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TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

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Free Spares Guide 2000

Surveillance camera switcher unit

Servicing dumb terminals

Modern CATV techniques

TV in the Sixties

FAULT REPORTS
TVs, VCRs, PC Monitors and Satellite

CONTENTS

April 2000 Vol. 50, No. 6

Editor
John A. Reddihough

Production Editor
Tessa Winford

Consultant Editor
Martin Eccles

Publisher
Mick Elliott

Advertisement Sales Manager
Matthew Harradine
0181-652 3033

Group Sales Executive
Pat Bunce
0181-652 8339
Fax 0181-652 3981

Editorial Office
0181-652 8120
Fax 0181-652 8111

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Next issue, dated May on sale April 19th.

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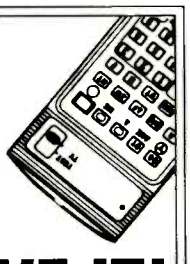

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International Affairs

TV, which was once a largely national affair with its national broadcasters and different transmission systems, is becoming increasingly international at all levels. This is of course a result of the adoption of satellite broadcasting. Satellites don't recognise national boundaries, though with encrypted material it is still possible to impose reception limitations on a country-by-country basis. It's likely however that these will become increasingly irrelevant.

There is at present much activity designed to forge international links between broadcasters, with Rupert Murdoch's News Corporation playing a major role. DirectTV, the major US satellite TV broadcaster, is likely to merge its operation in Japan with Sky PerfecTV, the largest Japanese satellite TV broadcaster. As its name suggests, Sky PerfecTV has News Corporation as a major shareholder. One aim of this move is to reduce losses – satellite broadcasting in Japan, a large but fragmented industry, has to date failed to provide much by way of profits. Sky PerfecTV has some 1·6 million subscribers, to which it could add DirecTV's 400,000 Japanese subscribers. This would give the combined operation a significant boost at a time when NHK and the other Japanese terrestrial broadcasters are about to launch new satellite services.

There has been much wheeling and dealing over Asian broadcasting services, and links are being established between various European broadcasters. One reason for all this activity is the problem of all those hundreds of digital channels. How do you fill them? More to the point, how do you provide hundreds of channels for viewers in a diverse range of geographical markets? It clearly makes sense for broadcasters to establish links that will enable them to maximise the use of programme material and bargain for it from a position of strength. In Japan, Sky PerfecTV and DirecTV have no fewer than 320 channels between them, one of the reasons why profitability has been difficult to achieve.

There are other aspects to the increasing number of mergers and inter-company agreements. In particular there is the growing convergence between broadcasting, on-line operations and the internet. This is making companies think about their future activities. It's a daunting problem: what people will eventually want is difficult to know for certain until various options have been tried out, but the cost of getting things wrong could be enormous. Apparently to cover its bets, News Corporation has been in discussions with Microsoft and Yahoo!, the world's largest software company and internet portal respectively. The idea initially seems to be to exchange shareholdings so that, once links have been established between the companies, it will be possible to optimise the use of programme material made available via different technologies. The merger of America Online and media giant Time Walker is another indication of the way in which things are developing.

It's interesting that one relatively small market, the UK, has been highly successful in the development of digital satellite TV. The reasons are of course the fact that it's run by one firm, and those free STBs. BskyB expects to have over five million mostly digital TV subscribers by the end of the year.

TiVo comes to the UK

An agreement between TiVo and BSkyB should lead to the launch of TiVo's personal video recording system in the UK later this year. PVRs use a computer hard disk to record programmes in digital form – the recorder carries out MPEG encoding and decoding as required. At present the storage capacity is about thirty hours of programme material. The TiVo system has been in use for some time in the USA, where the recorders incorporate a phone link for contact with advertisers and to enable new software to be downloaded. The PVR provides advertisement skipping and has a pause and other features. It can also learn viewer's programme preferences. For further information on the system see page 297 last month.

The recorders are expected to sell for about £400-£500 in the UK. They would carry both the TiVo and BSkyB logos.

Spares Guide

There have been many address and franchise changes since our 1999 Spares Guide was published. These are recorded in the current Guide, which is bound in with this issue. But changes continue at a rapid pace. Two occurred during the brief period between passing the Guide and the main editorial pages of this issue for press. Willow Vale Electronics has been sold, and GenServe has moved to new premises. See pages 329 and 355 respectively for further details.

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", Reed Business Information, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Editorial correspondence should be addressed to "Television", Editorial Department, Reed Business Information, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

INDEXES AND BINDERS
Indexes for Vols. 38 to 48 are available at £3.50 each from SoftCopy Ltd., who can also supply an eleven-year consolidated index on computer disc. For further details see page 375.
Binders that hold twelve issues of *Television* are available for £6.50 each from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques payable to "Television Binders".

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4	RCPOP4	Amstrad SRD510/520/540/550/600
5	RCPOP5	Fergy 20A4/20B4/20C4/22b4/22D4/RCU1652 T722/T762/T731/T738/T741 JVC CT3S/RCU1652
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2SA684	2SD1555	BC237	BD911	BUW12A	LA7116	STK5342	TDA2050	TIC106D
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2SA933	2SD1650	BC238	BDW94C	BUZ71A	LA832	STK5481	TDA2577A	TICP106D
2SA940	2SD1651	BC238B	BF199	BUZ77B	LA833	STK7253	TDA2578A	TIP110
2SA950	2SD1761	BC239	BF240	BUZ80	LA7835	STK730-060	TDA2579A	TIP111
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But the subject doesn't stand still. New models, new faults - there is always something to add. So here we have the fifth edition, which has been completely updated and now has 300 pages and a more attractive cover. In addition to receiver fault notes and general information you'll find many useful button sequences for resetting parental lock codes, resetting installation choices to factory defaults and other less well known operations, practical information on LNB's with typical current drains, a list of manufacturers and suppliers addresses, other useful information and a beginners section. Digital receivers are now available so the manual includes a chapter to deal with these too."

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What a Life!

Ants and electric current, is there a link? No lack of repair work in Spain. In fact all too much of it, mainly from the expats. A lesson in line output stage testing. Donald Bullock's servicing commentary

One thing Spain doesn't lack is ants. I've never seen as many colonies as we have here. The other day I decided to run a mains lead out on to the patio, so that I could listen to the radio while we were sitting beside the pool checking the condition of our wines. Later I noticed that crowds of ants were running along beside the mains lead, in both directions.

After a while Greeneyes switched the radio off. The ants immediately dispersed and found other things to do. Then, when she switched it on again, they immediately returned to their jogging along the lead. I've noticed this before when I have used a power lead in the garden. Who knows the answer to that one?

Expats

The wine turned out to be good, and improved each time another glass was poured out.

"How good to get away from repair jobs" I said. She patted my hand and made me feel almost as important as her dogs.

But we're not the only expats here. There seem to be hundreds of 'em. Our peace was soon disturbed by Dick Pushie, who sailed through the gates carrying a video recorder – just as we were about to start on the giant prawns.

"Don't say it, don't say it" he grinned, "I know you're not here to do repairs. And I don't blame you. But this 'un's different. It's for me. It can't be much, 'cos it was all right yesterday. If you could just have a look. No hurry. I'll come back tonight if you like."

"If you leave that thing here, Dickence, you'll be lucky to see it in a fortnight" I said, "and I'll charge you the earth."

But he left it all the same. It was a Panasonic NVL25B and it was dead. So I decided to hide it away until I felt well enough to face up to overhauling the power supply.

Shortly after he left Mr Peste marched in with a computer monitor.

"Drunk again eh?" he guffawed, "here, I've got something for you to do to relieve your boredom. Cuts out every half hour. Can't be much, 'cos it only started doing it lately. Just as well too, 'cos I can't spend much on it. I can get a new Hankypanky 80 Coo Coo for next to nothing at the supermarket when I'm in England next week – with a free overcoat thrown in."

"Call back in August" I said, lunging at the wine bottle and wishing it was whiskey.

Genius

The next day brought heavy rain and a power cut. It's not all sun, oranges and bullfights in Spain. When power returned I had a look at Peste's monitor. It was a Philips 17A280BQ, the like of which I'd never seen before. As I sat staring into the chopper circuit, wondering where to start, I spotted a little 1MΩ resistor. Might as well follow hunches I thought. No, not hunches – profound understanding of electronic failure mechanisms! Anyway I tested it and it was open-circuit. A new one put the monitor to rights.

"How did you know it was faulty?" Greeneyes asked.

"Genius" replied.

Then I opened Dickence's Panasonic VCR. Dead, eh? I gazed into the power supply and saw C9, a 1µF, 400V electrolytic capacitor. I don't trust low-value electrolytics, especially when they live a high-voltage life. So I hooked it out and tested it. Almost open-circuit. When I fitted a replacement the machine burst into life.

Greeneyes looked over. "More genius?" she asked.

"You've got it in one" I replied.

"But if you were a bit cleverer you could stop all these repairs coming in" she said. "Here's Tarzan coming up the path now, carrying another recorder."

Videos

"Mr Blunkett?" piped a high, silvery voice.

I looked around but there was no one else. It was Tarzan talking.

"I'm told you do repairs to these things" he piped, as he handed me an Hitachi VCR. "It's dead. Was all right until the power cut."

I opened it up and noticed another 1µF electrolytic in the power supply. This one was rated at 250V working. I checked it and found that it read 0·3µF. A replacement did the trick.

I looked over at Greeneyes, who hadn't noticed. So I attracted her attention, pointed to the electrolytic and held up three fingers.

"Same to you" she said, "and don't look now, you've another visitor."

She was right. This tall, thin woman with thick glasses was carrying a Daewoo V200 video. She had a bulky hearing aid in her hand. And there was a short woman with her.

"I hear you repair videos" said the tall, thin lady.

As I breathed in to say no she pushed her microphone box against my lips.

"It works only when it feels so inclined" she continued, "like my dear departed husband." She pulled out a hanky, took off her glasses and nearly fell into the pool as she dabbed at her eyes.

"I miss my husband" she said. The short lady laughed.

I breathed in to speak and got the microphone treatment, so I skipped well back and gabbled "give me a call tomorrow".

It was another machine I didn't

know. Intermittent operation could be a difficult one. I dismantled it and gave it a look over, hoping to see something obviously wrong. But I couldn't. I did however see a 1µF, 100V working electrolytic in the power supply. So I checked it and got a reading of 0·5µF. When I fitted a replacement the recorder worked every time. I began to wonder whether I'd acquired some sort of magic, and pondered on how rich I might become.

Just as I boxed the Daewoo up the two ladies returned.

"I couldn't wait until tomorrow" the tall, thin one said, "with nothing to watch I kept thinking of my poor husband."

The small woman laughed again.

I spoke to her as Mrs Tall walked off down the drive. "Forgive me asking, but is there something I don't understand about her husband?"

Another laugh. "You think he's dead" she said, "but he got enormously fat and she threw him out."

Odd jobs

The next day was sunny and hot again. Greeneyes, who likes to do a little gardening, listed a few small jobs she wanted done. She tends to do that.

"You do realise that since we arrived here I've spent every single minute doing repairs?" I said. "I came here to relax. To loaf about."

As I spoke the gates clanged and a jogger ran in, wearing a silly blue and yellow outfit. He was carrying a VCR – Hitachi VTF70.

"Ha, there you are" he bawled, as though he'd been looking for me for the past week. "This little chap gave up the ghost yesterday. During the power cut. Most annoying. Fix it if it's cheap, old bean. Not worth spending much on them these days. So dashed cheap new."

He passed the machine to me, spun around and was 500 yards away within a few seconds.

I tried a tape in the machine. There was no playback. I couldn't detect any mechanical failure, and feared that there was little else I could do as I didn't have any servicing information. But before giving up I decided to check a few voltages. Those around the STK5372H power chip were obviously haywire, and what's more the IC was running hot.

So later that day I picked up one from Pedro's in the village. When I'd fitted it the machine worked normally.

Some TVs

That evening we decided to go out for some tapas. "Thank heaven for a bit of peace" Greeneyes said as we sat down. But Bert was sitting at the next table. He does the nasty gardening that Greeneyes' lazy husband ought to do.

"Just the chap" he declared, before I'd a chance even to order anything. "My TV's as dead as a doornail and my missus is giving me hell. I'll bring it around tomorrow."

He did too. It was a JVC C14ET1EK – the 14in. JVC set with an Onwa chassis in it. When I looked inside I immediately saw that the surge-limiter resistor was open-circuit. As I couldn't detect any reason for this I fitted a replacement and switched on. The new resistor immediately failed.

I disconnected the bridge rectifier diodes and carefully checked them. They were all OK, and there was no detectable short across their output. What else could cause this fault? As I was gazing at the chassis and thinking, I spotted a small green disc capacitor with a tiny burn spot. It was one of the protection capacitors in the bridge rectifier circuit. A resistance check across it produced a reading of about 350Ω. No wonder the surge-limiter resistor kept blowing! I fitted a new capacitor and resistor then switched the set on again. This time it sprang to life and produced a good picture.

An hour after he'd collected it, Bert was back with his Spanish neighbour and her set. It was yet another Hitachi product, Model C2146TN.

"He is good, then pff – the picture he flies to the clouds" she said. She looked up, and so did I.

When they'd departed I connected the set and tried it. It worked perfectly, with an excellent picture, for an hour or so then the brightness suddenly died. A voltage check at the collector of the line output transistor Q702 produced a reading of about 2V. So I disconnected its collector and checked again. The HT was now normal. I naturally assumed that there was a line output stage fault and checked the transistor. It read OK, but I fitted a replacement anyway. I then switched the set on again. It worked for about an hour, as before, then cut out. Once again the HT at the collector of the line output transistor was down to about 2V, the transistor read OK and the HT rose to the normal value when the transistor was disconnected.

I checked the usual components in the line output stage – the EW modulator diodes and the tuning capacitors – but everything was OK. Next time the set failed I felt the line output transformer to see if it was hot. It wasn't . Surely, I reasoned, if the HT was suddenly being reduced to 2V something would be overheating? When the set again failed I plied the board with freezer. It made no difference.

Greeneyes had listed a few jobs she wanted done. . .

I considered the situation. The HT was normal, but was being suddenly reduced to a very low level after an hour or so. There had to be excessive current flow, didn't there? This usually means overheating, but there wasn't any. It didn't add up. What was wrong? Could I be sure that the cause of the fault was in the line output stage? Perhaps the HT was collapsing because of a fault in the supply.

My first priority had to be to isolate the fault area. So I disconnected the line output transistor's collector and wired in a bulb as a dummy load. Then I switched the set on again. An hour later the bulb went out. That cleared the line output stage and indicated the presence of a supply fault. I used the meter to check back from the bulb and came to R738, a 6·8Ω, 7W resistor. There was no HT at one end of it, plenty at the other. So this was the site of the fault! I checked the resistor and its joints carefully. The resistor was OK, but the joint at the output side was bad. For an hour or so this had no effect. After that there was enough conduction to operate my digital meter but not enough to operate the line output stage.

Resoldering the joint cured the trouble of course. The lesson was that experience leads us to make assumptions which are usually correct but can be misleading. There's a right way to diagnose faults, and taking short cuts can simply result in wasted time.

TELETOPICS

BSkyB steams ahead

BSkyB has a lot to be pleased about with its latest subscriber figures, which relate to the last quarter of 1999. During the period the number of subscribers to Sky's channels increased by 543,000, bringing the total to 8·4 million in the UK and Eire. The number of direct-to-home, i.e. via dish, subscribers rose by 384,000 to 3·97m. This increase was over 30 per cent higher than the previous highest quarterly growth. The number of digital subscriptions increased by 796,000, to over 2·3m. This total has since risen to more than 2·6m. Over 50 per cent of DTH subscribers are now taking the digital services.

Churn rates (cancelled subscriptions) for the second half of last year were 210,000 analogue (compared with 256,000 in the same period during 1998) and just 15,000 for digital subscriptions. Less than one per cent of those who have taken digital subscriptions since these began have cancelled them.

By the end of the present year BSkyB expects to have around five million DTH subscribers in the UK, and could well switch off its analogue services some time next year.

BSkyB introduced its Sky Sports Extra interactive service last August. This consists of a number of simultaneous parallel channels that enable viewers to select alternative camera angles, additional information, match statistics etc. According to BSkyB 36 per cent of SkyDigital viewers now watch live Premier League games through this service. There are four alternative camera angles, including one which follows a player during the course of the game. BSkyB has now extended this system to Rugby. It will also be used for televised cricket.

During the coming year to eighteen months BSkyB will be investing some £250m in New Media Ventures sky.com and skysports.com. The aim is to establish cross-platform portals that enable viewers to move between TV, the interactive TV service Open and the internet.

During the second half of last year BSkyB's revenues rose to £849.7m, an increase of 13 per cent in comparison with the previous year. Costs rose by £176.1m to £821.9m however as the company invested in new subscriptions and subscriber management facilities. There was an operating profit of £27.8m compared to £107.2m and, after increased investment in joint ventures, a loss before taxation of £61.5m.

BSkyB has formed a 50:50 venture with Kingston Communications to deliver TV programmes and video via ADSL digital phone-line transmission, initially in Hull and the surrounding area. There is also a plan to deliver programme information to Vodafone mobile phone users, initially via SMS (Short Message Service) text and later by WAP (Wireless Application Protocol). The company is also involved in negotiations to provide content for BT Cellnet web-enabled mobiles, and has taken stakes in several internet companies and web sites including Sportel and Streets Online.

The Jama solder-seal kit is a new and unique product that's now available in the UK from Gandata Ltd. It has many applications, the basic one being to provide secure cable connections. The kit contains an assortment of solder seals to establish quick, waterproof cable connections; an assortment of heat-shrinkable tubes for protection; and a Jama hot-air gun. The gun is a butane-gas powered device that produces hot air at a temperature of 650°C maximum. It can be refilled with ordinary cigarette-lighter gas and has electronic ignition and a double safety lock. The gun is available separately. For further details contact Grandata Ltd., K.P. House, Unit 15, Pop In Commercial Centre, Southway, Wembley, Middx HA9 0HB – telephone 0208 900 2329, fax 0208 903 6126 or e-mail grandata.ltd@btinternet.com

New VHS cassette

JVC has announced a new video cassette specification known as VHS Clear. It enables VHS cassettes to be manufactured with transparent and, if required, brightly-coloured housings. VHS cassettes have traditionally been black or dark-coloured, because the system relies on photosensors to detect the end of a tape. Two photosensors are used, to detect when a tape has reached the end of record, playback or fast forward or has fully rewound. Light from a bulb shines through the clear tape-leader at the end of the tape and is picked up by the sensor.

A transparent housing could cause malfunction because of reflected or extraneous light. With the new VHS Clear cassettes, light shades are added near the photosensor holes at the left and right of the cassette to ensure that the sensors work correctly.

Five patents have been taken out for the new system, which applies with VHS, S-VHS and D-VHS cassettes.

TV licence up

The TV licence fee is to increase by £3 to £104 a year from April 1st, with a further rise of 1·5 per cent above the RPI each year until 2006/7. This will provide the BBC with some £200m extra a year to help fund new digital channels, a third of what the Corporation hoped to get. There will be no digital supplement.

Video news

JVC has launched the first data VHS (D-VHS) VCR in the UK, Model HM-DR10000. It can record and play back in the D-VHS, S-VHS and VHS modes: a built-in MPEG-2 encoder/decoder is used for digital recording and playback. A frame synchroniser ensures picture stability, and can also be used to digitally dub and clean up old VHS material. The data transfer rate is 14·1Mbits/sec. Maximum tape playing time is at present seven hours (DF420), but with the incorporation of the LS3 mode this can be increased to 21 hours. JVC is also launching a VCR that uses VHS-ET technology. This enables S-VHS recordings to be made using high-grade VHS tapes.

Sony is to launch a new range of TV sets that incorporate Digital Reality Creation-Multifunction (DRC-MF) technology. This uses digital processing techniques to increase picture resolution by up to four times. More details will be provided in a forthcoming issue of *Television*. Other new Sony equipment includes a 41in. widescreen rear-projection TV set, Model KP42DS1, with an integrated DTT tuner and Nicam sound. It has provision to fit the ONdigital module for pay-TV services, and four picture modes – smart, zoom, wide and 4:3. There's a Sony Digital-8 camcorder with a long-play record facility that increases the recording time by a factor of 1·5, and Sony is to launch the first camcorder with a built-in printer, Model DCR-TRV820. This Digital-8 model incorporates a Memory Stick card to store still images. According to Sony the Digital-8 format now accounts for eight per cent of the camcorder market by volume and 13-14 per cent by value.

Panasonic is to launch a new range of MiniDV tapes that feature Super Linear Play technology. This is an extension of the company's Linear Play technology, which uses a special base-film and tape coating to provide up to 80 minutes' recording time in standard play and two hours in the long-lay mode. With Super Play Technology there's greater stability and fewer dropouts occur in the LP mode.

Samsung has launched a 32in. IDTV set, Model WS-32W6DT, that's designed for free-to-air DTT reception. It has compatibility with MHEG-5 digital text services.

Alba is due to release an internet TV set under the Bush brand. Further details next month.

Hitachi has announced a combined DVD player and CD recorder, Model DVW1E, which is expected to sell at £600 to £650. LG expects to launch a similar model shortly and Philips is planning something similar.

PC World is selling computers that can be used as digital video recorders (DVRs). The system uses software developed by the Canadian company MGI, and provides up to thirteen hours' recording time. The software is pre-installed in PCs sold under Dixons top-brand name – these PCs cost between £1,500 and £2,500.

Thomson Multimedia has introduced the Life range of 10in. and 14in. TV sets with innovative design for use around the house. The compact 10in. sets are ideal for use in the kitchen, being water and grease resistant with a built-in handle and complementary remote control unit. The 14in. portables have a similar specification, with automatic channel installation, teletext and front sockets for connection of a camcorder or games console.

Low static-charge freezer

Servisol has launched two new low static-charge freezer sprays to complement its existing range. The Freeze It 21 (200ml) and Freeze It 26 (400ml) provide rapid-cooling for fault location, also cooling for thermally sensitive parts during soldering or calibration. The spray has been specially developed to inhibit the build up of static charge, making it ideal for use with static-sensitive electronic components. For further details contact Ambersil Ltd., Wylds Road, Castlefield Industrial Estate, Bridgwater, Somerset TA6 4DD. Phone 01278 424 200, fax 01278 425 644 or e-mail ambersil@btinternet.com

Digital TV news

CWC says that it has signed up over 100,000 subscribers to its digital cable TV service, which was initially launched in the Manchester area last July and is now being rolled out nationally. According to CWC fifty per cent of the subscribers are new to cable TV. They spend more than analogue subscribers on pay-per-view movies, watching four times as many. Half the subscribers that can currently access interactive services have registered for e-mail. One in three subscribers makes use of CWC's selected web site service on a daily basis.

A report published by Digital Technology Consulting and Screen Digest forecasts that by 2005 33 per cent of UK homes (8·4 million) will be receiving digital terrestrial TV, making the country the leader in DTT viewing. At the same stage the USA is expected to have some 11·2 million DTT homes, a penetration of 11 per cent.

The Department of Trade and Industry is to publish a White Paper that will present proposals to reform broadcasting and telecommunications regulation to take into account the convergence that has occurred in these fields.

The UK's largest internet service provider, Freeserve, is to launch ADSL trials in Manchester and London, with ITN and Virgin providing some of the content. The service will include the delivery of video, music and games to home PCs.

Willow Vale sold

Component distributor Willow Vale Electronics Ltd. has been sold to Connect Distribution Services, which already owns HRS Electronics, Electrue Sales, Medco and Partsmart. It's understood that Willow Vale will continue to be run as a separate business, operating from Connect's base in Birmingham. Willow Vale's distribution centre in Manchester and the sales and accounts offices at Reading have been closed, with about thirty redundancies. Connect's managing director has issued a statement to say that by combining some of Willow Vale's expertise with that of Connect the combined organisation should be able to provide an enhanced service to both suppliers and customers. Enquires should be directed to Willow Vale, Connect Business Park, Bordesley Green Road, Birmingham B9 4UA. Telephone 0870 600 0271, fax 0870 600 0272.

J. LeJeune takes a look at the latest cable TV technology, including the use of optical fibres, and the facilities that will become available to subscribers

Modern Cable TV Techniques

The use of optical communications technology for the transmission of radio and TV signals over cable systems is having a revolutionary effect on network capacity. The final step that would bring optical fibre right into the home has not so far been achieved, but is probably not all that far away. Currently the optical-fibre section of a CATV network is used as a trunk line or highway for signals that feed small, local coaxial cable distribution networks. The capacity of optical fibre is enormous, and recent developments such as wavelength-division multiplexing (WDM) substantially increase the number of individual services a single fibre can carry.

WDM simply means that signals modulate light beams of different wavelength, much as radio transmitters modulate a range of different frequencies in say the VHF band. In frequency terms light occupies a band near the centre of the electromagnetic spectrum. As the frequencies involved are measured as a thousand million (10^9) MHz, it's easier to quote the wavelength. Two wavelengths are commonly used, 1,310 and 1,550nm. Both are in the infra-red region. The 1,550 option enables optical amplifiers to be used.

The HFC configuration

Domestic TV sets are equipped to tune to frequencies in only the VHF and UHF bands. So cable operators use a network configuration known as hybrid fibre/copper (HFC). It works very well. The optical network is capable of high performance and is therefore used to deliver radio and TV signals to 'nodes', which are basically interconnection points where the optical fibre meets the copper coaxial and copper-pair telephone cable. Fig. 1 shows the idea. At each node the optical signal is demodulated by a device that uses a high-speed PIN diode.

The optical signal consists of a beam of infra-red light that's been modulated directly by the entire network RF spectrum. At the head end the RF signals are stacked in frequency (frequency-division multiplex), the TV carriers being exact multiples of 8MHz – so the spacing is similarly 8MHz. This is done to minimise an effect known as combined triple-beat distortion: any interfering beats occur at or very close to a vision carrier, where their visibility is very low. There are several final-frequency plan arrangements – much depends on the size and performance of the coaxial cable RF distribution networks.

The optical demodulator is slightly non-linear. Thus control circuitry is required to maintain the PIN diode bias at the point where distortion is least. The demodulator's output consists of the RF channels in their original order. These are amplified and distributed to subscribers via the coaxial cable networks.

Each subscriber requires a set-top box which contains equipment to tune the special cable channels that occupy the VHF and UHF bands. The VHF radio signals that are also carried are available via any standard FM tuner. A cable-band tuner plus any descrambling circuitry for subscription channels constitute the contents of the STB.

Telephone signals are passed via different optical demodulators and demultiplexers to each copper pair that feeds subscribers. For outgoing speech, each line modulates an individual carrier. The carriers are multiplexed together and fed to a fibre-optic transmitter to feed the upstream optical fibre network.

Interference

A cable network is subject to interference from internal and external sources. With a fibre-optic section the main problems arise from non-linearity in the modulation process and spurious propagation modes in the fibre. The latter cause pulse stretching. Modern fibres give less trouble, and careful setting up can prevent further problems in the network.

Fibre-optic cables have very low loss, often about 0·35dB per 100km, and are immune to electrical interference. This is very helpful when they have to pass close to electrical switchgear or commutator motors. For signal transport in hazardous atmospheres they are without rival. They are an obvious choice for communications purposes where very sensitive electronic apparatus is in use, for example in hospitals.

Switching fibres

Until recently all routeing of fibre-carried signals had to be done electrically, by demodulating them, routeing then remodulating them back on to onward-going fibre. Optical switchers have now become available. They use a micromirror system that's activated electrically under microprocessor control. Optical switchers save money and improve reliability by reducing the number of demodulation/remodulation operations a signal has to undergo.

Optical routeing works up to sixteen times faster than previous methods and permits better management of the available bandwidth. There should also be a massive reduction in power requirements, in the region of 100:1.

Inside the optical router 256 micromirrors each respond to an individual light wavelength. Each mirror is positioned so that it can be tilted to link any one of 256 incoming fibres to any one of 256 outgoing fibres. The mirrors are arranged on a silicon slice that's less than an inch square.

The use of optical switching provides much faster access to internet services and enhanced optical telecommunications switching speeds for every possible purpose.

The network

A cable network, if well designed and built, is the simplest way of transmitting either analogue or digital signals. It has superior carrier-to-noise performance, good immunity to interference, and there should be few (if any) reflections. It can also be highly secure – it's virtually impossible to tap into the optical sections. A cable network is ideal for digital communications, providing high-speed data transfer with very low bit error ratios.

A choice of delivery methods is possible between the fibre node and the subscriber's home. Telephone signals pass as audio with a 3kHz bandwidth, using the normal twisted copper-wire pair: the same pair will carry ADSL signals for video-on-demand services or data.

