filtering. A collector-emitter short-circuit in the power transistor will thus produce an over-size, hum-modulated picture.

Shading and Brightness Modulation

The occasionally encountered shading or brightness variation across the screen is akin to a hum bar except that the unwanted raster modulation occurs at line frequency instead of at 50Hz or 100Hz. A common cause of this trouble is serious value loss and/or leakage in a capacitor providing the supply for the tube's first anode(s). Similar trouble can occur in brightness control circuits.

Hum on Sound

There are basically four causes of hum on sound: (1) as with hum bars, inadequate smoothing of a mains-derived supply; (2) pick-up of a mains or field frequency waveform, especially from the magnetic fields around a transformer, due to badly earthed a.f. screened leads, an unearthed volume control casing or misplaced wiring; (3) a "floating" high-impedance a.f. input circuit; (4) modulation of the sound signal by the vision signal (not strictly speaking hum).

The "buzzy" nature of this latter type of interference arises from three factors, (1) the large low-frequency luminance content of the vision signal, (2) the 50Hz repetition rate of information and (3) the high-amplitude, relatively long-duration field sync pulse trains.

Vision buzz generally arises in the i.f. circuitry or in the tuner. There are several possible causes. In some cases it may simply be due to an over-advanced sensitivity or r.f. gain control. Other common causes are: a.g.c. failure or reduction below the working level appropriate to the signal strength; impaired decoupling of an a.g.c. rail; a 33·5MHz sound attenuator circuit failing to provide the correct level of attenuation; alignment drift preventing the f.m. sound signal from being correctly positioned on the overall i.f. response curve; and, in particular, misaligned 6MHz intercarrier sound tuned circuits. Where a ratio detector circuit is used to demodulate the f.m. sound the problem can be caused by a misaligned transformer, an open-circuit detector diode, a badly matched pair of diodes or loss of capacitance in the detector circuit's reservoir capacitor.

Inadequate a.g.c. action will generally also result in a noticeably over-contrasted picture, possibly with a tendency to sound-on-vision (cross-modulation). For confirmation of an a.g.c. fault, feed the aerial via a plug-in attenuator so that negligible a.g.c. action occurs. Then, if tuning for optimum picture resolution coincides with maximum, buzz-free sound, the overall alignment can be regarded as satisfactory with failure of the a.g.c. circuit to develop an adequate control voltage as the likely cause of the trouble.

Where vision buzz is not accompanied by increased contrast and tuning for optimum h.f. definition peaks with maximum volume, check that the fixed trimmer in the 33·5MHz attenuator trap is not dry-jointed and that the trap is still correctly tuned to 33·5MHz.

When vision buzz develops only after a period of use, thus suggesting that a sound i.f./demodulator chip is being adversely affected by rise of temperature, a faulty electrolytic in this area is a strong possibility.

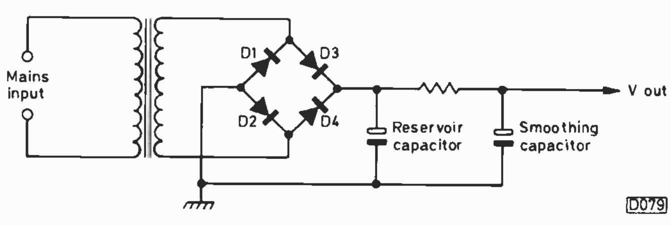


Fig. 1: Basic bridge rectifier circuit with RC filter.

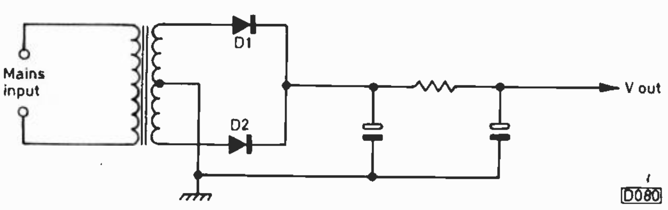
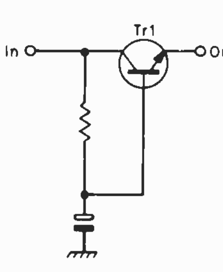


Fig. 2: Basic two-diode full-wave rectifier circuit with RC filter.



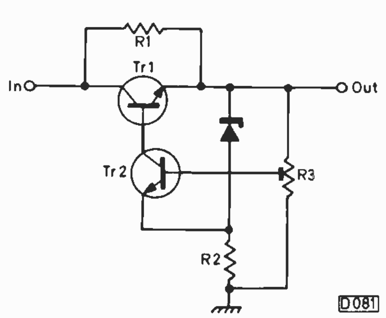


Fig. 3 (left): Basic active filter circuit.
Fig. 4 (right): Typical series regulator configuration. R1 provides a start-up supply and shares the dissipation with the power transistor Tr1. The error voltage is developed across R2, driving the emitter of Tr2. R3 sets the ouptut.

Camcorder Servicing

Part 5

Steve Beeching, T.Eng.

Before considering fault symptoms with solid-state image sensor camcorders, which we'll be doing next month, more ought perhaps to be said about the basic colour processing principles. Its important to understand these if such camcorders are to be handled successfully.

Colour Filter

The colour filter used with solid-state image sensors has magenta (M), green (G), cyan (C) and yellow (Y) sections. As we saw last month, M = R + B, G = G, C = B + G and Y = R + G. We also saw that successive lines are added within the sensor, so that the output from the horizontal shift register is G + C, M + Y, M + C or G + Y. These represent G + (B + G), (R + B) + (R + G), (R + B) + (B + G) and G + (R + G). The output obtained from the sample-and-hold circuit consists of a luminance component plus an h.f. carrier that's modulated by the colour information.

The simplest way to show what happens is to use blocks, as before – see Fig. 1. A and B show a section of one line n in G + C, M + Y etc. and G + (G + B), (R + B) + (R + G) form respectively. As shown at C and D, the bandpass and low-pass filters produce an h.f. colour component and a lower frequency luminance component which combines the elements from successive samples (pixels).

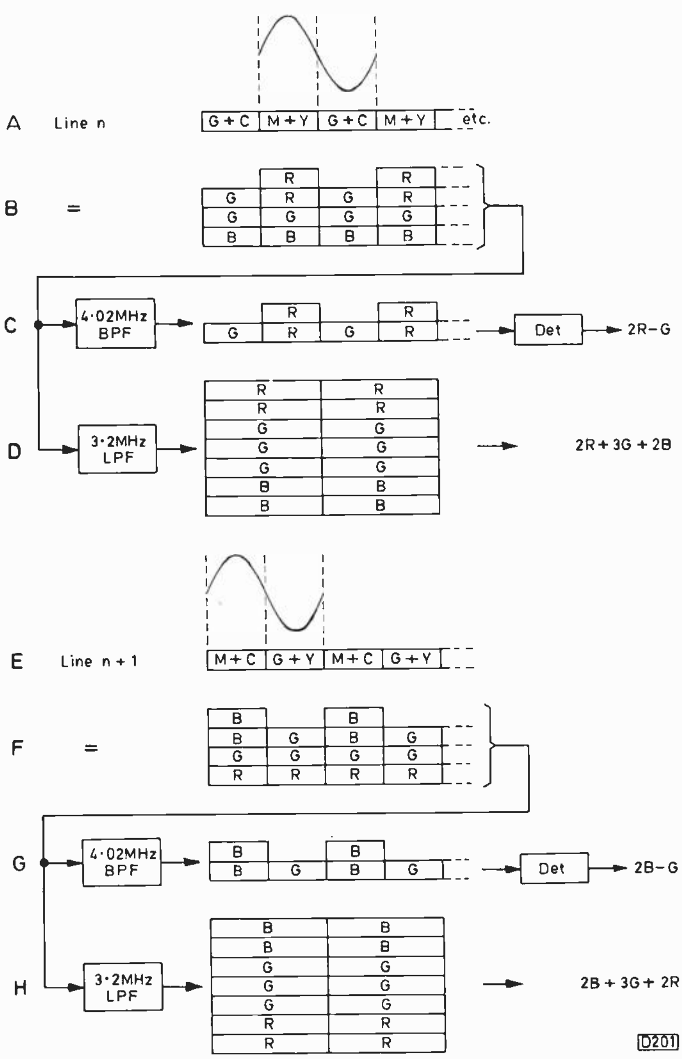


Fig. 1: The way in which the signal samples (pixels) are processed to produce separate luminance and 2R – G/2B – G colour signals on alternate lines with the earlier system that uses filtering and matrixing.

Luminance Output

Taking the section shown under the sinewave in A we have

$$\begin{aligned}&(M + Y) + (G + C)\\ &= (R + B + R + G) + (G + G + B)\\ &= 2R + 3G + 2B.\end{aligned}$$

This is the luminance component on line n.

On line n + 1 the sinewave is phase shifted by 180° and the luminance signal this time – see E and F – is

$$\begin{aligned}&(M + C) + (G + Y)\\ &= (R + B + G + B) + (G + R + G)\\ &= 2R + 3G + 2B\end{aligned}$$

the same as in line n.

Colour Component

Now since each pair of blocks is, from the colour point of view, the equivalent of the positive and negative excursions of a 4MHz sinewave, the colour component obtained on line n is

$$\begin{aligned}&(M + Y) - (G + C)\\ &= (R + B + R + G) - (G + G + B)\\ &= (2R - G)\end{aligned}$$

while on line n + 1 we get

$$\begin{aligned}&(M + C) - (G + Y)\\ &= (R + B + G + B) - (G + R + G)\\ &= (2B - G).\end{aligned}$$

Matrixing Outputs

The matrixing system thus yields a wideband luminance signal on each line while 2R – G and 2B – G are produced in alternate lines. We saw last month how simultaneous R – Y and B – Y signals are subsequently obtained for PAL encoding.

High-resolution System

With the later high-resolution system that employs sampling and filtering to separate the luminance and h.f. colour signals (see Fig. 8 last month) the equivalent conditions are shown in Fig. 2.

Sample-and-hold circuit SH1, fed with sample pulse 2, samples the M + Y signal in line n and holds it over the next G + C component. Sample-and-hold circuit 2, fed

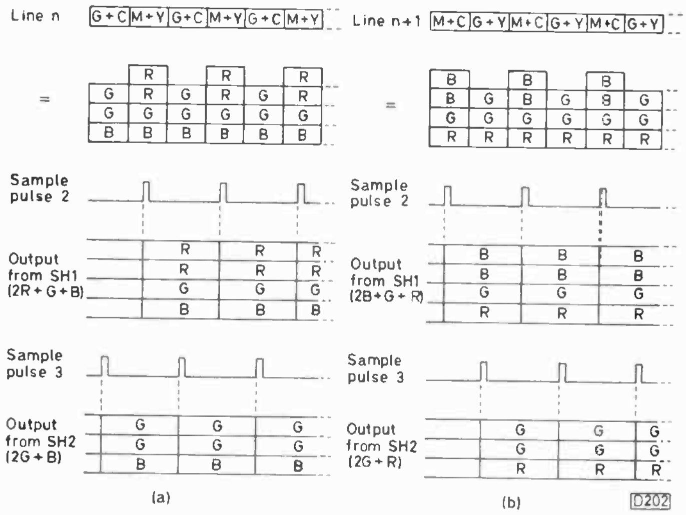


Fig. 2: Equivalent conditions with the later high-resolution system that uses sampling instead of simple filtering to separate the h.f. components of the output from the image sensor. (a) Line n; (b) Line n + 1.

with sample pulse 3, on the other hand samples the G + C signal. On line n + 1 SH1 samples M + C and SH2 samples G + Y.

This gives rise to the following outputs. On line n the l.f. luminance (YL) is 2R + G + B and the colour component 2G + B, while on line n + 1 YL is 2B + G + R with 2G + R colour. As shown in Fig. 8 last month these signals are fed to add and subtract networks. The result of this in line n is

$$\begin{aligned} YL &= (2R + G + B) + (2G + B) \\ &= 2R + 3G + 2B \\ \text{colour} &= (2R + G + B) - (2G + B) \\ &= 2R - G \end{aligned}$$

while on line n + 1

$$\begin{aligned} YL &= (2B + G + R) + (2G + R) \\ &= 2B + 3G + 2R \\ \text{colour} &= (2B + G + R) - (2G + R) \\ &= 2B - G \end{aligned}$$

Now for something a bit more complex. As green is more or less equivalent to YL the expression G = K.YL holds, where K is a constant. So within the adder and subtractor a constant K.YL is added to the 2R − G and 2B − G signals, giving 2R − G + K.YL = 2R and 2B − G + K.YL = 2B, i.e. we end up with 2R and 2B on alternate lines in both the systems shown in Figs. 7 and 8 last month.

Correction – Saticon System

On the subject of colour processing there remains a correction to be made to paragraph three of Part 3 (page 470 in the April issue). With the Saticon tube the cyan diagonals, sloping from left to right, give cyan, green, cyan, green etc. (not cyan, gap etc.). The yellow stripes sloping from right to left give yellow, green, yellow green etc. The scanning is horizontal of course, not diagonal, giving in Fig. 2 gap (white), green, gap, green etc. on line n and yellow, cyan, yellow, cyan etc. on line n + 1. The error was introduced during the editing of the article: J.A.R. has been suitably chastised for trying to over-simplify everything!

The Philips CP90/CP110 Chassis

Harold Peters

When I last wrote on the evolution of Philips CTV sets (June 1987) it seemed that the 2A chassis with its single panel construction would for some time be the main general-purpose chassis. This was not to be. As we went to press the CP90 and CP110 were announced as replacements, a pattern that is about to be repeated.

Many of you, being quite happy with the 2A, must have wondered "why change?" Now that responsibility for the design of Philips TV sets has been moved to the other side of the language barrier perhaps we shall never really know. I suspect that market forces dictated the move, for no sooner had the 2A become established than flatter, squarer tubes were with us — and with them the "square look" that made it convenient to stick the customer controls on the main chassis itself.

Much of the circuitry in the CP90 and CP110 is inherited from the 2A chassis. We will concentrate on the differences therefore. While on the subject of differences, the main changes to be found in the CP110 as opposed to the CP90 are in the line timebase (designed for 110° tubes) and in the chopper power supply, where a TEA1039 control chip is used instead of the CP90's discrete component circuitry. There is also a different colour decoder chip and the circuitry used in the RGB output stages differs. Our comparison will for the most part be between the CP90 and the 2A.

Mechanical Features

While the overall layout of the CP90/CP110 make them look like a 2A with user controls added, individual component layout is vastly different between all three chassis.

The control panel area follows the trend of the portables by including the on-off switch on the PCB, but without the attendant hazard of the incoming lead being anchored to tags at the back of the board. With these sets the mains supply arrives at the board via a connector which is close to the switch. At the other end of the front of the board there's a phone jack with a loudspeaker muting switch. Next to it (CP90 chassis only) there are input jacks for baseband video and audio signals. These jacks are connected in parallel with the complementary scart connector pins. In their place in the CP110 there's a contrast control — the only knob on the set. Everything else is done by pressing buttons. And therein lies a snag.

The pushbuttons are black on a dark background and are mounted beneath the tube in such a way that when you use them your eyes will be on a level with and very close to the brightly lit tube face. You just can't see what you're pressing — or anything else for that matter for about five minutes afterwards. This wouldn't matter too much were it not for the fact that the open-memory button is next to the channel-up button, with the result that many a user accidentally starts the tuning-up procedure (or more likely the detuning procedure) when all he wanted to do was to go from ITV to Channel 4. The writer's colleagues all fit a small plastic sleeve over the open-memory button to serve as a kind of braille warning. The CP90/CP110 were designed with remote control operation in mind of course, but there are occasions when you need to use the front control panel.

The previously mentioned scart socket at the rear of the chassis is a full scart connector with provision for RGB inputs and the control line at pin 8. A button on the remote control handset switches from off-air to baseband signals.

A number of different types of c.r.t.s are used in these sets, including some with grey glass faceplates. This means that minor changes in the timebase and video circuits are required to obtain the correct drive conditions. The things to check when doing a tube swap are the c.r.t. mounting bolts and the degaussing coil fixings, which vary from set to set.

Serviceability on the bench is good, but the design limits serviceability in the field — you are left balancing the chassis on one knee while taking voltage readings . . .

Circuit Features

The tuner, i.f. strip, colour decoder and sync circuits are in the main all handed down from the K40/2A series chassis. In the field output stage there's a cascaded pair of transistors in place of the chips previously used. Connectors are fitted so that a teletext decoder and SECAM transcoder can be added — the latter is a board that identifies a SECAM transmission and turns it into "quasi-PAL" for processing on the main board.

The chopper and line output stages are conventional. A BUT11AF is used as the line output transistor (BU508A in the CP110). By having two separate chassis for 90° and 110° tubes the massive 16-way permutation of components and links found in the 2A chassis is avoided. The set itself looks no tidier but the circuit is much easier to follow.

The chopper circuit used in the CP90 chassis is much like that in the 2A, but in the CP110 a TEA1039 chip replaces the discrete control circuitry. With both circuits the chopper goes into a "tickover" state when the set is in the standby mode, to provide sufficient current to keep the remote control receiver going.

The intercarrier sound, switching and audio circuitry are all contained within a TDA8190 chip. A welcome feature here is the inclusion of a tunable sound detector coil in place of a fixed ceramic filter. This enables you to maked sure that sibilance doesn't occur.

Remote Control and Tuning

Both chassis have a remote control system with VST (voltage synthesised tuning). It's a new system, VST2, that retains some of the features of the version used in the CTX chassis, such as the RC5 handset code and the need for a ni-cad back-up battery, but is this time integral with the main board.

The 2A chassis used FST (frequency synthesised tuning), in which a crystal generated frequency is compared to the tuner's local oscillator frequency and a.f.c. is applied to synchronise the two. It was a user-friendly system that permitted station selection by channel numbers, but was rather heavy on components.