The coaxial network has two-way capability, with downstream signals occupying a band from 50-860MHz and upstream from 5-50MHz. The downstream signals will be mainly TV and radio and can be analogue and/or digital, with the upstream signals consisting of mainly digitised speech or data. See Fig. 2.

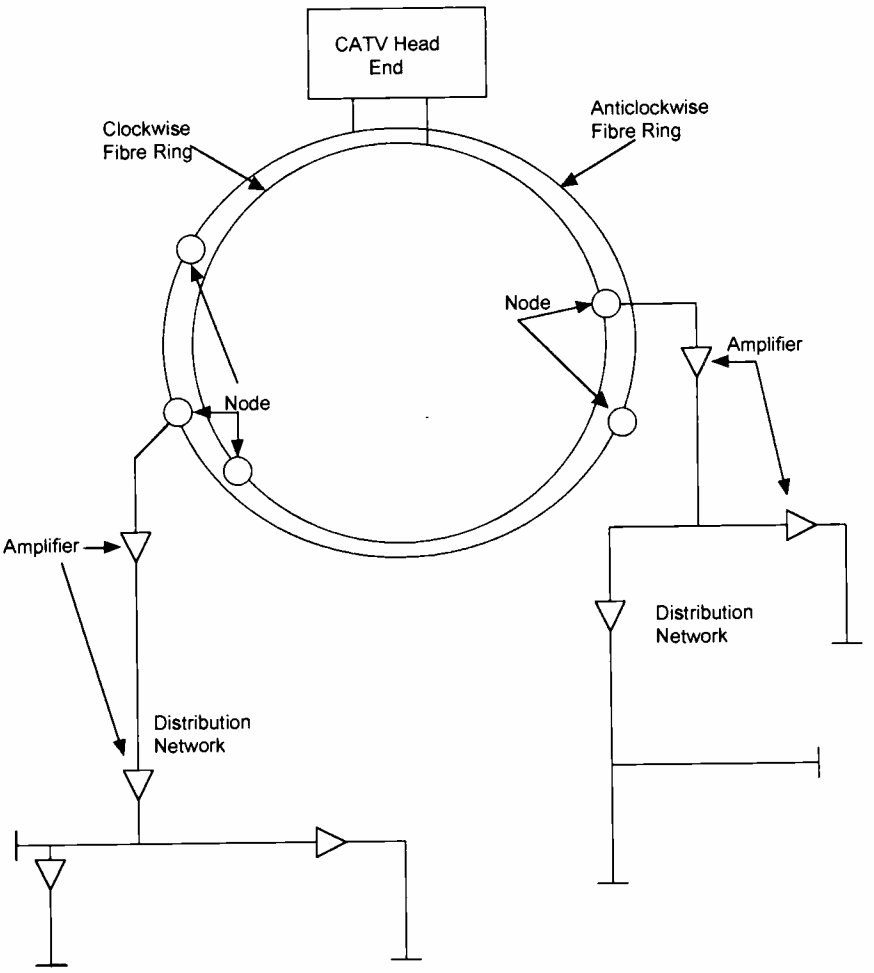


Fig. 1: A basic HFC network.

Coaxial network design

Because coaxial cable attenuates VHF/UHF signals, a coaxial cable network requires amplifiers for extended reach. The network should be lossless from end to end, cable losses being made good by the amplifiers. There are two problems. First the amplifiers add noise which, being random, obeys a power law: each time the number of amplifiers is doubled, the carrier-to-noise ratio is worsened by 3dB. Secondly intermodulation distortion occurs because of the non-linear transfer characteristic of the amplifiers. This generates beats between the signals carried by the network, the most common being second-order beats and combined triple beats. Careful amplifier output stage design, using push-pull circuitry, can reduce the distortion to a low level, but system planners have to be aware of the cascadability limits of the amplifiers used.

Signals have to be tapped off and attenuated for feeding to subscribers, and feeder spurs have to be supplied with signal from the distribution lines. The hardware used for these purposes requires careful and cunning design to provide directional properties or asymmetric attenuation.

A splitter may have a forward loss of 3·5dB at each output from the input. But the figure between outputs should be much higher, often better than 26dB (20:1) being required. With such a splitter a disturbance on one line won't have a serious affect on the other output.

The subscriber tap requires a similar directional characteristic to prevent spurious signals from a faulty TV set having a serious impact on the network. With care-

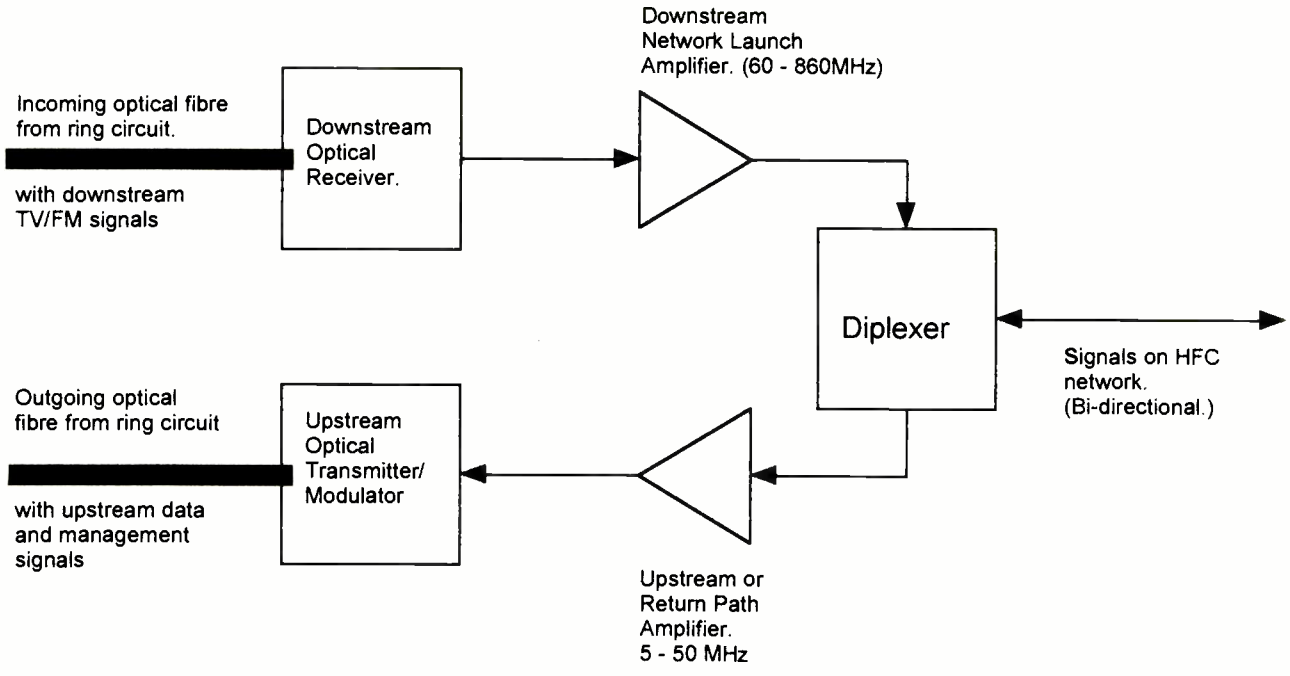
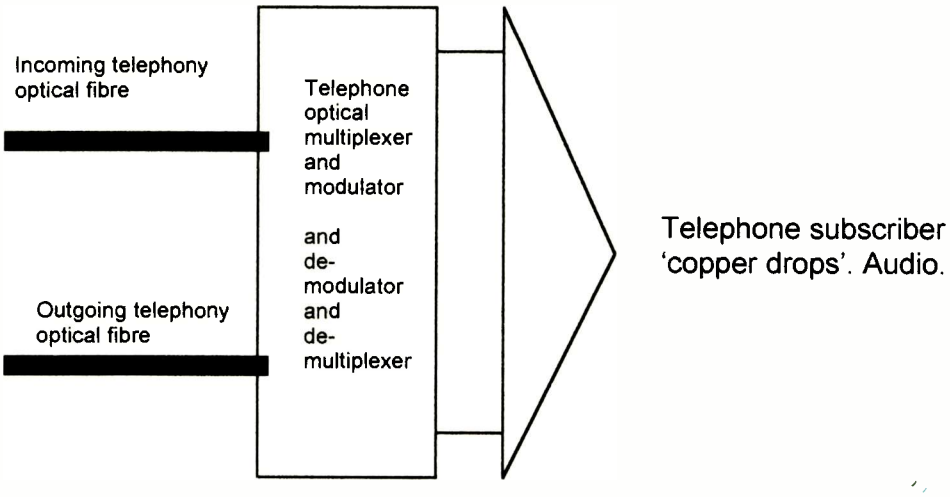


Fig. 2: Fibre node arrangements.



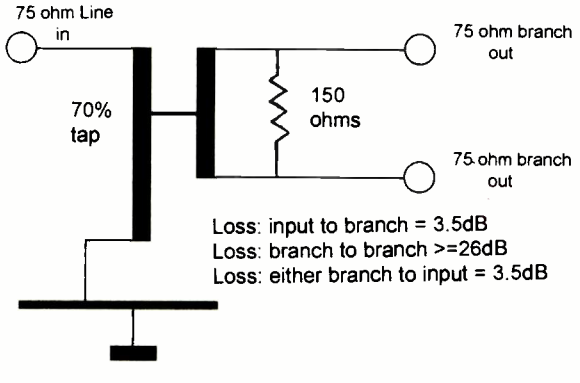


Fig. 3: A two-way equal splitter circuit.

ful design, an isolation ratio of up to 40dB (100:1) can be achieved.

Resistive splitters and taps are a thing of the distant past: modern devices use ferrite transformer techniques. Most designs are based on the old 'hybrid' transformer principles, which are akin to the anti-sidetone telephone circuit. Fig. 3 shows a two-way equal splitter.

All network hardware should have as flat a frequency response as possible – unless a shaped response is required. An example of the latter is an equaliser whose response is exactly opposite to that of the cable attenuation: the combination of cable and equaliser should provide a flat response over the required frequency range.

Where the carrier-to-noise ratio is a problem, some distribution amplifiers have equalising facilities built into an inter-stage coupling. This arrangement removes the residual equaliser loss and as a result is more flexible.

Until cabling went underground, the effect of temperature on cable attenuation had to be taken into account – warm cable introduces a greater loss than cold. This

called for the 'thermal equaliser', a difficult piece of equipment to design and site properly so that it would react appropriately to temperature changes.

Line and local power

Amplifiers in a copper coaxial network require power, which can be provided via the cable or locally at mains voltage. In recent years all amplifiers have included a switch-mode power supply that operates over an input voltage range of 35-60V AC. For local mains power operation a step-down transformer that provides 60V AC is used. Its output is fed to the amplifier's input or output via a power insertion filter. The 60V AC can be fed to other amplifiers upstream or downstream.

In many networks the 60V AC is supplied by a constant-voltage transformer of the saturated-inductor type. This type of transformer doesn't provide a truly sinusoidal output waveform with low loading or a high mains voltage, and is unnecessary with today's switch-mode supplies.

When line power is present on the cables it is important to maintain the integrity of all connections. Corrosion must be eliminated at first signs. A poor connection can introduce rectification, with the result that hum is injected into the system.

The use of DC for line powering has largely ceased because of corrosion problems and inflexibility.

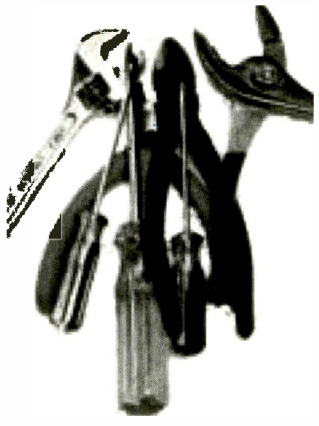
When planning a network, line powering considerations have to be added to those of signal level. This makes the planner's job a complex and responsible one.

Fibre all the way

Some major CATV network equipment manufacturers are advocating the use of fibre right through to the subscriber outlet. This would provide many advantages: security from signal piracy; privacy for telephone and internet users; a very wide bandwidth, which means high-speed data transmission and reception; and immunity from electrical interference (from domestic appliances, spurious RF and high-power radio transmissions). Cost would be a disadvantage initially, but would fall with universal conversion to a fully optical network. This has to be the next step for cable TV companies.

Set-top fibre terminals will probably include a hard-disk drive. This would enable programmes to be recorded, provide information about viewing habits, enable advertising to be targeted and make it possible to introduce many other features. The STB could become a 'home server' with connections to 'intelligent' domestic appliances. An intelligent dustbin for example could read the bar codes on discarded food packaging and re-order items from the supermaket via the internet. Too bad if you threw out a kilo of Mongolian goat's milk cheese you hated and found that your dustbin had re-ordered it!

Another interesting way of terminating a cable system in the home is to use a DECT – Digitally Enhanced Cordless Telephone. This could provide links for phone, TV, audio and computer use.



John Edwards' Casebook

Sony KVM2151U (BE2 chassis)

The mains fuse had shattered because the STR54041 chopper chip IC601 was short-circuit. I looked around for reasons, and found that there were dry-joints at all four leads of the mains bridge rectifier D601. I don't know about you, but I am very unsure when a major component fails for no obvious reason. It just doesn't seem right to simply replace it and switch on. Even when the set then works I feel uneasy, and consider the set to be repaired only after a long soak test.

In this case I replaced the fuse and chip, carried out the resoldering then, while keeping an eye on the new fuse, I slowly applied mains power via my variac. At about 110V there should have been signs of life but the power supply remained dead. I increased the input to normal, at which point there was about 300V at pin 3 of IC601. But there was 0V instead of about 0·3V at the drive pin 2, to which the start-up resistor network is connected. After switching off and discharging the main reservoir capacitor C604 I set about checking the few components in this area. The BC637-16 limiter transistor Q601 was found to be short-circuit base-to-collector.

With a new transistor fitted I again wound up the mains input via my variac. At about 90V the power supply attempted to start up, coming to life fully at 110V. At this point the HT stabilised at 130V as the input was increased to the full mains voltage. The set produced a good picture and sound and, or so I thought, all was well.

A week later I received an irate phone call from the set's owner, explaining in very graphic tones his displeasure that the set had once more failed. "What did I intend to do about it?" He reckoned a full refund plus "inconvenience money" was in order. I reckoned not. Anyway within an hour the set was back on the bench, staring at me. It took up residence in the workshop for a further week, during which three transistors in position Q601 failed. Each one went short-circuit base-to-collector, with no signs of stress leading up to its demise. I had by then checked every component in the power supply, including the chopper transformer (one was borrowed from a scrap set), and was feeling very old and tired. The thought of a refund was now becoming a distinct possibility.

Then, by chance, while inserting yet another new transistor, positioned as per the etched drawing on the PCB, I turned over the board to solder the leadout wires and this time noticed something odd. I blinked a few times in disbelief. Turning the board over and over a few more times and comparing the tracks with the leadouts confirmed that the etched print of the transistor ECB and body were the wrong way round. I had been fitting the transistors incorrectly! Although annoyed with myself at not noticing this before, I was nevertheless very relieved.

As for the owner, when he collected his set he made it very clear that in future he would go elsewhere. When I thanked him he gave me a confused look then departed.

Sony KVX2521U (AE1 chassis)

The top half of the picture was stretched out, with foldover across the centre. The bottom half was normal. Correct linearity was restored by replacing the field scan coupling capacitor C531 (680µF).

Philips 14CF1014 (CF1 chassis)

The customer complained that his set kept switching off at random. When I removed the metal screening plate that covers the chopper transformer I saw that every pin was dry-jointed. I did some quick resoldering, slid the board back into the cabinet and switched the set on. It behaved itself for the rest of the day, so I phoned the owner to arrange for collection the following afternoon.

Next morning, while working on another set, I looked over at the soak-test bench and saw that the set was now suffering from field collapse. A glance at my watch indicated that I had about an hour before collection was due. I hastily put the set on the bench, removed the back, slid out the board and turned it upside down. The field output transistors TR7400 and Tr7401 were both dry-jointed. After another quick resoldering job the set worked normally. I was about to switch it off when it did so itself.

Back to the same routine: remove back cover, slide out board and turn over. I then scanned the board looking for more dry-joints. There was one at the collector of the line output transistor – a slightly discoloured ring surrounded the pin. I decided to spend what little time I had left resoldering everywhere, and had just completed the last joint when the set's owner arrived. I hastily reassembled it and left it switched on for him to see.

"That's fine" he said, giving the set a hearty slap on the side of the cabinet. "Always went off when I did that" he explained. I was very relieved that it didn't do so this time.

Bush 2557NTX

This set was dead with a blackened mains fuse. On inspection I found that the mains bridge rectifier BR901 and its reservoir capacitor C905 (220µF, 400V) were both short-circuit.

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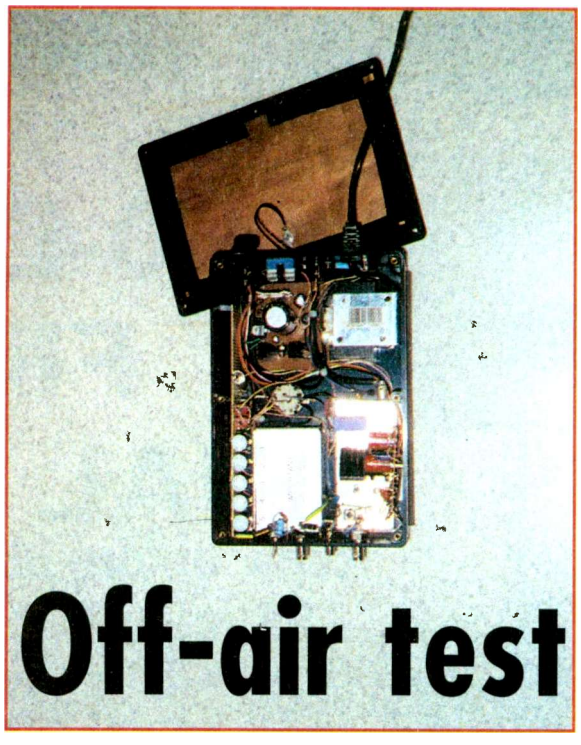

Off-air test signal source

In this concluding instalment Keith Cummins deals with construction and setting up. The modules and their interconnections were described last month

The off-air signal source is designed to provide 'real' test signals to supplement those from an AF oscillator and TV pattern generator. For details of the modules used and their interconnections refer to pages 282-285 last month. This time we will deal with construction and setting up, then conclude with full details of the components required for the project.

Construction

Fig. 6 shows the basic layout adopted for the prototype, which is housed in an MB6 ABS box that was obtained from Maplin Electronics. Constructors may well have their own ideas about how to arrange things, especially if they decide to leave out some of the optional facilities (see Part 1). The power supply board and mains transformer will be needed irrespective of other considerations: as can be seen, these items occupy about a third of the space available.

As supplied by Sendz Components the power unit is a stand-alone module with two connecting leads – a mains lead that's terminated with a Continental two-pin plug, and an output lead that's terminated with a DIN plug. The first step is to open the module then remove the transformer and PCB. This is best tackled by cutting, at each of the four corners, into the join between the two halves of the case. You will then have an indication of the depth to which you next need to cut along each side. Once the sides have been nearly cut through the case can be split apart by inserting a screwdriver blade and twisting it. Care is obviously needed when doing this.

You will then find the mains transformer with the mains lead directly connected to it. The transformer's secondary windings are connected to the PCB. There's no need to disconnect the mains lead. Leave it attached to the transformer. Its strain relief can be fitted to the new case by cutting out a notch, as shown in Fig. 6. The Continental plug can be removed later and a 13A type, with 3A fuse, fitted in its place. The transformer is double-insulated, so earthing is not required.

The next step is the modification to the PCB to obtain 12V and 36V outputs. Fig. 7 shows the relevant tracks: a simple cut and link job is all that's required. Remove the output lead from the board's terminals, which now provide 12V, 36V and 0V as shown in Fig. 6.

The mains transformer and PCB, still connected together, are then transplanted to the new case. As the transformer has no fixings I stuck it to the case with double-sided sticky tape then held it in position with a right-angle bracket, using double-sided tape between the bracket and the transformer. I used a steel bracket bought at B&Q – it was left over from my house renovation. A small clip, also shown in Fig. 6, can be used to hold the PCB in position. The power consumption is very low, so the transformer is very underrun. Its temperature rise in use is thus small.

If you intend to include the FM facility a Velleman P1771 kit will have to be assembled, with the changes shown in Fig. 8 (see also Figs. 4 and 5 and Table 2 last month). Mount the PCB in an aluminium screening box. The one I used measures 50 x 80 x 25mm and has a close-fitting lid that's secured by screws at each end. Drill the box to provide wiring access – to minimise spurious radiation, make the holes as small as possible. Space the board at least 10mm away from the bottom of the box, otherwise the proximity of the aluminium to the oscillator's printed coil may act like a shorted turn and stall the oscillator. It's convenient to arrange the box so that its lid can be removed with the box mounted in the case, enabling adjustments to be carried out. Ensure that the box is connected to the 0V line.

As constructors will have their own ideas, I've not specified wiring detail except in the power supply and FM module areas. The rest of the assembly is not critical, although I recommend the following precautions. Use heavy earth wiring throughout. Connect C2 (Fig. 1) directly between the tuner chassis and pin B, likewise connect C1 between the tuner chassis and pin VT.

The pin connections to SK2 are: (1) signal indication – measure with respect to pin 4; (2) 0V; (3) +12V unswitched; (4) +12V switched; (5) no connection.

To improve the overall screening, since a plastic box is specified, line the inside of the lid with foil and connect this to 0V.

You don't have to build the whole unit at once. You can test the power supply and tuner/if module first, provided you've built the on/off and channel selector circuit.

Testing and adjustment

Tuning and adjustment of the tuner/IF unit are carried

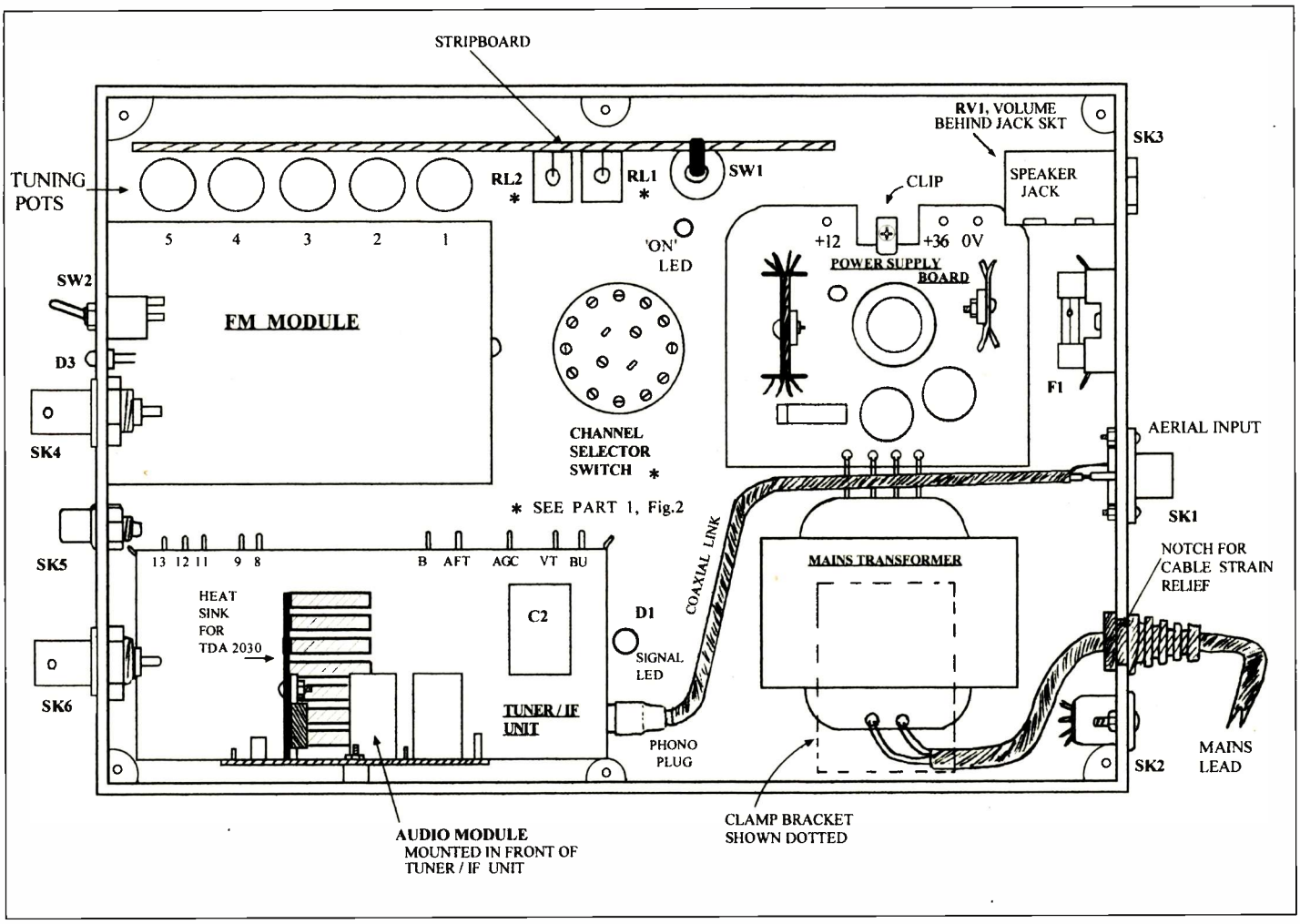

Fig. 6 (above): Basic layout of the unit.

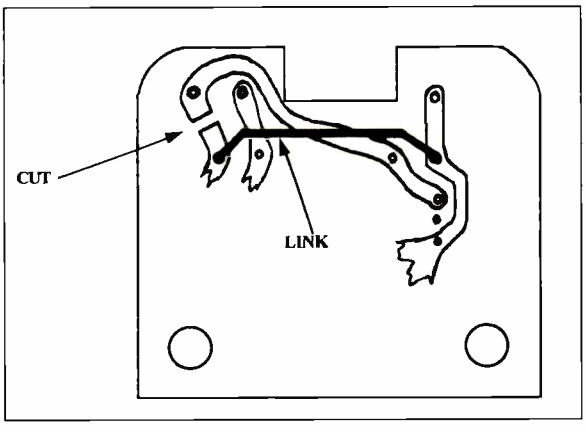

Fig. 7: The cut-and-link modification on the print side of the power supply PCB.

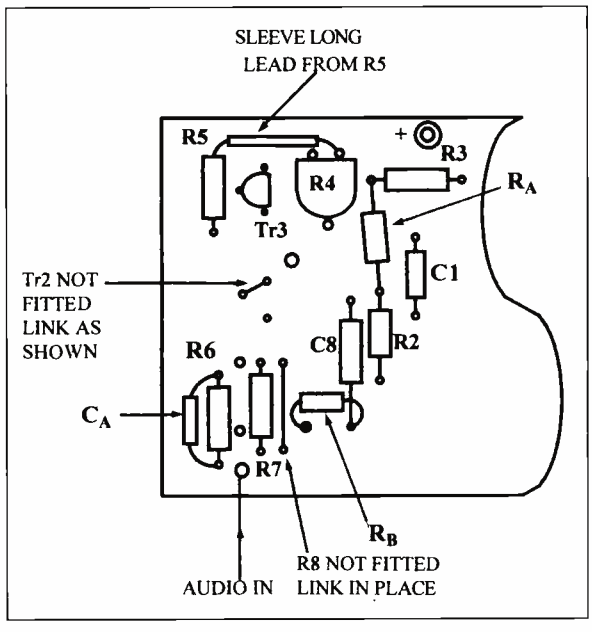

Fig. 8: Modifications to the Velleman P1771 FM transmitter module – see Figs. 4/5 and Table 2.

out as follows:

(1) Check that the voltages are present and correct.

(2) If the audio module is not fitted, create a 'half-rail' voltage (6V) by connecting two 2·2kΩ resistors in series between the 12V supply and 0V and linking their junction to one side of SW1.

(3) Connect an aerial.

(4) Connect a monitor to the video output (SK6) and an amplifier to the audio output (SK5).

(5) Check that audio and video noise are both present.

(6) Close switch SW1, i.e. defeat the AFC.

(7) Select tuning switch no. 1 and tune, with tuning potentiometer no. 1, until the required channel is received.

General assembly (Fig. 1):

MB6 ABS box. Maplin order code YN39
Sharp 1810587 PA1 tuner/IF unit from Sendz Components
12V and 24V regulated power supply from Sendz Components

C1	100nF, 63V	disc ceramic
C2	1,000µF, 16V	electrolytic
C3	220µF, 16V	electrolytic
C4	0·47µF, 16V	electrolytic
C5	10µF, 16V	electrolytic
C6	10nF, 63V	disc ceramic

R1	47Ω	R5	470kΩ
R2	100Ω	R6	1kΩ
R3	2·2kΩ	R7	1kΩ
R4	47kΩ	R8	68Ω

All 0·3W, 10%

D1	LED	yellow, 5mm
D2	Zener	BZY5V6
D3	LED	red, 3mm
Tr1	ZTX550	

RV1	5kΩ log. volume control*
L1	4·7mH choke. Maplin order code UK80B
F1	1A fuse, 20mm slow, with carrier
SW1/2	Miniature SP/ST toggle switches
SK1	chassis mounting coaxial socket
SK2	180° 5-pin DIN socket
SK3	Mono 0·25in. jack socket*
SK4, 6	75Ω BNC sockets
SK5	Phono socket

*Required only when audio module is fitted

Sundries: Phono plug for aerial input to tuner, connecting wire, coaxial cable for aerial link etc., stripboard, nuts and bolts, spacers, control knobs for the rotary switch and volume control.

On-off switching and channel selection module (Fig.2):

R1	4·7kΩ	R3	1·2kΩ
R2	3·3kΩ	R4	1Ω, 0·5W

All 10%, 0·3W unless otherwise specified

RV1-5	67kΩ tuning potentiometers: Supplied by Sendz Components in kits of eight
D1	LED, red 3mm
RL1,2	12V, 1kΩ reed relays (see text)
SW1	2-pole, 6-way rotary switch (Maplin order code FF74)

Sundries: Stripboard, terminal pins, nuts and bolts, link wire etc.

Audio module (Fig. 3):

C1	100µF, 10V	electrolytic	
C2, 3	4µF, 10V	electrolytic	
C4, 6	1,000µF, 16V	electrolytic	
C5	100nF, 63V	disc ceramic	
R1, 2	2·2kΩ	R5	68kΩ
R3	10kΩ	R6	1Ω
R4	2·2Ω, 0·5W	R7	470Ω

All 10%, 0·3W unless otherwise indicated

IC1	TDA2030V with heatsink (approx. 6sq. cm)

Sundries: stripboard, terminal pins, nuts and bolts, link wire etc.

FM module (Figs. 4/5):

Velleman P1771 kit, Maplin order code VF67

CA	470pF, 160V, 5%		polystyrene
C8	0·1µF, 63V		disc ceramic
RA	10MΩ	R5-7	100kΩ
RB	1MΩ	All 0·3W, 10%	

Aluminium box. 50 x 80 x 25mm. Possible equivalent Maplin AB12, order code LF13P

Sundries: nuts and bolts, spacers, link wire etc.

(8) Adjust for best vision and sound.

(9) Check the adjustment of the tuner/IF module's demodulator tank coil (see Fig. 1) to see if any improvement can be achieved. Probably not, but it's worth checking.

(10) Open SW1. Don't worry if the picture goes off-tune. Connect a meter between TP1 and TP2 (see Fig. 1) and adjust the AFT discriminator coil for zero voltage. The picture should then be back to normal.

(11) Close SW1 and tune in the remaining channels 2, 3, 4 and 5.

(12) Open SW1. The tuner is now set up, with the AFC active.

(13) The signal LED should be working.

The set-up procedure for the FM module is as follows:

(1) With a 'normal' sound level being received, e.g. a newsreader, adjust R4 (set deviation) in the Velleman module for a 250mV peak-to-peak audio signal at its slider, i.e. the input side of C8.

(2) Tune an FM radio to a quiet part of the band above 104MHz.

(3) Adjust the set frequency trimmer C4 (see Figs. 4/5) until the radio picks up the signal. Be careful to ensure that the frequency is centred and is not 'down the side', which would introduce distortion. This latter situation can arise when the radio is adjacent to the oscillator while its screening cover is removed. Complete this procedure as quickly as possible in order to minimise the time during which radiation could be excessive.

(4) Replace the screening box cover and recheck. There may be a slight frequency shift.

In conclusion

I've found the unit to be very useful. I don't use it all the time of course, but it appears to be very stable. It was precisely on tune when switched on after a period of three weeks, so the power supply seems to be adequate for providing the tuning voltage. On another occasion I knocked the unit off a shelf on to a wooden floor. When I switched it on everything was OK, so I conclude that it's a tolerant and reliable piece of equipment!

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43700000	LOT02	800p
AMSTRAD		
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3714002	LOT02	800p
043714002J	LOT02	800p
43700000	LOT02	800p
AM152591	LOT55	1250p
FERGUSON		
00 D-3-508-002	LOT381	1400p
06 D-3-083-001	LOT82	1100p
06 D-3-083-002	LOT82	1100p
06 D-3-084-001	LOT23	1050p
06 D-3-087-001	LOT23	1050p
06 D-3-088-001	LOT84	1200p
06 D-3-093-001	LOT204	1250p
06 D-3-508-003	LOT276	1200p
06 D-3-512-001	LOT204	1250p
29201-022-01	LOT63	1500p
473197	LOT304	1300p
D 059 / 37	LOT200	1250p
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043714002J	LOT02	800p
43700000	LOT02	800p
CF 124 B	LOT67	1250p
CF 124 E	LOT67	1250p
HITACHI		
2424593	LOT44	900p
2432461	LOT169	1250p
2432761	LOT169	1250p
2433453	LOT82	1100p
2433751	LOT01	1050p
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2433892	LOT84	1200p
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2434141	LOT33	800p
2434274	LOT44	900p
2434393	LOT405	1800p
2434593	LOT44	900p
2435006	LOT401	1500p
2435131	LOT251	1300p
2436201	LOT90	850p
2433891H	LOT23	1050p
MATSUI		
20070	LOT438	1250p
20071	LOT438	1250p
20072	LOT438	1250p
20073	LOT438	1250p
20074	LOT438	1250p
20075	LOT438	1250p
3714002	LOT02	800p
3221008	LOT438	1250p
043714002J	LOT02	800p
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3119 198 62930	LOT57	1000p
3122 108 10246	LOT111	1200p
3122 138 36070	LOT111	1200p
3122 138 36072	LOT111	1200p
3122 138 36920	LOT57	1000p
3122 138 36922	LOT57	1000p
3122 138 36930	LOT57	1000p
3122 138 37050	LOT132	1300p
3122 138 37620	LOT90	850p
3122 138 38040	LOT73	1000p
3122 138 38123	LOT395	1200p
3128 138 20200	LOT433	1100p
3128 138 20201	LOT433	1100p
3128 138 20202	LOT433	1100p
3189 128 30400	LOT90	850p
4812 140 10246	LOT111	1200p
4812 140 10369	LOT90	850p
4812 140 10421	LOT90	850p
4822 140 10274	LOT123	1100p
4822 140 10246	LOT111	1200p
4822 140 10306	LOT57	1000p
4822 140 10381	LOT128	1100p
4822 140 10384	LOT127	1550p
4822 140 10406	LOT73	1000p
4822 140 10544	LOT433	1100p
4822 140 10566	LOT433	1100p
AT 2076 / 10	LOT57	1000p
AT 2078 / 21	LOT395	1200p
AT 2079 / 21	LOT395	1200p
AT 2079 / 40	LOT73	1000p
AT 2079 / 99	LOT276	1200p
SAISHO		
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043714002J	LOT02	800p

Part No	Code	Price
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1000p		
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1-439-286-13	LOT46	1000p
1-439-286-21	LOT46	1000p
1-439-332-41	LOT100	1200p
1-439-332-42	LOT101	1200p
1-439-332-52	LOT100	1200p
1-439-363-11		
LOT268 1100p		
1-439-363-21	LOT268	1100p
1-439-387-11		
LOT311 1200p		
1-439-387-21	LOT311	1200p
1-439-416-11		
LOT255 1300p		
1-439-416-12	LOT255	1300p
1-439-416-21	LOT255	1300p
1-439-416-23	LOT255	1300p
1-439-416-41	LOT255	1300p
1-439-416-51	LOT255	1300p
TOSHIBA		
1810951	LOT55	1250p
2433751	LOT01	1300p
23236098	LOT288	1200p
23236198	LOT288	1200p
23236201	LOT395	1200p
23236245	LOT395	1200p
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VALUE	CODE	PRICE	PER PACK
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470uF	CAP29	120p	10
16 volts			
330uF	CAP30	175p	10
470uF	CAP31	175p	10
680uF	CAP32	210p	5
1000uF	CAP33	210p	10
2200uF	CAP34	525p	10
3300uF	CAP35	500p	5
4700uF	CAP36	610p	10
25 volts			
10uF	CAP37	45p	10
22uF	CAP38	45p	10
47uF	CAP39	48p	5
100uF	CAP40	70p	10
150uF	CAP41	95p	5
220uF	CAP42	120p	10
330uF	CAP43	140p	5
470uF	CAP44	190p	10
680uF	CAP45	315p	5
1000uF	CAP46	365p	10
1500uF	CAP47	390p	5
2200uF	CAP48	200p	2
3300uF	CAP49	220p	2
4700uF	CAP50	365p	2
6800uF	CAP51	390p	2
35 volts			
10uF	CAP52	50p	10
22uF	CAP53	45p	10
33uF	CAP54	50p	5
47uF	CAP55	85p	10
100uF	CAP56	85p	10
150uF	CAP57	95p	5
220uF	CAP58	145p	5

VALUE	CODE	PRICE	PER PACK
35 volts continued.....			
680uF	CAP59	650p	10
1000uF	CAP60	435p	10
2200uF	CAP61	245p	2
3300uF	CAP62	1000p	5
50 volts			
10uF	CAP63	50p	10
22uF	CAP64	70p	10
47uF	CAP65	85p	10
100uF	CAP66	85p	10
220uF	CAP67	175p	10
330uF	CAP68	245p	10
470uF	CAP69	435p	10
680uF	CAP70	490p	5
1000uF	CAP71	525p	10
2200uF	CAP72	325p	2
63 volts			
0.47uF	CAP73	35p	10
1uF	CAP74	35p	10
2.2uF	CAP75	35p	10
3.3uF	CAP76	50p	10
4.7uF	CAP77	35p	10
10uF	CAP78	50p	10
15uF	CAP79	95p	5
22uF	CAP80	75p	10
33uF	CAP81	85p	10
47uF	CAP82	95p	10
68uF	CAP83	130p	5
100uF	CAP84	120p	10
150uF	CAP85	280p	5
220uF	CAP86	280p	10
330uF	CAP87	400p	10
470uF	CAP88	525p	10
680uF	CAP89	500p	10

VALUE	CODE	PRICE	PER PACK
1000uF	CAP90	540p	5
100 volts			
0.47uF	CAP91	50p	5
1uF	CAP92	85p	10
1.5uF	CAP93	70p	5
2.2uF	CAP94	50p	5
3.3uF	CAP95	50p	5
4.7uF	CAP96	50p	5
10uF	CAP97	95p	10
22uF	CAP98	105p	10
33uF	CAP99	155p	5
47uF	CAP100	175p	10
100uF	CAP101	210p	10
220uF	CAP102	600p	5
470uF	CAP103	600p	5
250 volts			
3M3	CAP104	175p	10
10uF	CAP105	260p	10
47uF	CAP106	435p	10
400 volts			
1uF	CAP107	215p	5
2.2uF	CAP108	225p	5
4.7uF	CAP109	315p	5
10uF	CAP110	400p	5
22uF	CAP111	250p	2
47uF	CAP112	350p	2
450 volts			
1uF	CAP113	280p	5
2.2uF	CAP114	320p	5
4.7uF	CAP115	495p	5
10uF	CAP116	550p	5
22uF	CAP117	415p	2

CD Pick Ups

Part No	Price
KSS 152 A	£13.00
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KSS 240 A	£16.25
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RCTRTH8151	£20.00
RCTRTH8112	£15.00
CDM12.1	£15.00
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MAKE & MODEL	CODE
ALBA	
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AMSTARD	
SAT250 , SR950 , SRD2000 , SRD700,SRD950 , SRX1002 , SRX2001 , SRX301 , SRX501 , SRX502	SATPSU16
SRD510 , SRD520 , SRD540 , SRD545 , SRD550	SATPSU3
SRD500	SATPSU4
BRITISH TELECOM	
SVS300	SATPSU17
BUSH	
IRD150	SATPSU12
ECHOSTAR	
SR5500 EARLY PSU WITH ADJ.	SATPSU12
FERGUSON	
SRD 5 , SRD16	SATPSU1
SRD4	SATPSU11
SRV1	SATPSU2

MAKE & MODEL	CODE
FINLUX	
SR5700	SATPSU12
SR5100	SATPSU23
GOODMANS	
ST700	SATPSU1
GRANADA	
KR1 , LR1 , LR2 , M/N92MR1/A	SATPSU1
HR 1, JR1	SATPSU2
NR2 , PR2	SATPSU8
M92MR2	SATPSU9
GRUNDIG	
STR1	SATPSU1
GIRD2000 , GIRD3000	SATPSU2
GRD150 , GRD250 , GRD280 , GRD300 , STR200S	SATPSU20
HITACHI	
SR-1050D	SATPSU1
MASPRO	
SRE250S/1 , SRE 350S/1	SATPSU1
SRE250S , SRE350S , SRE450S	SATPSU2
ST5 , ST-12	SATPSU20

MAKE & MODEL	CODE
MATSUI	
RD600	SATPSU20
MITSUBISHI	
ST-PB10	SATPSU1
NOKIA	
SAT1500 , SAT1600	SATPSU2
SAT1700 , SAT2200 , SAT2202	SATP-
SU23	
PACE	
PRD700 , PRD800 , PRD900 , PSR800 , PSR900 , MRD950 , MRD960	SATPSU1
MSS500 , MSS1000	SATPSU10
MRD920 , SS9000 , SS9010 , SS9200 , SS9210 , SS9220	SATP-
SU2	
MSS100 , PRIMA	SATPSU8
APOLLO , MSS200 , MS290 , MSS300	SATPSU9
PANASONIC	
TU-SD200	SATPSU1
TU-SD250	SATPSU9

MAKE & MODEL	CODE
PHILIPS	
STU802/05M , STU804 , STU811 , STU824	SATPSU1
STU801	SATPSU2
STU3301	SATPSU20
STU909	SATPSU22
STU350	SATPSU9
SONY	
SAT301	SATPSU10
THOMSON	
SRD11 , SRD 14	SATPSU1
SRD7/8 , SRS3 , SRS4	SATPSU2
THORN	
SAT99 , SAT120	SATPSU1
TOSHIBA	
SAT99 , TU-SD200	SATPSU1
TS540	SATPSU10

CODE	PRICE	CODE	PRICE	CODE	PRICE	CODE	PRICE	CODE	PRICE
SATPSU1	600p	SATPSU4	600p	SATPSU10	1230p	SATPSU16	1250p	SATPSU22	1050p
SATPSU2	550p	SATPSU8	650p	SATPSU11	650p	SATPSU17	850p	SATPSU23	650p
SATPSU3	600p	SATPSU9	900p	SATPSU12	1600p	SATPSU20	600p		

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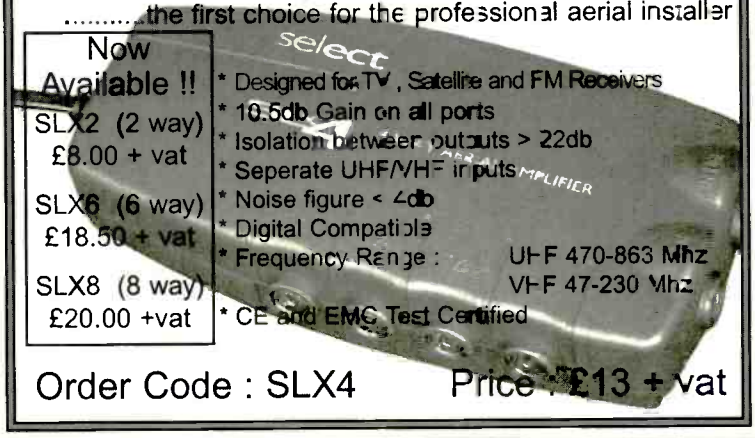

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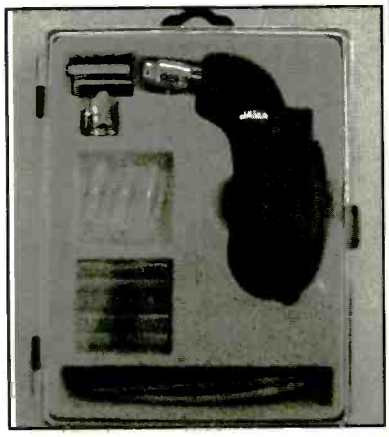

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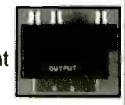

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BU2508DF	120p	BUZ80AF	200p	MJ15022	400p	TIP34C	60p	LM393	45p	STR440	800p	TDA1180	120p	TEA5101A	300p	UPC1188H	350p
BU2520AF	170p	BUZ90A	180p	MJ15023	400p	TIP35C	65p	LM723	40p	STR441	950p	TDA1518BQ	240p	TEA5101B	175p	UPC1488H	115p
BU2520DF	225p	BUZ90AF	280p	MJ15024	400p	TIP36C	65p	SAA1293	550p	STR44115	475p	TDA1557Q	300p	TEA5170	200p		
BU2525A	325p	BUZ91A	260p	MJ2501	100p	TIP41A	20p	SAB3035	275p	STR451	800p	TDA1558Q	300p	UC3842N	60p		
BU2525AF	220p	IRF510	70p	MJ2955	55p	TIP41C	22p	STK4131	480p	STR4512	400p	TDA2004	150p	UC3842AN	80p		
BU2525D	240p	IRF520	75p	MJE13007	100p	TIP42C	22p	STK4141 II	420p	STR50103A	260p	TDA2005	150p	UC3843	80p		
BU2527AF	400p	IRF530	75p	MJE13009	100p	TIPL791A	80p	STK4142	530p	STR54041	320p	TDA2030	80p				
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BUH1215	450p	IRF720	85p	S2000A3	175p	HA13152	800p	STK5331	300p	STRD1806	360p	TDA4600	200p				
BUH315	200p	IRF730	125p	S2000AF	90p	HA13153A	900p	STK5332	180p	STRD1816	350p	TDA4600 II	160p				
BUH315D	175p	IRF740	90p	S2000N	150p	HA13155	920p	STK5333	650p	STRD4420	550p	TDA4601	120p				
BUH515	200p	IRF820	90p	S2055A	175p	HA13157	950p	STK5337	500p	STRD6108	450p	TDA4605	190p				
BUH515D	250p	IRF830	85p	S2055AF	175p	LA4440	200p	STK5481	470p	STRS6707	1000p	TDA4950	100p				
BUH517	275p	IRF840	85p	S2055N	150p	LA4445	200p	STK5482	285p	STRS6708	575p	TDA8170	170p				
BUH517D	175p	IRF9610	95p	TIP121	35p	LA4460	120p	STK73410	350p	STRS6709	600p	TDA8171	230p				
BUH715	425p	IRF9620	85p	TIP122	30p	LA4461	120p	STK73410 II	500p	STV9379	400p	TDA8172	200p				
BUT11A	35p	IRFBC30	120p	TIP125	30p	LA4705	400p	STK7348	400p	TA8207K	175p	TDA8350Q	275p				
BUT1AF	35p	IRFBC40	210p	TIP127	35p	LA7830	90p	STK73605	375p	TA8215	300p	TDA8362N3	1200p				
BUT12A	80p	IRFZ44	160p	TIP2955	50p	LA7851	200p	STK73907	700p	TA8221AH	600p	TEA1039	150p				
BUT12AF	90p	MJ11015	250p	TIP29A	22p	LM1207N	450p	STK7406	650p	TA8227	250p	TEA2018A	80p				
BUT18A	80p	MJ11016	300p	TIP3055	50p	LM2405T	625p	STK7563F	650p	TA8251AH	700p	TEA2037	200p				

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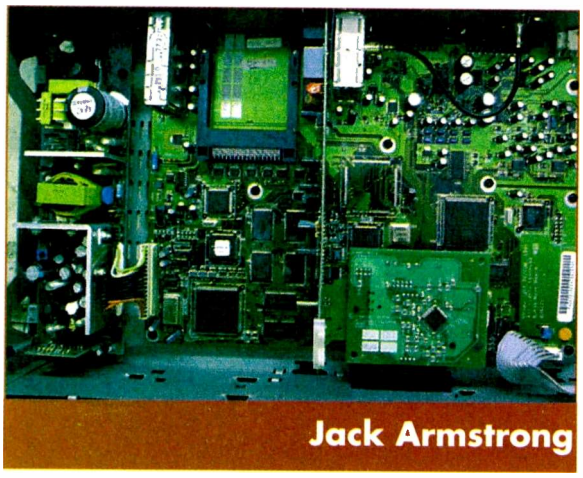
HELP WANTED

The help wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement department about this feature.

Wanted: Audio/control head for the Panasonic Model NV333 VCR, new or serviceable used, also a Perspex cover for the Ferguson Studio 25D music centre (1977 vintage). F.C. Bailey, 53 Peile Drive, Taunton, Somerset TA2 7SZ. 01823 253 905.
Wanted: Nokia dish control unit type ACU5152 or ACU8152 for use with the Nokia SAT1700 Mk II satellite receiver. Phone Andy on 0191 567 8645.
Wanted: Circuit diagram for the ADE Logic 4 alarm security control panel, photocopy OK. D. Lee, 16 Devonshire Place, Claughton, Birkenhead, Cheshire CH43 1TU16.
For sale: Panasonic RQ-DP7 portable DCC player, ex-demo model, boxed as new, with all accessories etc, £50. Contact Ancrum Electronics on 01382 454 511.
Wanted: M52016SP IC for the JVC TV Model CS2190. Central Electronics, 6 Queen Street, Stirling FK8 1HN. Phone 01786 451 230 or fax 01786 449 830.
Wanted/for disposal: Require a LOPT, type TLF-01-01 2YF, for an unbranded Taiwanese monitor. Have for disposal 110 issues of *Television* between 1985-99, also ten miscellaneous service manuals. Any offers for the lot. Phone David Smith on 023 8087 0051 (Southampton) or e-mail dsmithg@globalnet.co.uk
Wanted: Upper cabinet and cassette hatch cover, in grey, for the Sony VCR Model C7, also an RMT200 remote-control unit. Must be in mint condition. A.C. Griffin, 89 The Ridgeway, Sedgley, West Midlands DY3 3U1V. 01902 880 063.
Wanted: A T900514-036 chip (I501) for the Hitachi TV Model C21P819 and a ZC84328P chip (IC7) for the Ferguson TV Model 51P7. Mick Pope, 76 Barkby Thorpe Lane, Thurmaston, Leics LE4 8GS. 0116 260 2270. E-mail mick@pope16.freeserve.co.uk
Wanted: Circuit diagram for the Philips CCTV Model LDH0402/01, also a January 1971 copy of *Everyday Electronics* with article on Thorn Ferguson TV. Peter Ward, 01425 475 445 (Ringwood).
Wanted: RGB drive panel for the Grundig Super Colour Model B8681, series M4026RK (CUC740 chassis), or parts to repair the board. Phone Frances Marcus on 0171 911 5054 (daytime) or e-mail francesmarcus@hotmail.com
Wanted: Service manuals and remote control units for the following satellite receivers and VCRs. ITT Nokia SAT1100, Diskxpress DX1000, Toshiba BTR-5SAT, Matsui VCP100 and Philips VR285. Ron White, 29 Nunnery Street, Castle Hedingham, Halstead, Essex CO9 3ND. 01787 460 105.
Wanted: Circuit diagrams for the power supply and RF/data/video I/O boards used in the Maxi Eclipse 370TT data and video projector (3 CRT type). Bob Mitchell, 5 Second Row, Linton, Morpeth, Northumberland NE61 5SQ.
Wanted: Service manual/circuit diagrams/information on the ITT Cine-Vision 200S video projector. Ian Mackintosh, 7 Wellington Court, Trearddur Bay, Holyhead, Anglesey LL65 2LJ. 01407 860 864. E-mail Mad@Max69.freeserve.co.uk
Wanted: Circuit diagram (photocopy OK) for the WEM Westminster 15 amplifier. Cortons Electrical, 29 Red Lion Street, Aylsham, Norfolk NR11 6ER. 01263 733 391.
Wanted: LOPT for the Tatung Model T21TD60 (D series chassis) plus service manual/circuit diagram (photocopy OK). C. Irvine, 46 Sandringham Crescent, Moortown, Leeds LS17 8DF. 0113 228 0999 or 0113 392 3825.
Wanted: Circuit diagram and if possible component layout for the Granada Model C22X25, which I understand is fitted with the Salora H chassis. Also require user instructions for the Orion combi unit Model 2093SC. Photocopies fine. Phone 01622 716 294 (Maidstone).
Wanted: Converter/chopper transformer (T301) for the Sanyo 80P CTV chassis. D. Jones, 4 Warminster Close, Sheffield S8 9BH. 0114 255 4685.
For disposal: Video-size box full of camcorder circuits, mainly Panasonic, for cost of postage/carriage. Tillotson's TV Service. Phone 0113 281 2067.
Wanted: Tuner drawer and AFC case for the Ferguson TX10 chassis, a working chassis (PCA1150/D1) for the Ferguson TX100, and a remote control unit for the Akai VSF410 VCR. Ron Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP. 01708 558 792.
Wanted: 115V zener diode (D601) for the Sharp Model C3705 – or nearest equivalent type. P.T. McKeever, 4 Castleview Park, Derry BT48 8DL. 01504 353 613.

Satellite WORKSHOP



Jack Armstrong

Now that SkyDigital satellite receivers are beginning to come out of their warranty period the trade is being asked about repairs. I have made some enquiries and the following notes summarise the current situation as far as I have been able to assess it.

It's still not certain when Sky will switch off its analogue broadcasts from the Astra satellites at 19·2°E. With more and more digital receivers being installed, a date some time in 2001 seems likely.

From the servicing point of view a Sky digibox will be almost impossible for the one-man firm to repair. The boards are mainly of seven-layer construction, which means that in addition to tracks on the top and bottom there are five layers of tracks inside. A large number of the components are of the surface-mounted type, and several of them are large, expensive surface-mounted chips with hundreds of connections.

One firm at least has 'bit the bullet' however. Horizon Satellites in Basingstoke (01256 841 860) has invested thousands of pounds in the equipment and training that will enable it to offer a digital receiver repair service. The man in charge, Martin Green, tells me that parts and service information are available for Pace receivers, but that other manufacturers seem to be reluctant to provide anything.

Amstrad for example doesn't provide any spares or service information. CPC, which is a stockist for Amstrad, is referring all enquiries to BSkyB. Meanwhile BSkyB is apparently trying to set up a repair operation for the Amstrad DRX100. Whoever gets this repair business is, it seems, going to have to invest at least £100,000 in component stocks – without knowing what stocks will be needed! The DRX100 is made for Amstrad by the Samsung factory in Portugal. It's quite likely that only sufficient parts to fulfil the manufacturing contract have been ordered, with very few left over to meet any service requirements. Anyone now wanting to order spare parts is going to have to pay an awful lot of money, since some parts are custom-designed and for most there will be a large minimum order quantity – not to mention a probably long lead time. For this reason BSkyB is currently offering a replacement digibox to the 300 customers whose DRX100 has failed outside warranty. If you have one of these, you might consider insuring it right now!

Pace was the first manufacturer to supply digiboxes. The company's service department has, in my opinion, been second to none since Bill Fraser took it over about nine years ago. Spare parts and service manuals are available for all models, including the Pace 2200 digibox. Dealers can get free training at the Pace factory, and the Technical Helpline is almost free, calls being charged at standard national rates. You can also get help by e-mail, and the Pace web site has a password-controlled technical section for dealers. Few other companies provide such comprehensive support. Other companies, including A.R.D., are advertising Pace digibox spares.

Should a Pace digibox fail, the owner can either take it to a dealer or parcel it up and send it direct to Pace – after obtaining a Returns Authorisation. The advantage of sending it direct is a possible saving of money: Pace currently charges just £76.38, which includes return to the customer. The owner must be sure to send the digibox in its original packaging or equivalent, and must make sure that the receiver really is faulty. A digibox can be sent by Parcel Force for about £6, or by next-day carrier for a little more. Do insure it. This brings the cost to about £82 minimum. If the digibox is damaged in transit, exhibits no fault on arrival, or has been damaged by water, lightning or by having been dropped, Pace might levy a heavy charge.

On balance it might be better to take a Pace digibox to a local dealer, who should be able to test it before packing it up carefully and forwarding it to Pace. The charge would probably be very little more than the £82 mentioned above, since dealers can often get a discount. Units less than a year old will be repaired free of charge by Pace, but the dealer will obviously charge a handling fee – especially if he has to find packaging materials or collect/deliver to your premises.