VST is more economical with parts and you would think that the ability to turn up the correct varicap tuning

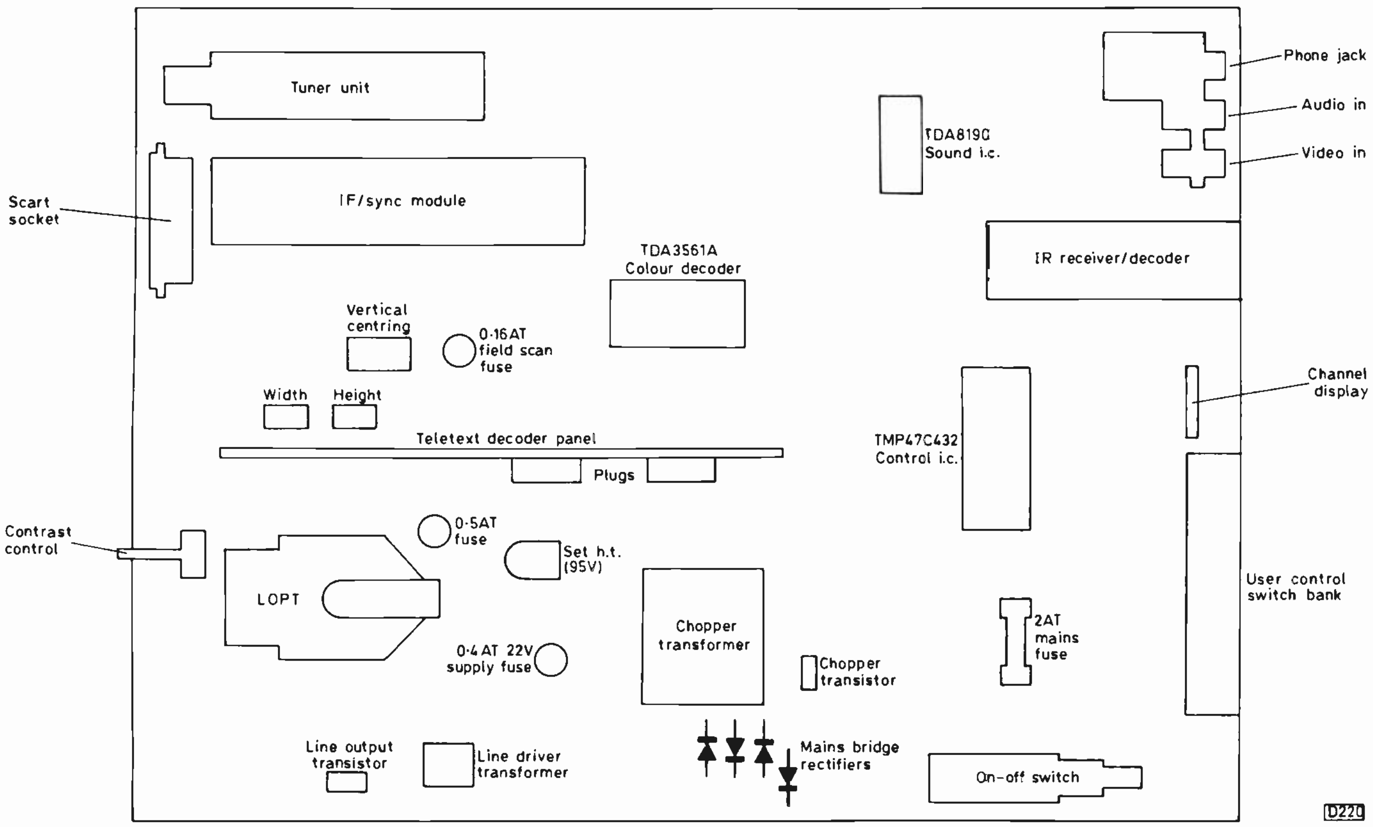


Fig. 1: Basic layout of the Philips CP90 chassis, showing the main components.

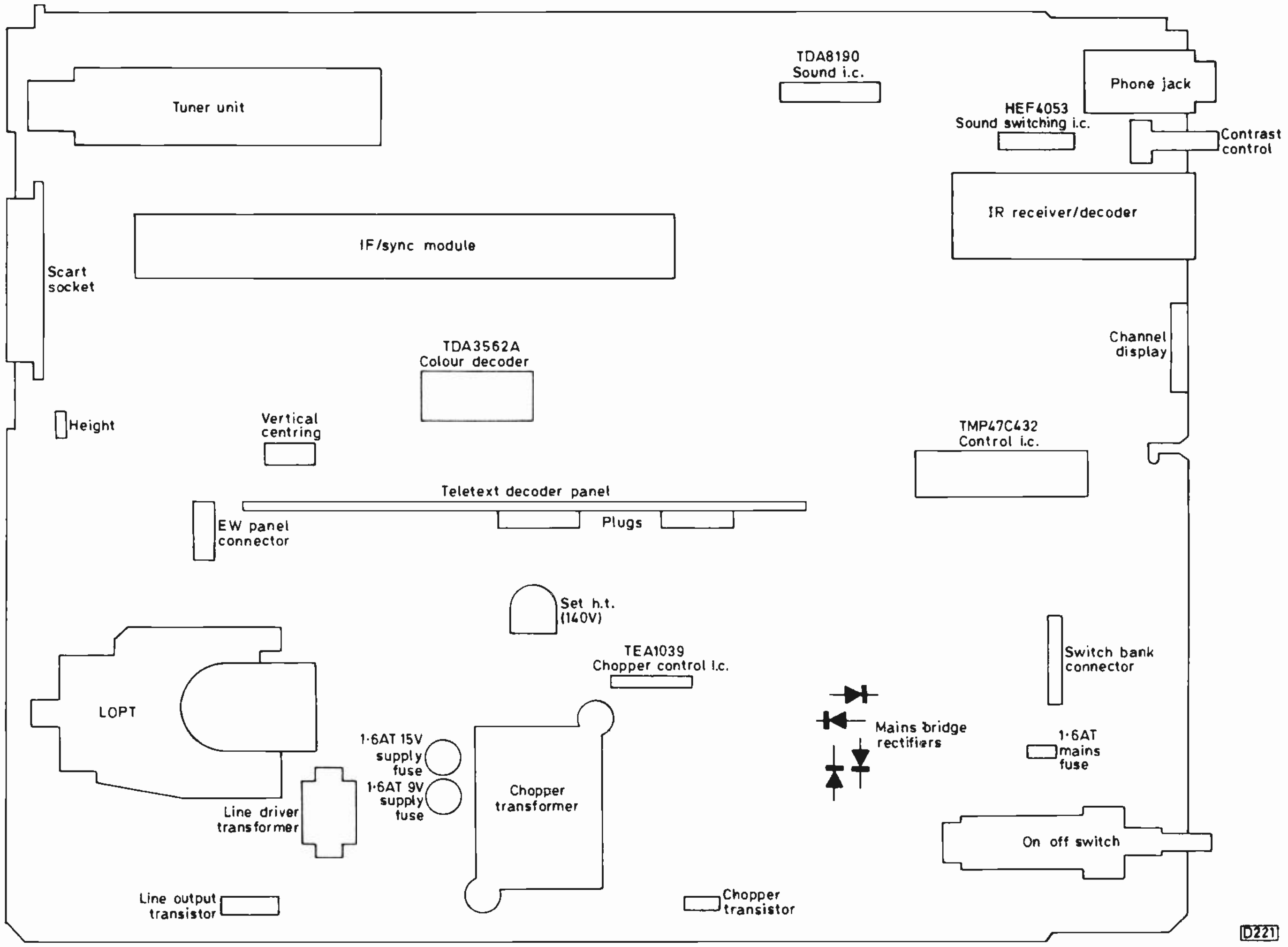


Fig. 2: Basic layout of the Philips CP110 chassis, showing the main components.

voltage on demand would be just as effective as with FST. For the most part it is. There are two shortcomings however. First, the elements inside the tuner settle down physically from new, needing a slightly different voltage to select the required channel than that first set. This is readily overcome by reprogramming the tuning after a few days' use or even after a pre-delivery soak test. The other shortcoming is not so easily fixed but was eventually acknowledged as being a problem. It's the fact that a 1V change in the varicap tuning voltage at the lower end of Band IV can shift the tuning by up to three channels while the same voltage change at the upper end of Band V hardly moves the local oscillator off vision carrier, due to the exponential voltage/capacitance characteristic of the varicap diodes. Normally at the top end the a.f.c. hardly has any effect at all. It can be increased of course — there are volts to spare with all a.f.c. systems — but then when the user tries to tune in to his VCR down at ch. 33 the set "locks up" or jumps channels due to the excess voltage. This occurred at first with the CP90/CP110 chassis, but later models have been extensively modified to improve the a.f.c. action at the top end of the band. The changes are spread all over the chassis, so it's not possible to provide a simple diagram. The gist of what happens is that varicap voltages above 12V get extra a.f.c. while those below don't. Engineers wanting to know more should ask Philips for Service Tip 92A.

Non-remote Version

When the CP90/CP110 series were being designed it was assumed that remote control would be fitted on all sets. This overlooked the needs of vast numbers of rental customers with basic sets, wanting to renew without going up a step in charges. For this and other reasons a couple of non-remote control versions of the CP90 chassis were introduced, one with a scart connector and one without. In these sets the front control pushbutton assembly is in part replaced by rotary controls while the VST system is replaced by a TUON (tuning only) unit similar to that fitted in non-remote 2A sets. Both have the discrete component chopper circuit, both can have the SECAM transcoder added, but neither will accept a teletext board.

Hints and Tips

To work on the CP110 you should have the CP90 data as well. The order codes for the servicing information are as follows:

Item	*CP90*	*CP110*
Service manual	727 15737	727 15947
Circuit description	725 15748	727 15889
Teletext decoder supplement	727 16185	727 16185

As with all contemporary designs the CP90/CP110 has a reliability record that makes it difficult to list "stock faults". In fact most of the service tips that have come from Philips Service relate to the wide variety of different c.r.t.s you may encounter. This is mainly because after production commenced the style was changed with the adoption of a range of tubes with grey-tinted faceplates. This involved changes to the brightness and beam limiting circuits. Another change was to a fastext decoder which Philips perversely call FLOF (full level-one features). If it were not for the Philips *Service Link* and John Spilsted's carefully maintained fault log we would not be able to provide the following service notes.

First the chopper power supply, which is best serviced using a variac and with a 60W bulb as a dummy load in place of the receiver circuitry.

The BUT11AF chopper transistor in the CP110 chassis fails from time to time, usually with high mains voltages. Before replacing it check that C2661 has been changed from 1,500μF to 2,200μF, that R3658/9 have not changed value and that C2657 (2·7nF) has been removed. Then replace the TEA1039 chip and bridge rectifier diodes D6657-D6660 as well as the BUT11AF.

When the BUT11AF chopper transistor fails in the CP90 chassis D6674 should be changed from type BAX14 to type BYD33J. It's good preventive practice to make this change whenever one of these sets comes in for service.

No sound and vision with the set stuck in the standby mode occurs when D6670 (1N4148) in the CP90 chassis goes open-circuit.

For poor width/e.h.t. regulation, flutter at the edges, with the CP110 chassis check T7671 (BC328) and the chopper transformer. The chopper transformer in the CP110 chassis can be responsible for odd faults such as flicker, jumping, supply collapse etc. because of loose wound foil not connecting with the leadouts. Check the transformer by pressing it. This doesn't happen with the CP90 chassis which uses a conventional wire-wound chopper transformer.

No results with the CP90, the h.t. being low at 50V, can be caused by two items in the line output stage, the transformer and D6610.

A shorted line output transformer in the CP110 chassis produces the following symptoms: no results with a loud tripping noise. For striations on the left with this chassis check whether D6630 is open-circuit. If you have intermittent failure to start up with the CP110 chassis check for a dry-joint on the line driver transformer. Unfortunately access to this component is poor.

Two things have been found to cause low width with the CP90 chassis, a dry-joint on D6609 in the diode modulator circuit and R3600 (8·2Ω) going open-circuit. Low width with the CP110 chassis occurs when C2620 (22nF) goes open-circuit, taking with it R3599 (47Ω), R3629 (1MΩ) and R3630 (47kΩ).

For lack of height with the CP90 chassis check R3582 (3·3Ω) which can go high in value.

Field foldover with the CP110 chassis should lead to a check on C2574 (680μF).

For intermittent picture fade with the CP110 chassis, check for a dry-jointed link wire at R3438 on the c.r.t. base panel.

If there's low video from pin 19 of the scart connector with the CP90 chassis, reduce the value of R3517 from 6·2kΩ to 1kΩ.

Buzz on quiet sound passages with the CP90 chassis can be cured by replacing the ceramic filter 1103 with the four-legged type 310 27563.

For no sound or vision with a snowy raster present on the CP110 chassis check for a dry-joint on the 10Ω safety resistor R9051. This is in the 12V supply to the tuner and is not shown on the circuit – it's used in place of link 9051.

No sound with the CP90 chassis has been traced to C2046 being leaky, upsetting the video recognition input to the sound chip. It's not shown on the circuit diagram, being inside the sync module – not an obvious one!

For tuning drift on high channels, see the previous remarks on the VST a.f.c. modifications.

A faulty SAA5243 chip on the teletext panel can cause the following symptoms: memory changes pages without being asked; characters are displayed double, e.g. PP112200; the fastext buttons have no effect.

The G90 and G110

After a successful couple of years the CP90 is already going out of production, the new G90 chassis gradually taking its place. Suffixed /A for mono, /B for stereo and /E for European, the layout of this chassis is basically the same as the CP90 but as you look in the back you see few conventional discrete components. This is because wide use is made of surface-mounted components which are on the copper side of the board.

The G90 takes several features from the 3A chassis — the multistandard colour decoder chip set, the colour transient improvement (improved!) and the on-screen channel display. This latter feature will also show up to eight fault conditions, F0-F7. If there's no raster you can still find what code is being produced by using an oscilloscope to measure the off time of the flashing LED just below the c.r.t.

Another feature is the "sleep" facility. You can program the set, in increments of fifteen minutes up to a maximum of ninety minutes, to turn off to standby. The G110 version is due this autumn.

Product Review: Satellite TV Filter

Roger Bunney

In the August 1988 issue I described a simple i.f. bandwidth filter unit for use with weak satellite TV signals. It can lift an otherwise unusable signal to something approaching watchable quality. Using new components from Maplin, it costs only around £3 to build.

Recently I noticed that Micro-X (telephone no. 01-459 1200) has introduced a variable bandpass filter, the Phantom IFP70, for use with 70MHz i.f. receivers and obtained one for evaluation. It's housed in an attractive black aluminium case with contrasting brushed aluminium front panel and measures approximately 6 × 1¾ × 4in. excluding the two front knobs that add a further half inch depth and the rear sockets. The front panel controls are for power on/off, gain and bandwidth. Even when the unit is not being used as a filter a 12V input is required to maintain signal continuity via the switching diodes. The unit incorporates a stabiliser and will work with a supply of 9-15V, via a standard low-voltage tubular 2·5mm plug. Input/output at 70MHz is via American F sockets. Though F plugs are simple they are difficult to wire unless a crimping tool is available. With the larger Radio Shack F plug however you can solder the coaxial screen to the plug body on its crimping ring, two layers of heatshrink providing adequate mechanical strength. Maplin can supply inexpensive F plugs.

The filter is connected into circuit via the i.f. loop facility at the rear of the receiver – you will find that this is present on most receivers, intended for making a connection at 70MHz to an unscrambler. It also gives you access to the i.f. strip to enable filtering to be introduced – connect the receiver's output to the filter's input and the filter's output back to the receiver's input. Most receivers also have F connectors, so it may help to obtain from a dealer two F-plugged leads, say about two feet long, to make interconnection simple.

Imported manual receivers like mine tend to have minimal facilities. They offer maximum "hands-on" operation however. It's unusual to find dual bandwidth video switching, the i.f. bandwidth generally being fixed at around 30-32MHz. Because of this you will tend to get sparklies with a weak signal – also when a half transponder signal is displayed via a full bandwidth receiver. For improved results with weak or half transponder signals you need to optimise the i.f. bandwidth. The aim is to improve the signal-to-noise ratio.

Operation of the Phantom IFP70 unit is extremely simple and the results can be dramatic. Connect the filter to the i.f. loop and apply 12V. Set the gain control to mid-travel and the bandwidth control fully anticlockwise (wideband position). Select a weak satellite TV downlink signal, push the power button to the on position and rotate the bandwidth control slowly clockwise. You will see the picture change. Many receivers don't have a readily accessible a.f.c. on/off switch, and as the bandwidth is reduced you may get slight detuning. Correct for this with slight adjustment of the main tuning knob. If the a.f.c. can be disabled easily do this to avoid the need for retuning. Reducing the bandwidth gives a dramatic reduction in the residual noise (sparklies) on the screen – they may even disappear, leaving you with a very good picture.

Bandwidth limiting is a very effective means of noise reduction. Half transponder signals from Intelsat craft can be lifted out of the noise since you are tailoring the i.f. passband to the bandwidth of the incoming signal. With weak full transponder signals, gradual bandwidth reduction provides a considerable improvement, though there's a critical point where highly saturated colours such as red or blue go into heavy noise. Slightly backing off the bandwidth control will give you an acceptable compromise.

With the gain control at minimum (fully anticlockwise) the unit introduces about 10dB of attenuation. At normal mid-setting the gain is around 14dB.

The filter has a maximum bandwidth of 32MHz (−6dB points) and gives continuous reduction to 12MHz. The input/output impedance is 75Ω.

Inside the unit there's an extremely neat and well designed board. The single sided A4 instruction sheet describes it as a "dual varactor tuned notch with three-pole fixed 70MHz bandpass filter".

I found that all noise could be removed from Astra signals – reception of these at my location is through trees and is thus normally noisy. With a 1·5m prime-focus dish directed at 18·5°W I found that almost sparklie-free reception of the Italian downlinks was possible. This was also the case with Scandinavian signals from 1°W. The EBU news feed from 27°W was similarly noise-free apart from the reds. I don't have access to measuring equipment, but a comparison of the results obtained with photographic signal/noise charts displaying noisy off-screen images shows that the unit can provide a very worthwhile 10-12dB improvement in the signal-to-noise ratio.

The unit is perhaps expensive at around £100 plus VAT – but I was so impressed with the sample that I purchased it.

VCR Clinic

Reports from Eugene Trundle, Alfred Damp, Ian Bowden, E.M. Beddow, Nick Beer, V.W. Cox and John C. Priest

Panasonic NV7200

During the space of a week we've had two of these machines with the same fault. The symptom is that at the beginning or end of a cue or review session the machine appears to enter the still-frame mode for a few seconds then reverts to stop. The mode switch can sometimes be responsible for this. In both of these machines however the cure lay in replacing both loading belts. Slippage of these belts is more often accociated with failure to complete tape loading. **E.T.**

Panasonic NV-G25

The complaint with this machine concerned LP recording: there was a poor picture, poor sound and the speed varied. We found that the results in the SP mode were not very different and that the tape was riding high past the audio/control head stack then wrinkling between the capstan and the pinch roller. The problem was caused by a faulty pinch roller – the one that lowers itelf into position. A new one and a clean up restored good results in both the LP and the SP modes. **E.T.**

JVC HRD400

If you come across a case – possibly intermittent – of no E-E sound and no recorded sound check for a hairline crack in the print at the rear of the main PCB (03) adjacent to the left-hand unsoldered lug of the r.f. modulator can. It seems that the modulator "rocks" when the aerial plugs are inserted or withdrawn, stressing the PCB. **E.T.**

Panasonic NV2000

This machine had a mixed bag of symptoms: no clock display, the tuner not working, the capstan running slow and erratically and hum bars on the monitor screen. All were cleared at one stroke when C1009 (1,000μF, 35V) in the power supply section was replaced. **E.T.**

Hitachi VT120

The customer's report was that the picture was intermittent. On test the machine displayed a noise bar that rolled through the picture, as though there were no control pulses. Both own recordings and prerecorded tapes were affected. We found that the control pulse input to the servo i.c. was present and correct, but a check on the other waveforms around IC601 revealed that the capstan phase control pulse at pin 11 was missing. As all the inputs were correct the chip was replaced, clearing the fault. **A.D.**

Ferguson FV22L

A modification kit for this machine has been produced to deal with intermittent faults in the timer mode. The faults that occur are that the machine will switch out of a timed recording or will not stop at the selected time, the recording continuing until the end of the tape when the cassette is ejected.

This modification also cured an intermittent fault in the "instant record" mode. What would happen was that if the machine was set to record in this mode for over an hour it would turn itself off approximately one hour before the selected time. **A.D.**

Philips VR6362

This machine would switch on and off but wouldn't accept a cassette. When a 9V battery was connected across the loading motor the mechanics would thread in and out correctly, thus exonerating the eject rack and differential gear assembly. The fault was being caused by the load motor driver chip which had a short-circuit output pin – the pin that drives the load motor in the threading in direction. **A.D.**

Mitsubishi HSB30

There was no playback picture with this machine. We traced the playback f.m. into and out of IC2A1 and then to transistor Q2B2 where it disappeared. Replacing Q2B2 cleared the fault – it was open-circuit. **A.D.**

Panasonic NV-F70

This machine was completely dead. The mains fuse was intact so the fault was in the switch-mode power supply, where the primary side wasn't starting up. C1109 (1μF, 400V) should provide a pulse to the chopper transistor within IC1101 (STRD6008X) to get things going but there was no pulse at pin 2. The i.c. was found to have an internal short-circuit between pin 2 and pin 4 (ground), a replacement restoring normal operation. Note that there's an error on the circuit diagram, where the base and emitter of the chopper transistor are shown shorted together. **I.B.**

Panasonic NV-G12

When play was selected the drum motor didn't move so the machine cut out. This was quickly traced to an open-circuit fusible resistor, R2012 (6·8Ω, 0·5W), which is connected from the unregulated 14V supply to the common connection of the three-phase DD drum motor. The resistance to chassis on the motor side was only 7·5Ω – this turned out to be the resistance of one phase of the motor.

A check at connection P201 revealed where the short was – on the winding connected to pin 1. When the head amplifier was removed to check the leads the reason for this was found. One of the ten leads was trapped between the right-hand head amplifier support bracket and the main chassis. It must have been like this since the machine was made some eighteen months ago. **I.B.**

Ferguson FV10

The reported fault was that this machine wouldn't accept a tape. This was so – if a tape was manually inserted the fast forward and rewind modes would operate but play wouldn't, as there was no drum rotation. The tape could also be ejected, but there was no carriage-stop detection and the front loading motor would keep going for a few seconds until the machine switched itself off.

The cause of these problems was loss of the switched +12V and +5V supplies due to a faulty multiregulator chip, IC801 (STK5481). It's mounted on the right-hand side of the main PCB. **I.B.**

Philips VR6460

This machine nearly drove us round the bend. The customer's complaint was that it played back its own recordings quite well but with films from the hire shop there were wow on sound and noise bars on the picture. Our field engineer gave the machine a thorough clean up, paying particular attention to the tape path and the control head, though the machine worked perfectly while he was there.

A week or so later the inevitable repeat call came and the machine was brought back to the workshop, together with a film. Once it was opened up on the bench our first step was to try an MH2 test tape and see whether it would play this back correctly. It did. Several other tapes were tried and seemed to be o.k., but the machine flatly refused to play the film supplied. The capstan servo seemed to lose lock, as if the control pulses were missing. As the tape was suspect it was tried on another machine, which played it back normally. So now we were thoroughly confused!

After a lot of time was wasted scoping the control pulse outputs etc. and setting up the lateral position of the control head as per the manual we discovered that if the back tension was reduced by resting a finger against the tension arm the fault almost cleared. A similar effect could be obtained by increasing the pinch roller pressure. The pinch roller and back-tension band were replaced and, you've guessed it, the fault was still present!

We decided that the back tension was excessive. This was backed by our observation that the tape seemed to be very tight between the exit guide and the pinch roller. At this point the penny dropped. Could the lower drum be too shiny so that the tape was sticking to it? Changing the lower drum completely cleared the fault. The price of this unit was £220 from Philips, £150 from Panasonic. Fortunately the machine was insured! **E.M.B.**

Ferguson FV11

The temporary field engineer accused the tuner of being the cause of no signals. He ought to have known better! There was no tuning voltage – the regulated 30V supply was being lost across R53 as there was a short from the tuner's BT pin to chassis. We found that the pin hadn't been trimmed and was shorting to the bottom cover. When this was corrected the machine still didn't tune as there was now no load on the BT rail. The control transistor had no drive from the frequency-synthesiser tuning chip IC3 as there was no 5V supply. A break was discovered in the print between IC3 and the 5V regulator IC1. **N.B.**

Sanyo VHR1300/Salora SV6600

The customer had complained about poor pictures and the heads were badly worn. When these were replaced things looked fine. While the machine continued to play the test tape I relocated the PCB that hinges over the mechanism: the drum and capstan servos then began to vary widely. By flexing the board both motors would stop and the machine would unlace. The fault could be provoked by prodding or poking in the servo area of the board to any degree. As the fault was so general I checked the servo d.c. supplies and found that the always 5V and 15V voltages disappeared between CN1003 and CN1004. The tracks that link these two connectors run right at the back of the panel, over the r.f. connection sockets, and were all broken in two places each. A point to note if you have a heavy-handed customer. **N.B.**

Philips VR6462/Pye DV464

For failure to eject fully, failure to rewind a tape fully into the cassette before eject, and sometimes swallowing a cassette when attempting to extract a partially ejected cassette proceed as follows.

Check the alignment of the guide reference holes D and E on the control disc or cam gear (item 247, part no. 4822 466 21014) below the chassis. Operate the mechanism two or three times then recheck the alignment. If it has shifted, examine the V-shaped lever (item 242, part no. 4822 403 52252) and the glide block or cam follower (item 238, part no. 4822 466 813650) which is pivoted on the end of the shorter arm of item 242 and rides in the spiral groove of item 247. Sometimes the pin set into the end of the lever arm on which the guide block pivots becomes loose in its setting, allowing the guide block to float loose and the linkages to go out of sync.

If this is the case item 242 can be replaced. It can also be repaired as follows. Remove lever 242, taking care not to lose the pin if loose. Remove the pin and put it safely to one side. Also remove and take care not to lose the fine spring that surrounds the pin and locates in a small hole in the arm. This spring is not shown in the relevant diagram and doesn't have a part number – if you lose it you will have to order the lever complete.

Take the lever minus spring and pin and lay the end flat on a firm surface, vice jaws or a steel block. Give the pinhole area of the lever two or three light taps on the top and bottom with a small hammer. In this way the hole will be shrunk sufficiently to allow the pin to be pressed firmly and securely back into place. This must be done carefully, for example by lightly gripping the lever and pin between vice jaws, holding the pin in exact register and perpendicular to the surface of the lever with fine-nosed pliers or tweezers, and pressing firmly home by applying pressure from the vice. Warning: before you apply pressure make sure that the pin is on the correct face of the lever – it's possible to insert it from the other side. When the pin and lever have been correctly fitted reassemble the lever, glide block and control disc as described in the manual, paragraph 2.1.19. Finally, after checking the alignment of reference holes D and E as above test the load and eject action a few times and recheck D and E again. **J.C.P.**

Sanyo VTC5000, VTC5150 etc

For no colour in the record mode but playback of previous recordings being o.k., check whether diode D1008 is open-circuit. When it goes open-circuit the 5·12MHz signal doesn't reach the colour down-converter. Intermittent colour recording and return to the E-E mode is caused by dirty contacts on the record/playback relay RY1001. **V.W.C.**

Vintage Scene: The Telectroscope

Chas E. Miller

On an autumn day in 1896 the crowds going about their business in Vienna's Karlsplatz were faintly puzzled to see men placing a mysterious black box on the sidewalk, facing the Karl's Church. After making some adjustments to the siting of the box and to its unrevealed contents the men jumped into a carriage and were driven off at a gallop. Little did the passers-by realise that they were witnessing the setting up of an early demonstration of cable television.

Jan Szczepanik

The inventor whose brainchild was about to be shown to a select gathering was a 24 year old Polish emigrant called Jan Szczepanik (pronounced Shtaypanic). Born in the little Galician village of Krosno on July 12th 1872, Szczepanik had been orphaned at an early age and raised by an aunt. He was trained as a schoolteacher and received his diploma in 1892. His first teaching job was at the village school in Korzyna, where he was apparently popular with the pupils but not his employers, who found that he was devoting a great deal of his time to optical and electrical experiments. These were directed partly towards inventing a weaving machine that would take the time-consuming drudgery out of the manufacture of large tapestries, and partly towards producing a device that would enable him to see at a distance, i.e. television. The factors behind these twin passions related to his boyhood in Krosno, where he saw men and women working long, ill-paid hours at hand-looms, and to a promise he'd made to a young lady that he would someday construct a machine that would enable him to see her no matter how far away she might be. That's the story, anyway.

By late 1894 Szczepanik believed that he was on the verge of success with what he then called his "distance seer", on paper at least. But he was urgently in need of funds to produce a working model. He wrote to the Austrian Minister of War to the effect that he had an invention of great military importance and that it would be presented to him in return for money with which to develop it. Why Szczepanik chose Austria in preference to his native country is not related by history: maybe it was a second choice after being turned down by Warsaw. Be that as it may, after being invited to bring his drawings to Vienna Szczepanik failed to convince the Austrian authorities that his invention had any future and was soon reduced to hawking it around the capital in an attempt to find a backer. After two months of this he gave up and went back to his teaching job in Poland.

Unknown to Szczepanik at the time however the news of his work had not after all gone unnoticed. A Viennese businessman by the name of Ludwig Kleinberg decided that there might just be something in it, and wrote to Szczepanik inviting him back to Austria. When he returned Kleinberg set him up with a small factory, workmen, materials and capital, and gave him a brief to produce a working example of his revolutionary weaving machine. Kleinberg may well have come to regret his actions, for during the following months he was brought close to bankruptcy by the escalating cost of Szczepanik's experiments. The eventual urgent need to raise additional capital was met by Kleinberg taking a wealthy German architect called Franz Hagen into partnership with him. From this point on matters seem to have improved rapidly. Patents were soon taken out, and these realised some £100,000 – a vast sum in those days – from licencees in Germany and England. Although an account of how the weaving machine worked may not appear at first sight to have much to do with television, I must ask you to bear with me – it will reveal a surprise.

The Weaving Machine

The basic principle employed was to photograph any desired design using a special giant-sized camera, at that time the largest in the world. A contemporary photograph showing Szczepanik standing alongside this camera suggests that if he was of average height it must have stood over six feet high. When the bellows were at full stretch it was some twenty feet long. It weighed over two tons, and had to be supported by a small railway track. The lens was five inches in diameter. If my rusty knowledge of photography serves me correctly this indicates a maximum aperture of f48, so lengthy exposures must have been needed with the glass plates used. These were correspondingly massive, being four feet square and weighing in at 65lb. Each plate was ruled into over 800,000 tiny rectangles to produce – and this is the word that leaps from the 90 year old description – a raster.

So here, in the unlikely context of a tapestry factory, we find the first reference to a word known to all of us but whose origin I've never found to be explained in any of the technical books I've read. When the photograph of the desired design was printed on paper the rectangles forming the raster corresponded to the different threads, bindings and so on of the tapestry to be made. It was claimed that this method made it possible to produce in less than an hour a pattern that would previously have taken six to eight months to prepare by hand. This sounds comparable to the kind of time savings made possible in certain jobs nowadays by the use of a computer. With the huge potential savings in costs for textile firms thus made possible, it was a forgone conclusion that the idea would pay off. Soon money was flowing into Szczepanik's hands, enabling him to restart his television experiments.

Television Experiments

Reading the account of Szczepanik's experiment in the Karlsplatz in 1896 one is immediately struck by the preamble. It dealt with the persistence of vision and the need to break pictures up into a large number of elements in terms little different from those to be found in modern textbooks.

The transmitter employed a scanning disc perforated with upwards of 40,000 holes, revolving between a lens and a circular selenium cell. As the scanning disc rotated, successive picture elements reached the selenium cell whose resistance varied in step. Yes it does sound like a description of Baird's apparatus, but at this time Baird was an eight year old schoolboy. Furthermore Szczepanik considered the scanning disc to be a crude way of going about it and within a short time had abandoned the disc in favour of something better. It did serve however to convince his business partners that his telectroscope was a practical proposition.

The transmitter Szczepanik had set up in the Karlsplatz was connected via the Viennese public telephone network to a receiver in Herr Kleinberg's house, where the selenium cell's output was received as a constantly varying a.f. This was applied to a receiver which had a light-modulating device consisting of two thin metal plates whose close proximity enabled them to be vibrated electromagnetically by the incoming a.f. As they did so the gap between them varied, and by placing the device in front of a light source – an electric lamp – it acted as a light modulator, in step with the transmitter's output. We don't know the frequency range of the Viennese telephone system at the time, but it seems doubtful whether the modulating frequencies received could have exceeded a few thousand Hz. Another scanning disc that revolved, hopefully at least, at the same speed as the one in the transmitter was placed next to the light modulator. In this particular experiment there was no attempt to view the picture produced directly. Instead it was focused on to a photographic plate. When this was developed it showed a poor but unmistakable image of Karl's Church. It was sufficiently convincing for Szczepanik to be given adequate financial means to embark on improvements.

Improvements

The first of these was the replacement of the clumsy scanning discs with an ingenious system of vibrating mirrors. Each was made of highly polished metal some two inches long by quarter of an inch wide, with most of the reflective surface blacked out to give just a knife-edge strip along its length. Two were employed, arranged at right angles to each other. They were mounted on "sounding boxes" – a type of diaphragm – designed to respond to sounds of around 4kHz produced by an electric bell. The sounding boxes were provided with tuning arrangements to ensure that both responded accurately to the bell and vibrated in perfect unison. When they were vibrating the effect so far as the human eye was concerned was not of knife edges but of a small rectangular mirror.

The image from the lens was focused on the first, horizontal mirror which, as it vibrated, had the effect of scanning the image vertically. Light from this image was focused on to the second mirror which, being vertically mounted, scanned the image horizontally. The overall effect was to reduce the image first to a line and then to a single point which was in turn focused on to the selenium cell. To the eye it would seem that a full picture was being projected on to the cell, but in fact the cell received a rapidly moving modulated light spot. It does sound familiar, doesn't it? But this is not the complete story. A prism was interposed between the lens and the first mirror to split the incoming light into its component colours. According to the wavelength of each colour, its exit angle from the prism varied very slightly but significantly from that of the other colours. When the final image was focused on the selenium cell the output from this was thus dependent both on the colour and the intensity of each picture element. As before, the signals were carried to the receiver(s) by cable.

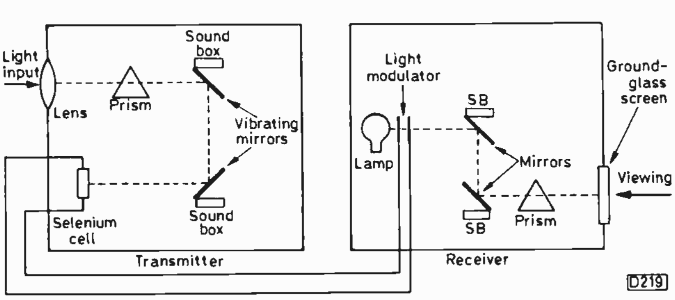


Fig. 1: Basic principle of the telectroscope.

The receiver employed a pair of vibrating mirrors arranged in the same way as in the transmitter. Synchronism of movement was achieved by having the sound boxes and actuating bell tuned to the same note as that used at the transmitter. The mirrors reflected light from an electric lamp via an improved modulating device. This had thin metal "lips" which passed a changing band of light as thin as a hair. After deflection by the mirrors the light, now consisting of a series of points, passed through a prism to reverse the colour-splitting process. In this way an image in full natural colour was apparently built up on a ground-glass screen.

Paris Grand Exhibition 1900

According to the writer who provided an account of the telectroscope in 1899 "the ground-glass plate . . . receives (pictures) in their original colours in a perfect vision which moves and changes as the objects or figures at the transmitter move and change". But whether this description was inspired by a practical demonstration or Szczepanik's own explanation is unclear. What may be significant here is that when asked when the telectroscope would be seen in public Szczepanik replied that this would not be until the coming Paris Grand Exhibition in 1900. A French syndicate had deposited to a third party a bond of two million francs for the rights to demonstrate the telectroscope in a special building which would hold between eight and ten thousand people. The syndicate was to take 40 per cent of the profits, Szczepanik and his associates 60 per cent. On the basis of several demonstrations a day over six months, with an admission charge of three francs per head, Szczepanik estimated that the profits would comfortably exceed six million francs. Under the terms of the agreement Szczepanik was forbidden to exhibit the telectroscope prior to the Paris event, on pain of forfeiting his own bond of one million francs.

The reporter next asked whether pictures could be thrown on to a screen for large-scale viewing, to which Szczepanik replied that there would be no difficulty – it would be as simple as operating a magic lantern. As for the distances over which pictures might be transmitted, in theory there was no limit but in practice the cost of the cable would be a determining factor. Up to that date the longest distance that had been achieved was just under forty miles.

Well, those were the somewhat grandiose predictions for Victorian-age cable TV. The reality was probably somewhat less impressive. In one of his books F.J. Camm dismissed Szczepanik's equipment as "little more than a shadowgraph". Its name, and perhaps its principles, were borrowed from an earlier invention by a M. Senlecq of Ardres, France, dating from 1879. Yet there remains that interesting use of the word "raster" and of vibrating mirrors, which have had a recent revival in modern infrared analytical machines. Interestingly enough these also employ a mathematical formula devised by a nineteenth century scientist, Fourier. There's not much new under the sun. . .

Servicing Compact Disc Players

Part 4

Joe Cieszynski

OVER the past three months we've been laying down the foundations on which a sound knowledge of the compact disc system can be based. We have tried to adopt a practical approach, and last month talked about some initial checks and the basic start-up procedure followed by most CD players, i.e. focus search, disc run-up/tracking search and reading the table of contents (TOC). This month we will conclude our "foundations course", after which we'll be able to move on to more involved theory and advanced fault location routines.