Panasonic also offers a repairs service, but there are no spares nor any service information. A faulty Panasonic TU-DSB20 digibox must be taken to the nearest Panasonic dealer, who will arrange to return it to the factory for repair. It will speed things up if you have the original packaging, but leave all accessories (remote control unit etc.) at home, as these are not required and could get lost. The charge is likely to be similar to that made by Pace. Models TU-DSB30 and TU-DSB20 are still under twelve months old and should be returned to the dealer (with proof of the purchase date) for free repair.

Grundig doesn't carry out repairs but has appointed repair agents to do this. Again neither spares nor service information is available. Faulty digiboxes should be delivered to an authorised Grundig dealer for sending to a repair agent. At present, repairs are being handled by GenServe in Swindon and Digitech in Manchester. Don't contact either of these companies about digibox repairs unless you are a Grundig agent.

GenServe and Digitech carry out repairs to both analogue and digital Nokia receivers, and supply parts and service information for them. You can contact the two firms direct for information. GenServe has a technical help service for dealers at £50 plus VAT a year. This payment also gives you access to free advice on Nokia TV sets, video and audio products, including associated brands such as ITT, Finlux, Luxor, Salora and Skantic.

For more information dealers can reach GenServe on 01793 436 107 and Digitech on 0161 654 6664.

More information about the digibox is available at the following web site:
http://www.satcure.co.uk/digibox.htm

Nokia ACU5152

The installer who brought this dish positioner ("antenna control unit") along announced that it was dead. In fact it wasn't, because when I plugged it in there was a ticking noise followed by a bang and smoke. Then it was dead!

The L6203 motor driver chip IA04 can go short-circuit, so I started to carry out some checks in this area. When I measured the diodes in the associated bridge circuit they all read zero resistance – until I desoldered IA04. The diodes then produced correct readings, so the IC was faulty. I couldn't see or detect any other faults here, which was rather puzzling. After putting on my safety spectacles I reapplied power. Nothing spectacular – in fact the unit failed to light up.

Further checks showed that there was no output from the 7805 regulator IA01. The 20V supply was at 36V however, while the 40V supply was at 78V! I bet I broke a world record at plug pulling . . .

As IA01 was obviously dead I fitted a replacement. I then gave GenServe a quick call, and was advised to check the two small electrolytic capacitors in the power supply – they can be the cause of high voltages when faulty. Replacements restored normal voltage readings and a new L6203 chip produced normal dish control.

Pace MSS300

The lady who called about this receiver had been given a nonsensical diagnosis by a BSkyB adviser. But at least she hadn't been told to "wipe the card", which seems to be the standard advice for almost any fault. The problem appeared to be loss of the horizontally-polarised channels. An installer from many miles away had replaced the LNB, charged her for the pleasure then announced that the receiver was faulty and there was nothing he could do.

I didn't see the symptom myself, as she didn't want to pay me for a call out. Fair enough. Her son brought the receiver to my workshop and, as soon as I had time, I tested it. The power supply was whistling like a banshee, and the pictures were obscured by horizontal streaks. Fitting the capacitors in Relkit 9 (from SatCure, phone 01270 753 311) cured these faults and the receiver was then fine.

The cause of the lack of horizontally-polarised channels might have been interference, at about 25kHz, from the power supply. This can switch a universal LNB to high-band operation. The diagnosis is easy to miss if the installer doesn't have the knowledge to check by tuning to the lowest frequency.

[redacted]

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems by e-mail. You can reach him via the Internet web site at:

http://www.ukstay.com/jack

If you have no Internet access you can write to him c/o Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps. envelopes.

Test Case 448

Repairs that 'bounce' are a pain in the butt for both the customer and the technician concerned. The latter can seldom get payment for the second or any subsequent repair carried out on the item involved – whether or not the symptom or the cause is the same. The following is a true, depressing bounce story!

The subject of our tale is a Toshiba V711B VCR. It was about eight years old and came into the workshop initially because the mechanism had jammed. This problem was easily solved by fitting a new mode switch then cleaning and lubricating the deck and tape-loading arrangement. It was a routine job, and the customer happily paid the bill and bore his machine away. Just three weeks later it came back. Our receptionist wrote on the job card 'No go, as before. Recent repair'.

TechnoCrat, who had carried out the initial repair, was annoyed and rather indignant when he discovered that this time the fault was far away from the deck and the mode switch, though the net result was the same – the machine did not work. There was no front panel display and, when the machine was turned on, no action beyond illumination of the standby light.

After an investigation which took rather too long TechnoCrat found that the ICP fuse Z802 (400mA) was open-circuit. It feeds the DC-DC converter module on the logic/servo board U601. A meter connected to the legs of the device produced a reading of about 130mA, which seemed reasonable, and the machine then worked correctly in every respect. So another N10-type fuse was fitted and the machine was sent on its way, with no charge for the new work.

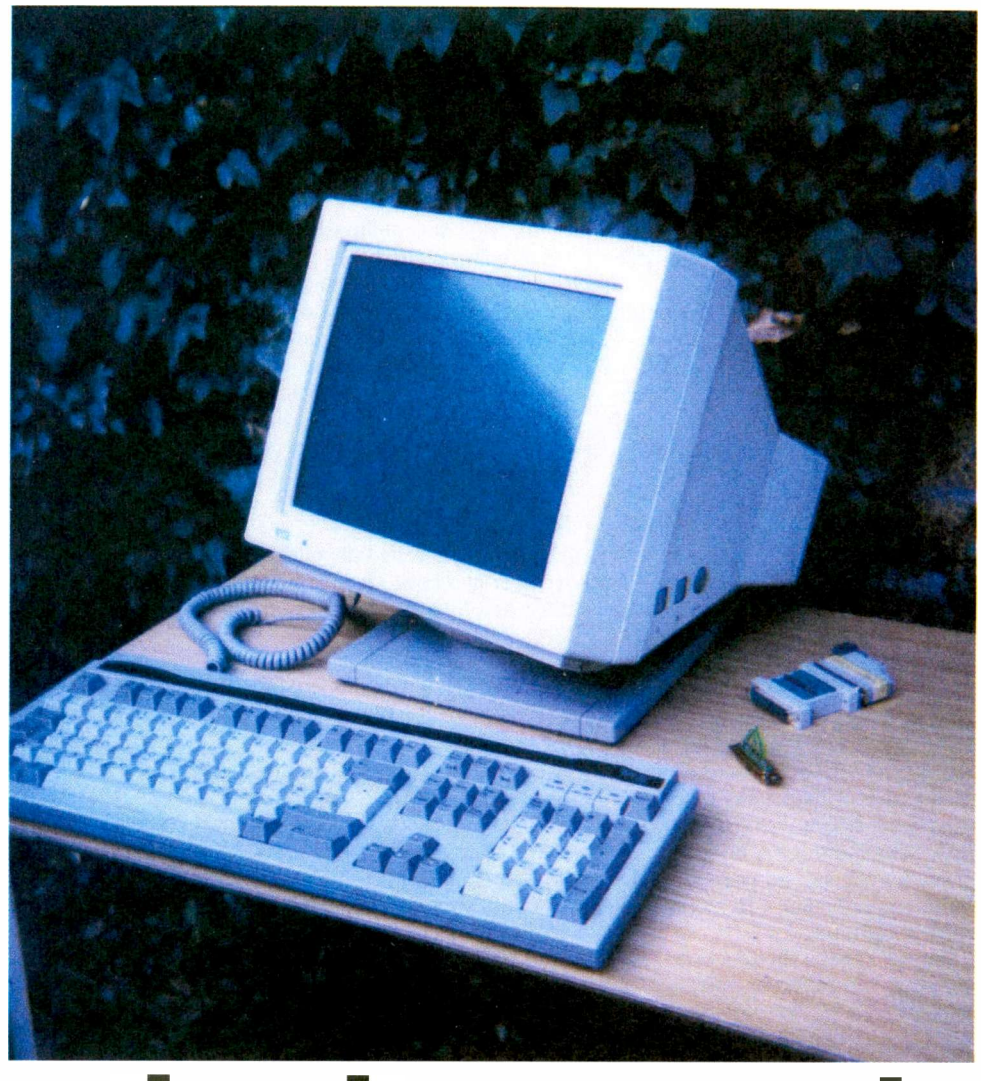
Only three days later Mr Jones (we'll call him that) was again at the service reception counter with his troublesome VCR. This time he was quite irate and aggressive. Service Manager smoothed things over, promised a quick repair and sent the hapless TechnoCrat back to his bench with the offending machine. The same ICP fuse had failed, and once again an ammeter connected in its place produced a normal reading of 130mA or so. As before, the machine sprang to life once power had been restored to the DC-DC converter module. TechnoCrat's mind was made up: the converter module must be faulty. He'd had trouble with these little Toshiba cans-of-tricks before, though the one sitting on the shelf in the store room was not right for this model.

A replacement module was ordered post-haste and was fitted as soon as it arrived a couple of days later, along with another ICP fuse. Service Manager and TechnoCrat bowed Mr Jones out of the workshop, and breathed sighs of relief when he and his machine has disappeared into the distance.

We'll draw a veil over the uproar at reception when the VCR came back the day after next. Same symptoms, with Z802 open-circuit for the third time. The almost hysterical Mr Jones was this time given a loan machine, and the Toshiba VCR was put into what could be called 'intensive diagnosis', using an oscilloscope and everything!

The root cause of the problem was finally found. It was not on board U601, nor was it on the front display panel that the DC-DC converter feeds. What was producing these fuse failures? For the answer, turn to page 375.

A dumb terminal is one of a number linked to a mainframe computer. Many are now elderly and prone to failure, though repair is often still required. Ian Rees has found this to be a profitable field for servicing. The following article, based on the Wyse WY120 terminal, serves as an introduction to this type of work



Servicing dumb terminals

With so many consumer electronics products now hardly being worth repair, it has become increasingly difficult to find anything that *is* worth repair or refurbishment. I diversified into computers and monitors several years ago, but even this market has become depressed because of the low retail prices of new goods.

An area I was slow to see as being a profitable one is dumb terminals. Such a terminal will be one of a number that are connected to a company's mainframe computer. Many of these terminals are now elderly and are starting to fail. Companies seem pleased to find that it's possible to get them repaired, and this gives us servicing people an opportunity.

The faults you get with these units – in the power supply, timebases and video circuits – are mainly the same as those you encounter in everyday TV servicing work. This article covers the Wyse Model WY120, which was manufactured in the early Eighties. It was distributed by ICL and others with their logos on it. Although the present article concentrates on this model, it will serve as a general introductory guide on how to tackle this type of product.

Servicing accessories

A number of accessories may have to be made up or obtained in order to test a dumb terminal.

Loopback adaptor: The loopback socket communicates with the mainframe computer via an RS232 connector. In the absence of a mainframe computer, a loopback adaptor is required so that the terminal can talk to itself, echoing back the key presses from the keyboard. This is a simple matter of linking together the pins of a 25-pin D-type plug (DB25).

Viewed from the rear of the DB25 plug, the pins are numbered as follows:

(13) o o o o o o o o o o o o o (1)

(25) o o o o o o o o o o o o o (14)

The connections required between the pins in the plug are as follows: link pins 2 and 3, 4 and 5, 8 and 20. Once made, the adaptor can be plugged directly into the socket on the terminal marked 'Main' or 'RS232'.

A useful addition for servicing is to plug in the adaptor via an RS232 port analyser such as the CPC 'Check Tester' (order code CST-MB460P). This cheap device, costing less than £5, has an array of LEDs that follow the signals on the RS232 lines, giving a useful indication of the state of a port.

Self-diagnostic connector: The Wyse WY120 terminal has a self-diagnostic check feature which is activated by

switching on the mains supply with one of two types of specially-wired DB25 plug inserted in the 'Aux 1' printer socket. Links for the two types of plug are as follows:

Even parity link pins 2 and 10, 4 and 11, 6 and 12, 8 and 15.

Odd parity link pins 3 and 10, 5 and 11, 7 and 12, 9 and 15.

Flyleads: To be able to work on it the PCB will have to be removed from its plastic base. Numerous earthlinks have to be disconnected to remove the PCB. To preserve the connections when live testing, six short flyleads with crocodile clips at each end will have to be made up.

Isolation, anti-static and keyboard: As always, an isolated mains supply is essential when checking one of these terminals. Use of a personal anti-static strap is advisable to prevent damage to CMOS chips in the digital circuitry. Finally, beg or borrow from your customer a keyboard with a suitable RJ11-style plug to suit the terminal.

Self-diagnostic testing

Initial testing, to find out whether there's scanning and a raster, is done before you open up the terminal. Carry out the self-diagnostic check at the same time. Before you switch the terminal on, insert the loopback adaptor and the even-parity self-diagnostic DB25 plug.

At switch on a beep should be heard and the screen should show a running display that's similar to the 'test' output of a printer. Let this run for about five minutes. If, at the end of this time, the display has not stopped or the unit beeped again the test is OK. If the system finds a fault it will display a code on the screen. Table 1 lists the codes and the fault information they provide.

The same procedure can be carried out using the odd-parity self-diagnostic DB25 plug, though I do this only as a final test.

Pins 4, 5, 8, 20, TD and RD of the port analyser should produce hi (on) LED indications, all other pins lo (off).

At the end of the test, press the space bar. This will produce a screen full of Ms for focus adjustment, with three square contrast boxes at the centre of the screen.

Press 'control' and 'A' to produce a pincushion display.

Press 'control' and 'S' to toggle the display between 60-78Hz refresh rates.

Press 'control' and 'A' again. This produces a full-screen display of all the characters' attributes used by the terminal.

Press 'control' and 'A' again to take you back to the screen full of Ms.

These tests provide a comprehensive check on the memory, logic, EPROM, RAM and port communications. The ability to identify the component or area where a problem is present is very helpful in diagnosing problems with which you may not at first be familiar.

Access

A considerable amount of dismantling is required to carry out any internal work on the PCB.

To remove the back cover, place the unit on its face on a soft surface. Find and remove the two screws that hold the side control panel in place, then push the control panel back into the casing. Remove the two larger cover screws. Press on the top of the case to ease the guides as you slide the cover backwards and off.

In this state visual examination and keyhole voltage checks can be carried out but little else. For full service access the PCB has to be detached from the base. This is best done in two stages.

Stage one is to separate the PCB and base from the CRT and front panel. Cut through the glue and unplug the tube base. Discharge the EHT connector and disconnect the field yoke and LED indicator. Remove the earthing wire at the CRT band, leading to the keyboard socket. With ICL units the side-support struts can be detached at the CRT end, but Wyse-branded units have a tongue that makes this impossible. With these units, unplug the line output transistor and snip the holding strap on the EHT rectifier assembly.

Unclip the mains lead and detach all the earth links fixed to the centre of the struts. Remove the strut fixing screws at the PCB ends. Finally loosen but do not remove the two screws, under the CRT, that hold the base to the front panel. The complete base and PCB can now be separated from the front panel and CRT.

Final dismantling involves unplugging the keyboard connector, the two plastic clamps and the rear fixing screws. The control panel is held by two screws. The PCB is now free from the base and can be removed.

Servicing

Now that the unit has been split into the PCB and CRT assemblies, work can begin. The two parts will have to be temporarily reconnected however: make sure that no shorts occur. Plug in the line output transistor, which is mounted on the right-hand strut, with the tongue of the plug nearest the metalwork. The keyboard socket attached to the base will have to be removed and the keyboard connected to the CRT. Ensure that all earth connections are bonded, especially the CRT's Aquadag coating connection to chassis.

After the complexities of modern equipment it's a joy to work on these units. The PCB is double printed, with the upper side being mostly an earth plane. Any board charring can cause leakage between the surfaces. Take care not to cause solder shorts when fitting replacement components – only a small insulated hole is available through the upper ground plane.

The power supply

The chopper power supply circuit is simple and elegant, see Fig. 1. A programmable zener device (IC102) is used in the error-voltage sensing circuit. Otherwise the power supply is a conventional self-oscillating arrangement.

As the units are ten or more years old, it's advisable to check the ESR of the electrolytic capacitors. The circuit is very tolerant, and even when capacitance values have changed a lot the symptoms one would expect do not show. The lack of fusible components tends to result in burn ups and failure of components on the secondary side of the circuit. Be prepared to look farther than the obvious smoky or shorted components.

A single-pole switch turns the mains supply on and off, so isolate the terminal elsewhere before working on it. There is no bleed resistor across the mains bridge rectifier's reservoir capacitor (C105) which can thus remain charged under certain fault conditions. The output is set by adjusting VR101 to obtain 30·5V at the cathode of D113.

In common with many monitors, the tube's heater sup-

ply is obtained from the power supply instead of the line output stage – from the junction of R110/D112.

If the tube looks flat, or is slow to come on, check the voltage across its heater pins (3 and 4). If low, C120 may be to blame. Complete loss of the heater supply suggests that R110 (22Ω, 2W) is open-circuit or D112 (12V zener diode) is short-circuit.

The line timebase

The item that most commonly fails in the line output stage is D204, which produces the tube's first anode supply. Even when it has not failed I replace the RGP5100 diode with the European BYD33M equivalent. D202 (RGP30J) can also fail, though this doesn't happen as often.

The 2SC2898 line output transistor Q202 rarely gives trouble, and can be readily checked because it is socketed on the right-hand mounting strut. When Q202 has been disconnected I always fit a 60W bulb as a dummy load, though the power supply seems to operate quite happily without it. The EHT rectifier is incorporated in the line output transformer. There is a 200MΩ bleed resistor potted inside a small tube that's attached to the same strut as Q202. I have come across a few cases of corona discharge from the EHT lead where it emerges from the tube. As this is very close to the line output transistor, I prefer to remount the assembly on the yoke of the LOPT, fixed with a plastic tyewrap strap.

Loss of line drive is generally caused by failure of the 2SC1213 driver transistor Q201 or R211 (39Ω, 2W) which provides the feed to the driver transformer T201. I have to date never had failure of the MC1391P chip IC201 which produces the line drive.

When checking around the scan coils, note that the coupling capacitor C212 (1·8μF, 100V) is at the earthy side, so there are pulse voltages at both side of the coils.

The frame timebase

The frame timebase is based on a TDA1170N chip, IC301. The IC can fail, but isn't the first suspect. Problems are usually caused by ageing electrolytics (C305 100μF, C306 100μF, C311 22μF and C313 3,300μF) or noisy presets (VR301 50kΩ, VR302 100kΩ and VR303 10kΩ).

Video output stage

With all the complexities of modern colour TV video circuits Fig. 2 must produce a smile. At first glance it appears to be a conventional analogue output stage, until you notice that the two transistors Q401 and Q402 are not used as amplifiers. The input comes via IC401 (74S05), whose output is fed to the emitter of Q402. The latter acts as a switch that applies fixed digital voltage levels to the CRT's cathode. Table 2 shows the various drive conditions. Q401 sets the bias at the base of Q402, under the control of VR401 (user brightness control) and VR402 (preset brightness). The latter is on the CRT base panel.

Table 1: Fault codes

Code	*Fault area*	*Function*
0	U3	Character RAM
1	U9	Attributes RAM
2	U2	Font RAM
A	U7/10	Main port RTS-CTS
a	U11/12	Aux 1 port D6, D7-error
b	U11/12	Aux 1 port D2, D3-busy
C	U11/12	Aux 1 port D4, D5-pe
c	U7/10	Main port DTR-DCD
d	U11/12	Aux 1 port D0, D1-ack
K	B1	No battery backup
P	U5	Code PROM checksum error
X	U7/10	Main port txd-rxd

The digital section

Fortunately the digital section gives few problems. Personally I bail out at an early stage if the fault is deeply entrenched. Unless you are a real whizkid or a masochist, it's rather a waste of time chasing the cause of an obscure fault in this part of the terminal. Only one of the ICs is fitted in a socket, so substitution is a slow process. Whenever a replacement has been required I have always fitted an IC socket. At least I could then retrieve the new IC in mint condition if my diagnosis was wrong, and refit the old one without subjecting it to another ordeal by fire!

The terminal unit is built around an 8032 microprocessor chip, U6, which sits next to the only socketed IC in the unit (the EPROM U5).

Fig. 3 shows a block diagram of the digital section, indicating how the various ICs are connected in relation to the data paths. The IC types and functions are as follows:

U1	LM393	Battery backup and audio
U2/3	6264P-10	Font/character RAM
U4	SLA7490	Custom IC
U5	27256	EPROM
U6	8032	Microprocessor
U7	1489A	Buffer for CPU
U8	74S04	Video driver
U9	8464	Attributes RAM
U10	1488	CPU out buffer
U11	74LS377	Data latch
U12	74LS365A	Buffer status
U13	74LS368	Keyboard buffer

A 3V lithium battery is soldered to the PCB at the rear of the power supply. The battery has an expected life of ten years. So most are now coming to the end of their lives and may need replacement. The battery backs up the information in the attributes RAM U9.

In conclusion

These are interesting units to repair. As far as I know there aren't any spares. If there are, they would probably be too expensive for use in products of this age and origin. But that's not new with this type of equipment! Fortunately most firms that use these terminals have several of them and don't mind some being cannibalised for spares.

Terminals are often found at computer auctions, used to make up the numbers in lots of monitors. When pallets of these terminals do come up for sale, usually nobody (except me) bids and they go for next to nothing. No, I won't tell you where I go, because they may be knocked down to you next time!

Finally the Wyse web site is worth a look. User support for this and all their products is, short of taking the back off, available in depth.

As always I'm happy to offer assistance where I can. I can be contacted by e-mail at imrees@tesco.net

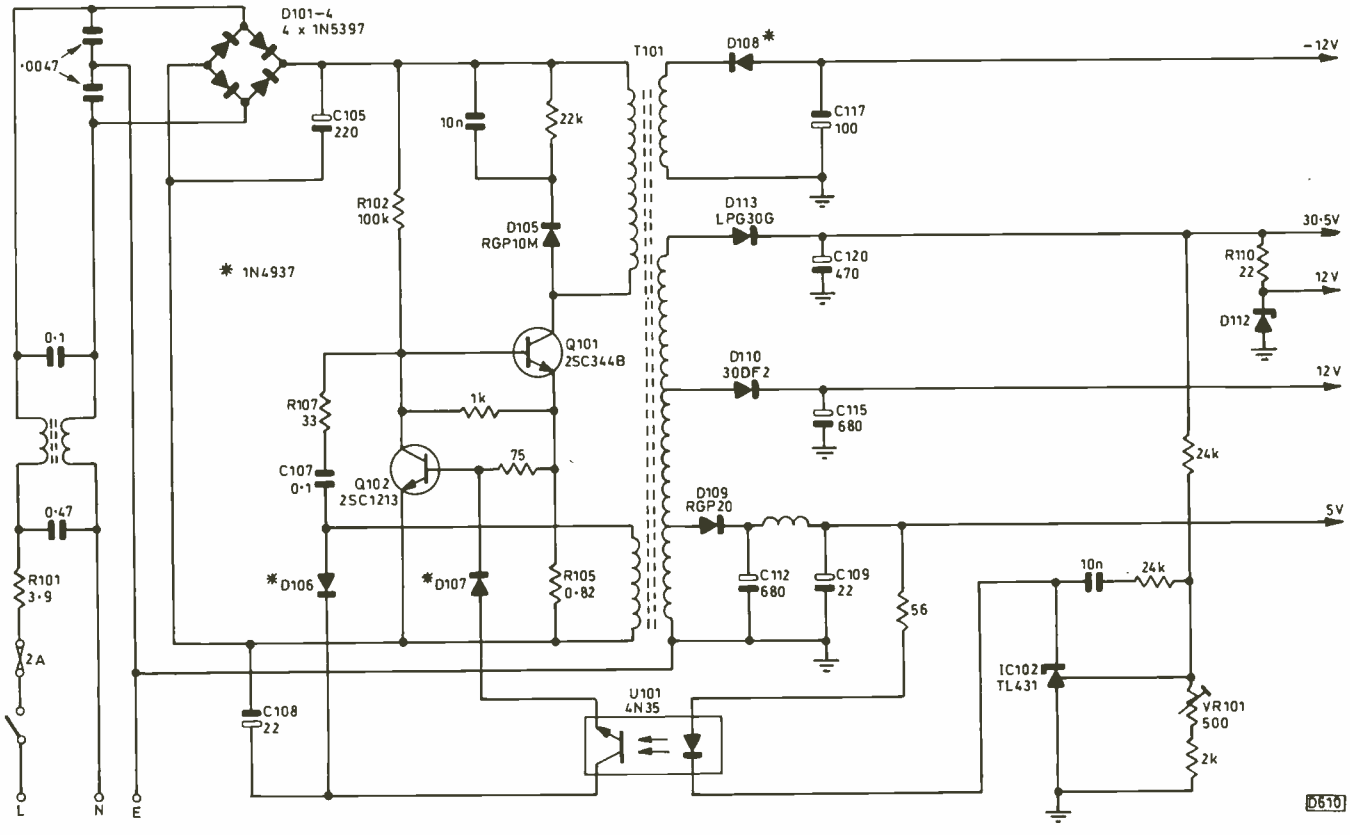


Fig. 1: The power supply circuit used in the Wyse WY120 terminal unit.

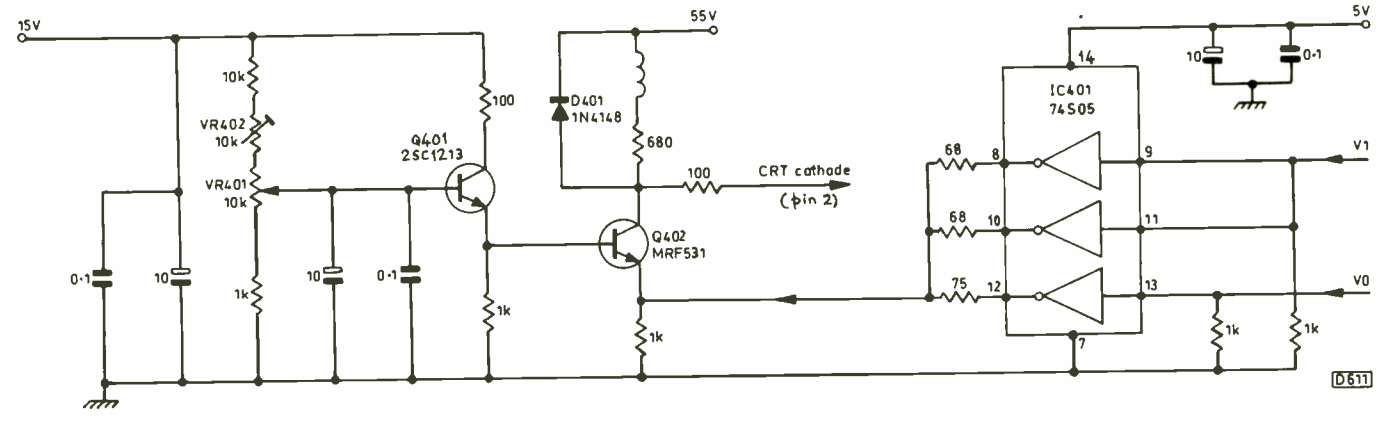


Fig. 2: The video drive circuit. The 55V supply for Q402 is obtained from D205 (RGP5100) and C217 (10µF) in the line output stage.

Table 2: CRT drive conditions

Input to IC401		*Brightness level*
V1	V0	
0	0	CRT off
0	1	low
1	0	medium
1	1	high

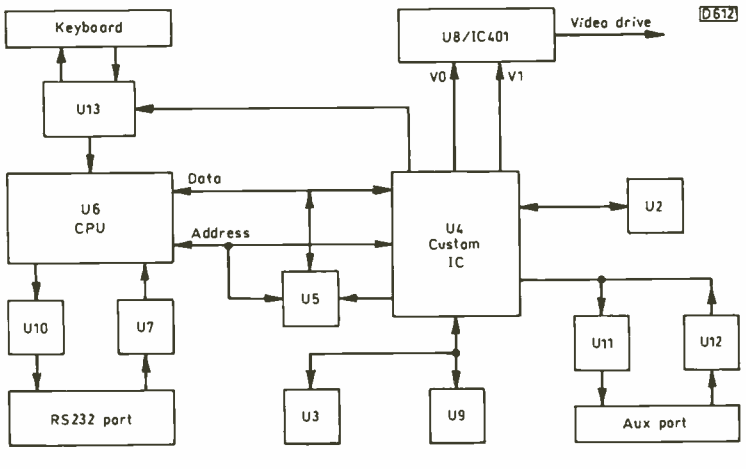
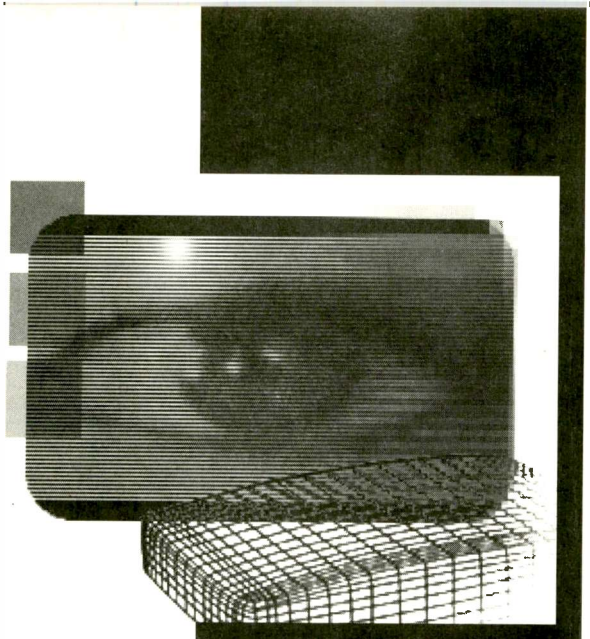


Fig. 3: Block diagram of the logic circuitry.



Monitors

Reports from Ian Field

Viglen CA1726LE

This monitor was dead. It has the same power supply panel as the Digital VRC16HA and the scan panel of the older VR16CA. Since regulation faults in the power supply can result in all kinds of problems on the scan panel, I always start with the power supply.

C70 and C71 (both 100µF, 250V) and R65 (249kΩ, 1%) in the B+ regulator should be checked. They are in the rail regulated by the SG3524 and Q13 (2SK1010). If the Buck regulator diode D23 (31D4) fails, the power supply will trip. When Q13 is short-circuit the scan PCB will be damaged – this also applies with failure of C70/71. C34 (22µF, 350V) smooths the supply fed to Q13: if it fails of its own accord, it will confuse Q13. If it has burst, the likely cause is regulation failure in the main SG3842 circuit. This is the master chopper circuit from the mains input.

The 16V output from this regulator is sampled for regulation, via R46/50 (values selected on test), a conventional TL431 and optocoupler providing the feedback to the non-isolated side of the circuit. The smoothing electrolytics for the 16V supply are C38 (1,000µF, 35V) and C42 (1,000µF, 25V).

As there was nothing amiss in the power supply it was reassembled and put back in the chassis. There are separate scan and EHT output transistors, Q206 (2SC3886A) and Q221 (2SC3884A) respectively, on the scan panel. Each output section has its own B+ pulse-width modulator on this panel, separate from the master B+ PWM on the power supply panel. Q236 (2SC4742) is the scan B+ PWM, QP6 (2SK1010) the EHT B+ PWM. Usually only the output transistors fail, but the PWM transistors should be checked. Sometimes the 2SC4742 fails: the 2SK1010 rarely fails.

In this case Q206 had failed. The cause was traced to C220 (10µF, 250V). It read off the scale on my home-made ESR tester, which has an ESR FSD of 7Ω . C235 (22µF, 350V) should also be checked: it's in the EHT circuit, next to the LOPT. As the reading was about 0·5Ω, I decided to replace it. Before fitting the replacement I checked its ESR. It was nearly double that of the previous component, which I decided to refit with an 0·15µF, 400V MKT capacitor in parallel to bypass the relatively high ESR of the electrolytic. The added capacitor will reduce the self-heating effect within the electrolytic capacitor, prolonging its life.

Dell D1528LS

This monitor suffered from loss of both line and frame sync. After checking I401 (TDA9102C) and I702 (MTV003N) by substitution, also various peripheral components, I noticed that the line output transistor was getting very hot and the LOPT rather warm. Knowing the customer, I didn't bother to ask whether the price of a new LOPT would be acceptable and put the monitor aside.

Some days later an identical monitor arrived with a broken CRT. Once the main panel from this monitor had been transferred to the initial one, it produced a blank raster with flyback lines. As the load resistors in the RGB output stages were getting hot, their HT supply was obviously present. Further checks showed that the tube's G1 pin was at quite a high negative voltage, –48V. Since the tube's cathodes were very low at around 15-22V, the cause of the fault was almost certainly on the CRT base panel. Either the MN1203 chip or all three RGB output stages were faulty.

Before deciding what to check next, I noticed that only the G2 (first anode) lead is soldered. Everything else is plugged in. Obviously the thing to do was to swap over the two CRT base panels. The video input connector is stuck on with white glue however. Attempts at levering it apart would be likely to result in damage. The remedy I adopted was to unsolder the connector from the CRT base panel and let it hang in a pot of cellulose thinners for a few minutes. The two items could then be levered apart without damage to the connector.

Hyundai Delux Scan 15PRO (HL5864E)

This monitor came in because of a blown fuse. The first thing I noticed when I removed the back was a 'spare' plastic cover wedged between the bottom of the CRT and the main PCB. It should have been clipped on to the underside tagboard on the scanning yoke.

With the PCB out, no cause of the blown fuse could be found. In fact the TEA2262-based chopper power supply seemed to be working correctly. On closer examination, the pressed steel bottom tray that the PCB slides into appeared to be bulging upwards in the middle, giving the impression that too much weight had been put on the swivel base. The only solution was to salvage a sheet of insulating material from a scrap monitor. Such a sheet is often used for screening and has a conductive coating on one side. It had to be cut to shape to avoid covering the ventilation holes, and glued in place with the non-conductive side upwards to prevent the PCB touching the metal chassis tray.

Once the monitor was up and running the CRT base was found to have a very touchy intermittent

fault, the symptoms being red flashes, odd colours or an almost blank screen. R436 (1kΩ, 7W) in the class A red output stage had a very bad dry-joint. Perhaps the user had been thumping the monitor!

Belinea 104010

There was no display and the monitor made screeching and chattering noises. The power supply was working, and there was line drive. But there was little by way of a pulse at the collector of the line output transistor. The flyback-type B+ supply PWM was inactive, with the result that the inductor and rectifier provided the LOPT with a lower than usual voltage. A slight tweak on the B+ preset started this circuit up and a picture appeared. It was very narrow however, and the line output stage heatsink was getting very hot.

The flyback tuning capacitor C417 (3·9nF, 1·6kV) was bulged and had split its encapsulation. Once this item had been replaced and the B+ control had been reset the monitor produced a good display.

Anonymous

This anonymous monitor had the model name 29J56N, model number JD156N FCC ID: AMP JD156X. The main PCB had the brand name Jean on the screen print. The power LED was on but there was no EHT. The cause was simple: complete separation around the solder joint at the LOPT pin that should be connected to the collector of the output transistor. There was no arc damage to the PCB or to any other component.

It always pays to examine the soldering however. In this case the only other faulty joints were at connector P102, where three out of the four pins had separated from the track. This is curious, because P102 isn't normally used. It appears to be the 'electronic screwdriver' port for the front panel microcontroller chip.

Apricot XJ49906 (17in)

This monitor has the same case and metalwork as the VRC16 but is fitted with a Sony Trinitron CRT and has much-simplified circuitry. The one that came in recently was dead with the 2SC3886A line output transistor short-circuit. On initial inspection the power supply, which is very much simpler than the versions seen previously, appeared to be dead with 320V at both ends of the chopper transformer's primary winding. When the two multiway connectors, fitted end-to-end, were removed the power supply started up. So the cause of the shutdown was most likely to be on the time-base panel. Once the line output transistor had been replaced – a 2SC4742 with insulator is a better idea than a 2SC3886A – there was a raster with some loss of width. The flyback tuning can be altered to remedy this, but I found that an additional 680pF was the limit!

As the CRT's heater was a bit sluggish I replaced the 470µF and 100µF (both 25V) electrolytics, in the power supply, that smooth the 6·3V output. The white flylead from the CRT base to the smaller of the pair of multiway connectors leads straight to these capacitors. The regulation optocoupler circuit shares this supply, so adding Mylar capacitors of about 0·47µF or a little more across these electrolytics is a good idea.

IBM 6314-002

This monitor was dead. On inspection I found that there was a large crack across the rear-centre PCB fixing screw hole, reaching almost to L956 in one direction and up to C974 in the other. Although it was possible to link and brace across the parted tracks, the board would not withstand the same stress so well next time. The only solution was to cut out the damaged struts in the base of the metal chassis.

The soldering at P701 (flyback switching MOSFET subpanel) must be checked in these monitors: arcing here can wreck the line output stage.

Also a reminder on how to store the front-panel settings: hold the store button while pressing the mode button. Store successful is indicated by the LEDs all flashing five times simultaneously.

Compaq 151FS (Model 444)

The complaint was that this monitor wouldn't switch on. True enough, when I tried to do so it seemed to remain lifeless. Voltage checks quickly established that the mains bridge rectifier was producing an output of 320V, and that there was a supply at pin 7 of the UC3842 chopper control chip. But there was no reference voltage output at pin 8, and the output pulses at pin 6 were either not present or were too narrow to detect.

As the MOSFET and its gate protection zener diode were not responsible for the loss of pulses at pin 6 I checked for shorts in the secondary side of the circuit and eventually found that D933 (UG4D) was short-circuit. I couldn't find an equivalent for this device, so I fitted a BYM26E which worked fine.

Apricot XJ54748

The LED was pulsing but there was nothing else. When I opened the case I saw that the chassis had that distinctive Tatung look about it. There was a nasty dry-joint at Q805 (2SC1815) in the power supply, but resoldering it made no difference. A check on the UC3842 chopper control chip revealed that its voltages were missing, so I went off in search of start-up resistors. It looks as if the power supply monitoring circuit is supplied by R884 and R888 (both 47kΩ, 2W), and that the start-up resistor, which is MOSFET assisted (Q804 BUK454800A), is R868 (47kΩ, 3W). These last two items were both OK. Q804's gate receives bias via R864/5 (both 2·2MΩ), one of which was open-circuit. A replacement restored normal operation.

WEB SERVICE

Here's a new feature reporting on useful web sites for TV professionals and amateurs. This month the info was compiled by Peter Marlow

Amstrad

http://www.amstrad.co.uk

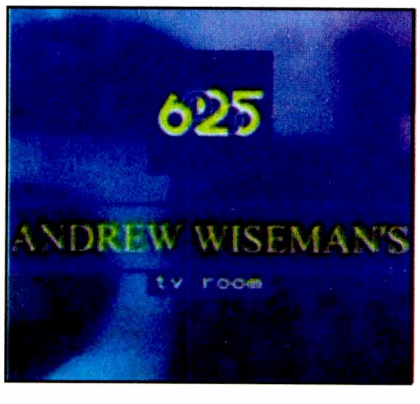
http://web.ukonline.co.uk/clifflawson

Amstrad now has its own official web site covering current products. For information on older products the Cliff Lawson web site is essential viewing.

Andrew Wiseman's TV Room

http://625.simplenet.com

An informative personal site about TV past and present. There's a discussion about the future of digital TV. There's also a logo gallery where you can listen to the old BBC and ITV intros, and see logos from cult programmes such as the Prisoner and Dr



Who. You can even watch old public information films (although I had a problem connecting to the server). There are useful sections explaining Digital Television and Programme Delivery Control for video recorders (thanks to Laurence Day for bringing this site to my attention).

Baird 30 Line Recordings

http://www.dfm.dircon.co.uk

For history buffs and the curious here's a fascinating site containing early TV recordings and their background.

BBC

http://www.bbc.co.uk/info/reception

http://www.bbc.co.uk/enginfo

If you need any help with your reception go to this site – both of the addresses point here. There's special advice for people with loft installations, and caravaners and boating enthusiasts.

Darren Meldrum's Home Page

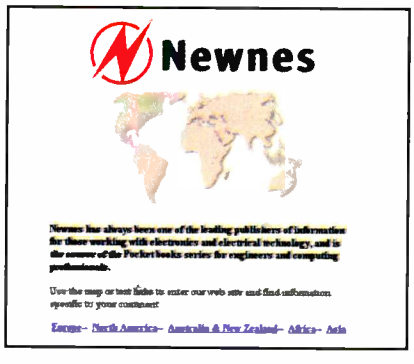
http://www.meldrum.co.uk/mhp/index2.html

This excellent site is dedicated to television especially the bits in-between – the announcements, idents and, for the nostalgic among you, the Test Cards. It also contains some useful links to other sites (as do many other sites).

MB21

http://www.mb21.co.uk/index.html

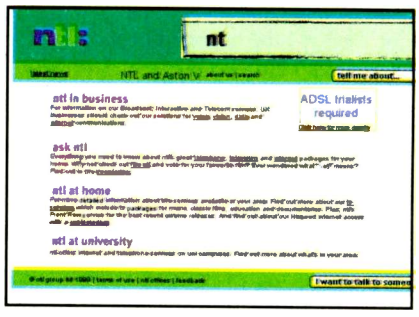
Another enjoyable site with a "telenostalgia" section about the technical aspects of television. There's also a section on transmitter sites, teletext "then and now", and a "rough guide" to widescreen television



Newnes

http://www.newnespress.com

Check out this site for the latest book titles on TV & Video Servicing and Technology and their famous Pocket Book series. You can shop on-line and also register for an Email service to tell you when relevant new titles are published.



NTL

http://www.ntl.co.uk

Go to this site for information on NTL's Broadcast, Interactive and Telecom services, including packages for home area by area. There's also a useful transmitter site map and database, giving locations and information. The site also contains useful documents, which describe digital TV, interactive TV and digital Radio. There's also a useful contacts list.

Newsgroups

uk.tech.broadcast

uk.tech.digital-tv

uk.tech.tv.sky

If you have never got into newsgroups then these are worth a look. You"subscribe" (free of charge) to a newsgroup through your e-mail software (eg. Outlook Express). If it's not obvious how to do it then check out the help section on your Internet Service Provider's front page. Newsgroups are like notice boards where subscribers can send an Email to be viewed by everyone else.They are generally a source of help and advice, with plenty of humour too! Maybe there should be a TV engineer specific newsgroup called "uk.tv.engineers". Any thoughts? (thanks to Iain Dobie for this information)

Pace

http://www.pace.co.uk/trade/index.htm

The Pace site has a product finder. On servicing, there is a restricted access area

TELEVISION

TV/VCR SPARES GUIDE 2000

The following list gives spares department addresses and telephone numbers or, where these are the same, service department or head office addresses and telephone numbers. Also included are details of various spares distributors. Stocks of spares may no longer be available for defunct brands.

Aiwa UK Ltd., P.O. Box 443, West Drayton, Middx UB7 0NZ.
020 8899 5520
Fax 020 8899 0055.
See also CPC, KSA Wholesale Components and Willow Vale.

Akai UK Ltd., Haslemere Heathrow Estate,12 Silver Jubilee Way, Parkway, Hounslow, Middx TW4 6NQ.
020 8897 6388
Fax 020 8759 6118 (Service).
See also CPC, Wizard, Willow Vale and Chas Hyde.

Akura Spares for pre-1999 models available from CPC and SEME. For subsequent models check with Akura Group, Spectra House, Spring Villa Park, Spring Villa Road, Edgware, Middx HA8 7EB.
020 8951 4323
Fax 020 8951 4174.

Alba Radio Ltd., 12 Thames Road, Barking, Essex IG11 0HZ. Spares for Alba, Bush, Roadstar and some Goodmans and Hinari models. Some Brother microwave, Dirt Devil and Power Devil spares.
020 8787 3000
Fax 020 8787 3110.
See also Willow Vale, CPC, Wizard.

Ambassador Brand name used by Sentra Electronics.

Amstrad Spares handled by CPC Ltd. See also Chas Hyde & Son Ltd., Willow Vale and Wizard.

A.R.D. ELECTRONICS

A.R.D. Electronics Plc., Warehouse and Distribution Centre, Shorten Brook Way,, Altham Business Park Altham, Accrington, Lancashire BB5 5YL
01282 683 000
Fax 01282 683 010.
e-mail: sales@ard-plc.co.uk

Autovox See Comet Group plc.

Beko (UK) Ltd., 40 Caxton Way, Watford Business Park, Watford, Herts WD1 8QZ.
01923 818 121
Fax 01923 819 652/3.

Beovision/Beocord Bang and Olufsen UK Ltd., Unit 630, Wharfdale Road, Winnersh, Wokingham, Berks RG41 5TP.
0118 969 2288
Fax 0118 969 3388.
See also CPC.

Binatone Electronics plc., Unit 1, Ponders End Industrial Estate, East Duck, Lees Lane, Enfield EN3 7SP.
020 8344 8888
Fax 020 8344 8877.
Trade only.

BPL Spares for TV sets made in India available from Falmouth Hi Fi, 14 Market Strand, Falmouth, Cornwall TR11 3DE.
Spares also available for Crown, Dansai, Datsurai, Kuro and Zenor
01326 313 412
E-mail falmouthhifi@yahoo.co.uk

Bush See Alba Radio Ltd. Also HRS and Willow Vale.

Cambridge Spares available from SEME.

Canon UK Ltd., Photo Division, Brent Trading Centre, North Circular Road, Neasden, London NW10 0JF.
020 8459 1266
Fax 020 8459 4202.
See also CPC.

Cathay Spares available from Diamond Television.

Comet Group plc., After Sales, PO Box 92, Preston PR2 9GY.
08706 052 020
Fax 01772 664 835.

cpc

CPC Ltd., Component House, Faraday Drive, Fulwood, Preston, Lancs PR2 9PP.
01772 654 455
Fax 01772 654 466.
Authorised spares distributor for Aiwa, Akura, Alba, Amstrad, Bosch, Citizen, Epson, Ferguson, Fidelity, GoldStar, Goodmans, Grundig, Hinari, Ingersoll, JVC, Kenwood, LG, Logik, Matsui, Miele, Orion, Osumo, Pace, Panasonic, Philips, Pye, Saisho, Samsung, Sharp, Sony, Thompson, Toshiba and Triumph.
Compatible spares available for Akai, Baird, Bang and Olufsen, Beko, Blaupunkt, Brandt, BT, Cambridge, Cannon, Casio, Crown, Daewoo, Decca, Dual, Finlux, Fisher, Fujitsu, Funai, GEC, Granada, Hantrex, Hitachi, ITT, Loewe, Luxor, Marantz, Maspro, Memorex, Mitsubishi, NEC, Nikkai, Nokia, Normende, Pioneer, Proline, Questar, Rediffusion, Roadstar, Saba, Salora, Sansui, Sanyo, Schneider, Sentra, Shintom, Siemens, Skantic, Solavox, Tashiko, Tatung TEC, Telefunken,Tensai and Thorn.

Crown Spares available from Key Electronics. See also CPC and SEME. Made in India models see BPL.

Daewoo Electronic Sales UK Ltd., Daewoo Building, 640 Wharfedale Road, Winnersh Triangle, Wokingham, Berks RG41 5TP.
0118 925 2500
Fax 0118 925 2532.
Note: Daewoo brand products only, not OEM products. For the latter, refer to the original distributor. Account holders only. See also CPC and Seme.

Decca See Tatung (UK) Ltd., CPC and Wizard Distributors. Spares for chassis up to and including the 110/115 series available from D&S Electronic Services, Building 15, Unit 4, Stanmore Industrial Estate, Bridgnorth, Salop WV15 5HR.
01746 766 641
Fax 01746 766 641.

Denon Spares available from Hayden Laboratories Ltd., Hayden House, Chiltern Hill, Chalfont St Peter, Gerrards Cross, Bucks SL9 9UG.
01753 888 447
Fax 01753 278033.

Diamond Television, 15/15a Rodbourne Road, Rodbourne, Swindon, SN2 2AG. Spares for Cathay and Venturer products. Murphy TVs with model numbers starting CTV, the Murphy

VCR7101, Sansui SV77 VCR and Osaki VCR31/2/3 plus mechanical parts for the VCR35 also spares for the Venturer audio range.
01793 497 591
Fax 01793 431 687.

Dual See Wizard Distributors.

Dynatron Pre-1981 sets, see Philips Service; post-1981 sets, spares from SEME.

Elftone Electronics Ltd., 4 Beresford Avenue, Wembley, Middx HA0 1YZ.
020 8902 6222
Fax 020 8903 5011.

Etron Brand name used by Nikkai Imports Ltd.

Eurosat Distribution Ltd.,5, Oxgate Centre, Oxgate Lane, London NW2 7JA.
020 8452 6699
Fax 020 8452 8788.

Expert. Sets use Tatung, GEC, or Luxor chassis.

Ferguson Spares available from Thomson Multimedia Sales UK Ltd., 30 Tower View, Kings Hill, West Malling, Kent ME19 4NQ.
01732 520 920
Fax 01732 520 995.
See also CPC, HRS, Chas Hyde, SEME, Willow Vale and Wizard.

Fidelity Spares available from SEME, HRS, CPC, Wizard and Willow Vale.

Finlux Spares available from Genserve Ltd. and CPC.

Finlandia Spares available from Granada Rental Services.

Fisher Spares available from Sanyo UK Sales Ltd., Sanyo House, Otterspool Way, Watford, Herts. WD2 8JX.
01923 222 244
Fax 01923 818 251.
See also Chas Hyde.

Fujitsu General, Ground Floor, Elstree House, Elstree Way, Boreham Wood, Herts, WD6 1LS.
020 8421 7000
Fax 020 8421 7029.

GEC Spares available from CPC, HRS, SEME and Willow Vale.

General See Fujitsu General.

GenServe (GTS) Ltd., Bridgemead Close, Westmead Industrial Estate, Westmead, Swindon, Wilts SN5 7TS.
Spares lines:
01793 556 002
Fax 01793 556 015.
Service line (phone/fax):
01793 436 107

GoldStar See LG Electronics UK Ltd. Also A.R.D. and CPC.

Goodmans See Alba Radio Ltd. or Comet Group plc. depending on model. Also CPC.

Granada Rental Services,
Unit 1, Roman Way Ind. Estate, Longridge Road, Ribbleton, Preston, Lancs PR2 5BD.
01772 470 480/1/2
Fax 01772 654 803.
Spares for Decca, Finlandia, Granada, Rediffusion, Sanyo, Tashiko and Tatung. Trade only.

Granada Spares available from Granada Rental Services.

Grundig Spares available from CPC and Willow Vale. Spares for VCR4000 and SVR4004 ranges available only from Willow Vale.

Harwood Spares available from Key Electronics.

Hinari Spares available from CPC, Chas Hyde and SEME.

Hira The Hira Co., Ltd., Hira House, 1 Elizabeth Street, Manchester M8 8JJ.
01618 347 432
Fax 01618 324 566.

Hitachi Sales (UK) Ltd., Dukes Meadow, Millboard Road, Bourne End, Bucks SL8 5XF.
01628 643 435
Fax 01628 643 000.
See also Chas Hyde and Willow Vale.

HMV Sets use Ferguson or Fidelity chassis.

HRS Electronics Ltd., Medco House, Connect Business Park, Bordesley Green Road, Birmingham, B9 4UA.
0121 766 6668
Truedata orderline 0121 766 7274
Public orderline 0121 766 5124.
Wide range of video, audio and television spares for Fidelity, GEC, Hitachi, Nikkai, Pace, Philips, Pye, Saisho, Sanyo, Sharp, Tatung, Toshiba and many more. Also all leading domestic appliance brand spares.

Chas Hyde & Son Ltd.,
Prospect House, Barmby Road, Pocklington, Yorks YO4 2DP.
01759-303 068
Fax 01759-303 620.
Web site: charleshyde.co.uk
Sole authorised UK distributor for Akai, Hitachi, Nokia and Sanyo. Approved spares and accessories distributor for Alba/Bush, Thomson/Ferguson, JVC, GoldStar, Konig, LG Electronics, Matsui/Saisho, Philips and Sharp. Founder members of the König club. Extensive spares stocks available for Mitsubishi, Samsung, Sony and Toshiba. Selected ranges of specific genuine and/or replacement pattern spares for Decca, Fidelity, Hinari, GEC, Grundig, Luxor, Normende, Orion, Panasonic, Saba, Salora, Sentra, and Tatung.

ITT Spares available from GenServe Ltd. See also CPC, Chas Hyde and Wizard.

JVC (UK) Ltd., JVC House, JVC Business Park, Priestley Way, Staples Corner, London NW2 7BA.
020 8450 3282
Fax 020 8452 2534.
Account holders only.
See also CPC, Chas Hyde and Willow Vale.

Kenwood Electronics UK Ltd., Kenwood House, Dwight Road, Watford, Herts WD1 8EB.
01923 816 444
Fax 01923 819 131.
See also CPC and KSA.

Key Electronics Unit 5, Brow Mills Industrial Estate, Brighouse Road, Hipperholme, Halifax HX3 8EF.
01422 203 676
Fax 01422 203 674.
Spares for Crown Corporation, Harwood, Kyosho and Ssangyong products.

Konica Plane Tree Crescent, Feltham, Middx TW13 7HD.
020 8751 6121
Fax 020 8755 0681.

Körting See SEME.

KSA Wholesale Components, 582 Green Lane, Small Heath, Birmingham B9 5QG.
0121 772 2834
Fax 0121 772 7487.
Authorised spares distributor for Aiwa, Kenwood, Philips, Philex, Pioneer, Samsung and Toshiba.

Kuro Made in India models see BPL.

Kyoshu Spares available from Key Electronics.

LG Electronics UK Ltd., LG House, 264 Bath Road, Slough, Berks SL1 4DT.
01753 500 400
Fax 01753 517 445.
See also A.R.D. Electronics, CPC and Willow Vale.

Lloytron Laltex Group, Laltex House, Leigh Commerce Park, Greenfold Way, Leigh, Lancashire WN7 3XH.
01942 687 000
Fax 01942 687 070.

Logik Brand name used by Dixons. Spares available from Mastercare, CPC, HRS.

Loewe Spares available from Wizard.

Longreach Marketing Ltd., Riverside Business Park, Lower Bristol Road, Bath, Avon BA2 3DW.
01225 444 894
Fax 01225 448 676.
Distributors of satellite, aerial and CCTV equipment.

Luxor Spares available from GenServe Ltd., CPC, Chas Hyde and Willow Vale.

Manhattan Eurosat Distribution Ltd., Oxgate Lane, London NW2 7JA.
020 8452 6699
Fax 020 8452 6777.

Marantz Hi Fi UK Ltd., Kingsbridge House, Padbury Oaks, 575/583 Bath Road, Longford, Middx UB7 0EH.
01753 680 868
Fax 01753 680 428.
See also SEME and CPC.

Mastercare PO Box 60, Hemel Hempstead, Herts HP2 7TZ.
01442 888 444
Fax 01442 888 145.
Spares for Dixons/Currys ranges – Matsui, Link, Logik, Prinz, Saisho. Also Sanyo.

Matsui Brand name used by Currys and Dixons. Spares

available from Mastercare. Also CPC, Chas Hyde, SEME and Wizard.

Metz No UK source of spares. Manufacturers address: Metz Werke Gmbh 2 Co., D8510, Furth, Germany.

Mitsubishi Spares available SEME, CPC, Willow Vale and Wizard.

Morphy Richards Spares available from R and M Technical Services.

Murphy Spares available from Diamond Television for TV sets beginning with CTV and VCR 7101. Some sets fitted with Fidelity chassis. Older sets fitted with Rediffusion chassis. Earlier sets fitted with Rank chassis.

National, National Panasonic. See Panasonic.

NCS See GenServe (GTS) Ltd.

NEC Spares available from SEME and CPC.

NEI See Stewart (Iain) and SEME.

Nikkai Spares available from CPC, HRS, Stewart (Iain), Willow Vale and Wizard.

Nokia Spares available from GenServe Ltd. and Willow Vale.

NordMende Spares available from Thomson Multimedia.

Orion See CPC.

Osaki Brand name used by Rumbelows. Spares for models VCR31/32/33, also mechanical parts for VCR35 available from Diamond Television.

Osume See CPC.

Pace Micro Technology plc, Victoria Road, Saltaire, Shipley, West Yorkshire, BD18 3LF.
01274 532 000
Fax 01274 537 128.
Spares also available from A.R.D. Electronics, Eurosat, HRS, CPC and Willow Vale.

Panasonic (UK) Ltd., Panasonic House, Willoughby Road, Bracknell, Berks RG12 8FP.
01344 860 133
Fax 01344 861 598.
Account holders only.
Non-dealer orders handled by SEME Ltd.

Philips Service Centre, 420/430 London Road, Croydon CR9 4QX.
020 8686 5414
Fax 020 8681 0796.
Account holders only supplied.
Also spares for Dynatron. See also CPC, HRS, Chas Hyde, KSA, Willow Vale and Wizard.

Pioneer (GB) Ltd., Pioneer House, Hollybush Hill, Stoke Poges, Slough SL2 4QP.
01753 789 876
Fax 01753 789 534.
Account Holders only.
See also CPC, KSA and SEME.

Prinz Brand name used by Dixons. See Mastercare.

Proline Brand name used by Comet Group plc.

Pye See Philips Service. Also SEME.

Quart see Denon, Hayden Lab.
Questar See CPC.

R and M Technical Services
97-99 Warton Road, Isleworth, Middx TW7 6EG.
020 8560 6644
Fax 020 8560 5853
Helpline 0181 758 0338.
Spares for Morphy Richards and Roberts Radio models.