The RF Waveform

One thing we mentioned last month was ways of observing the off-disc r.f. waveform to ascertain the performance of the laser. Examination of this waveform can tell you far more than whether or not the laser is working as it should do: I prefer to liken it to the off-tape f.m. waveform in a VCR. Just as you can ascertain the condition of the heads, tape path, servo adjustment and tape from the f.m. envelope in a VCR, examination of a CD player's r.f. waveform will tell you about the condition of the servos, preamplifiers and disc in addition to the state of the laser. First then what exactly is the r.f. waveform?

As we have seen the data is stored on the disc in the form of a series of pits which, for the reasons discussed in Part 1, are proud of the surrounding land area. As the laser's beam approaches a pit the amount of reflected light is progressively reduced. Hence the current in the pick-up detectors falls. This condition is shown at A in Fig. 1. When the beam is over the pit the current remains at a low level, as shown at B. As the beam moves off the pit the current once more rises to a maximum value, see C and D.

The laser beam crosses pits at a rate of millions per second as the disc rotates. Hence the waveform shown in Fig. 1 represents only a very small sample of the actual output signal. In practice when you scope the output you find that the rising and falling pit transitions take on a sinusoidal appearance. Furthermore as the pit rate is not constant the scope will show a number of streams of data, i.e. a multiple number of sinewaves. This is known as the r.f. waveform. Depending on the speed at which you set the scope's timebase you will see one of the waveforms shown in Fig. 2.

RF Signal Processing

Fig. 3 shows in block diagram form the r.f. amplifier section of a typical CD player. This diagram is based on the Sony CX20109 chip, which also contains the focus and tracking signal amplifiers plus other relevant circuitry. We'll come to these later. You'll find this i.c. in many players other than those of Sony manufacture.

The four main pickup detectors are connected in two parallel pairs. The current that flows through these is proportional to the reflected light and is fed to separate operational amplifiers. These are used as current-to-voltage converters. The outputs from these two amplifiers are known as the A + C and B + D signals. They are fed to the focus error amplifiers and are also added together at the junction of R1 and R2. The test point at the summing amplifier's output is the point that gives you access to the r.f. waveforms shown in Fig. 2. Due to their small amplitude it's not possible to observe the signals at the photodetectors.

Now that the signal is large enough it can be squared in order to reconstitute the original binary data. This is done in the auto asymmetry control section. Here amplifier 1 acts as a slicing amplifier whose slicing level is set by amplifier 2. The combined operation of these two amplifiers in conjunction with the phase locked loop oscillator is complex, but we'll keep to a simple approach.

The oscillator is free-running and generates a constant squarewave at the bit rate of 4·3218MHz. When the squared data from amplifier 1 is applied to the PLL the oscillator swings in sympathy with the data and becomes locked to it. If you refer back to Fig. 8 in Part 1 you will see that the point at which the r.f. signal (C) is squared is at the centre of the sloping edges (D). But an examination of Fig. 2(a) shows that not all the sinewaves in the r.f. waveform are of the same amplitude. Thus a fixed slice level is no good. Amplifier 1's slicing level has to be variable so that the centre of each sinusoidal excursion can be noted and the correct squarewave extracted. This is

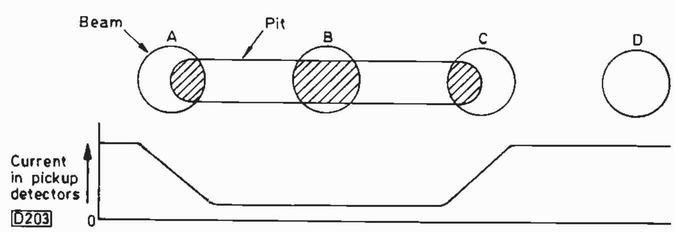


Fig. 1: Laser beam traversing a pit, showing the effect of the pit on the output current waveform.

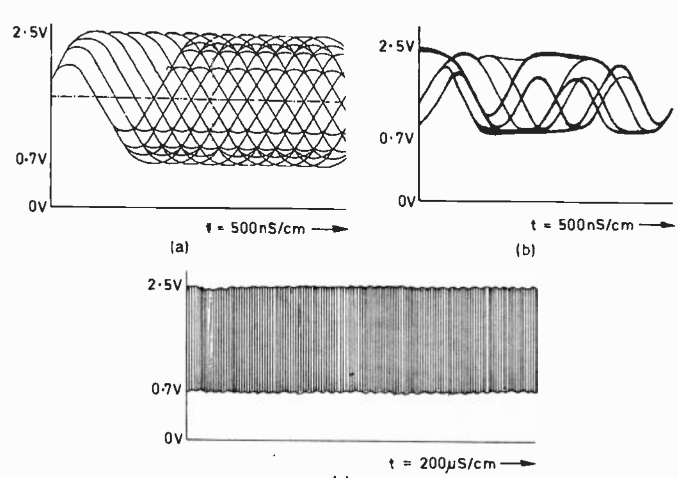


Fig. 2: Off-disc r.f. waveforms. (a) Observed during a passage of music. The d.c. level and peak voltage may differ from model to model. (b) Observed while reading the table of contents or between tracks. (c) Observed during a passage of music, but this time at a slower timebase speed. Instead of seeing the individual increase/decrease of the reflected beam intensity you can see a much larger sample of data.

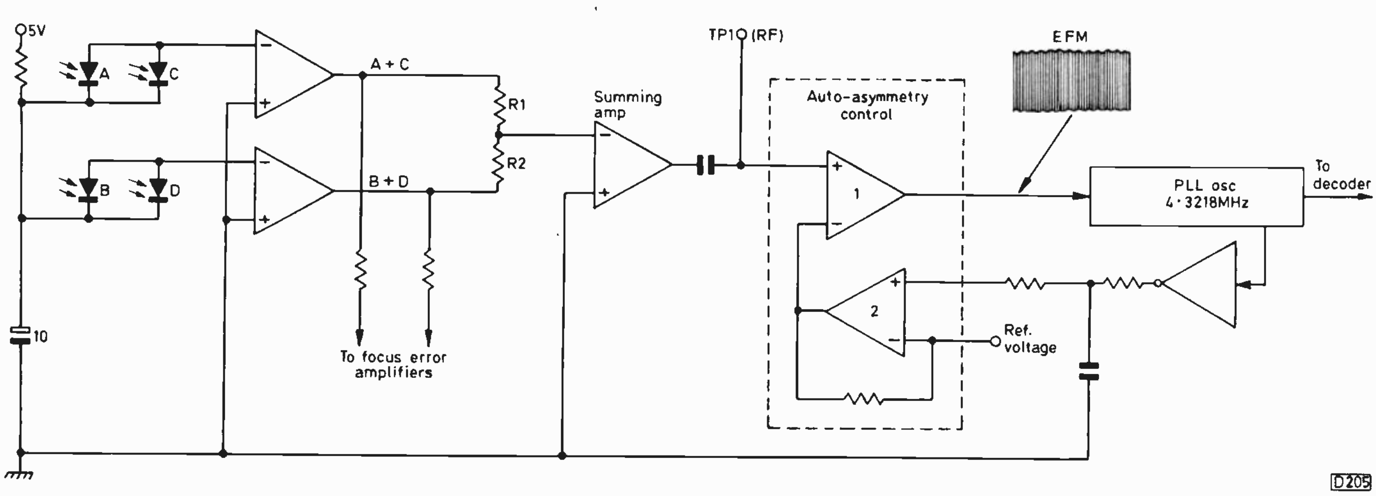


Fig. 3: Block diagram of a typical r.f. processing circuit, based on the Sony CX20109 chip.

illustrated in Fig. 4, which shows the resultant of the multiple sinewaves as a solid line and the variable slice level as a broken line. At the centre of each transition the output from amplifier 1 toggles and a squarewave relating to the pit information is thus produced. The way in which this is actually done is quite involved, but basically it relies on the comparison of the output signal from amplifier 1, via the PLL oscillator, with a d.c. reference.

The squarewave extracted from this circuit is fed to the main decoder where, after much processing, binary data containing left/right audio information is recovered.

The signal obtained at amplifier 1 is referred to as the EFM (eight to fourteen modulated) signal, which is the name given to the data stream on the disc. This waveform is of limited use for servicing. Note that it is present even when the disc has stopped, because the PLL oscillator should always be running. If you have a player with the disc running correctly but no audio output and you wish to confirm that the data is getting as far as the EFM output the best approach is first to scope the EFM signal with the player in the stop mode, noting the waveform, then to put the player into the play mode. You should then see the EFM jitter rapidly as the PLL becomes locked to the incoming signal. It is most unlikely however that you will come across a player where the disc speed is correct but the EFM signal is not present. This is because the disc servo relies on the EFM data as a reference: when this is missing the servo will generally run the disc up to full speed, which is well above the normal 200-500 r.p.m.

Scoping the RF

When using an oscilloscope for servicing, no matter what the equipment is, it's important that the scope is correctly triggered and that the waveform is stable. Many hours can be saved by ensuring that the timebase speed bears a relation to the waveform being checked and that

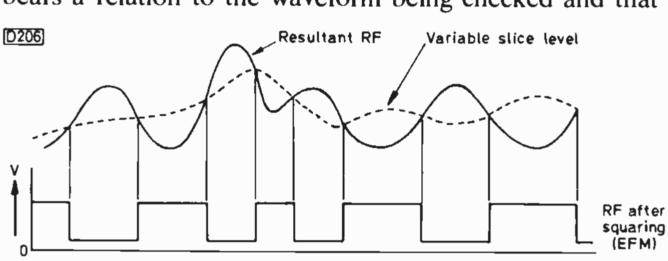


Fig. 4: The waveform squaring process carried out by the auto asymmetry control section of the circuit.

the triggering is adjusted to give a stable trace. Consider the f.m. signal in a VCR: when adjusting the guide rollers you want the timebase to be set so that you can see the outputs from both heads. Use of the drum flip-flop for triggering is ideal to keep the trace stable. When observing a CD player's r.f. waveform it's particularly important that the trace remains stable and that the timebase is set so that you can observe the portion of r.f. you need to see. We'll describe a means of doing this, but before we do so a word about oscilloscopes in general would be appropriate.

When VCRs started to sell in large numbers in the late Seventies service personnel were told that unless they had a scope with a bandwidth of at least 20MHz many of the waveforms they would need to see would be inaccessible and adjustments would be difficult. The service department where I worked boasted a 10MHz antique, and I was soon made well aware of what this meant when I attempted to set the capstan discriminator of a Ferguson 3V00 with the trace racing across the screen! Thankfully a 30MHz scope was purchased soon afterwards.

The situation with CD players is similar. Only 20MHz won't do! If you look at the adjustment procedures given in most manuals you will find that they often read something like "using your 100MHz storage scope . . ." Well, I know what you're thinking, but let me try to ease the pain. Although you may have difficulty in obtaining a stable trace with a 20MHz scope you don't have to go to the other extreme before you attempt to repair CD players. I've worked on CD players using a variety of oscilloscopes and must confess that some of the tests I'm about to outline are not always possible unless the scope has a bandwidth of at least 30MHz. But it also depends on the manufacture and condition of the scope. The one I normally use is a 35MHz Cossor D61. Although ex-RAF it produces nearly all the results I require. Clearly however the wider the bandwidth the better. Bear this in mind if you attempt the techniques I'm about to outline.

Triggering

The trick in obtaining a stable display is to get the scope to trigger on a set point in the r.f. waveform. The problem of course is that there isn't one! So you have to put one there. If you are the proud owner of a test disc all you need do is to play the passage with a simulated scratch (dropout): the scope can be triggered by this. The cost of test discs makes them something of a rarity however, so let me suggest a different approach which I learnt during a training course run by Hitachi.

Take a good disc with a playing time of one hour minimum. The one hour playing time is necessary because discs with shorter recordings may not have data stamped all the way to the outer edge. Thus you wouldn't be able to check a player's performance with the laser at this point, where disc eccentricity and wobble are at their greatest. Place on the disc a simulated scratch of 0·6mm width. This is easily done using 0·6mm PCB artwork tape which is available from a number of suppliers – I obtained mine from RS Components, and at £1·20 for a 20m roll it worked out far cheaper than a test disc set, not that it entirely replaces one. The only precaution you must take is to ensure that the tape runs across the disc diametrically, as shown in Fig. 5.

The principle involved is very simple. When the disc is played there will be a regular dropout between 200-500Hz. A good scope can be triggered by this, not the 1·5MHz r.f. signal. Once this has been done you can adjust the timebase speed so that the portion of r.f. waveform you want to see can be observed. Let's look at some examples.

Waveforms Obtained

Fig. 6(a) shows the display whilst playing the centre portion of the track of the dropout disc. The disc speed will be around 400 r.p.m. Adjust the timebase speed to 200μsec/cm and set the triggering to the negative-going slopes. What you see therefore is the tail end of the r.f. before the laser scans the tape, the 0·6mm dropout period, then the return of r.f. as the laser comes off the tape. A good machine should be able to play this without any audible disturbance. The waveform shown in Fig. 6(a) is what you will see when the laser is o.k. and the focus and tracking servos are properly adjusted and working correctly.

The conditions illustrated in Figs. 6(b-d) indicate that there is a fault or misadjustment in the focus and/or tracking servos. You can now see why I liken the CD player's r.f. waveform to a VCR's f.m. waveform, because you can instantly see whether there seems to be a problem in the servo sections of the player. The portion of the waveform we're interested in is the area immediately after the dropout. I've called this the servo recovery period. When the laser is scanning the tape on the disc the servos lose their references. They will react in an attempt to find their references once more. In the meantime the servo loop will be open. As soon as data begins to come through again the loops will be closed and the servos will settle down. This should happen very rapidly, as shown in Fig. 6(a). In the case of a fault or misadjustment the time taken to lock up will be longer, producing the effects shown in Figs. 6(b-d).

You will now be hoping that I'm going to describe a way of deciding which servo is defective by looking at the shape of the recovery period. Unfortunately I must disappoint you. I've spent a lot of time experimenting with this, but until now even players of the same type have

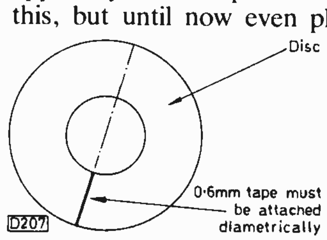


Fig. 5: A simple test disc can be made from a one-hour commercial recording and PCB artwork tape (RS Components order code 555 370 for example).

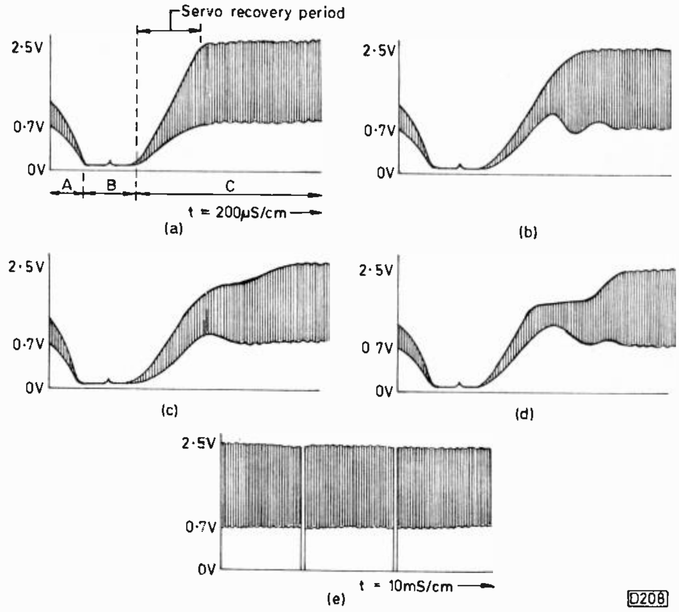


Fig. 6: R.F. waveforms obtained when playing the dropout disc. (a) With a correctly adjusted player. A is the end of r.f. before the dropout, B the dropout period and C the restored r.f. (b) The recovery period shown here is slow. This effect is commonly seen with players where the complaint is of very intermittent problems. (c) A more serious effect. Could be due to multiple misadjustments in both the focus and the tracking servos, though this would not necessarily be the case. (d) A serious error. The fault is more likely to be in the tracking rather than the focus servo. (e) Overall view of the r.f. waveform. A similar effect appears when playing a disc with multiple scratches — they show up as random dropouts in the waveform.

given different effects when a particular adjustment has been offset. In the captions to the waveforms I've given some ideas, based on my experience, to serve as a guide, but these must not be taken too literally. If it's any consolation to you, it was a disappointment to me as well when I found that I couldn't tie down a particular waveform to a specific fault. Nevertheless this test is very useful when trying to establish the whereabouts of those niggling intermittent faults like "it won't play some discs" or "it jumps a few tracks every few hours".

Fig. 6(e) shows the waveform obtained when the dropout disc is played with the scope's timebase set to 10msec/cm. This gives you an overall view of the r.f. waveform and is useful when carrying out some adjustments. It's also useful when checking those awkward discs that customers say will not play with their own machine but work with their friends' players. If there are any blemishes on or in the disc they will show up just as the black tape does. It's then for you to decide whether the player requires attention or whether the disc's blemishes are just on the limits of tolerance. It may be interesting to compare the servo recovery time when playing the complained about disc with that when playing your dropout disc. If the servo recovers quickly on your good disc it's likely that the complained about disc is too badly damaged to be played without problems.

When we come to discuss the servos in a CD player we'll be referring back to the waveform shown in Fig. 6. It will then become clearer why they take the form they do when a dropout occurs. Before we can do this however we must take a closer look at the data streams on the disc, i.e. CD encoding, which is what we'll start to do next month.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £2 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

ITT CVC1204 CHASSIS

A few seconds or minutes after switching on the picture and sound go, leaving a blank screen with either a snow effect or lines of snow moving up and down. This condition lasts from around five minutes to up to twenty minutes, then the picture suddenly returns and the set works normally until switch off.

This problem is often caused by dry-joints in the r.f./i.f. module CMR800/1. Unplug and carefully dismantle it, checking for bad joints and connections at the tuner end. Make sure that the correct tuning voltage enters the module at pin T27.

SANYO VTC5300

On three occasions the cassette has locked down but not loaded, the function keys having no effect. Normal functions can be restored by easing the lock lever (item 31) forward. The machine usually works satisfactorily, the fault occurring at irregular intervals.

Pin 16 of the syscon chip Q3003 (LC7800) should go low when the cassette cradle is lowered. If it doesn't, check the cassette switch and its connections. If necessary also check the eject switch – at pin 2 of S3006.

HITACHI CBP260

This set tends to get stuck in the standby mode. Usually changing C909, C915, C916 or C919, or all of these capacitors, provides a cure but the fault will return at a later date. The standby mode is rarely used and could be made inoperative by removing the components associated with Q902.

An official modification for this problem is to change C919 to 220μF. Also if necessary replace C906 and C918, and check the joints on CP901, T901 and T703.

FERGUSON 3V22

The tape remains stationary in all modes. If the play button is held down – the mechanism will not latch – a chattering noise is heard, like a solenoid not holding in. The play/record buttons will latch when the timer is used, but return to the off position when the timer switches on.