Roadstar See Alba, CPC and SEME.

Roberts Radio Spares available from R and M Technical Services.

Saba Spares available from CPC.

Saisho Brand name used by Dixons. See Mastercare, CPC, HRS, Chas Hyde, SEME, Willow Vale and Wizard.

Salora Spares available from GenServe Ltd. and CPC.
Samsung Euro Service Centre, Unit A, Stafford Park 12, Telford Shropshire TF3 3BJ.
01952 207 171
Fax 01952 293 459 (spares only).
Also CPC, Chas Hyde, KSA, Willow Vale and Wizard.
Agents in N. Ireland Don Berg Electronics Ltd., School Masters House, Ranafast, Co Donegal, Eire.
00 353 754 8275
Fax 00 353 757 1031.

Sansui Spares available from Willow Vale and CPC, or Diamond Television for VCR Model SV77.

Sanyo UK Sales Ltd., Sanyo House, Otterspool Way,Watford, Herts WD2 8JF.
01923 222 244
Fax 01923 818 251.
See also Chas Hyde.

Schneider Spares available from Wizard and CPC.

Seleco See SEME

SEME Ltd., Hudson Road, Melton Mowbray, Leics LE131BS.
Sales Hotline 01664 484 000
Fax 01664 563 976.
E-mail: sales@seme.co.uk
Web: www.seme.co.uk
Internet catalogue: www.seme.co.uk/solo
Authorised spares distributor for AEG, Airflow, Alba, Aiwa, Baird, Beko, Bendix, Bissell, Bush, Crown, Creda, Cannon, Daewoo, Electrolux, Europart, Ferguson, GoldStar, Hotpoint, LG, Marantz, Matsui, Mitsubishi, NEC, Normende, Osaki, Panasonic, Pace, Philips, Pioneer, Pye, Parkinson Cowan, Saisho, Sharp, Sony, Technics, Telefunken, Thomson, Toshba, Tricity, Thorn and Zanussi.
Spares Available for Akura, Akai, Amstrad, Bush, B&O, Blaupunkt, Braun, Cambridge, Crown, Dansai, Decca, Denon, Dynatron, Fidelity, Fisher, GEC, Finlandia, Finlux, Fujitsu, Funai, GEC, Goodmans, Graetz, Granada, Grundig, Hinari, Hitachi, ITT, JVC, Jackson, Kenwood, Körting, Loewe, Logik, Luxor, Memorex, Murphy, NEI, Nokia, Orion, Proline, Rediffusion, Roadstar, Saba, Sabre, Salora, Samsung, Sansui, Schneider, SEG, Seleco, Sentra, Sharp, Siemens, Solavox, Tashiko,.Tatung, Thorn, and Toshiba.
For Panasonic & Pioneer Spares telephone **01280 823 523**
Fax 01280 814 916.

Sentra Post-1991 spares available from Alba.
See also SEME, CPC and Wizard.

Sharp Spares available from A.R.D. Electronics, Willow Vale, CPC, HRS and Wizard.

Siemens Spares available from Appliance Care Limited, Unit 4, Ballymount Drive, Ballymount Road Industrial Estate, Dublin 12.
00 353 145 02655
Fax 0145 02520.

Skantic Spares available from GenServe Ltd. and CPC.

Solavox Brand name used by Comet Group plc. See also CPC.

Sony UK Ltd., Spares Division, PO Box 58, Newbury, Berks RG13 9LQ.
01635 861 133
Fax 01635 874 099
Account holders only. See also CPC, Chas Hyde, Willow Vale and Wizard.

Ssangyong Spares available from Key Electronics.

Steepletone Products Ltd., Park End Works, Croughton, Nr Brackley, Northants NN13 5RD.
01869 810 081
Fax 01869 810 784.

Stewart (Iain)
Stockist for NEI and some Nikkai spares, also spares for current Akura models.
01484 842 761

Tandberg R.D.E. Tandberg, Holly Tree House, The Green, Full Sutton, York YO4 1HW.
01759 372 795.

Tashiko Brand name used by Granada. Spares available from Granada Rental Services.
See also CPC.

Tatung (UK) Ltd., Service Division, Stafford Park 10, Telford, Shropshire TF3 3AB.
01952 290 111
Fax 01952 292 096.
Trade only.
Spares also available from CPC, HRS, Wizard and Willow Vale.

Technics See Panasonic

Telefunken Spares available from Thomson Multimedia (see Ferguson) and CPC.

Teleton See Fujitsu General.

Texet Spares available from The Hira Co, Ltd.

Thomson TV and VCR spares available from Willow Vale.

Thorn brand equipment. Spares available from Thorn UK Ltd., Glaisdale Drive, Bilborough, Nottingham NG8 4LA.
0115 900 7111
Fax 0115 929 5899.

Toshiba European Service Centre, Units 6/7 Admiralty Way, Southern Trading Centre, Camberley, Surrey GU15 3DT.
01276-694 000
Fax 01276-600 521.
Trade only. See also A.R.D. Electronics, CPC, HRS, KSA, Chas Hyde, Willow Vale and Wizard.

Trical Brand name used by Hinari Consumer Products Ltd.

Trio See Kenwood Electronics

Triumph Brand name used by Currys. See Mastercare, CPC.

Uniden Eurosat Distribution Ltd., 5 Oxygate Centre, Oxgate Lane, London NW2 7JA.
020 8452 6699
Fax 020 8452 6777.

Venturer Audio spares vailable from Diamond Television.

Willow Vale Electronics Ltd., 11 Arkwright Road, Reading Berks RG2 0LU.
01189 876 444
Fax 01189 879108.
Spares distributor/stockists for: Akai, Alba, Amstrad, Aiwa, Bush, Ferguson, Fidelity, GEC, GoldStar, Goodmans, Grundig, Hitachi, JVC, Mitsubishi, Nikkai, Nokia, Pace, Panasonic, Philips, Pye, Saisho, Samsung, Sansui, Sharp, Sony, Tatung, Thomson, Toshiba. Other spares available.
Service aids and Equipment distributor for Altai, Antex, Black-Star, Censol aerosol products, Eagle, Electrotube, ERL, Fluke, Hameg, JBC soldering, Kamasa, König, Labgear, One for All, Oryx, Philex, Portasol, Servisol, Uniross, Vogels, Weller and Wolsey.
Distribution Centre:
Enterprise Park, Reliance Street, Manchester M40 3AZ
0161 682 1415
Fax 0161 682 9031.

Wiltsgrove Ltd., 28-29 River Street, Digbeth, Birmingham B5 5SA.
0121 772 2733
Fax 0121 766 6100.
Official distributor for Antex, Adcola, CME, König, Nikkai, Philex and Thorn.

Wizard Distributors, Empress Mill, Empress Street, Manchester M16 9EN.
0161 872 5438 or
0161 848 0060
Fax 0161 873 7365
Help Line 0161 873 8370
E-mail: sales@wizard-distributors.co.uk
Website: www.wizard-distributors.co.uk
Spares stocked include Akai, Alba, Amstrad, Decca, Dual,Ferguson, Fidelity, Grundig Satellite, Hitachi, ITT, Loewe, Matsui, Mitsubishi, Nikkai, Pace, Philips, Pye, Saisho, Samsung, Schneider, Sentra, Sharp, Sony, Tatung, Toshiba. Trade only.

Zenor Made in India models see BPL.

General/miscellaneous parts suppliers

Delta Electronics
248 Wickham Road, Shirley, Croydon, Surrey CR0 8BJ.
020 8656 6006
Fax 020 8407 0047
Spares distributor for König and Philex. Genuine spares for Ambersil, Beko, Mercury, Mitsubishi, Philips and TDK .

Economic Devices,
32 Temple Street, Wolverhampton WV2 4AN.
01902 773 122
Fax 01902 429 052.

East London Components,
63 Plashet Grove, East Ham, London E6 1AD.
020 8472 4871
Fax 020 8503 5926.

Electromail, PO Box 33, Corby, Northants NN17 9EL.
01536 204555
Fax 01536 405 555.

Electrovalue Ltd,
Unit 5, Beta Way, Thorpe Ind. Park, Egham, Surrey TW20 8RE.
01784 433 604
Fax 01784 433 605.

Express Tubes,
The Mill, Mill Lane, Rugeley, Staffs WS15 2JW.
01889 577 600
Fax 01889 575 600.

Farnell Electronic Components, Canal Road, Leeds LS12 2TU.
01132 636 311
Fax 01132 633 411.

Grandata Ltd
distributor of electronic components

Grandata Ltd,
KP House, Unit 15, Pop In Commercial Centre, Southway, Wembley, Middx HA9 0HB.
020 8900 2329
Fax 020 8903 6126.

J.W. Hardy,
231 Station Road, Stechford, Birmingham B33 8BB.
0121 784 8478
Fax 0121 789 7931.

Harrison Electronics,
Century Way, March, Cambs PE15 8QW.
01354 651 289
Fax 01354 651 289.

Irwin Electronics,
Unit 200, JC Albyn Complex, Burton Road, Sheffield S3 8BX.
0114 273 9622
Fax 0114 275 9909.

JJ Components,
Rear of 243/247 Edgeware Road, Collindale NW9 6LU
020 8205 9055
Fax 020 8205 2053.

LRC Videos
3-5 Whitfield Street, London W1P 5RA.
020 7323 2107
Fax 020 7323 2191.

Manor Supplies,
9 Whitchurch Parade, Whitchurch Lane, Edgware, Middx HA8 6LR.
020 8952 8808
Fax 020 8952 8809

Maplin Electronics, Freepost smu 94, PO Box 777, Rayleigh, Essex SS6 8LU.
01702 554 000
Fax 01702 554 001.
E-mail:
<recipient>@maplin.co.uk
Website: www.maplin.co.uk

Marapet Electronic Components,
1 Hornbeam Mews, Gloucester GL2 0UE.
01452 532 253

M.C.E.S.

MCES, 15 Lostock Road, Davyhulme, Manchester M41 0ES.
0161 746 8037
Fax 0161 746 8136.
Tuner, modulator, upper drum and LNB repairs.

Nikko Electronics, Dalbani House, 257 Burlington Road, New Malden, Surrey KT3 4NE.
020 8336 0566
Fax 020 8336 0579.

PHILEX ELECTRONIC

Philex PLC, 110-124 The Broadway, West Hendon, London NW9 7PP.
020 8202 1919
Fax 020 8202 0015.

PV Tubes, 108 Abbey Street, Accrington, Lancs BB5 1EE.
01254 390 936
Fax 01254 872 166.

RS Components, PO Box 99, Corby, Northants NN17 9RS.
01536 201 201
Fax 01536 201 501.

Sendz Components, 63 Bishopsteignton, Shoeburyness, Essex SS3 8AF.
01702 338 894
Fax 01702 338 805.

KÖNIG ELECTRONIC

TW Electronics (Newbury) Ltd., Beacon House, Harts Lane, Burghclere, Newbury, Berks RG20 9JZ.
01635 278 678
Fax 01635 278 266.

Vista Electronics,
Unit 2, Wingate Grange Industrial Estate, Wingate, Co. Durham TS28 5AH.
Tubes:**01429 837 100**
Components: **01429 838 057**
Fax 01429 837 101.

Television reader offer:

x1, x10 switchable oscilloscope probes, only £21.74 a pair, fully inclusive*

*Additional pairs as part of the same order, only £19.24 each pair.

Please supply the following:

Probes

Total_____

Name _____

Address _____

_____

_____

Postcode _____ Telephone _____

Method of payment *(please circle)*

Cheques should be made payable to Reed Business Information

Access/Mastercard/Visa/Cheque/PO

Credit card no _____

Card expiry date Signed

Please allow up to 28 days for delivery

Seen on sale for £20 *each*, these high-quality oscilloscope probe sets comprise:

- two x1, x10 switchable probe bodies
- two insulating tips
- two IC tips and two sprung hooks
- trimming tools

There's also two BNC adaptors for using the cables as 1.5m-long BNC-to-BNC links. Each probe has its own storage wallet.

To order your pair of probes, send the coupon together with £21.74 UK/Europe to Probe Offer, Jackie Lowe, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Readers outside Europe, please add £2.50 to your order.

Specifications

Switch position 1

Bandwidth	DC to 10MHz
Input resistance	1MΩ – i.e. oscilloscope i/p
Input capacitance	40pF+oscilloscope capacitance
Working voltage	600V DC or pk-pk AC

Switch position 2

Bandwidth	DC to 150MHz
Rise time	2.4ns
Input resistance	10MΩ ±1% if oscilloscope i/p is 1MΩ
Input capacitance	12pF if oscilloscope i/p is 20pF
Compensation range	10-60pF
Working voltage	600V DC or pk-pk AC

Switch position 'Ref'

Probe tip grounded via 9MΩ, scope i/p grounded

for Pace retailers and service partners. If you are a member of the trade and you deal with Pace products you can apply for access by following the instructions. The free access area contains some useful Frequently Asked Questions and links to other useful sites such as the Lyngemark Satellite Chart at http://www.lyngsat.com. (thanks to Iain Dobie for this lead)

Servicing Advice

http://www.repairfaq.org/REPAIR/F_Repair.html

Here are some frequently asked questions about servicing consumer electronic equipment, with a US bias. But there's some good material on monitors and CD players and CD-ROM drives. (thanks to David Edwards for this information)

Taxan

http://www.taxan.com

http://www.valuevision.co.uk

Look here for information on Taxan monitors and their new Valuevision range, with information on servicing, spares and latest software drivers.

Transmitter Alignment Programme

http://www.tvtap.mcmail.com

This site contains the timetable of work on the TV Transmitter Adjustment Programme or TAP. The programme's aim was reported earlier in Teletopics, but briefly it is to maintain existing analogue services as work progresses on digital television UK "to fulfil official regulatory licence requirements". When transmitters are being worked on there are local messages.

UK Electrical Direct

http://www.uked.com

For a comprehensive on-line directory, buyers guide and resource locator for the UK

Electrical Industry look at this site. Many of the companies listed have links to their own web sites, making this a one-stop shop for a huge amount of information.

Reed Connect

http://www.reedconnect.net/

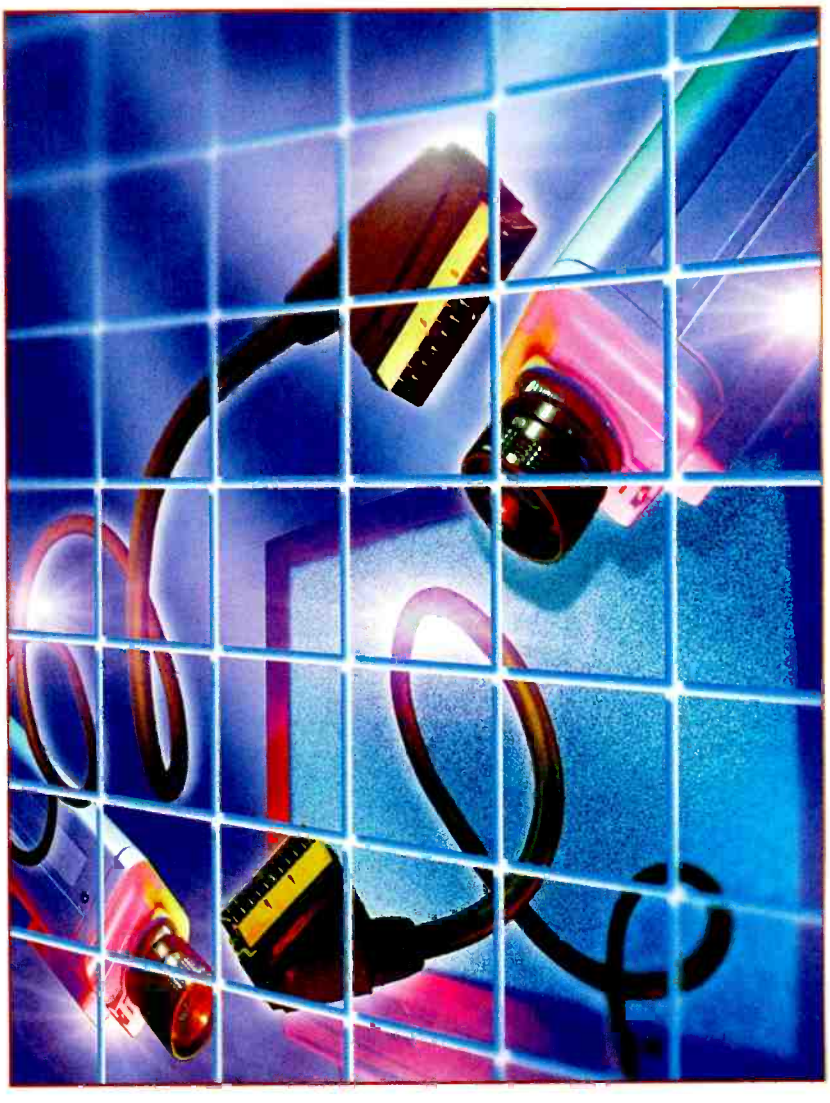
Another free internet access site, this time from Reed Business Information. However the site possesses a useful UK People and Business Finder, with an e-mail search. There's also business news and local information, and some good links to directory sites.

And finally..

Did you hear that the European Commission wants the UK to drop the "co.uk" suffix in favour of a "co.eu" – another needless change and attempt to dilute national identity. Maybe they should also insist that US companies should become "co.us" rather than "com".

New web sites and newsgroups are appearing all the time, and useful ones have a tendency to move! Please report any new sightings to peter.marlow@softcopy.co.uk

Michael Dranfield describes a unit that provides automatic timer-controlled switching between the outputs from two video cameras with scart output connectors



An auto scart switcher unit

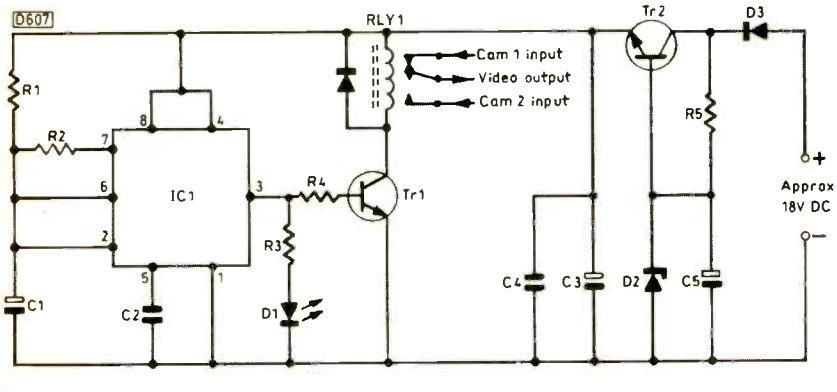


Fig. 1: Circuit diagram of the scart switcher unit. The video inputs and the output (flying lead) are all connected to pin 20 of the relevant scart connector.

A local dealer and good friend asked me to solve a problem for him. He had sold a couple of home security cameras, of the type with a scart output that plugs straight into a TV set, to another shopkeeper. His customer now wanted to record the outputs from the two cameras alternately. Could I come up with something that would do the job?

Solution

After giving the matter some thought I came to the conclusion that the easiest and cheapest solution would be to build a timer and a switching circuit into a two-way scart splitter box that's available from CPC.

Space inside the splitter box is a bit tight, but there is enough just behind the cable entry point for a small PCB. By using the smallest available components, without going to surface-mounted types, this turned out to be just possible.

Circuit description

Fig. 1 shows circuit diagram. The unit is based on an IC timer with switching provided by a changeover relay. IC1, the 555 timer chip, operates as an astable multivibrator with a 50:50 duty cycle. It drives a single-pole changeover DIL reed relay via transistor Tr1. I decided to use a relay so that when the power to the unit is switched off there is still a video loop-through from one of the camera scart sockets.

Five-second recordings were required from the two cameras alternately. The value of C1 sets this timing. If the value of C1 is doubled, the recording time will be doubled.

LED D1 across the output from IC1 provides a useful indication that the unit is in operation.

Tr1 is included so that the relay (RLY1) can be driven from the full 8·4V supply. The protection diode connected across the relay's coil is an integral part of the specified relay.

Because of the lack of space within the scart splitter box, the unit is powered by an external mains adaptor. These generally provide a poor-quality, unregulated output, so an on-board regulator (Tr2, D2) is built into the unit. The total current consumption is less than 40mA. With such a low consumption the output from an unregulated adaptor set at 12V is more likely to be about 18V.

Tr2 is a conventional series regulator, providing an output that's set by zener diode D2. The inclusion of C5 turns the circuit into an active ripple filter: the value of C5 is multiplied by the gain of the transistor. C3, which decouples the supply, is included because the 555 timer chip is notorious for producing large glitches on the supply when switching.

Although it's not shown, I included a miniature on/off switch. Power is supplied via a 3·5mm jack socket. D3 provides reverse protection: it's included to make the unit customer proof!

Construction

I built the unit on Veroboard. After fitting the unit in the scart splitter box all you have to do is to cut the print between the scart sockets and connect the three wires from the relay.

Sound

There's no provision for sound as this was not required. An additional relay could be connected in parallel with RLY1 to switch between camera sound outputs.

Parts list

C1	120µF, 10V	
C2	0·01µF	146-224
C3	22µF	490-842
C4	0·01µF	146-224
C5	10µF	105-867
R1	51kΩ	514-433
R2	22kΩ	514-342
R3	680Ω	513-982
R4	4·7kΩ	514-184
R5	680Ω	513-982
D1	Green LED	621-006
D2	9·1V zener	369-809
D3	1N4001	365-117
Tr1, 2	ZTX337	358-095
IC1	NE555	409-364
RLY1	Reed relay	103-583

Miniature type with single-pole changeover contacts

Twin outlet scart splitter box. From CPC, part no. AVSA4

All part numbers Farnell unless otherwise stated. Farnell Electronic Components can be reached on 01132 636 311

LATE NEWS ROUNDUP

ONmail

ONdigital's e-mail service ONmail is due to become available at about the time this issue goes for press. A modem connection is required, and for about £30 users will be able to buy a small keyboard about the size of a remote control unit with an infra-red link. While away from home users will be able to pick up their e-mail via a PC. Internet access via the ONdigital box is to follow "in due course".

Round Robins on disc

Repairers who don't have internet access and thus can't receive the weekly TV, VCR, satellite and monitor Round Robin fault reports from Martin Pickering can obtain the entire archives to date on CD-ROM for just £5 plus VAT from SatCure, PO Box 12, Sandbach, Cheshire CW11 1XA (phone 01270 753 311). There have been over 80 Round Robins to date which include a great deal of helpful servicing information. The CD-ROM also includes the entire SatCure web site information, around 250 pages, which can thus be consulted without an internet connection. The web site is at http://www.satcure.co.uk

GenServe

Due to expansion GenServe is on the move. After 31st March the company's address will be 10, Caen View, Rushey Platt, Swidon, Wiltshire SN5 9RW. Telephone (temporary) 04215 13 561 or 0836 769 784.

All about film capacitors

Ray Porter, M.Sc., C.Eng., MIEE, describes the differences between the various types of plastic-film capacitors available, their characteristics and failure rates

Plastic-film capacitors are widely used in electronics. They are available with a variety of types of dielectric film. The following article explains how their construction and ratings vary across the range of types available. It's based on data taken from publications issued by Philips, Wima and Evox-Rifa.

Construction

Film capacitor construction consists of either layer upon layer of metallised film or a wound cell of dielectric film and metal plates. Metallisation is 30-50nm thick on the surface of the dielectric. Plates are usually aluminium foil 5-10microns thick. Connections consist of metallisation across the ends. This keeps the inductance of the structure as low as possible by minimising total lead length. Fig. 1 shows the basic construction.

The capacitor structure may be either visible, resin dipped or enclosed in a plastic housing. The type of encapsulation is selected for minimum size while providing adequate protection from physical and environmental damage.

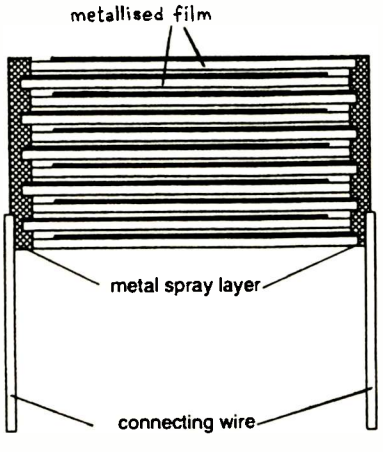


Fig. 1: General form of construction, layered version. Some types consist of layers of foil and film wound cylindrically.

Table 1 shows the characteristics of different types of dielectric used. Polyester is probably the most common film dielectric. It has the full chemical name polyethylene terephthalate – Mylar is one trade name. Polyphenylene sulphide is used in surface-mounted film capacitors as it stands up to the high temperature during the process of surface-mount soldering.

Pulse rating

The pulse-handling capability of a capacitor is judged by its volts per microsecond rating. Since $I = C\,(dv/dt)$, this is mathematically equivalent to its current rating.

The current within the capacitor causes heating, because of the capacitor's equivalent series resistance (ESR). Capacitors with high pulse ratings sometimes have foil rather than metallised electrodes: foil conducts the heat away from the centre of the component more rapidly. Table 2 shows typical pulse voltage ratings.

Body size – is bigger better?

Heat is dispersed more readily from a large surface area, i.e. a larger-bodied capacitor. This should enable a higher pulse rating to be achieved. But as Table 2 makes clear, the pulse rating depends on size *and* construction. So the permissible dissipation to body size relationship shown in Fig. 2 is not the determining factor in assessing pulse-handling capability. It follows from this that where an application involves high stress, e.g. in a line output stage, it is advisable to fit manufacturers' official replacement capacitors – they should have been selected after a thorough consideration of the circuit application. Practical service engineers may well query this on occasion.

Self-resonance

All capacitors are resonant in the series mode at a fre-

Table 1: Characteristics of film dielectrics.

Dielectric	*Minimum film thickness (microns)*	*Dielectric constant at 23°C*	*Max. temp. (°C)*	*Dissipation factor at 100kHz (%)*	*Insulation time constant**	*Capacitance change at 60°C (%)*
Polyester	0·9	3·3	125	1·7	25k	+1
Polycarbonate	1·5	2·8	125	1	25k	–0·2
Polypropylene	4	2·2	100	0·02	100k	–1
Polystyrene	4	2·5	85	0·02	100k	–0·2
Polyphenylene sulphide	2	3	150	0·12	10k	–0·2
Paper	7	5·5	100	2	15k	+1·2

*C x R (insulation) secs.

quency that's determined by their capacitance and self-inductance. This is exactly the same as with a conventional series tuned circuit. The impedance across a capacitor's terminals is very low at resonance – it's equal to the component's ESR at that frequency.

At frequencies above self-resonance the impedance rises, the capacitor behaving like an inductor. This self-inductance depends on body shape and size. Fig. 3 shows how the impedance varies with frequency near resonance for capacitor values between 22µF and 1nF.

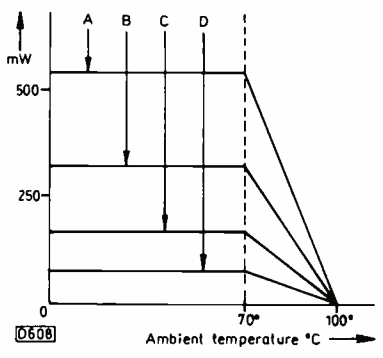
Failure rates

The following information is derived from manufacturers' laboratory life testing. It shows the importance of good design rule application when selecting a capacitor for use in a particular position.

Voltage derating: When a film capacitor is used at half its rated working voltage failures occur up to fifty times less often. Operation at 150 per cent of the rated working voltage leads to a ten times greater failure rate.

Temperature derating: At 80°C failures occur a hundred times more often than at 20°C.

Dielectric type: Polyester is the most reliable film dielectric. Polypropylene and polystyrene fail ten times more often. Paper-film capacitors fail a hundred times more frequently than polyester.



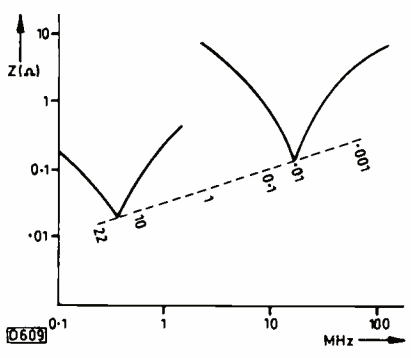


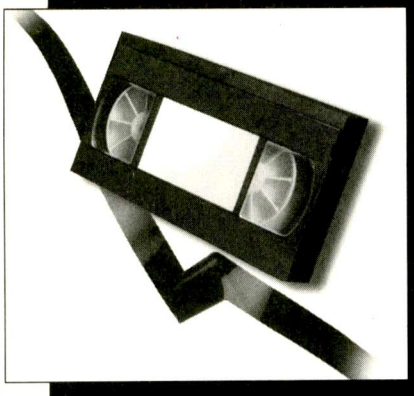
Fig. 2 (left): Maximum permissible power dissipation for various capacitor body sizes. A 15·5mm thick, 27·5mm pitch; B 11mm thick, 22·5mm pitch; C 8·5mm thick, 15mm pitch; D 4·5mm thick, 10mm pitch.

Fig. 3 (right): Typical capacitor resonances with 7·5mm and 37·5mm lead pitch.

Typical laboratory failure rates for a polyester capacitor operated at its rated voltage are 0·1 per cent of capacitors after six years' use. A simple example will illustrate how this works out in practice. Assume that a dealer sold 1,000 TV sets in one year and that each incorporated ten film capacitors. During the first six years of continuous use ten sets would have failed because of film-capacitor faults.

Table 2: Pulse voltage ratings.

Dielectric	*Construction*	*Rating*
Polyester	Metallised, wound, 100V DC, 27·5mm pitch	4V/µsec
	Metallised, wound, 63V DC, 5mm pitch	110V/µsec
	Foil, wound, 100V DC, 28mm pitch	10kV/µsec
	275V AC wound with metallised paper, 15mm pitch	1·5kV/µsec
Polypropylene	Metallised, layer	10V/µsec
	Metallised, wound, 160V DC, 27·5mm pitch	15V/µsec
	Foil, wound	10kV/µsec
Polycarbonate	10mm pitch leads, 100V DC	60V/µsec
	27·mm pitch lewads, 100V DC	9V/µsec
Polyphenylene sulphide	Surface mount 25V	30V/µsec
	Surface mount 160V	70V/µsec



VCR Clinic

Reports from Philip Blundell, AMIIEelec Dave Hewitt Gerry Mumford M. Della Verita Paul Smith and Michael Maurice

SharpVCT510HM

This machine wouldn't play or record tapes. A cassette would be accepted, but when play was selected the loading process would stop part way then go back to the stop mode. Scope checks showed that the capstan and drum FG pulses were present but the drum PG pulses were missing. The PG coil was found to be open-circuit.

Fortunately continuity was restored by resoldering the lead-outs: the pulses were then back. If the coil cannot be repaired the motor PCB is available as a spare part at a reasonable price. **P.B.**

Panasonic NVHD100B

Because of the cost of a new lower drum assembly, a noisy drum bearing often means that the machine has to be written off. Before you assume the worst however try this. Remove the earthing brush then the three Torx screws that hold the earthing disc in place. Remove the disc then put a drop of thin oil down the side of the shaft. Leave for a couple of hours then reassemble. It worked for me! **P.B.**

Mitsubishi HSB30

A neighbouring dealer had fitted new video heads to this machine because of loss of playback. When he tested it however he found that the recordings were marred by black spaghetti streaks on peak-white areas of the picture. Fortunately he had lent the customer a replacement machine and had noticed, when he installed it, that the customer's tapes recorded prior to the head failure also suffered from black streaking. A slight tweak on the white-clip control VR2A2 put an end to the streaking. **P.B.**

Philips VR6542

This machine's threading mechanism had jammed. The cause of the trouble was evident once the plate on the underside had been removed: a piece of plastic had broken off the master cam. A new cam, mode switch and belts restored normal operation. **P.B.**

ITT VR3916

The take-up reel tacho pulses at the collector of Q1 on the deck terminal board were intermittent. As a new 2SD636 transistor in position Q1 had no effect the reel optosensor became suspect. Three suppliers I tried said his item is no longer available. Fortunately I was able to salvage one from a scrap machine. Equivalent models in the **JVC** and **Ferguson** ranges are the HRD150 and 3V45 respectively. **P.B.**

Panasonic NVF65

There was bad patterning on the E-E video, the result being poor recordings. Checks in the power supply with a Genie ESR meter soon revealed that C1118 (100µF, 50V) on the secondary side was faulty. A replacement cured the patterning. I also replaced C1109 (1µF, 400V) on the primary side as it is often the cause of a dead power supply. **D.H.**

Sony SLVE700

There were two faults with this Nicam VCR. First tape chewing and terrible tracking. The cause of this was the take-up tape guide buckling over as it entered the V block at the end of its travel. When I split the deck from the PCB – a complex operation to say the least – I discovered that the tape guide slider is held tight to the slide path under the deck by only a bronze-coloured spring arrangement (not unlike some Matsui and Aiwa budget-priced models). A new spring assembly, which is attached to the body of the tape guide by a tiny screw, cured the problem. The part numbers for these rather flimsy bronze spring units are 3960-68801 (take-up side) and 3960-68701 (supply side).

The second fault was to do with sound: the customer said that the E-E sound was distorted and that the input from his camcorder at position L2 was similarly distorted. Having spent a considerable time tracing through the sound path I discovered that audio-wise nothing much was getting past the BA7632AF-E2 scart switching chip IC102, which is a surface-mounted device on the smaller scart board at the back left-hand side, above the main PCB. Its part no. is 8759 44569 and it is not exactly cheap. For test purposes the E-E sound can be linked across at the ribbon cable connections to the scart board. The replacement chip I fitted cured the problem. For good measure I also replaced the 12V regulator chip IC1404 for the supply to the scart switching chip. **D.H.**

JVC HRJ400

A tape was stuck in the deck, there were odd symbols in the display and there was no action. The cause was CP1 in the power supply – it was open-circuit. As there seemed to be no reason for the failure of this N20 800mA circuit protector and everything seemed to be fine once it had been replaced, I decided to ask JVC's excellent technical department whether there might be any known cause of its random failure. I was told that static discharge between the case and the mecha-

nism could sometimes account for it blowing, and was advised to make up a leaf-type earthing spring to fit between the cassette housing and the top cover, as in older machines.

The customer subsequently told me that he had been inserting a tape when the machine failed. On reflection, if you brush against the TV set's screen while touching the VCR quite a large charge can be passed to the VCR's case – especially if you are kneeling on a nylon carpet at the time! **D.H.**

GoldStar W201

This machine powered up but there was only a clock display, which reverted to <> after a few seconds – as if the deck timing was out. In fact the timing was OK. Checks revealed that the 12V supply was missing at the loading motor drive IC. It's switched by a fairly complicated transistor arrangement, where I found that Q132 (KSA709C) didn't switch on when asked to do so. A replacement transistor cured the fault, though the original tested OK with a meter – it must have had very slight base-emitter leakage. **G.M.**

Matsui VX6600

This machine's recordings played back as a mass of coloured lines, though the stereo sound was perfect. I couldn't find any faulty components but, fortunately, slight adjustment of the FM carrier preset (VR4001) on the YC subpanel completely cured the fault. **G.M.**

Mitsubishi HS740V

The power supply would start up then shut down very quickly. Cold checks showed that the AP01C diode D903 was leaky – about 390Ω. It's part of the snubber/efficiency network connected across the primary winding of the chopper transformer. **G.M.**

Philips VR422

The customer said that a cassette was jammed in the machine, the display flashed and he could hear a faint ticking noise from inside. When I put the machine on the bench and plugged it in there was no life at all. Checks in the power supply revealed that C2114 (47µF, 25V) was faulty. When a replacement had been fitted the machine came on and all functions operated correctly. **P.S.**

Aiwa HVFX2800K

During playback of prerecorded tapes there was a noise bar at the bottom of the picture. When the machine's own recordings were played back the picture continually jumped. The alignment of the guides, back tension and take-up torque were all checked and found to be OK. What cured the fault was slight adjustment of the position of the drum motor on top of the video heads. To realign, loosen the two Allen screws on the upper brass bush and turn the whole unit (in this case anti-clockwise) while monitoring the picture. Once operation is correct, relock the screws. **P.S.**

Daewoo V200

The customer couldn't tune his TV in to this VCR and neither could we! The RF converter wasn't functioning because the 12V line was at 1·3V. It didn't take long to trace the cause of the trouble to the 13V zener diode D654, which was leaky. **P.S.**

Goodmans RC7051 (LG D17 chassis)

There were two faults with this machine. The RF aerial input socket had snapped, and there was intermittent loss of colour or the tape would go faster on playback (looked like a capstan motor fault). Instead of buying a new RF-through booster I modified the one in the machine, adding an RF socket between the scart connector and the actual booster.

The second fault was a bit more tricky. The machine had apparently been dropped, so I hit it with the back of my giant screwdriver. As the intermittent fault was still present I lifted the main PCB and hit it again. Something dropped off. It was crystal X301, which is next to the LA7390 PAL/Secam chip IC301. Resoldering it cleared the fault. **M.DV.**

LG N309i

The complaint with this new machine was that it didn't always make a timed Video Plus recording. It was returned after a week with a 'no fault found' letter. A few days later it came back with a note to say that the clock didn't always show the correct time. We put it on the test rack and, sure enough, after a short while the clock was two hours fast. Later that same day the clock was correct again.

A call to the LG technical department revealed that the type of PDC (Programme Delivery Control) signal transmitted by some broadcasters can upset the microcontroller chip. The advice was to disable the PDC by adding a signal diode in position D622 on the front PCB. When this had been done the clock kept perfect time. **P.S.**

Sanyo VHR245

This machine would take in a cassette partially then eject it. Inspection revealed that the tape-flap lever, item 040C, was missing from the carriage, which fell out in two pieces when the mechanism was inverted. A new lever and spring (item 040B) restored normal loading. **P.S.**

Panasonic NVJ45

This machine wouldn't do timer recordings and many attempts were usually required to get it to go into play or record. When I checked its operation I found that the loading guides would move about half way then stop. As there was no obstruction when I tried manual loading I decided to replace the mode switch. This cleared the trouble and a new pinch roller completed the repair. **M.M.**

Toshiba V703B

There were no functions and the display was dim. When this happens, tell the customer to disconnect the machine from the mains supply and not reconnect it before bringing it to you for repair. The cause of the fault is the two capacitors, 15µF/50V and 47µF/16V, in the power supply. Note that they are os-con (organic semiconductor) electrolytics: correct replacements obtained from Toshiba must be used. **M.M.**

Samsung VIK310

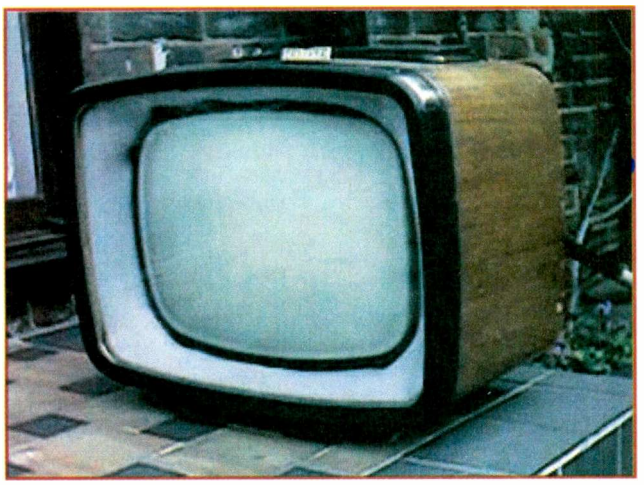
After fitting an upgrade kit and checking through the power supply I retested this machine. It started up but died after a few minutes. Checks showed that the voltages on the secondary side of the power supply were very low, though no obvious reason could be found for this. I eventually cured the fault by replacing the STR11006 chopper chip. **M.M.**

Bush BTV10

This combi VCR/TV unit produced neither sound nor a picture and wouldn't play back or record. There was a raster or sorts however, and the VCR section operated mechanically. The cause of all these symptoms was R24, a 1Ω fusible resistor in the video section's power supply. It was open-circuit, a replacement restoring normal results. **M.M.**

TV in the Sixties

The Sixties was a time of great change for TV. At the start of the decade there were just monochrome sets with valves, designed for 405-line transmissions at VHF. By the end there was 625-line colour at UHF, with transistorised chassis that used the odd IC. Austin Fairchild describes this period of rapid development



The Murphy Model V410 was considered to be an advanced design in 1960.

In a previous article I took a look at the TV scene in the Fifties, the post-war recovery period. The following decade was one of growth. The "space race" had begun in 1957, when the USSR launched Sputnik 1 and terrified the Americans. Thereafter the USA began to spend countless billions of dollars on space missions. This got underway in earnest in the Sixties, with the announcement that America would be going all out to get a man on the moon by the end of the decade. There followed the Mercury series of earth-orbit missions, then the Apollo launches. Success was achieved in 1969.

Most of these missions were televised, and in those days anything to do with space was hot stuff. It was inevitable that everyone wanted to have a television set. At the time an average receiver would be a monochrome one with a 14in. tube – there was no colour until 1967. It would cost about 75 guineas. TV sets were often priced in guineas (21 shillings) as it made the price look a bit easier on the pocket. Anyway 75 guineas, equivalent to about £78.75 in today's currency, was a lot of money then. My wage at the time was about £14.10s. 0d. (£14.50) a week – and that was with overtime! But I lived quite well, and could afford to buy a TV set on HP. For those who couldn't, rental was a good option.

The Sixties was a period of tremendous growth for rental TV. Much else was rented at that time, even radios, also washing machines, spin driers, refrigerators and, later on, audio tape recorders (no VCRs then). For most people these things were too expensive for cash purchase. There were no credit cards then. And when it came to a TV set, the question of reliability had to be taken into account: renting took care of repair costs.

TV reliability

The TV sets of the period were notoriously unreliable. They still used valves, which meant that a large amount of heat was generated. The dropper resistor contributed to this: it was used mainly as a series device to reduce the mains voltage to the level required to power the valve heaters. These were generally connected in series, so the heater voltages of all the valves were added together and the total was subtracted from the mains voltage. The difference was the voltage across the heater section of the dropper resistor, whose value was determined by simple application of Ohm's Law.

As valves are voltage-operated devices, there was no need to stabilise the current. So the power supply circuits in TV sets were very simple. They often consisted of nothing more than a dropper resistor, a half or bi-phase rectifier and a couple of smoothing capacitors. If a TV set had a transformer and a full-wave rectifier in addition to the other components, it was sophisticated! As the valve heaters were connected in series they were like Christmas-tree lights: should one fail they all went out and the TV set ceased to function.

Another common problem with valves is the cathode-to-heater short. When this fault occurs in a valve, some of the heaters in the chain would go out and some would stay on. Those that stayed on would glow like searchlights, often becoming damaged as a result.

Dropper failure could cause loss of HT (dead set with the heaters glowing), or no heater supply with HT present. When the HT rectifier valve went low emission, there was low EHT, a small picture and poor performance all round. CRTs would go soft or low emission, the result being a faint picture, or cathode-to-heater short-circuit, the result this time being uncontrollable brightness.

On average a TV set would have twelve to fourteen valves, any one of which could go low-emission or fail in some other way. All valves have a finite life, so each one would probably have to be replaced at one time or another. The amount of heat generated in an average TV set would dry out the capacitors, which then failed. So you can see why people rented!

The CRT could cause various problems. Because of its cost, it was the general practice to place its heater at the earthy end of the chain. In this position it was less likely to be overloaded by a heater chain fault. But during the winter months, when the mains voltage dropped a bit, it would be starved of power. This would eventually lead to 'cathode poisoning' with loss of emission. The 'cure' for this was to fit a booster transformer designed to overrun the heater by 10, 20 or 30 per cent. It would work fine for a while, until the CRT completely expired. At about this time CRT reactivators came into being – and a weird and wonderful collection of devices they turned out to be. Regunned tubes also started to appear. You couldn't do this with the 'hard-glass' triode tubes made by Emitron. These were fitted in a number of older sets. Yes, they were still around, at least during the early Sixties.

Developments

A great deal of development occurred during the Sixties. Many TV sets and radios made in the early Sixties were still hard-wired: the introduction of the printed-circuit board changed the construction of electronic equipment forever. The first one I ever saw was in a Pam transistor radio. PCBs were ideal for use in transistor radios, because of the small size of the components used and the fact that such radios ran almost cold. They were not so good for use with valve circuitry, as the heat from the valves caused all sorts of problems. Print cracks could develop if a board became warped. If it became carbonised there could be serious leakage and tracking problems. In addition it was more difficult to remove components from a PCB. Many technicians at that time didn't like PCBs.

As the Sixties progressed, transistors took over more and more in TV sets. They first appeared in a rather random fashion, for example in the sync separator stages in some Pye models. Then the IF strip became transistorised. Early transistors were based on the use of germanium, which was far from ideal. The change to silicon produced devices that were more robust and had a better signal-to-noise ratio.

Car radios became fully transistorised, and 'solid-state' circuitry ceased to be based on earlier valve arrangements. Many hi-fi amplifiers had been transistorised from the late Fifties, and all tape recorders were now solid-state. Both reel-to-reel and compact-cassette recorders were available at this time. Initially, audio cassette recorders had a maximum upper frequency response of only about 9kHz. To increase it meant either a smaller head gap or a faster speed. Philips, which developed the compact audio cassette and holds the patents for the design (which we still use today!) wouldn't allow an increase in speed. Good reel-to-reel recorders had a frequency response that extended to 20kHz when the tape speed was 15in./sec. This is true hi-fi. In time the frequency response of compact-cassette recorders did improve, because of the use of better head materials with a smaller gap. This led to the demise of the reel-to-reel audio recorder as a domestic product

We began to benefit from spin-offs of the space race between the USA and the USSR. The need to squeeze as much technology as possible into the early computers in the Mercury space capsules used by the USA lead to the first integrated circuits. This technology soon found its way into consumer equipment. Often these devices were hybrid encapsulations rather than true chips, but they did improve reliability and saved space. The few chips around in those days were analogue devices. There was no significant use of digital techniques in TV sets then.

Major developments in the TV field came with the announcement of BBC2. It would use the 625-line standard, with transmissions at UHF instead of VHF. Once the details had been finalised and a starting date had been set, manufacturers got to work producing dual-standard sets. Initially a number of receivers that could be converted for dual-standard operation appeared, but so much work was required to carry out the conversion that the expense hardly seemed worthwhile. If sets had the 405/625-line switching built in, it was only necessary to add a UHF tuner and install a suitable aerial. Then, if you were lucky, you might get good BBC2 pictures. To start with most UHF tuners used valves such as the PC86 and PC88. They were all manually tuned. Some had slow-motion drives and others had push-buttons. They didn't have a lot of gain, so it was important to have an adequate aerial and use low-loss cable.

The coming of colour

The start of BBC2 with 625-lines and UHF transmission in 1964 paved the way for another major development that came strong on its heels. This was the introduction of colour TV in 1967. There had been various colour test transmissions in the late Fifties and early Sixties, generally using the US NTSC colour system adapted to 405 lines. The biggest problem with NTSC is chroma signal distortion along the transmission path, leading to colour changes in the received picture. US receivers incorporate a 'hue' control to compensate for this.

Various techniques were developed to overcome the problem, the main ones being the French SECAM system and the German PAL system. There was a great deal of debate in the mid Sixties as to which should be used in the UK. Eventually PAL (Phase Alternation Line) was adopted – the broadcasters came to the conclusion that it provided slightly more robust reception under difficult conditions.

The smallest, lightest transistor portable set, by Sony in the early sixties.

The announcement that colour was to be introduced made it imperative for BBC1 and ITV to be transmitted in 625-line form at UHF. This followed rapidly. While we waited for colour TV, those of us who regarded ourselves as *real* technicians devoured every bit of information on the subject we could find. The most important source was *Television* magazine. No, I've not been bribed to include this plug! It's a fact that almost everything I learnt outside working hours came from the magazine. I can remember some negative thinkers at the time who hastily gave up the trade because colour TV appeared to be far too complicated!

But manufacturers continued to produce 405/625-line sets, and even the first colour receivers were of the dual-standard variety. It would be many years before the VHF channels were finally switched off.

Early colour receivers

When I returned to the workshop after lunch one day in 1967, I can't remember exactly when, there were two very large cardboard and wooden crates sitting outside the shop. One had "Ferguson Colourstar" on the box, the other had "HMV Colourmaster". Colour had arrived! I quickly unloaded the van and shot into the shop to talk to the boss.

"When are we going to open the colour TVs?" I asked.

"Straightaway Austin" he replied, "I was just waiting for your return. I couldn't handle those big crates by myself, and I want to get one of the receivers on show as quickly as possible."

We cleared a space near the front of the

window, and proceeded to manhandle the gigantic packages into the shop. The Ferguson set was taken to the back of the shop – it was an 'advanced order' from a customer. We then started to unpack the HMV set. Both were manufactured by Thorn and had the same chassis. Only the cabinets differed. The HMV name was synonymous with quality, and this set was the more expensive of the two. Its price was 349 guineas (£369.45), a fortune in those days. But we were trading in an upmarket area, and selling colour TVs at that price wasn't a problem.

Once the set had been unpacked I fitted a mains plug and read the instructions. I also went to the workshop to fetch two new pieces of equipment, a crosshatch generator and a degaussing coil. Why didn't I set up the receiver in the workshop? It was simply a matter of marketing. The gigantic colour set stood out a mile, and soon attracted a crowd of people – just to watch me set it up in the window! I felt like a king!

In those days colour TV chassis bristled with knobs for convergence adjustment, the purity had to be set up and the tube often needed to be demagnetised (degaussed).

Convergence (getting the green, red and blue rasters to coincide) was a lengthy procedure and had to be done with both 405 and 625 lines – although there was no 405-line colour, the picture would have colour tints if the convergence was out. There were one or two test films during the day, for demonstration purposes, and this helped to sell a few more sets – so long as they were set up correctly. I won't describe the procedure as it's long-dead technology. Those too young to remember it can consider themselves lucky that it's all done in the tube today.

One of the most important features of those sets was that they were truly 'solid-state'. In fact the Thorn 2000 chassis was a world's first: no valves at all, and fully modular. We had another technician at the time. I remember him taking a quick look and giving in his notice! Colour was complicated enough, but transistors as well! I wonder how he's doing now? Probably making a fortune mending computers!

Another thing changed with the introduction of fully-transistorised sets. The power supply became much more complicated, because of the need for regulation. The 2000 chassis bristled with zener diodes and series-regulator transistors. Just before the end of the decade we would see the first TV chopper power supply, in the Thorn 3000 chassis.

End of the decade

In 1969 I went to work for a leading rental company. Because of my experience with colour, I was given a top post and paid extra: the basic rate was £21.50 a week, with an extra £2 for colour. I was surprised to find that there were still colour TV sets with valves, the Baird 700/710 series for a start. These Baird-brand sets had valve timebase circuits and were dual-standard models, though the 405-line switching had been disabled (it wasn't necessary in our area). In fact most setmakers at the time continued to produce hybrid (valve/transistor) chassis, probably because line output transistors were then rather unreliable. But the valve alternative also had its problems. There was a risk of fire, and the transformers often failed.

Colour TV, because of the setting-up difficulties and the rather unreliable nature of the line output stage, became a licence to print money for the rental companies. Servicing the sets was fun too! We did well with our rentals that year. It was the year when Neil Armstrong and Buzz Aldrin walked on the moon.

Letters

We welcome letters from our readers and try to publish as many as we can. You can send them typed, handwritten, or on disc. Address them to the Letters Editor, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Theft of Service

In the USA they have something that's known as "theft of service". It can affect us all from time to time, and is not exclusive to the brown goods trade. Consider the following situations:

(1) You carry out a repair at the customer's premises only to find that on completion of the job the customer has no money and is not able or prepared to pay you. What can you do? You *cannot* remove the equipment from the customer's premises: that would be regarded as theft. The police will decline to get involved, except to ensure that there's no breach of the peace. It's a civil matter and you would have to pursue your claim in the civil courts. Often this isn't worth it.

(2) You have removed a piece of equipment from the customer's home, with permission, to repair in the workshop. You repair it and return it to the customer, only to find that the customer is unable/unwilling to pay for it. Again you cannot remove the equipment, and you would probably not be able to remove your spares. And again the police will regard it as a civil matter and will not get involved. If you try to obtain any money other than by pursuing the matter through the civil courts you will find yourself on the wrong side of the law.

If someone removes an item from a shop without paying for it the criminal offence of theft is committed. The same is true if someone tries to remove their TV set or VCR (for example) from your premises without having paid for work done: this would also be considered as theft. Likewise one wouldn't let anyone remove items from a shop without payment having been made.

Theft of service can happen to any of us. It is something that should be dealt with by parliament. The Home Secretary has the power to bring in new laws, which the legislators then draft.

Michael Maurice,
Wembley, Middx.

The original TV standards battle

I was amazed by Dr Waddell's assertion (letters, March) that the bandwidth allocated for the pre-war TV service from Alexandra Palace was inadequate for a 405-line TV signal to be transmitted correctly, and that this was the reason why many observers at the time failed to see any difference between Baird's 240-line pictures and the Marconi-EMI 405-line ones. I don't know what bandwidth Dr Waddell thinks is necessary for the "correct" display of 405-line pictures, but the 3MHz allocation gave the 405-line system a better ratio of horizontal to vertical resolution than either the 525- or 625-line systems in use today. Indeed the pre-war 405-line transmissions had a better horizontal resolution than present-day broadcast NTSC, and a *much* better horizontal resolution than 625-line VHS.

The real reason why many observers could see little difference between the two systems is that, flicker aside, the two were subjectively fairly similar, both having a resolution of about 300 lines horizontally and 200 lines vertically. The benefit of the larger number of scanning lines with the Marconi-EMI system was to some extent cancelled out by the use of interlaced scanning.

It was not because of any defects of the 240-line standard that the Baird system was abandoned so quickly (though the 25Hz sequential scanning would have caused unacceptable flicker with brighter, post-war tubes) but because of studio equipment inadequacies. The Baird equipment was unreliable and inflexible. It is well known that the BBC production staff and performers hated having to use it. The equipment not only broke down far more often than the Marconi-EMI equipment, but was prone to faults that caused serious loss of picture quality – and, in the case of the intermediate-film transmitter, sound quality. I find it strange that anyone, even in 1935, could have taken this piece of equipment seriously. It was bulky, expensive, operationally inflexible and prone to all sorts of faults and difficulties.

I do not understand why Dr Waddell should choose to mention either the pre-war Baird TV sets or the Cintel telecine machines in his defence of Baird, since neither of them had any real connection with Baird himself. As Alastair Carruthers pointed out, the former were produced by Bush Radio, while Cintel's excellent telecine machines were not produced until three years after Baird's death.

David Looser,
Ipswich, Suffolk.

NPTV installations

My congratulations to Chris Holland for his concise explanation of the NPTV issue last month (March, page 266). Joe Public has more than enough difficulty finding his way through the 'subsidised maze' of pay-for satellite TV in this country: Chris's explanation should be of considerable help to those who simply want digital satellite TV reception without a Sky viewing package.

But there seems to be a problem with payment for digiboxes that are installed without taking on a Sky

subscription contract. Independent dealer/installers are expected to place equipment from their stock at risk in viewers' homes without payment for it. Only the £100 NPTV installation fee can be collected.

As an authorised Sky dealer/installer I've installed three such systems since December last and haven't received a bean for any of them to date. Naïve I may be, but it's only now that I realise I may have to wait a very long time before British Interactive Broadcasting or BSkyB pays up. At least I got the £100 installation fee in each case, but no more NPTV installation bookings, thanks very much!

Trevor Wiltshire,
Proprietor, Tora Technology,
Tadley, Hants.

Cracked PCBs

I was appalled to read the article on dealing with PCB cracks (March). This may get a set working, but there are serious implications.

Our industry is inundated with Health and Safety requirements, something the article totally overlooked. It's a fact that the incidence of fires caused by TV sets is on the increase (Alliance for Consumer Fire Safety in Europe, 1998). Manufacturers have stated that for safety reasons a cracked board must always be replaced (for example see the Toshiba Technical Bulletin CDH54, June 1995). Should a repaired board result in a house fire, could the repairer justify his action on the grounds that he was trying to save his customer money? A Fire Officer might well name the repaired set as the source of the fire.

Anyone following the advice given in the article will simply be bringing the service side of the industry into disrepute. PCB repair should not in any circumstances be undertaken.

John Halstead, BA, MSc.,
Managing Director,
Broadbent Television,
Huddersfield.

Comment: Toshiba Technical Bulletin CDH54 states that for safe and reliable repairs cracked boards should in all circumstances be replaced. Broken or lifted track can be repaired in low-voltage areas, the recommendation being to remove the print from the PCB back to the nearest solder or component pads then use insulated wire to connect these points – only short lengths of wire should be used, anchored to the PCB with hot-melt glue. When broken or lifted track is in a high-voltage area the PCB should always be replaced, unless the action being undertaken is part of an official Toshiba modification. A PCB with burn damage should be replaced unless the damage is limited to surface discoloration from a hot or damaged component. The Bulletin emphasises that safety should always be the prime consideration.