This is a very common problem and is almost always due to failure of the cassette lamp, which is mounted in a black holder just in front of the reel idler assembly.

PHILIPS K30 CHASSIS

There seems to be a purity problem with this set. The picture has a blue haze about three inches wide on each side. There's dark blue towards the edge of the picture and a reddish colour in the centre.

The double posistor R6292 is often responsible for this. A good check is to run the set for about half an hour then feel this component. It should be quite warm. If not replace it. If it is warm, degauss the tube screen manually. If the effect is still present after this the tube itself is suspect.

SHARP VC581

The head switching phase is incorrect in the record mode. Both channels can be adjusted correctly in playback but in record (no adjustment available) the switching point locks in about twenty lines early. The phase becomes correct when pause is entered, but on returning to record the fault reappears. IC704 has been replaced and the voltages around this chip seem to be normal.

We suggest that you first check C731 and R753 which are associated with pin 25 of IC704, and also check with a scope that the V-sync signal from the Y/C board is good. If these points are in order it's possible that the positioning of the Hall element or magnet (PG parts) is incorrect.

ITT CVC20/2 CHASSIS

There's a ticking noise when this set is switched on. The power LED stays on but the other LED goes on and off with the ticks. A new line output transformer has been fitted and the transistor checks o.k. Diodes D23 and D24 on the power supply sub-panel have been replaced.

The ticking effect indicates that the set is tripping. Since you get no bursts of sound or picture on each trip cycle the problem is probably due to (1) an incorrectly set current trip potentiometer (R810) or (2) an overload that causes the current trip in IC801 to operate. In the latter case try disconnecting the tripler then check D18, T14, D21 and D22 – it might be worth rechecking D23 and D24. The power supply section can be checked and set up independently of the line timebase by disconnecting L14 and wiring a 240V, 60W bulb across C50.

FERGUSON 3V23

We've had the same intermittent fault on several of these machines but because of its infrequent nature – it might not occur for hours or even days during a soak test – we've been unable to deal with it. Occasionally in the play mode the machine will switch off and eject the tape. The cassette can be reinserted immediately and the machine will then play normally.

We suggest that you try disconnecting the input from the IR remote control receiver. If the problem no longer occurs it's likely that the f.e.t. (X1, type 2SK105H) in the IR preamplifier can is noisy.

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TELEVISION JUNE 1989

HITACHI NP8C CHASSIS

When the channel is changed the colour disappears, leaving a monochrome picture. Colour can be restored by retuning. A high-gain, 21-element aerial is in use and the picture gain is o.k. most of the time here at Clackmannan, but the picture goes to monochrome when the gain is low – this occurs when low rain clouds come over.

First ensure that the aerial connections within and outside the set are good, with no looseness, corrosion or dry-joints. Check also that the a.g.c. control R203 is set to the full gain position. If these things are in order it's likely that the colour decoder subcarrier oscillator has drifted and needs resetting. You could go through the setting-up procedure in the manual but you will probably find that careful adjustment of R515 *with the fault present* will restore colour permanently.

TEST CASE

318

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.

Spring had sprung and, as is usually the case at this time of the year, many members of our workshop staff were away for one reason or another: manufacturers' service courses, days off in lieu (of what?), nasty coughs and so on. The upshot was that the service manager didn't want too many sets brought in for repair. So each job card issued to the field engineers came with a nutshell diagnosis – and a hint of nemesis if the set was uplifted.

With this threat hanging over him Philbert found himself in front of a customer's Sanyo TV set, Model CPB2146, chassis type E2. With teletext, picture-in-picture and all the bells and whistles! Fortunately the service manager had armed him with a service manual.

Green faces the customer had said. On inspection he found that the faces and all other picture content that should contain an element of red or pink was a ghastly, sickly (but not bright) green. The same applied to the little PIP picture when this was called up, and to the teletext display. Not a chroma decoder fault then thought Philbert as he removed the back of the set.

His first action was to turn down the colour and check the grey-scale. The monochrome picture didn't look too bad - a bit on the "cold" side maybe. Next the colour setting was restored to normal and the output from a colour-bar generator was fed in. Yuk! The red bar was missing, the yellow bar was green, the magenta bar blue. The green, blue and white bars were o.k., but again the latter had a cold look about it. Servicing beginners stop here: what does this display tell you about the fault?

Philbert realised that the picture tube's red gun was not contributing much. A look at the circuit diagram showed him that the three RGB output transistors are combined into a "module" (A602) on the c.r.t.'s base panel. All nine leadouts are available separately however, so Philbert started by comparing the collector voltages in the simple class A RGB output stages. There was no disparity between that of the red output transistor and the other two. Similarly the base and emitter voltages of the three transistors were virtually identical.

Philbert came to the conclusion that since the *standing* voltages at the collectors of the three RGB output transistors were the same the likelihood was that the red output transistor wasn't getting any signal *drive*. To check this he interchanged the red and blue drive input leads to terminals 4 and 5 on the tube's base panel. This altered the screen positions of the colour bars, putting a blue bar in the position normally occupied by the red one. The drive circuitry was thus eliminated from the search and attention was turned to the red output stage.

Having restored the correct connections, Philbert brought in his oscilloscope and confirmed that the R and B signals were indeed reaching the bases of the respective output transistors. Maybe the preset potentiometers in the red output stage were faulty? Twiddling VR612 (red bias) and VR611 (red drive) had no effect on the picture, though the red output transistor's emitter voltage changed as VR612 was adjusted. The potentiometers themselves and the associated fixed resistors were all checked with an ohmmeter and found to be o.k.

Where was the cause of the trouble? Not far away! For the answer see next month's issue.

ANSWER TO TEST CASE 317
– page 525 last month –

Our elderly Bang and Olufsen 20AX chassis receiver last month had a fault that used to be very familiar to TV engineers – a travelling hum bar at mains rate traversed the screen. It was plain that mains-rate ripple had invaded the internal supply lines and was modulating the scan and the signal waveforms, but how was it getting in? Finding the solution would have been made very much easier had the technican studied the symptom (and the circuit) more closely!

A single hum bar indicates a disturbance at a 50Hz rate, i.e. once per TV field. This chassis uses a full-wave rectifier/regulator circuit, so any fault downstream of the two thyristors would have produced a 100Hz ripple with *two* hum bars on the screen. Clearly one of the thyristors wasn't working, though both had been changed and both were being driven at their gates. When the scope was hooked to the anodes of the two thyristors in turn all became plain. The mains feed to one of them was missing because one section of choke 5L1 (a device we long ago christened Beobuzz . . .) had gone open-circuit. The other section of the choke was, naturally, very hot and bothered.

This once again illustrates the need to analyse the symptoms carefully, whether the circuit involved consists of a microprocessor or a throbbing thyristor!

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by the The Riverside Press Ltd., Thanet Way Whitstable, Kent. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £18, overseas (surface mail) £21 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

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BUSH T20	£18
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TOSHIBA	£30
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(CALLERS WELCOME)

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AA117	9p
AA119	9p
AAY32	9p
AC107	40p
AC125	25p
AC126	25p
AC127	21p
AC128	21p
AC128K	26p
AC141K	30p
AC142K	30p
AC153K	23p
AC176	22p
AC176K	28p
AC187	21p
AC187K	28p
AC188	21p
AC188K	28p
ACY18	48p
ACY19	48p
AD142	100p
AD149	60p
AD161	35p
AD162	35p
AD164	200p
AF106	50p
AF109	45p
AF124	50p
AF125	50p
AF126	50p
AF127	50p
AF139	30p
AF239	30p
AF201	70p
AF379	45p
AL100	450p
AL112	300p
AM150	28p
AM151	30p
AM154	35p
AM156	35p
AM158	50p
ASZ15	100p
ASZ17	100p
AU113	600p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BAY78	250p
BAY82	20p
BB101	13p
BB103	16p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC115	10p
BC118	11p
BC140	20p
BC141	20p
BC142	20p
BC143	20p
BC147	8p
BC148	8p
BC149	8p
BC157	8p
BC158	10p
BC159	8p
BC160	30p
BC171	10p
BC172	10p
BC177	14p
BC178	14p
BC179	14p
BC182	7p
BC182L	7p
BC183	7p
BC183L	7p
BC184	7p
BC184L	7p
BC212	7p
BC212L	7p
BC213	7p
BC213L	7p
BC214	7p
BC214L	7p
BC237	7p
BC238	7p
BC239	7p
BC300	20p
BC301	20p
BC302	20p
BC303	20p
BC304	25p
BC308	10p
BC327	7p
BC328	7p
BC337	7p
BC338	7p
BC441	28p
BC446	8p
BC449	15p
BC461	28p
BC477	18p
BC478	18p
BC479	18p
BC489	20p
BC490	18p
BCF16	22p
BC528	22p
BC537	25p
BC546	8p
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BC550	8p
BC556	8p
BC557	7p
BC558	8p
BC559	8p
BC560	8p
BC637	20p
BC638	20p
BC639	20p
BC640	20p
BCY32	200p
BCY33	200p
BCY34	200p
BCY42	20p
BCY56	16p
BCY70	16p
BCY71	16p
BCY72	16p
BD111	99p
BD112	95p
BD115	30p
BD124P	50p
BD124	110p
BD128	35p
BD131	25p
BD132	25p
BD133	50p
BD135	20p
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
BD142	45p
BD144	90p
BD150	30p
BD157	38p
BD158	38p
BD166	30p
BD175	30p

BD177	30p
BD179	32p
BD181	45p
BD182	60p
BD184	60p
BD187	30p
BD201	33p
BD202	38p
BD203	42p
BD204	42p
BD222	31p
BD225	31p
BD232	31p
BD233	30p
BD234	32p
BD235	28p
BD236	30p
BD237	21p
BD238	24p
BD239	30p
BD240	40p
BD241A	40p
BD243A	50p
BD244	50p
BD245	50p
BD246A	50p
BD265	45p
BD267	45p
BD269	45p
BD278	50p
BD311	100p
BD312	100p
BD313	100p
BD314	100p
BD315	150p
BD316	150p
BD317	150p
BD318	150p
BD331	40p
BD332	40p
BD361	60p
BD362	60p
BD370	30p
BD371	30p
BD410	28p
BD433	28p
BD434	30p
BD435	31p
BD436	30p
BD437	28p
BD438	36p
BD439	40p
BD440	40p
BD441	40p
BD442	40p
BD520	60p
BD533	50p
BD534	58p
BD535	38p
BD536	38p
BD537	40p
BD538	40p
BD643	50p
BD645	50p
BD647	50p
BD649	50p
BD651	50p
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BD680	40p
BD681	45p
BD682	45p
BD705	50p
BD707	50p
BD709	50p
BD711	50p
BD736	50p
BD826	50p
BD828	50p
BD875	50p
BD897	50p
BD899	50p
BD901	50p
BD977	50p
BDX32	100p
BDX33	60p
BDX53	60p
BDX65	80p
BDW23	55p
BDW24	55p
BDW93	50p
BDW94	50p
BDY20	100p
BDY92	100p
BF137	35p
BF154	25p
BF167	30p
BF173	40p
BF178	30p
BF180	16p
BF181	18p
BF183	20p
BF184	20p
BF185	20p
BF194	7p
BF195	7p
BF196	8p
BF197	10p
BF198	10p
BF199	8p
BF200	16p
BF225	30p
BF240	18p
BF241	10p
BF245	25p
BF247	25p
BF254	15p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF262	25p
BF263	25p
BF270	18p
BF273	15p
BF311	21p
BF324	25p
BF336	20p
BF337	25p
BF338	20p
BF355	28p
BF362	30p
BF367	13p
BF371	17p
BF391	18p
BF392	18p
BF393	20p
BF414	18p
BF420	18p
BF421	18p
BF422	21p
BF423	20p
BF440	16p
BF450	20p
BF451	17p
BF455	14p
BF458	19p
BF459	19p
BF461	60p
BF462	62p
BF469	30p
BF470	28p
BF471	28p
BF472	28p

BF479	30p
BF493	18p
BF494	16p
BF495	16p
BF506	25p
BF595	16p
BF596	16p
BF597	10p
BF615	30p
BF617	30p
BF680	30p
BF757	40p
BF758	41p
BF759	40p
BF760	40p
BF763	40p
BF869	22p
BF870	22p
BF871	22p
BF872	23p
BF960	38p
BF961	35p
BF963	40p
BF964	38p
BF966	40p
BFR34	110p
BFR36	110p
BFR40	25p
BFR51	21p
BFR62	21p
BFR79	25p
BFR90	52p
BFR91	99p
BFR94	500p
BFS22	110p
BFT37	130p
BFT42	30p
BFT43	30p
BFW84	30p
BFW92	35p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFX89	60p
BFY17	30p
BFY18	40p
BFY41	28p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p
BFY57	25p
BFY64	25p
BFY90	45p
BLY48	85p
BLY49	85p
BR100	14p
BR101	43p
BR103	37p
BR303	85p
BRY39	55p
BRY49	38p
BRY56	35p
BSS74	33p
BSX20	15p
BSX26	18p
BSX29	19p
BT100A	70p
BT106	120p
BT109	90p
BT116	80p
BT119	100p
BT120	100p
BT138	60p
BT146	99p
BT151	58p
BTY79	160p
BU100A	110p
BU104	100p
BU105	80p
BU108	100p
BU109	100p
BU110	110p
BU111	140p
BU124	60p
BU126	70p
BU180	150p
BU184	100p
BU204	75p
BU205	70p
BU206	100p
BU208	75p
BU208A	80p
BU208D	140p
BU209	100p
BU225	190p
BU226	190p
BU312	120p
BU325	55p
BU326	85p
BU406	85p
BU406D	95p
BU407	75p
BU407D	95p
BU408	85p
BU408D	95p
BU409	95p
BU426	120p
BU500	110p
BU508A	120p
BU508D	100p
BY536	150p
BU526	80p
BU546	140p
BU608	150p
BU626	150p
BU636	150p
BU806	120p
BU807	95p
BU902	130p
BU903	130p
BU920	130p
BU921	130p
BU922	130p
BUX80	180p
BUX82	180p
BUX84	65p
BUX85	65p
BUY69A	200p
BUY70C	160p
C106D	28p
J174	38p
J300	50p
MCR220	120p
ME0411	38p
ME0414	125p
ME3001	12p
ME4103	12p
ME6001	12p
ME6002	15p
ME8001	15p
ME9021	12p
MJ802	350p
MJ900	200p
MJ901	200p
MJ1000	200p
MJ1001	200p
MJ10012	300p
MJ15001	325p
MJ15002	300p
MJ15003	325p
MJ15004	370p
MJ15022	400p
MJ2500	100p

MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MJE2955K	90p
MP8111	40p
MP8112	45p
MP8113	56p
MP8512	50p
MPN3404	50p
MPS6571	20p
MPS9012	20p
MPS9013	20p
MPS9014	20p
MPS9015	20p
MPSA05	15p
MPSA06	15p
MPSA13	15p
MPSA20	15p
MPSA42	15p
MPSA43	15p
MPSA65	25p
MPSA66	25p
MPSA70	15p
MPSA92	20p
MPSA93	20p
MR510	35p
MR856	36p
MRF479	350p
MV1622	80p
MV209	48p
MV2209	48p
OC28	250p
OC29	250p
OC35	250p
OC36	250p
OC45	50p
OC71	30p
OC72	50p
OC200	180p
OT121	120p
R2008B	100p
R2010B	100p
R2030	100p
R2306	55p
S2800D	52p
S2800M	72p
T2800D	52p
T2800M	72p
TAG4442	76p
TAG4443	76p
TAG4444	76p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	25p
TIP30C	30p
TIP31A	24p
TIP31C	30p
TIP32	24p
TIP32A	24p
TIP32C	28p
TIP33	50p
TIP33C	60p
TIP34	60p
TIP34C	60p
TIP35C	65p
TIP36C	65p
TIP41A	22p
TIP41C	25p
TIP42A	22p
TIP42C	25p
TIP47	40p
TIP48	40p
TIP50	60p
TIP51	120p
TIP52	120p
TIP53	120p
TIP54	140p
TIP105	65p
TIP106	65p
TIP107	65p
TIP110	47p
TIP111	50p
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TIP141	90p
TIP142	90p
TIP145	65p
TIP146	90p
TIP147	100p
TIP150	90p
TIP151	90p
TIP2955	42p
TIP3054	45p
TIP3055	42p
TIS43	45p
TIS44	40p
TIS61	15p
TIS88A	45p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN 10KM	60p
VN 46AF	88p
VN 66AF	100p
VN 88AF	115p
VN 89AF	110p
Y723	75p
Y827	75p
Y860	22p
Y969	65p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX326	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N.696	26p
2N.697	22p
2N.698	40p
2N.699	45p
2N.706	22p
2N.708	22p
2N.914	36p
2N.918	36p
2N.930	18p
2N.1131	28p

2N.1132	28p
2N.1613	24p
2N.1711	24p
2N.1893	30p
2N.2102	50p
2N.2160	300p
2N.2218A	24p
2N.2219	24p
2N.2221	23p
2N.2222	23p
2N.2369	15p
2N.2484	20p
2N.2646	40p
2N.2904	20p
2N.2905	20p
2N.2906	18p
2N.2907	18p
2N.2926	8p
2N.3019	28p
2N.3053	18p
2N.3054	40p
2N.3055	38p
2N.3055H	50p
2N.3440	58p
2N.3442	85p
2N.3525	150p
2N.3583	90p
2N.3585	120p
2N.3702	9p
2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3710	12p
2N.3711	12p
2N.3771	85p
2N.3772	90p
2N.3773	110p
2N.3799	18p
2N.3819	29p
2N.3866	68p
2N.3903	11p
2N.3904	11p
2N.3905	11p
2N.3906	11p
2N.4031	25p
2N.4036	25p
2N.4037	25p
2N.4058	13p
2N.4062	12p
2N.4064	100p
2N.4240	150p
2N.4248	130p
2N.4401	12p
2N.4403	12p
2N.4443	76p
2N.4444	76p
2N.4904	75p
2N.5061	20p
2N.5062	28p
2N.5088	20p
2N.5163	45p
2N.5192	50p
2N.5241	500p
2N.5245	45p
2N.5294	30p
2N.5296	30p
2N.5303	200p
2N.5320	90p
2N.5321	60p
2N.5366	25p
2N.5401	12p
2N.5448	12p
2N.5496	80p
2N.5777	40p
2N.6106	40p
2N.6107	40p
2N.6109	40p
2N.6254	110p
2N.6292	40p
2N.6384	120p
2N.6385	120p
2N.6403	160p
2N.6649	140p
3N.128	55p
3N.143	65p

DIODES

AA119	9p
BY100	40p
BY103	32p
BY126	6p
BY127	8p
BY133	8p
BY164	40p
BY176	85p
BY179	35p
BY182	32p
BY184	32p
BY187	32p
BY196	20p
BY206	11p
BY207	18p
BY208	18p
BY210	22p
BY223	72p
BY225	120p
BY226	18p
BY227	19p
BY228	32p
BY296	20p
BY298	26p
BY299	28p
BY476	90p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX55/800	32p
BYX70/300	29p
BYX70/500	32p
BYX70/800	36p
BYX71/600	80p
OA47	6p
OA90	6p
OA91	8p
OA200	7p
OA202	7p
IN.914	4p
IN.4001	4p
IN.4002	4p
IN.4003	4p
IN.4004	4p
IN.4005	4p
IN.4006	4p
IN.4007	5p
IN.4148	2p
IN.5400	9p
IN.5401	10p
IN.5402	10p
IN.5403	11p
IN.5404	11p
IN.5405	12p
IN.5406	13p
IN.5407	13p
IN.5408	13p
SKE4F2/06	50p
SKE4F2/08	70p
SKE4F2/10	90p

I.C. SOCKETS

8pin	6p
14pin	8p
16pin	9p
18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p

ZENER

400MV
BYZ88 RANGE
2V7 to 39V 6p
1.3W
BZX61 RANGE
2V7 to 39V 12p

VOLTAGE REGULATORS

7805	35p
7806	35p
7808	35p
7812	35p
7815	35p
7818	35p
7824	35p
7905	35p
7906	40p
7908	40p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L08	28p
78L12	28p
78L15	28p
78L18	28p
79L05	40p
79L08	40p
79L12	40p
79L15	40p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	220p
LM317T	180p
LM323K	420p
LM723	40p
78HGKC	570p
78HO5KC	800p
78H12KC	700p
78GU1C	190p
79GU1C	215p
79HGKC	800p

VALVES

DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
E891	44p
EBF80	45p
EBF89	50p
ECC82	80p
ECC83	80p
ECC84	70p
ECC85	80p
ECH81	100p
ECH84	70p
ECL80	65p
ECL82	80p
ECL84	70p
ECL85	70p
ECL86	90p
EF80	65p
EF85	65p
EF89	85p
EF183	75p
EF184	85p
EL34	250p
EL36	90p
EL84	75p
EL95	85p
EL500	100p
EL504	130p
EY86	45p
EY87	45p
EY88	65p
EZ35	65p
EZ80	70p
EZ81	55p
GZ34	200p
PC97	100p
PCC85	60p
PCF80	80p
PCF200	135p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	62p
PCL82	80p
PCL84	50p
PCL85	80p
PCL86	80p
PCL805	80p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	450p
PY81	90p
PY88	70p
PY500A	190p

L.E.D.'S

LED 3MM RED	5p
LED 3MM YEL	10p
LED 3MM GRN	10p
LED 5MM RED	5p
LED 5MM YEL	10p
LED 5MM GRN	10p

LINEAR IC'S

AN-124	230p
AN-127	250p
AN-136	250p
AN-203	210p
AN-210	165p
AN-214Q	170p
AN-228	280p
AN-234	350p
AN-235	450p
AN-236	235p
AN-238	400p
AN-239Q	400p
AN-240P	150p
AN-241	135p
AN-245	290p
AN-247	230p
AN-252	150p
AN-259	250p
AN-262	140p
AN-270	200p
AN-271	230p
AN-272	480p
AN-274	250p
AN-294	380p
AN-295	340p
AN-301	330p
AN-303	250p
AN-304	360p
AN-305	320p
AN-306	800p
AN-313	270p
AN-315	210p

AN-316	350p
AN-318	460p
AN-331	295p
AN-360	100p
AN-362	140p
AN-366	150p
AN-610	160p
AN-612	160p
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AN-5151	600p
AN-5430	280p
AN-5612	400p
AN-5620	330p
AN-5712	350p
AN-5722	140p
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AN-6120	400p
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AN-6300	600p
AN-6320	300p
AN-6330	380p
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AN-6341	350p
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AN 6884	240p
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AN-7115	150p
AN-7116	130p
AN-7120	130p
AN-7130	110p
AN-7222	300p
AN-7310	90p
AN-7311	90p
AN-7410	250p
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AN-7140	450p
AN-7145	195p
AN-7146	210p
AN-7154	180p
AN-7156	240p
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AN 7168	260p
AN-7178	270p
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AY3-1270	800p
AY3-1350	450p
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AY5-3600	570p
BA-301	65p
BA-302	90p
BA-308	100p
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BA-333	100p
BA-340	150p
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BA-658	380p
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BA 684	400p
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CA-3065	210p
CA-3080E	60p
CA-3085	135p
CA 3086	55p
CA 3088E	200p
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CA 3089Q	250p
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CA 3130S	100p
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CA 3140E	38p
CA-3160	85p
CA-3161E	140p
CA-3162E	450p
CA-3189E	230p
CA-3193E	230p
CA 3240E	90p
CA 3260E	170p
CA 3290E	150p
CX 108	750p
CX-130	450p
CX-136	610p
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CX-143A	580p
ER-1400	200p

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HA-1398	240p
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HA-1457	120p
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HA-11221	210p
HA-11223	340p
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ICM-7555	60p
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LA 3100	125p
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LA-4270	300p
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LA 4445	260p
LA 4450	150p
LA-4460	170p
LA 4461	180p
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LA-7019	160p
LA 7020	400p
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LA-7040	280p
LA-7042	280p
LA-7043	300p
LA-7045	300p
LA-7046	300p
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LA-7050	250p
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LA 7061	250p
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LA-7072	350p
LA-7090	300p
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LAG-634D	300p
LAM-508	200p
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LC-7132	400p
LC-7137	450p
LF-347	110p
LF-351	45p
LF-353	48p
LF-355	60p
LF-356	60p
LF-357	70p
LF-398	300p
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LM-307	42p
LM-308CN	70p
LM-310	220p
LM-311	35p
LM-318	120p
LM-319	165p
LM-324	35p
LM-325	45p
LM-334Z	115p
LM-335Z	120p
LM-336	140p
LM-337	250p
LM-339	37p
LM-348	55p
LM-358	45p
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LM-380	100p
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LM-382	130p
LM-383	300p
LM-384	130p
LM 386	85p
LM-387	100p
LM-389	150p
LM-391	160p
LM-392	100p
LM-393	55p
LM-394CH	370p
LM-558	160p
LM-709DIL	30p
LM-710	45p
LM-711	85p
LM-723	40p
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LM 733	60p
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LM-741MET	45p
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MC-1413	65p
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MC-1569	210p
MC-3302	70p
MC-3401	45p
MC-3403	60p
MC-3423	75p
MF-10	295p
ML-920	480p
ML-922	380p

NE-531	115p
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NE-555	20p
NE-556	40p
NE-564	380p
NE-565	110p
NE-566	130p
NE-567	115p
NE-570	360p
NE-571	290p
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NE-5534P	110p
SAS-560	110p
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SAA-1006	300p
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STA 401A	380p
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TC-5020	285p
TC-9109	500p
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TDA 2690	100p
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ULN 2002	70p
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UPC-1032	60p
UPC-1155	200p
UPC-1156	250p
UPC-1158H2	70p
UPC-1167C2	170p
UPC-1168	105p
UPC-1181	110p
UPC-1182	110p
UPC-1183	200p
UPC-1185H2	230p
UPC-1186	80p
UPC-1187	150p
UPC-1191	100p
UPC-1197	140p
UPC-1216	120p
UPC-1222	130p
UPC-1230	210p
UPC-1238	120p
UPC-1263	230p
UPC-1277	240p
UPC-1278	240p
UPC-1350	115p
UPC-1353	160p
UPC-1363	190p
UPC-1365	320p
UPC-1373	85p
UPC-1378	210p
UPC-1380	450p
UPC-1382	110p
UPC-1383	250p
UPC-1384	260p
UPC-1394	170p
UPC-1397	450p
UPC-1470	200p
ZN-423	100p
ZN-424	100p
ZN-425	320p
ZN 426	260p
ZN-427	560p

LINEAR IC'S — Cont.

ZN-428425
ZN-429215
ZN-435340
ZN-448510
ZN-459190
ZN-1034170
ZN-1040640
ZNA-134H2150
ZNA-234E920
2SJ-48480
2SJ-49425
2SJ-50425
2SJ-77350
2SJ-122580
2SK-15350
2SK-1945
2SK-4950
2SK-55100
2SK-68100
2SK-133480
2SK-134415
2SK-135415
2SK-147160
2SK-176800
2SK-191160
2SK-19245
2SK-195150
2SK-197140
2SK-210130
2SK-211130
2SK-217130
2SK-291300
2SK-294400
2SK-312750
2SK-322300
2SK-323130
2SK-555480
2SK-557650
3SK-8870

JAPANESE TRANSISTORS

2SA-473	35p
2SA-483	400p
2SA-490	60p
2SA-562	57p
2SA-563	45p
2SA-571	500p
2SA-634	50p
2SA-636	50p
2SA-673	20p
2SA-684	60p
2SA-699	100p
2SA-715	90p
2SA-720	20p
2SA-733	30p
2SA-798	55p
2SA-844	30p
2SA-872	40p
2SA-872A	50p
2SA-886	90p
2SA-899	60p
2SA-907	650p
2SA-909	700p
2SA-933	40p
2SA-934	40p
2SA-935	40p
2SA-937	40p
2SA-940	70p
2SA-950	30p
2SA-952	50p
2SA-953	60p
2SA-965	60p
2SA-966	70p
2SA-970	50p
2SA-979	85p
2SA-984	50p
2SA-992	30p
2SA-1012	130p
2SA-1015	30p
2SA-1102	190p
2SA-1103	200p
2SA 1104	200p
2SA-1105	250p
2SA-1106	250p
2SB-022	80p
2SB-324	55p
2SB-370	45p
2SB-546	70p
2SB-557	225p
2SB-561	50p
2SB-566	130p
2SB-595	80p
2SB-598	60p
2SB-600	500p
2SB-600	500p
2SB-616	190p
2SB-621	85p
2SB-646A	90p
2SB-647	30p
2SB-649	40p
2SB-688	120p
2SB-703	125p
2SB-705	200p
2SB-707	200p
2SB-716	30p
2SB-727	200p
2SB-754	80p
2SB-755	310p
2SB-761	170p
2SB-764	60p
2SB-772	45p
2SB-775	160p
2SB-791	280p
2SB-792	70p
2SB-795	60p
2SB-825	135p
2SB-861	160p
2SB-882	180p
2SB-884	120p
2SB-886	225p
2SB-895	120p
2SB-950	180p
2SB-951	190p
2SB-1009	110p
2SB-1037	110p
2SB-1077	180p
2SB-1091	100p
2SC-97A	380p
2SC-454	45p
2SC-458	15p
2SC-461	30p
2SC-495	60p
2SC-536	30p
2SC 681	340p
2SC-710	50p
2SC-733	30p
2SC-790	125p
2SC-792	380p
2SC-828	25p
2SC-930	50p
2SC-943	160p
2SC-945	40p
2SC-1010	300p
2SC-1050	300p
2SC-1060	99p
2SC-1061	100p
2SC-1070	65p
2SC-1096	60p
2SC-1106	180p
2SC-1114	415p
2SC-1115	400p
2SC-1116	290p
2SC-1161	110p
2SC-1162	35p
2SC-1164	600p
2SC-1172	150p
2SC-1173	60p
2SC 1213	50p
2SC-1214	40p
2SC-1226	75p
2SC-1279	30p
2SC-1306	90p
2SC-1308K	350p
2SC 1317	25p
2SC 1318	25p
2SC-1327	20p
2SC-1342	120p
2SC 1383	50p
2SC-1384	50p
2SC-1398	80p
2SC-1413	265p
2SC-1419	150p
2SC-1444	360p
2SC-1454	320p
2SC-1472	40p
2SC-1505	80p
2SC-1507	140p
2SC-1509	80p
2SC-1514	65p
2SC-1515	60p
2SC-1520	120p
2SC-1573	95p
2SC-1586	540p
2SC-1624	140p
2SC-1675	100p
2SC-1678	120p
2SC-1729	900p
2SC-1730	540p
2SC-1740	40p
2SC-1741	45p
2SC-1755	90p
2SC-1756	40p
2SC-1758	30p
2SC-1775	20p
2SC-1809	40p
2SC-1815	30p
2SC-1826	60p
2SC-1845	20p
2SC-1847	120p
2SC-1865	120p
2SC-1875	260p
2SC-1881	210p
2SC-1906	75p
2SC-1907	75p
2SC-1909	250p
2SC-1921	60p
2SC-1923	25p
2SC-1941	40p
2SC 1942	260p
2SC-1944	350p
2SC-1945	350p
2SC-1946	1500p
2SC-1947	450p
2SC-1957	70p
2SC-1969	160p
2SC-1971	400p
2SC-1972	600p
2SC-1983	130p
2SC-2001	60p
2SC-2002	40p
2SC-2003	25p
2SC-2023	180p
2SC-2026	60p
2SC-2028	75p
2SC-2029	120p
2SC-2053	120p
2SC-2060	60p
2SC-2068	90p
2SC-2073	70p
2SC-2075	80p
2SC-2078	95p
2SC-2086	60p
2SC-2098	600p
2SC-2166	90p
2SC-2228A	60p
2SC-2229	25p
2SC-2233	125p
2SC-2235	60p
2SC-2236	60p
2SC-2238	70p
2SC-2240	45p
2SC-2259	80p
2SC-2271	60p
2SC-2275	50p
2SC-2290	1800p
2SC-2314	70p
2SC-2324	120p
2SC-2329	480p
2SC-2334	240p
2SC-2335	120p
2SC-2335	120p
2SC-2369	100p
2SC-2371	45p
2SC-2373	210p
2SC-2407	110p
2SC-2408	120p
2SC-2470	65p
2SC-2482	40p
2SC-2484	240p
2SC-2509	580p
2SC-2545	55p
2SC-2547	65p
2SC-2550	70p
2SC-2551	70p
2SC-2562	90p
2SC-2564	245p
2SC-2565	280p
2SC-2570	60p
2SC-2577	125p
2SC-2578	220p
2SC-2579	200p
2SC-2580	240p
2SC-2581	290p
2SC-2608	620p
2SC-2611	40p
2SC-2611	65p
2SC-2625	380p
2SC-2681	270p
2SC-2688	70p
2SC-2695	2100p
2SC-2719	80p
2SC-2749	350p
2SC-2785	60p
2SC-2810	360p
2SC-2837	360p
2SC-2922	610p
2SC-2979	320p
2SC-2988	280p
2SC-3025	500p
2SC-3039	140p
2SC-3040	260p
2SC-3042	300p
2SC-3060	900p
2SC-3148	410p
2SC-3150	200p
2SC 3151	230p
2SC-3152	250p
2SC-3153	350p
2SC-3156	400p
2SC-3158	260p
2SC-3173	180p
2SC-3178	340p
2SC-3181	240p
2SC-3210	400p
2SC-3212	510p
2SC-3264	510p
2SC-3277	280p
2SC-3293	85p
2SC-3299	120p
2SC-3318	500p
2SC-3355	90p
2SC-3358	80p
2SC-3402	50p
2SC-3416	80p
2SC-3417	90p
2SC-3422	110p
2SC-3467	70p
2SC-3468	70p
2SC-3503	90p
2SC-3568	200p
2SC-3675	160p
2SC-3685	400p
2SC-3789	75p
2SD-024	60p
2SD-313	70p
2SD-325	60p
2SD-348	460p
2SD 371	240p
2SD 401	130p
2SD-438	100p
2SD-600	120p
2SD-613	70p
2SD-718	100p
2SD-1277	190p
2SD-1398	250p
2SD 1453	180p
2SD 1609	110p

BRIDGE RECTIFIERS

1A/50V	16p
1A/100V	18p
1A/200V	19p
1A/400V	21p
1A/600V	23p
1A/800V	28p
2A/100V	33p
2A/200V	33p
2A/400V	37p
2A/600V	43p
2A/800V	43p
3A/200V	43p
3A/400V	43p
3A/600V	44p
6A/200V	80p
6A/400V	72p
25A/100V	150p
25A/200V	165p
25A/400V	185p
25A/600V	200p
25A/800V	240p
35A/100V	185p
35A/200V	200p
35A/400V	220p
35A/600V	230p
35A/800V	260p
1.5A/100V	40p
1.5A/800V	40p

PLASTIC CASED TRIACS

4A/400V	60p
6A/400V	69p
8A/400V	68p
12A/400V	85p
16A/400V	105p
20A/400V	190p
25A/400V	205p
8A/400V	52p

THYRISTORS

0.8A/60V	20p
0.8A/100V	28p
0.8A/200V	29p
4A/400V	28p
8A/300V	59p
8A/400V	70p
8A/600V	79p
12A/400V	75p
12A/600V	90p
2N4444	76p
BR103	37p
BR303	85p
BT106	120p
BT116	80p
BT119	100p
BT120	100p
OT121	120p
TIC44	22p
TIC45	27p
TIC47	32p
17088	200p
17089	200p
17127	200p
15/80H	230p
15/85R	230p
SG613	850p
SG264A	300p

4000B SERIES CMOS IC's

4000	13p
4001	13p
4002	13p
4006	34p
4007	13p
4008	38p
4009	20p
4010	21p
4011	13p
4012	13p
4013	19p
4014	32p
4015	32p
4016	18p
4017	29p
4018	30p
4019	28p
4020	33p
4021	36p
4022	36p
4023	13p
4024	25p
4025	13p
4026	60p
4027	18p
4028	29p
4029	34p
4030	17p
4031	90p
4032	52p
4033	60p
4034	76p
4035	42p
4036	180p
4037	75p
4038	46p
4039	180p
4040	30p
4041	36p
4042	30p
4043	36p
4044	36p
4045	72p
4046	42p
4047	45p
4048	27p
4049	18p
4050	20p
4051	38p
4052	35p
4053	35p
4054	53p
4055	52p
4056	52p
4060	40p
4063	52p
4066	20p
4067	120p
4068	13p
4069	13p
4070	13p
4071	13p
4072	13p
4073	13p
4075	13p
4076	42p
4077	13p
4078	13p
4081	13p
4082	13p
4085	36p
4086	30p
4089	75p
4093	18p
4094	44p
4095	58p
4098	50p
4099	42p
4501	27p
4502	36p
4503	30p
4504	55p
4505	180p
4506	58p
4507	30p
4508	67p
4510	32p
4511	30p
4512	38p
4513	80p
4514	65p
4515	65p
4516	36p
4517	100p
4518	36p
4519	28p
4520	36p
4521	86p
4522	43p
4526	38p
4527	41p
4528	38p
4529	65p
4532	48p
4551	75p
4553	140p
4555	29p
4556	36p
4557	140p
4583	60p
4584	30p
4585	40p
40100	120p
40101	78p
40102	150p
40103	120p
40104	90p
40105	140p
40106	35p
40107	50p
40108	260p
40109	74p
40110	170p
40114	180p
40117	180p
40147	240p
40160	55p
40161	55p
40162	55p
40163	55p
40174	48p
40175	60p
40181	170p
40182	70p
40192	48p
40193	48p
40194	58p
40208	240p
40257	120p

74 SERIES

7400	20p
7401	16p
7402	18p
7403	20p
7404	35p
7405	10p
7406	40p
7407	40p
7408	25p
7409	20p
7413	35p
7414	45p
7416	40p
7417	32p
7420	22p
7421	25p
7425	15p
7430	25p
7437	28p
7438	35p
7442	45p
7447	60p
7450	22p
7451	10p
7454	25p
7470	30p
7473	30p
7474	40p
7475	25p
7481	90p
7482	70p
7485	30p
7486	28p
7489	80p
7490	35p
7492	45p
7493	35p
7495	48p
7497	80p
74107	30p
74111	52p
74116	85p
74119	85p
74122	40p
74123	20p
74125	40p
74126	45p
74132	42p
74141	55p
74145	70p
74153	45p
74155	45p
74157	45p
74160	50p
74164	50p
74167	35p
74173	50p
74174	70p
74175	65p
74176	45p
74180	50p
74182	45p
74192	40p
74196	40p
74197	45p
74393	70p

74HC SERIES HIGH SPEED CMOS

74HC00	14p
74HC02	14p
74HC03	14p
74HC04	15p
74HC08	18p
74HC10	20p
74HC11	14p
74HC14	28p
74HC20	20p
74HC21	20p
74HC27	20p
74HC30	20p
74HC32	20p
74HC42	32p
74HC51	20p
74HC73	26p
74HC74	26p
74HC75	30p
74HC76	30p
74HC77	40p
74HC85	33p
74HC86	29p
74HC93	50p
74HC107	31p
74HC109	31p
74HC112	31p
74HC113	31p
74HC123	43p
74HC125	35p
74HC126	36p
74HC131	38p
74HC132	37p
74HC133	35p
74HC137	55p
74HC138	36p
74HC139	24p
74HC147	45p
74HC148	40p
74HC151	36p
74HC153	35p
74HC154	110p
74HC155	50p
74HC157	36p
74HC158	36p
74HC160	44p
74HC161	44p
74HC162	44p
74HC163	44p
74HC164	44p
74HC165	58p
74HC166	70p
74HC173	55p
74HC174	38p
74HC175	38p
74HC181	130p
74HC182	60p
74HC190	46p
74HC191	60p
74HC192	60p
74HC193	43p
74HC194	47p
74HC195	47p
74HC221	100p
74HC237	50p
74HC238	65p
74HC240	48p
74HC241	47p
74HC242	55p
74HC243	60p
74HC244	44p
74HC245	49p
74HC251	25p
74HC253	37p
74HC257	41p
74HC258	50p
74HC259	55p
74HC273	42p
74HC279	37p
74HC280	65p
74HC283	65p
74HC297	950p
74HC298	52p
74HC299	105p
74HC354	38p
74HC356	45p
74HC365	34p
74HC366	36p
74HC367	36p
74HC368	36p
74HC373	47p
74HC374	50p
74HC375	60p
74HC377	55p
74HC386	20p
74HC390	55p
74HC393	50p
74HC423	70p
74HC533	68p
74HC534	65p
74HC540	73p
74HC541	73p
74HC563	73p
74HC564	73p
74HC573	73p
74HC574	70p
74HC583	90p
74HC595	85p
74HC597	85p
74HC620	110p
74HC623	110p
74HC640	90p
74HC643	90p
74HC646	150p
74HC648	150p
74HC651	110p
74HC652	110p
74HC670	90p
74HC688	150p
74HC690	120p
74HC691	120p
74HC4002	25p
74HC4015	85p
74HC4016	75p
74HC4017	48p
74HC4020	50p
74HC4022	40p
74HC4024	34p
74HC4028	40p
74HC4040	34p
74HC4049	50p
74HC4050	50p
74HC4051	95p
74HC4052	95p
74HC4053	95p
74HC4059	85p
74HC4050	33p
74HC4066	33p
74HC4072	33p
74HC4075	26p
74HC4078	32p
74HC4094	50p
74HC4316	100p
74HC4351	110p
74HC4352	160p
74HC4310	120p
74HC4511	85p
74HC4514	140p
74HC4515	130p
74HC4516	130p
74HC4518	70p
74HC4520	80p
74HC4538	90p
74HC4543	120p
74HC7266	75p
74HC22106	580p
74HC40104	190p
74HC40105	250p

74LS SERIES LOW POWER SCHOTTKY T.T.L.

74LS00	14p
74LS01	14p
74LS02	14p
74LS03	14p
74LS04	14p
74LS05	14p
74LS08	14p
74LS09	15p
74LS10	14p
74LS11	14p
74LS12	14p
74LS13	22p
74LS15	15p
74LS20	15p
74LS21	15p
74LS22	15p
74LS24	38p
74LS26	15p
74LS27	15p
74LS28	15p
74LS30	15p
74LS32	17p
74LS33	17p
74LS31	16p
74LS38	17p
74LS40	16p
74LS42	28p
74LS47	56p
74LS48	52p
74LS51	15p
74LS54	15p
74LS55	17p
74LS73	26p
74LS74	20p
74LS75	26p
74LS76	26p
74LS78	26p
74LS83	40p
74LS85	40p
74LS86	28p
74LS90	29p
74LS91	60p
74LS92	35p
74LS93	28p
74LS95	45p
74LS96	56p
74LS107	30p
74LS109	30p
74LS112	30p
74LS113	30p
74LS114	30p
74LS122	38p
74LS123	38p
74LS124	85p
74LS125	32p
74LS126	32p
74LS132	32p
74LS133	32p
74LS136	32p
74LS138	31p
74LS139	31p
74LS145	70p
74LS147	100p
74LS148	80p
74LS151	30p
74LS153	36p
74LS154	85p
74LS155	36p
74LS156	41p
74LS157	28p
74LS158	31p
74LS160	44p
74LS161	44p
74LS162	44p
74LS163	40p
74LS164	40p
74LS165	56p
74LS166	60p
74LS168	68p
74LS169	60p
74LS170	75p
74LS174	36p
74LS175	38p
74LS190	51p
74LS191	48p
74LS192	46p
74LS193	47p
74LS194	47p
74LS195	50p
74LS196	55p
74LS197	48p
74LS221	50p
74LS240	50p
74LS241	46p
74LS242	50p
74LS243	55p
74LS244	45p
74LS245	46p
74LS247	46p
74LS248	48p
74LS249	78p
74LS251	28p
74LS253	40p
74LS256	58p
74LS257	38p
74LS258	40p
74LS259	55p
74LS260	38p
74LS266	26p
74LS273	50p
74LS279	37p
74LS280	100p
74LS283	55p
74LS290	30p
74LS293	30p
74LS365	30p
74LS366	35p
74LS367	33p
74LS368	35p
74LS373	50p
74LS374	50p
74LS375	52p
74LS390	46p
74LS393	41p
74LS399	75p
74LS629	105p
74LS641	100p
74LS642	140p
74LS644	140p
74LS645	140p
74LS670	68p
74LS674	320p
74LS687	260p

COMPUTER IC'S

2114	200p
2532	330p
2716	200p
2732	280p
2732A	300p
2764	240p
27C64	550p
27128	350p
2625E-25	400p
4125E-15	450p
256DRAM	450p
4116	75p
4164	150p
6116	200p
6264-15	300p
6502	300p
6502A	400p
65C02	930p
6503	570p
6520	170p
6522	330p
6530	1050p
6532	460p
6545	880p
6551	530p
6800	210p
6802	220p
6803	800p
6808	500p
6809	600p
6810	150p
6818	380p
6820	140p
6821	140p
6840	310p
6845	620p
6850	110p
8080A	400p
8085A	300p
8155	360p
8156	360p
81LS95	120p
81LS96	130p
81LS98	130p
8224	270p
8226	270p
8228	270p
8243	250p
8250	850p
8087	11000p
8251	320p
8253	320p
8255	310p
8256	1200p
8257	350p
8259	360p
8271	3400p
8272	1200p
8279	450p
8282	300p
8283	400p
8284	440p
8287	360p
8288	650p
8748	1100p
8755	1400p
AY3-1015	290p
AY5-3600	570p
SP0256AL2	500p
Z80ACPU	180p
Z80BCPU	500p
Z80ADMA	650p
Z80AP10	230p
Z80BP10	480p
Z80ACTC	250p
Z80AS10	660p
Z80AS10-1	700p
Z80BP10-2	700p
Z80ADRT	680p
74S188	175p
74S189	210p
74S201	240p
74S287	190p
74S288	160p
74S289	180p
74S387	200p
75107	80p
75108	80p
75109	110p
75110	80p
75112	140p
75113	105p
75114	130p
75115	130p
75121	125p
75122	125p
75150	110p
75154	110p
75158	140p
75159	200p
75160	400p
75161	400p
75162	700p
75172	720p
75182	100p
75183	100p
75188	60p
75189	60p
75195	185p
75322	130p
75324	340p
75325	155p
75365	145p
75450	45p
75451	42p
75452	42p
75453	65p
75454	65p
75480	135p
75491	60p
75492	60p
8T26	95p
8T28	110p
8131	330p
8T95	90p
8T96	110p
8T97	90p
8T98	110p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

VIDEO RUBBER BELTS

AKAI

VS-2EG/5EG 5 belts/kit	180p
VS-9300 7 belts/kit	220p
VS-9700EG 6 belts/kit	200p
VS-9500/9800 7 belts/kit	220p

JVC

HR-3300/3600 9 belts/kit	220p
HR-3330 7 belts/kit	200p
HR-3360/3660 7 belts/kit	190p
HR-4130 7 belts/kit	195p
HR 7200 3 belts/kit	75p
HR 7600 3 belts/kit	145p
HR 7730 3 belts/kit	77p

NATIONAL

NV-300 5 belts/kit	160p
NV-333 5 belts/kit	135p
NV-777 4 belts/kit	130p
NV-2000 5 belts/kit	155p
NV-3000 6 belts/kit	180p
NV-7000 5 belts/kit	100p
NV-7200 5 belts/kit	90p
NV-8600 7 belts/kit	200p

SONY

SL-C7SL-J7 6 belts/kit	140p
SL-T7ME/T7MER 6 belts/kit	170p
SL-T9/P7/J9 7 belts/kit	210p
SL-8000-8080 6 belts/kit	240p

SANYO

VTC-5300 5 belts/kit	190p
VTC-5500 3 belts/kit	95p
VTC-9300 4 belts/kit	240p

HITACHI

VT-5000 7 belts/kit	155p
VT-8000 3 belts/kit	110p
VT-11 5 belts/kit	190p

FISHER

VBS-7000 6 belts/kit	245p
VBS 9000 3 belts/kit	120p

TOSHIBA

V-5250/5280 5 belts/kit	230p
V-5480 7 belts/kit	210p
V-5475 6 belts/kit	190p
V 7540 5 belts/kit	190p
V-8600 6 belts/kit	150p

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VC-6300 5 belts/kit	195p
VC-7300 5 belts/kit	160p
VC 8300 5 belts/kit	175p
VC-9300 5 belts/kit	155p

CASSETTE MOTOR

6V	290p
9VCW	290p
12VCCW	290p
12VCW	290p
13.2VCW	290p
13.2VCCW	290p

CASSETTE TAPE HEADS

Mono Head	90p
Stereo Head	150p
Mono Mini Head	230p
Auto Reverse Head	260p

VIDEO MOTORS

Sanyo	
Reel Motor (RM11) P/N 4-529V-10800	790p
Capstan Motor 4-5279-51000	2400p
Sony	
Capstan Motor BHF-1100D	2500p
Sharp	
Reel Motor RMOTB 1007 Gezz	1750p
Reel Motor RMOTM 1008 Gezz	1750p
Loading Motor RMOTM 1017	1000p
JVC	
Capstan Motor PU-55371V	2200p
Capstan Motor PU-45979	2260p
Drum Motor PU-46414	2250p

VIDEO PINCH ROLLERS

National	
NV-300	475p
NV-7000	475p
Sanyo	
VTC-9300	475p
VTC-5500	475p
Sony	
SL-T7	475p
SL-C7	475p
JVC	
HR-3300	500p
HR-3330	500p
HR-3360/3660	500p
HR-7200	500p
HR-3300	500p
Akai	
VS-9700EG	360p
Hitachi	
VT 5000	475p
Sharp	
VC-6300/6500	

IDLERS & PULLEYS REPLACEMENTS

Sanyo	
Reel, Pulley 143-0-662T-01201	520p
Gear Idler 143-04904-00900	450p
Take Up Idler 143-0-4204-00100	650p
Idler 143-256T-03200	450p
Sony	
Rew Pulley A-6746-348-B	400p
Rew Pulley A-6746-391-A/B	300p
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Idler Assembley 6886971	300p
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Fast Forward Idl PU 45896C	210p
National	
Idler	300p

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Switch Cleaner	100p
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SONY on/off SWITCHES 250p

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10 Volts		40 Volts	
22 MF	15p	10 MF	15p
47 MF	15p	15 MF	15p
100 MF	18p	22 MF	18p
220 MF	18p	47 MF	20p
470 MF	25p	100 MF	25p
1000 MF	35p	220 MF	30p
16 Volts		470 MF	35p
10 MF	15p	1000 MF	50p
22 MF	15p	2200 MF	190p
47 MF	15p	**50 Volts**	
100 MF	18p	1 MF	15p
220 MF	18p	2.2 MF	15p
470 MF	25p	4.7 MF	15p
1000 MF	50p	10 MF	20p
2200 MF	60p	22 MF	25p
4700 MF	110p	**63 Volts**	
25 Volts		0.47 MF	15p
10 MF	15p	1.0 MF	15p
22 MF	15p	2.2 MF	15p
47 MF	15p	4.7 MF	15p
100 MF	18p	10 MF	15p
220 MF	18p	22 MF	20p
470 MF	25p	47 MF	25p
1000 MF	50p	100 MF	30p
2200 MF	70p	220 MF	35p
35 Volts		470 MF	50p
10 MF	15p	1000 MF	100p
22 MF	15p	**100 Volts**	
47 MF	15p	0.47 MF	15p
100 MF	20p	1.0 MF	15p
220 MF	25p	2.2 MF	15p
470 MF	30p	4.7 MF	15p
1000 MF	60p	10 MF	15p
2200 MF	100p		

ELECTROLYTIC CAPACITORS AXIAL LEAD

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47 MF	25p	10 MF	25p
100 MF	30p	22 MF	30p
220 MF	35p	47 MF	35p
470 MF	45p	100 MF	40p
1000 MF	60p	220 MF	50p
2200 MF	120p	470 MF	60p
4700 MF	160p	1000 MF	100p
10 VOLTS		2200 MF	160p
470 MF	40p	**63 VOLTS**	
1000 MF	50p	1.0 MF	25p
2200 MF	70p	2.2 MF	25p
25 VOLTS		4.7 MF	25p
22 MF	25p	10 MF	30p
47 MF	35p	22 MF	35p
100 MF	35p	47 MF	40p
220 MF	40p	100 MF	50p
470 MF	45p	220 MF	60p
1000 MF	70p	470 MF	100p
2200 MF	125p	1000 MF	160p
35 VOLTS		**100 VOLTS**	
10 MF	25p	1.0 MF	25p
22 MF	25p	2.2 MF	25p
47 MF	30p	4.7 MF	30p
100 MF	35p	10 MF	35p
220 MF	40p	22 MF	35p
470 MF	90p	47 MF	40p
1000 MF	110p		
2200 MF	160p		

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ANTEX XS25W 240V Soldering Iron 240Vac	540p
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Spare Element for C15W 240V	260p

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Spare Nozzle	60p

SOLDER MOP 65p

SOLDER

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SOLDERING IRON STAND

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Spare Sponge	40p

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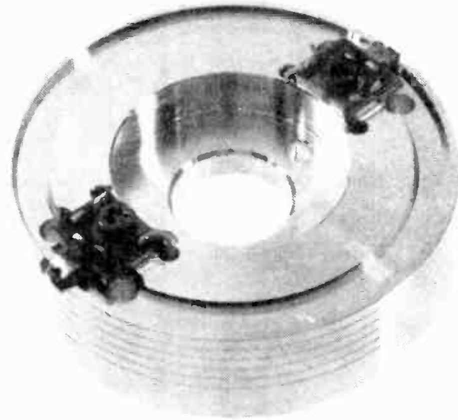

FERGUSON

	Type
3V00-22 (P.C.B. Type)	2511
3V23 3V29-39 ("L" Type)	2647

PANASONIC

	Type
NV300/333	
NV2000 Series	
NV3000 Series	
NV7000 Series	
NV8000 Series	2520

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VP 77-88	14.95
VSI-2.5	14.91

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4600/4700	23.75
7000	23.00
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3V23/35-39	14.95
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VT17/19	36.75
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VC220	21.50
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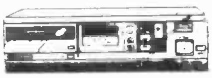

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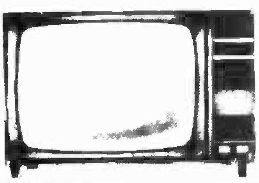

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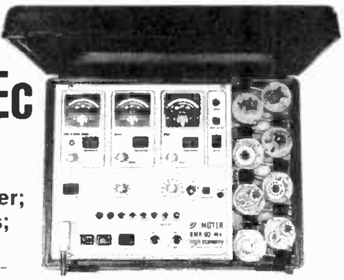

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KT3 PANELS

Sound Output RGB Output Chroma Panel, I.F. Panel and Line OSC £7.00 each

PYE 6 Key Switch & Panel G11 Front Panel	£10
SONY 1400KV Chroma Panel	£6
SONY 1400KV Touch button unit	£3.50
GEC Decoder Panel PC772A3 PC446A5	£6
12 Volt Mains Trans 500M/A	£1.00
Double 1.5 Digital Display. High brightness	20p

Quantity Reductions

BY204/4	25 for £1.00
BY206	25 for £1.00
KT3 touch button black	6 for £1
G11 touch button red	6 for £1
K30 full remote Dawer Ass with 3 I.C.	£7.00
K30 VHF, UHF Dawer Ass	£6.00
BY298 3 amp/fast/R	20 for £1.50
BU126	10 for £6.00
BU205	10 for £8.00
BU105	10 for £6.00
BF458	10 for £1.00
BF224	20 for £1.40
OA90	40 for £1.00
50 Ceramic Condensers	£1.50
Mixed Mounting Kit for Power Transistors	50p
300 Condensers	£1.50
300 Resistors	£1.50
150 Electrolytics	£2.00
15 Bulbs Philips	40p
GEC-Hitachi Thick Film Frame	£5

100 Fuses	£2.00
100 W/W Res.	£1.50
BF 199	20 for £1
10 × 20 Turn 100k pots. Rank	£2
BF 470	20 for £2
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye	£1.00

Mixed Packs

TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits	£1.00
25 Panel Mount Bulbs & Neons	£1.50
10A	£1.50
25 LED red/yellow/green	£1.50
20I/C Holders	£1.20
20 Large LED Red	£1.00
20 Small LED Red	£1.00
10×20 Turn 100K Pots	£1.00
Red & Green LED on Panel	1p each
Mixed 100 Transistor B.F. and B.C. and PET	£1.50 1000 for £10.00
12 Volt 4 Amp Video Battery Pack 10 of Type D Cells	£8.50
40 glass reed switch	£1
10 press to make switch	70p
40 Pots	£1.50
With Focus Pin, 10 Tube Bases, mixed	£2.00
1,000 Diodes, Condensers, Resistors on Bandolier	£1.00
20mm Fuse Holders	
Chassis Mount	20 for £1
EHT Diodes, small	20 for £1
300 Mixed Diodes	£2
100 500M/A Fuse	£1
Mixed V/Cap Pots ITT-GEC-Hitachi-Philips etc.	20 for £1
ITT Mains Switch with Remont CMC113	£1
12v DC relay 1½×1½×2 print type 10 amp D.P. change over	£1

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

LA11440	£1
TAA7750	50p
HA 411485	£1
UPC1373	50p
M58657P	£1
M491BB1	£3
M50441/550	£1
M58658P	£1
Matsushita PY34220 Tuner	£7
C. Cam Decoder with TDA3591	£5
Toshiba VHF/UHF EG5221	£6
Mitsumi MECI-F51	£5

Thorn Spares

New 9000 Decoder	£8.50
9000 Frame panel	£8
9000 Cyclops panel	£1.50
8800 convergence panel	£6
8500 convergence panel	£6
4000 Power supply	£3
1600 Mains lead, switch	
T605 1vNPN T066 80v/6A	10p
9000 Sound output panel	£1
3500 Focus unit	£1.50
3500 Mains Trans	£4
3500 cut outs	10 for £4
3500 IF panel	£2
3500 Frame panel	£3
3500 A1 Diode	20p
4000 Tube base	£4
3500 A1 pots	50p
Beam limiter panel	£1.50
3500 Power panel with Y969	£1
3 Way regulated adaptor 240V 6V/7.5/9V/300mA	£3.50
Rank/Toshiba prch unit 0354	£9.50
4 Push button unit prch	£1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00
7 Push button for CVC5 ITT	£8.00
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button GRC	£6.00
6 Push button PYE 731	£6.00
Hearing aid unit	£3.00
Rank Z718 4 P/B/Unit MECH	£4.00
7 Button Unit GEC with Lamps	£7.00
697 Push Button Unit	£6.00
Z916B panel	£5.00
T513AP panel	£5.00

Video Tuner

V.6100/05 TV and Tel/Text unit and hand set £90.00
Send for data.

Mains Droppers

Pye 731 3+56+27R £1.00

PHILIPS

K40 Text Panel £8.00
CP90 Chassis 14", 17" and 21" NEW £20.00

KT3-K30

OF-425	E.W. correction	
OF-550		10p
OF-513		10p
OF-557		50p

DIODES

BY 126	10p
BY 127	10p
BY 133	10p
BY 134	10p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206 – BY 407 Eqv.	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600, 4.8A/600v bridge	50p
BY 226	15p
BY 227	15p
BY 228 1500v	20p
Flat BY229 black	15p
BY 299 Red	20p
BY 229/400	30p
BY 299/60p Tag	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 448	10p
BY 527	10p
BY 602	10p
BYV 26C	10p
F 247	10p
GP20G	5p
GRP80G (TX10)	30p
XK 3102	50p
BYV 28/200	20p
Bridge TX10 800/3 amps	30p
KBPC35-02 Bridge	£1.50
Bridge Rec D35B10	40p

K35 Decoder	£8.00
K35 Sound OP	£4.00
Thick Film Daughter KT3 3122-127-43891	£3
12 CH K30 Tex Rec Front Panel with TC	£5
K35 IF	£5.00

Plug In

K4 Focus Pot £1.00

Fidelity Tube Base with transitor & focus pot £1.50

Bush Tube Base on panel £1.00

TX10 Tube Base on Panel £3.00

Line Transformers

G8 Lopt	£6.00
G9 Lopt	£4.00
6 Diode Tripler, Mullard	75p
Line O.P. Trans Mono TX 12" 14" Philips G8	
27482	£10
4822	£10
30273	£10
Thorn 1690 LOPT	£7.50
2 T Pots 3,500 Toll each type	£3.00
G8 Trans Philips	£7.00
G11 Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
Thorn B.W AD5308E + Stk + Lead	£1.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard AT 2036	£1.50
Pye 169 Line Trans	£3.00
Pye mono	£3.00
Rank mono 1704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3.00
Rank LOPT Z970	£3.00
CVC32	£6.00
CVC30 ITT	£7.00
CVC32 Line Tran	£7.00
CVC800 Line Trans	£6.00
CVC825 Split Diode	£10.00
CVC 45	£5.00
GEC Portable GTOT204f	£3.00
GEC Portable GTOT2046	£3.00
FHT Split Diode Leads ITT	£1.00
3500 LOPT & ITT Trans	each £2.00
LOPT Rank Z763	£5.00
K35 Split Diode 3122 13835930	£10.00

Universal Tripler

with small focus pot Green type £7.00

Black Triplers

KT3 Triplers	£6.00
STC Universal Tripler	£6.00
11 ITT	£2.50
11 TGA	£2.00
ITT CVC 5-8-9	£3.50
Rank T25LE Tripler	£2.00
Rank 11TCP A823	£3.50
TU 25 30K Rank	£3.00
11 TEZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.00
8500 Thorn	£4.00
9000 Thorn	£7.00
9500 Thorn	£4.50
9600 Thorn	£4.00
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
G8 Tripler	£5.00
CVC20-32	£5.00
Decca 80/100	£4.50
Grundig TVK 52	£2.50
11TBQ Pye 731	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193 63	£4.00
BG 100 41	£3.25
FRO Tripler print type with focus PO7 BG2087	£5
Text ultrasonic rec'r panel	£14.00
12 14V 20 for £5.00 200 for £25.00	
GEC 8 touch unit assy complete with all TC's + pots	£4.00
GIIEW Transformer	50p
GIIEW coils	£1.00
GII Transient Suppressors 245V	20p
GII Scan Coils	£5.00
GII 100K tuner pots	12 for £1
KT3 II panel	£6.00
KT3 line OSC transformer	£1
KT3 K30 infra-red receiver head	£1
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AE Sockets	50p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Pye K30, GEC, etc. Pre-mains stand-by switch	£1
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O P Trans	pair 25p
5 button touch tuner BBC 1/2 ITV1/2 video with ic SAS 560T 570T	£7.00
Control panel 5 sliders + mains lead	£1.50
GII 8 touch button unit replaces old 6 P B U	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O P Trans & Rec Stick for Portable	£3.00
CVC 20 25 30 35 40 decoder panel	£10
CVC 20/25 30/35 40 decoder panel (untested)	£5
CVC 40 45 IF panel	£5
40K Transducer	50p
PHILIPS NE 511N	£1.20
LM337M Reg	30p
20 GEC Black Spark Gaps	£1.00
KT3 Front Panel Control Assy	£2.50
BTW 30/50	50p

International Rectifier EHT Diodes G770/HV34 6KV		3 for 8p
6A/600V Stud Diodes	20p	BTW 92/800R £3
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25% OFF ALL PANELS

G8 LOPT Panel	£8.00
Rank T20 Z136 Panel	£6.00
NEW GEC 20AX Power Supply Switch Mode	£12.00
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GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 205 T unit	£3.90
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£10.00
Pye/Chelsea Timebase panel with LOPT	£10.00
Pye 731 Frame Panel	£5.00
Pye 731 Convergence Panel	£5.00
Pye 731 Chroma	£10.00
Pye 731 IF panel + tuner	£10.00
GEC portable chassis + LOPT 2114 New	£4.00
G9 Power Panel	£6.00
Mono RANK Chassis 127A NEW	£10.00
NEW G9 Frame Panel	£4.00
NEW G11 IF Panel	£10.00

225m + 25m 380v	£1.00
220m 385v	£1.00
240m 400v	£1.00
G11 470m 250v	£2.00
400m 400v	£1.00
175m 100m 100m 350v	£1.00
TX9 500m + 500m 175v	£1.00

G8 Tuner Unit + Panel	£4.00
G8 IF & Chroma	£6.00
G8 Chroma	£3.00

G11 IF Detector	£3.00
G11 Selector gain module	£3
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch + lead	£5.00
Pye 6 button switch portable	£1.00
GEC V cap VHF/UHF tuner and IF + sound O/P PC 706B3 (Export)	£12.00
GEC Line O P PC 659B3	£6.00
2110 GEC Power Panel	£8.00
CVC 20 Front panel with sliders + mains input panel	£4

CVC 40 PUSH BUTTON ASSY with sliders complete with lamp assy + pots 8 button units	£9.00
Universal Focus. Fits Pye, Thorn and Decca Units.	
T147 Rank tube base on panel	£1.00
Z718 Focus Unit	£1.50
T20 Focus Unit	£1.00
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
K30 Focus Pot	75p
K30 Tube base on panel	£1.00
TX10 Focus Units	£8.50
CVC 32 Focus Unit	75p
Fedility Focus Unit 14R-14S	30p
3500 Thorn Focus Unit	£1.00
ITT Small for use with Split	
Z718 Bush Focus	£2.00
Diode	50p
Remo TV12SP	50p
1600 Thorn EHT Rec and Lead	50p
TV14	50p
TV20	£1.00
TV45	50p

TX9 8 Button Unit	£6.00
TX100 8 Button Unit	£6.00
TX10 8 Button Unit	£10.00
TX10/TX100 16 Button	£10.00
G11 drawer ASS 3 pots Mains switch and lead	£2.00
K30 Drawer Ass with pots cable forme	£1.00
TX10 Drawer with 8 way pots ass.	£2.50
TX10 Ex port with band switch (drawer)	£2.50

420M 400V	£1.00
470M 380V	£1.00
220/400V	£1.00
1200PF 15KV	10p
.01 2KV	10p
TFT MFD Mains Filter ITT 3 Pin	15p
1/100 × 10	30p
22/100	10p
4.7M 100	5p
470 100	20p
4700 100	75p
47/160	10p
300 300 300V	80p
800 160	50p
.1 250 Pulse	5p
2.2 250v	10p
7N5 1500V	15p
3n3 250 A.C.	10p
33/250V	20p
.39/250V	15p
4n7/250 tested 5KV	25p
22/250	15p
47/250	10p
100/250	20p
GEC600/250	60p
700 250	£1
300+300 MFD 350v	£1.00
800 250	40p
32/300	20p
4 350	5p
8/350	8p
4.7M 350v	10p
33 350	20p
220 350	30p
300 350	40p
400 350	50p
22/375	15p
220 385 (ITT)	75p
330 385 CVC 820ITT	60p
0 1/400	15p
KT3 E.W. .39/400	15p
.56K 400v	20p
4700pf 400	10p
22 400	10p
8/400	15p
33 400	20p
400 400	40p
394K 400V	20p
220/450	40p
47/500	25p
0 1 600	15p
0.1/1200V wire end	20p
0 1 450 A/C wire end	15p
.22 1000	20p
.047/600	15p
0 047/1000	10p
0 01 1000	10p
0 11 1600v	
0 1/1000	10p
.47/1000v	65p
47/250V A.C.	10p
001K 1250	10p
0 0047 1500	10p
.005/1500	10p
.0105/1500	10p
1n8/1500	15p
2n2 1500	15p
.01/1600	15p
G11 S200 2KV	15p
0 1/2KV	20p
3n9/2KV	15p
0 0015 2KV	10p
6n2/2KV	15p
2n2 2KV	15p
470pf 4KV	10p
7500pf 2KV	10p
3000PF 3000V	10p
4n7/2KV	15p
6n2/2KV	10p
7n1/1500V	10p
8n2/1500V	10p
9n1/2000V	10p
8n2/2KV	15p
0.0082/2500	15p
150/3500	10p
1800/4KV	5p
4.7nf/5KV	10p
170/8KV	10p
180/8KV	10p
210/8KV	10p
1000/10KV	10p
47/100V	80p
Tube Thermpath 167	£1.00
Rank Secam Decoder Panel UHF & VHF 1115A	£13.00
10 off 91 CAP G11	£2.00
Philips K4 CAP 150M 385V	50p

CVC 20-25-30 Mains Switches	60p
Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Remote Switch 2800 ohm	£1.50
G11 Mains Switch	50p
4 amp Mains Switch	25p
GEC Mains Switch 4 amp	30p
KT3 Mainswitch	£1.00
G8 Mains Switch	75p
G11 Preh Red LED P/Button for C.H. Change	20p
RANK TOSHIBA Transductors TPC-2011	50p
Mains Switch ITT Long Type Print	75p
Mains Switch Philip Long Type TAG	75p
Mains Switch GEC Long Type TAG	75p
2000 Chassis Fidelity Mains Switch (4 TAG)	60p
250V 4A White Lorlin Mains Switch	60p
KT3-K30-K35 Full Remote Mains Switch (6 TAG)	£1
Teletext Adaptor Kit TY-500 Panasonic	£12
Philips Battery Tester All Types and charger vis	£6
Philips K4 Mains Switch with standby	80p

MAB 8420P-C031	£3.00
MAB 8400B-6	£3.00
MAB 8440P-D070	£3.00
MAB 8440P-D033	£3.00
MAB 8440P-D056	£3.00
MAB 8441P-T001	£3.00
M58484P	£2.00

Hand Sets
Fidelity
£15.00 to £35.00

ITT 8 and 6 Push Button	£1.00
Pye 725 LOPTs	£6.00
Pye 731 LOPTs	£6.00
Thorn 8500-8800 LOPTs	£5.00
CMC 301 front panel	£5.00
CMC 303 front panel	£5.00
CMC 302 Panel with TC mains switch etc	£5.00
CMD 800 Decoder	£8.00
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PHILIPS SBC 469 Stereo Microphone	£23.00
Meters Hills 520	£17.00
Meters Hills 420	£10.00
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HT100 Multimeter	£6.75
HT300 Multimeter	£7.75
HT500 Multimeter	£9.00
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Works at 24 feet Sound repeater
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Philips K4-K35, RC5350-RC5300, RC5370, RC5375 repaired same day £10.00

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged	£15.00
NEW Type RC4001 9 CH not 12	£6.00
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24 Button CT938 Fulremote	£5.00
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THORN

VCR Front Display Panel £7.00

Large type ITT TV and VCR Handset £15.00

GEC Ultrasonic 8CH Full Remote £10.00

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Decca RC 11	£14.00
Decca RC 12	£14.00
G11 Infra-red full teletext	£20.00
Dynatron-Full remote CTV 62 63 64	£19.00
Hitachi infra red handset	£18.00
Philips full remote KT3, 16C928/20C934, 7228/7324, K12 26C 797 TST 66K 1826	£12.00
GEC Full remote top button assy	£12.00
GEC Full remote repair service (exchange unit)	£18.00
GEC infra red full remote 8 channel (TC SAA1250)	£14.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
K35	
KT3/K30 Text	£15.00
KT3/K30 Full remote	£15.00
KT3 Power supply	£4.00
GEC infra-red 2236-2026	£4.00
GEC 8 button full remote	£14.00
GEC push pad handset button blobs each	10p
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RC4001 KT3 and Teletex	£14.00
ITCVC 32 handset repaired	£15.00
CVC 32 Hand Set	£15.00
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TX10 Focus Pots	£5.50

ITT

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K13 – K45

We have all parts for Philips Handsets

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Philips RC5	£15.00

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Replace Hand Set for
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Text and Non-Text £10.00

PHILIPS

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Tuner Units

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VHF-UHF with Data Tuner MFCI-F51 £3
F400 Family with Data Mosfet
Thorn TX10 Export V/Cap UHF, VHF £3
V/Cap Rank UHF Z776T Unit £6
V/Cap Rank VHF Z773T Unit £5
NEW G8 Tuner V/Cap £3.50
T20 6 Push Button Unit £7
ELC2000 on Panel £2.50
GEC 2110 V/Cap £5
FL618Q £20.00
ELC1042 NEW £6.00
ELC1043 (Ex Panel) £3.75
ELC2000 NEW £4.00
ELC2004 NEW £8.00
ELC2003 £4.00
ELC2006 NEW £4.00
GEC Tuner V/Cap Hitachi After 1979 FT548, ET547, FTS41B £8.00
FT546 £6.00
FT614 UHF Tuner
FT566P UHF Very Small £2.50
ET598P VHF/UHF Very Small £5.00
UHF FT566P, small £6.00
ASTEC UM1183 £10.00
V314 (VHF) £5.00
U321 £6.00
U322 £8.00
U341 UHF £6.00
U342 (UHF) £5.00
U343 Phono £5.00
U343C £6.00
U344C £10.00
U411 UHF £4.00
UVF10 £8.00
U V 411 Tuner £10.00
U V 412 £8.00
U V 415 £7.00
U V 417 £7.00
U.V 418 £10.00
U V 617 £10.00
U V 618 £12.00
U743 Tuner £7.00
Fidelity and Amstrad 2000 V/Cap Tuner £5.00
Small V/Cap Mitsumi
UHF .. £4.00
VHF .. £3.00
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NSF-UHF/VHF Varicap (old type) £8.00
Mosfit UHF/VHF (new type) £8.00
UE2-B31 Fidelity V/Cap T/Unit £6
UHF-VHF V/Caps on panel £3.00
HITACHI 20 Turn Pot 40p
U321 on panel £6.00
Tuner unit VHS Sylvania GTR Videon MTS 900 £2.50
Toshiba VHF-UHF EG522F £5.00
Mullard Video Modulator Application, video tape recorders, TV cameras, video games, closed circuit T.V., C.C.T.R system Data supplied £10.00
4 button Rank Z18 Tuner £4.00

UHF Tuner GTR Sylvania F4714A £2
VHF Tuner GTR Sylvania F3720B £2
Sylvania UHF F4720B £6.00
Sylvania VHF 900 £6.00
Small Tuner DX 175-220MHz
Auto Changeover £5.00
9000 Thorn Tuner on Panel £7.00
Change over switch co-ax type box with lead 50p
Delay Lines
DL700 £1.00
KT 3 Luminence 75p
Luminance Delay Line (CVC 45)
Co-Ax Joint 15p
Co-Ax Belling Lee Plug 12p
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BC173 5p
BC174 5p
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BC184 5p
BC204 5p
BC207 5p
BC212 5p
BC213 5p
BC214 5p
BC237 5p
BC238 5p
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