An alternative to the TV/video trade

I began in the TV trade at the tender age of thirteen as a Saturday boy for a small rental firm in Bristol. After leaving school I attended the local technical college for many years and was eventually awarded a licentiateship of the City & Guilds of London Institute. At this time video had just taken off, and things were good. But looking to the future I could see changes coming. So I altered course and went into broadcast video systems. Then, in 1990, redundancy came.

What next? A friend had moved into medical electronics at a local hospital. Why not try this I thought? The prospect seemed quite daunting initially: defibrillators that deliver 5kV at 50A, and linear accelerators with 30kV, 105A power supplies. But you adopt, as all good TV engineers do. The work is challenging and satisfying: very different from the numbers game of the TV trade.

I was promoted to Assistant Manager in 1995 and, more recently, to Workshop Manager. But we have a recruitment problem – no good ex-TV engineers applying for jobs! So if you are fed up with the TV trade, try your local large General Hospital. Most have an electronics service group, and as a rule the pay is quite good. Ask for the Medical Physics Department or Medical Electronics. Best of luck!

Ross Amesbury, Eng Tech, IIPEM, LCGI,
Warmley, Bristol.

Poor prospects

The current correspondence on the state of the trade, initiated by Michael Maurice in the September 1999 issue, reminds me of a letter of mine you published a couple of years back under the heading "Enter the trade? – Don't".

The brown goods manufacturing industry must be the only one that continually reduces the prices of its products as costs go up. When I started at Currys as a school leaver in 1976 the popular sets of the day were based on the Philips G8, Thorn 8800 and similar chassis and sold at about £260. Most were bought on HP, as it was a big price in comparison with a week's pay. Our first text sets came from Rank (Bush) and sold at £750. Colour portables were usually dearer than large-screen models but were of excellent quality, as they were nearly all manufactured by top Japanese companies such as Sony, Hitachi and Panasonic. Our first VCRs were the Philips N1700, the Sony Betamax and the Ferguson 3292 (a JVC clone): they sold at £750. We always knew that they would come down in price a bit as production built up and more manufacturers entered the market, but I never envisaged that twenty years on they would cost as little at £70. This has been achieved by sacrificing quality of course. Today's VCRs are shoddily built and not only are repairs not viable (except maybe for head cleaning) but the machines are not attractive to work on. You could enjoy servicing a 3V29, but these silly centre decks plugged into a single board with no access to the print side in situ are just a pain (why do they bother with fitting a bottom cover when its removal gets you nowhere?). I also never expected many of the major manufacturers of sets to go out of business, and that the TV market would be so dominated by the suppliers of the cheapest and poorest quality radio receivers and cassette players.

In his first letter Michael said that if VCRs cost at least £250 for the most basic models people would still buy them. This is perfectly true: Joe Public is not prepared to live without a TV set and a video, and would buy them at such a price. At present the only sets that are really viable as a service proposition are those extra large-screen models with Dolby Pro-Logic sound. But who amongst us wants to haul these monsters into the workshop? Servicing in the home is not really viable with today's sets, so we are in a quandary. And people who own monster sets expect them to be repaired as cheaply as they would like their two-bob tellies and videos repaired because, as Michael said, electronic products are nowadays seen as having little inherent value.

I have managed to scrape by because of two things. Back in 1979 I invested some money (and a fair bit since) in a mobile disco kit, and have been supplementing my earnings by doing a bit of DJ work here and there. I became self-employed in 1981, and the disco helped to

support me while I was establishing the business. It's a good job that I didn't give up the DJ work, because now it's become a life saver.

The other thing that keeps me going is that I saw this crisis coming a long time ago and decided to learn to repair white goods as well. While microwave ovens now sell at stupid prices because the makers of cheap tellies have moved in on them, washers, fridges and electric cookers are still pricey. White goods engineers would probably find it extremely difficult to tackle TV sets and the like, but for us brown goods engineers most domestic appliance work is laughably easy – *and* profitable. As mentioned in the same issue, Hotpoint charges £75 for a call out to fit parts that are free in the second phase of their guarantee period, which consists of one year with free parts and labour then four years with just free parts. Most people don't bother to claim during this second phase, as a local repairer can provide parts and labour for a lot less.

As an example, a common call is to fit a water pump. The trade price is about £6 including VAT. It is as easy as pie to fit, and you can charge £45. I'm no longer VAT registered, so it earns a gross profit of £39 and takes about fifteen minutes to do. It's just as easy to change fridge thermostats and oven elements. I charge £40 to replace a fridge thermostat which costs only £3: this takes five-ten minutes. In fact if there weren't so many competitors around here in the white goods servicing game I would stop handling brown goods altogether. It's only because of the number of others in the business that I still do some TVs and DJing – and still only get by.

Michael Maurice feels he must change career, and I wish him good luck. It's not easy to find an employer. I've been turned down by two supermarket firms that advertised for management trainees. I was told that I didn't have the right experience, even though I have worked for a major TV rental company as a branch manager, and at one time my own business had two shops that retailed a wide range of electrical goods – until the local pits closed and the shops became unviable. I've also tried to use my DJ skills to get employment in the radio industry.

Soon Jobcentres will be full of skilled TV engineers looking for work doing anything other than TV servicing, then nothing will get repaired and a once great job will have become part of history. In my teens I spent a long time studying and living like a monk to learn my trade. I have loved repairing TV sets and the like. But where has it got me? When you are in a job you can't enjoy any more and no one will employ you to do something else, it's like being in prison: you want to be out but the door is locked. I have also been reliably informed that some companies will not employ anyone with a background of self-employment. We are seen as lazy, workshy loose cannons who cannot take orders. So the prospects don't look good.

John Hepworth,
Peterlee, Co. Durham.

The Amstrad CTV3121

Fellow sufferers may find the following information useful. The set concerned was a 24in. text, Nicam and stereo Amstrad Model CTV3121 that had been bought from a supermarket at a ridiculously low price. All three CRT guns were hard on, with the sound OK. The quality of the circuit boards was excellent, and the chassis had a vaguely Philips-type look about it. The CRT base panel has a TDA6103Q chip that incorporates the RGB output stages. There were RGB inputs but no outputs. A replacement chip made no difference, so I required a circuit diagram.

Surprisingly for such a new model, I was able to obtain one from D-Tec at £10 plus £2 post. D-Tec thought it was a PT11 chassis that had been manufactured on the Continent by Profile. I've never heard of this firm, but the manual was a revelation. It was spiral-wire bound, with 75 pages, and had every bit of information you might possibly need – and could be read without a magnifier! It made most modern circuit information look like mumbo-jumbo.

The cause of the fault was soon found. A 1·8V DC bias is required at pin 5 of the RGB output chip and was missing. It's derived from the 185V rail via our old enemy the 220kΩ, 0·25W resistor (R211), which was open-circuit.

This chassis appears under many guises in low-price outlets and is one to look out for.

Laurie Watkinson,
Holsworthy, Devon.

Metal Rectifiers

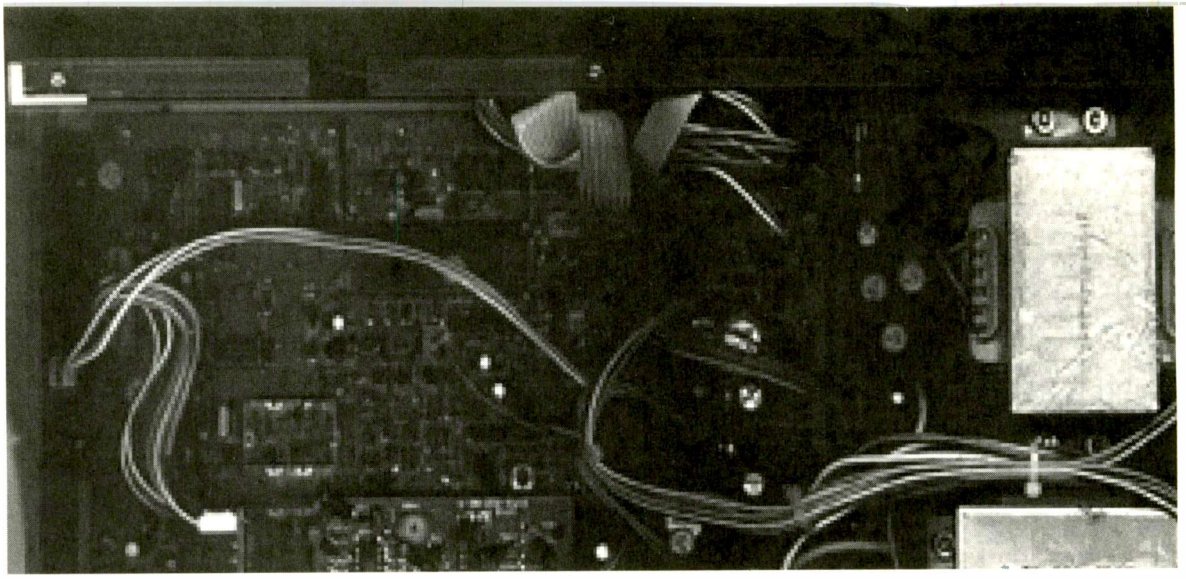
I read with interest Peter Murchison's article All about Diodes (February) from which I learnt, for the first time, how a metal rectifier works! As Peter mentioned, metal rectifiers were used to provide the HT supply in many sets manufactured during the Fifties. They had a high internal resistance, which became progressively higher as they aged. After a year or two, when the HT fell to about 200V, symptoms started to appear – reduced width and height, closely followed by frequent loss of line and field lock. As the cost of repairs was then relatively high (you could make a living from them!) most viewers didn't have their sets repaired until the HT had fallen to about 180V, by which time it was almost impossible to maintain a constant picture despite continual fiddling with the line and field hold controls.

The metal rectifiers in common use at the time were the 14A86/100 and STC RM4/5 types. Just before the advent of the incredible BY100 silicon rectifier diode someone developed a highly-efficient new type of metal rectifier that was smaller than the RM4 and was painted brown or maybe green (I have this problem with colours). I don't recall its type number, but it breathed a new lease of life into many TV sets.

Then the BY100 appeared. It was thought of as nothing short of miraculous, being able to transform a tired, worn out TV set into a thing of beauty – mainly because it could provide more HT than the set had ever previously seen. Because of our limited knowledge and stupidity, we would initially solder a BY100 directly across the existing metal rectifier. The silicon rectifier, with virtually no forward resistance, provided in excess of 300V HT until the valves warmed up and reduced it. Bear in mind that the reservoir/smoothing capacitors were rated at about 250V: we had one or two explosions, but most sets coped very well, with just a few clicking noises until the voltage dropped. Very soon we started to do the job properly, mounting the silicon diode on a tagstrip along with a 21Ω surge-limiting resistor.

Many setmakers stuck doggedly to valve rectifiers until the end. They were much better suited really, as they warmed up at the same rate as the rest of the valves – and they were much easier to change. But think of the fun we would have missed without the metal variety!

Peter Nutkins,
Charmouth, Dorset.



Satellite Notebook

Reports from Christopher Holland Hugh Cocks and Michael Maurice

Cable Trouble

Mr Watson's analogue Sky installation was due to be replaced with a digital one in about a month's time. But he approached us with the complaint that his analogue Sky News reception had deteriorated over a period of a few days. The other channels were OK, though I did notice a few sparklies on Sky 1 and Sky Premier when I visited him.

A different receiver made no difference, neither did a new LNB.

This left the coaxial feeder cable. When a temporary length of cable was connected reception of Sky News was perfect with the original LNB in place. It also cleared the sparklie interference with Sky 1 and Premier on adjacent frequencies. It's odd how coaxial cable can downgrade so quickly across a specific frequency range. When this fault occurs with a digital system the symptom will presumably be no pictures on certain channels.

The digital problem will be more difficult to diagnose because broadcasters can and do alter channel frequencies without us knowing. We know that with the analogue services Sky News is on Astra transponder 12 (11·377GHz V). The digital version is at 12·070GHz H along with several box office channels, Sky Cinema, Cartoon Network+ and the Money Channel, though this could easily change. Table 1 lists the current Astra 2A/1D channel frequencies (Astra 1D is a temporary back-up satellite pending the arrival of 2B later this year).

I had a similar problem with an installation where a fairly large prime-focus dish had been turned round for Astra 2A and a new LNB had been fitted. There were difficulties with reception of transponders 23 and 24 at around 12·15GHz. In this case a new feedhorn at the dish cured the problem. **C.H.**

Receiving Swiss TV

I was recently asked to install a satellite system for reception of Swiss national TV, which is available as a digital multiplex via Hot Bird at 13°E. There are six channels at 12·399GHz with horizontal polarisation, a 27,500 symbol rate, 3/4 FEC and Viaccess encryption. In addition there are several radio stations, which are transmitted in the clear. The service is mainly intended to provide coverage in the mountainous parts of Switzerland, but subscriptions are available to Swiss citizens who live within the Hotbird European footprint area.

A Nokia 9800 receiver was in use: it has a built-in Viaccess system, a separate conditional-access module not being required. The receiver has a second card and CAM slot which enables a standard PCMCIA-type CA module to be added. Viaccess CAMs can be obtained from specialist satellite equipment suppliers for use in earlier DVB receivers such as the Nokia 9600. An information channel is transmitted in the clear alongside the six encrypted ones: it provides details on how to obtain the card. An interested viewer should phone 00 41 305 6547 or fax 00 41 305 6551. Alternatively the e-mail address is
sataccess@srg-ssr-idee-suisse-ch
or, if internet access is available, go to
www.srgat.ch

Non-resident Swiss viewers must be registered with the Swiss Embassy in the relevant country. After application a check is made by Swiss TV to ensure that this is the case. A charge is made for card issuing, and there's an annual licence-type payment. The card application process can take a few weeks to complete.

A bonus for Swiss viewers is the free-to-air TV 24 Switzerland channel at 12·379GHz vertical, with the same SR and FEC. This is apparently the only private Swiss station. **H.C.**

Pace PRD800/900

I received two calls within twelve hours because of intermittent loss of the picture to just a blank screen. The usual cause, which has been reported in these pages before, is Q105 (BC846B). But both customers had had difficulty getting a correct diagnosis. One had been told that the LNB was faulty. When I called I confirmed that this was not so by using another receiver. An advantage when you visit a customer and check the equipment on site is that you can use a spare receiver to carry out this test.

Note that if you use one of these receivers with a Sony TV set the channel number, when Q105 produces the no-video fault, will appear at the top right-hand corner as if there's no signal. **M.M.**

Matsui VCR1500

The symptoms with this VCR/satellite combi unit were a very poor satellite picture and failure to decode encrypted channels. When you remove the top cover you will see the satellite section at the left-hand side. The decoder board is at the top. To cure the symptoms mentioned above, remove the decoder board and replace all the electrolytic capacitors at the rear right-hand corner. It's best to fit high-temperature capacitors. **M.M.**

Table 1: Astra 2A/1D channels.

Frequency§	*Pol*	*Channels and EPG numbers*
11·720 (1) S	H	BBC 1 England and Northern Ireland (101), BBC2 (102), BBC Choice (160), News 24 (507), BBC Knowledge (553).
11·740 (2) S	V	Living (112), Challenge (121), Bravo (124), Trouble (607), TVX Cable Travel Shop** (not in EPG – see 11·954GHz H).
11·758 (3) N	H	Ch. 4 (104), Ch. 5 (105), Rapture* (187), Premier Widescreen (305), Film 4 (324), Sports 1 (401), Sports 2 (402), Phoenix Chinese News* (673), The Box tests (this version not in EPG, see transponder 35).
11·778 (4) N	V	Sky Box Office Widescreen 1 (760), Sky Box Office Widescreen 2 (761), EPG audio track with '103 ITV' background. Note that this is the receiver default transponder.
11·798 (5) S	H	BBC1 Wales and Scotland (101), BBC Choice Wales, Scotland and Northern Ireland (160). All BBC Radio stations in package* except Radio 5 which requires minimum free-to-air card.
11·817 (6) S	V	UK Gold (109), UK Gold 2 (110), UK Style (148), UK Arena (151), UK Horizons (544), UK Play (644).
11·837 (7)	H	Premier (301), MovieMax (308), CNBC (510), Box Office 1-5 (701-705), Sky 1 Cable feed (not in EPG).
11·856 (8)	V	Premier 2 (302), MovieMax 2 (309), Sports News (413), National Geographic (538), Box Office 6-10 (706-710).
11·876 (9) S	H	Discovery Channels (531-535), Animal Planet (550).
11·895 (10) S	V	Paramount (127), Sci Fi (130), Nickelodeon Junior (606), MTVs (631, 632, 633 and 638), VH1s (635-636), Prime TV (not in EPG).
11·914 (11)	H	Premier 3 (303), MovieMax 3 (310), Sports 3 (403), Box Office 11-15 (711-715), Digital info (999) plus additional info channels identical to 999 but not in EPG.
11·934 (12) N	V	Premier 4 (304), MovieMax 4 (311), Sky Sports in pubs (401-3), Box Office 16-20 (716-720), Playboy/Adult (981), Retail info (997).
11·954 (13) S	H	Travel Shop* (653), TVX (977), Testcard** (not in EPG).
11·973 (14) S	V	Sony Asia (670), Music Asia** (677), Zee Bangla (678), Bangla TV (679), Pakistani TV (680), Asia 1 (682), Minaj (685), Channel East** (688).
11·992 (15) N	H	Open shopping.
12·012 (16) N	V	Open shopping.
12·032 (17) S	H	Open shopping.
12·051 (18) S	V	Travel* (181), TCM*** (327), CNN* (513), Cartoon Network (601), QVC UK* (650), Shop* (656), CNN Radio** (not in EPG).
12·070 (19) N	H	Cinema (315), Sky News* (501), Cartoon Network + 1 hour (602), Box Office 21-25 (721-725), Money Channel*** (516).
12·090 (20) N	V	Sky 1 (106), Disney (115), Cinema 2 (316), Business (480), Box Office 26-30 (726-730).
12·110 (21) S	H	U Direct Films (800-811), Classic FM* (916), Classic Gold* (919), The Mix* (920), Planet Rock* (921), Core* (922). All '900' chs radio.
12·129 (22) S	V	Ch. 4 Wales/S4C (184), BBC Parliament* (508), S4C 2* (519), Simply Money* (522), Bollywood 4U (667), Zee TV*** (676), Inspiration* (694).
12·148 (23) N	H	Granada Plus (118), Bloomberg (504), Nickelodeon UK (604), Box Office 31-35 (731-735), Box Office 70 (770), Info ch. (999).
12·168 (24) N	V	Sky Travel (145), Tara (178), MUTV (410), Box Office 36-40 (736-740), Playboy/Adult (974), Info ch.**** (998).
12·188 (25) S	H	Music Choice 1946/7/8** (851-886). Three music channels addable in extra channels, non-encrypted.
12·207 (26) S	V	Sky Sports Extra (404), Sports News (413).
12·226 (27) N	H	Breeze (136), Men and Motors (139), Racing ch. (416), History ch. (541), Computer ch. (547), Box Office 41-45 (741-745), Midnight Blue (980).
12·246 (28) N	V	Ski 1 cable (not in EPG), MovieMax (308), CNBC (510), Box Office 1-5 (701-705). Some duplication with transponder 7.
12·266 (29) N	H	MovieMax 5 (312), Fox Kids+ (611), Box Office 49-53 (749-753), Retail info Ireland (997).
12·304 (31) N	H	Open shopping.
12·324 (32) N	V	Adventure (540), Virgin Radio* (917), Talk Sport (918), Capital Gold* (923), XFM* (924), Youth FM* (935). Heart FM and Galaxy FM testing but not in EPG** yet.
12·363 (34) S	V	National Geographic + 1 hour (539), Nickelodeon Replay (605), Box Office (754-758 and 765-768).
12·382 (35) N	H	Sports Extra (404), Eurosport (419), Fox Kids (610), The Box (641), God Ch.* (691), Box Office Preview (700), Box Office 46-48 (746-748).
12·460 (39) N	H	Sports 2 interactive cricket and various sports tests (402).

§ Frequency in GHz. Transponder number in brackets. N = north footprint, S = south footprint (2A) – these overlap in the UK.
*Unencrypted channel available in the EPG.
**Unencrypted channel not in EPG but can be added as an 'extra channel'.
***Unencrypted channel but an active viewing card has to be inserted.
****Ch. 998 is encrypted but is available with an unactivated viewing card.

Most channels require an active viewing card to be inserted for them to appear in the EPG. Without an activated card only Travel (181), Rapture (187), Sky News (501), Parliament (508), CNN (513), S4C 2 (519), Simply Money (522), QVC (650), Shop (656), PCNE Chinese (673), God Ch. (691), Inspiration (694), U Direct Films Preview (800) and most of the radio stations from 911 upwards are available from a digibox.

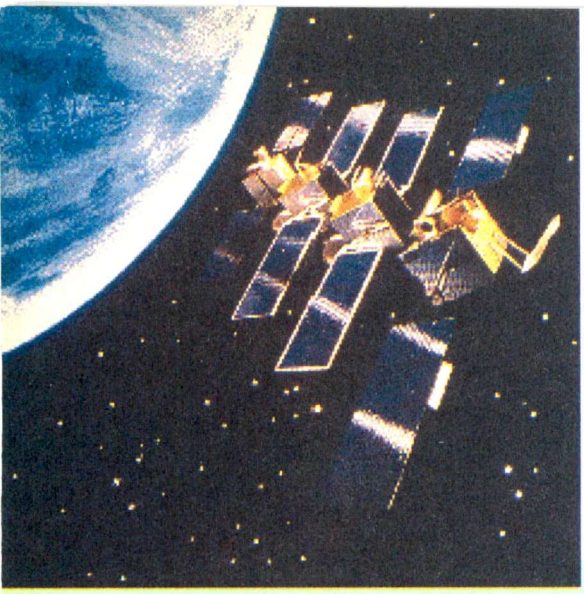
Viewers in Wales will have S4C on 104 and Ch. 4 on 184 (in other areas the numbers are reversed and S4C has to be requested).

The correct BBC Choice for the region is put on ch. 160. Other BBC Choice regional versions are viewable and are on chs. 951/2/3.

The correct BBC1 region is put on ch. 101. The other BBC1 regions are not listed in the EPG. They can be added as an 'extra channel' but are blocked by the viewing card.

Transponders 30, 33, 36, 37, 38 and 40 not in use at present.

Listings accurate at end February but liable to change.



Terrestrial DX and satellite TV reception. News from abroad and of developments in the satellite belt. A note on predicting F2 reception. Roger Bunney reports

DX and Satellite Reception

The first month of the new millennium produced very little by way of DX reception. A high-pressure system that became established during mid-January and lasted until the 29th produced very cold weather and helped lift tropospheric conditions slightly, providing Dutch Band III/UHF signals above the usual noise levels in eastern England and various Band III/UHF Irish channels in the West Midlands/NW. The Quadrantids meteor shower in early January helped, producing numerous, though unidentified, signal pings and longer-duration signals in Band I – the 8th was a particularly active day.

With sunspot cycle 23 now approaching its maximum, we had hopes of mega exotic DX reception, but there have been no reports of F2-layer DX reception in the UK. I've checked in the evenings for TE (transequatorial skip) signals from the south. Although very low-level, fluttery 'buzzy' signals are usually received by my scanner at and around the ch. E2 vision carrier frequency (48·25MHz), just above the noise level in a 5kHz AM bandwidth, there was no prospect of video reception even with the bandwidth reduced to a couple of MHz.

It was a very sad January, particularly as the sunspot count suddenly rose from an average of 140 to around 270 on the 16th before plunging back again on the 19th. Incidentally my usual check for emerging F2 propagation during the afternoons is with the scanner tuned to 35·22MHz and 35·58MHz. These are very active North American base pager stations. More on F2 reception later.

A golfer in the Bob Hope Chrysler Classic invites the sound FX man to get close-up sound. A Globecast transmission via NSS K.

Satellite Sightings

After the excitement that accompanied the start of the new millennium, January was an anticlimax in the satellite airwaves, with only mundane sightings. There have been suggestions that the UKI-149 analogue SNG truck will cease operations by the end of the month. It's been a favourite amongst satlink chasers, being seen over several years with mainly uplinked inserts for the breakfast shows, GMTV etc., usually via Intelsat/NSS K (21·5°W). It will be missed.

Its digital successor may already be in operation. While UKI-149 was busy at 0800 on the 4th, with a beef/butcher's shop item via NSS K (at 11·530GHz H), UKI-45 was providing GMTV with a digital feed from a Cheshire bakery via Eutelsat II F3 (36°E). This was at 11·566GHz with SR 5,632 and FEC 3/4. On the 20th UKI-253 carried a feed for GMTV from Loughborough, again via II F3, at 11·131GHz with the same SR and FEC.

The Miracle Channel was an interesting sighting that day, via Eutelsat W2 (16°E) at 11·176GHz V in analogue form. There were two audio subcarriers, Arabic at 6·6MHz and English at 7·2MHz. The programme is present daily from 1600-1700 GMT.

The Russian Orthodox Christmas was celebrated during the period, with really impressive pictures via the C-band Gorizont satellite at 40·5°E. This was on the analogue PTP channel (3·675GHz RHC). It's well received via the Russian spot beam, which in the UK provides an EIRP of about 36dBW. Reception is noise-free via my 1·5m dish with 17°K noise LNB and about ten steps of threshold extension on the Manhattan 6300 receiver.

Sports enthusiast Dean Rogers (London) was very fortunate with his NSS-K reception during January, particularly via the Globecast digital package at 11·590GHz V (SR 20,145, FEC 3/4). On the 16th for example there was ice hockey (Ottawa v. Capitals), US men's soccer (USA v. Iran from the Rose Bowl, Passadena) and ladies' professional golf (The Office Depot tournament from Palm Beach). On the 22nd he had more golf, with the Sabaru Memorial of Naples and the Bob Hope Chrysler Classic from the very impressive Bermuda Dunes County Club, California.

My own sports sightings during the month were mainly via Telstar 12, for example Italian national championship volleyball from Bergano at 1700 on the 23rd, in the clear at 11·135GHz V (analogue) with audio at 6·6/7·2MHz. The African Cup of Nations came live,

plus recorded highlights of a football match, from Accra, Ghana via Arabsat 2B (31·5°W) at 3·990GHz RHC. It was once again Dakar Rally time. I had this, at 0715 on the 24th, as an 'edgy' digital feed at 11·550GHz H (SR 5,632, FEC 3/4) via NSS K from the Spanish SNG truck Retevision E19. Signal levels were just above threshold and critical polariser setting was required to avoid pixellation. Sky Sports News was found at Intelsat 801 (31·5°W), another marginal signal with colour bars and a rolling ident "BT-TES-34". Frequency was 10·995GHz V, SR 5,632, FEC 3/4, VPID 308, APID 256.

President Clinton and his wife Hilary were both present at a large gathering of educational and academic people, Education and the American Dream, on January 20th at 1830GMT. This was broadcast from the White House via NSS K at 11·550GHz V (5,632 + 3/4). In more sombre mood, Holocaust Education was the theme of a Stockholm conference that appeared at 1800 on January 20th via Eutelsat II F3 (11·6GHz H, 5,632 + 3/4 and 308/256 PIDs). ABC Newsfeed SWE-013 carried live interviews for ABC News, USA. Conference topics included Nazi war crimes, Latvian atrocities, concentration camps etc. Incidentally the ITN-LYON feed at 36° is no longer in the clear. It now shows the ident ITN/LYON N02 ENC (11·097GHz H, 5,632 + 3 /4).

Yet another Turkish channel has appeared, an analogue test for BTV Europe via Eutelsat II F4 (10°E). It was seen during several evenings at 11·082GHz H (audio 6·6MHz).

Eric Duncan (St. Andrews), an old DXing friend, tells me that he is now into digital TV with an Echostar D-2500IP receiver. He says it's a "polished receiver with excellent software". But there is loss of dish-tracking reset readout accuracy with his Jaeger SMR1224. Reception reports are promised once the H-H problem has been sorted out.

Terrestrial News

UK: The ITC has introduced a restraining order on new local (RSL-TV) stations because of the need to provide channels for the development of the terrestrial digital TV network. The Local Independent Television Network (LITN), the body representing local TV stations, is seeking urgent discussions with the government ministry responsible for TV to resolve the deadlock, which threatens the growth and well being of local TV.

The local station (TV12) on the Isle of Wight has advertised that those in West Wight (Yarmouth, Freshwater etc.) can now receive the 2kW ERP ch. 54 H transmissions. TV12 is also advertising mainland coverage in the Lymington/New Forest area, with the signals reaching as far north as Lyndhurst. Here at Romsey, eight miles north of Southampton, the TV12 signals are received noise free using a standard wideband Unix 100W UHF aerial.

ONdigital is to launch five pay-per-view channels in late spring, now that its subscriber base has exceeded half a million. On March 9th media secretary Chris Smith will be making an announcement in the House of Commons on the analogue TV switch-off.

Digital TV: Rhode and Schwarz has devised a means of providing internet access via the DVB-T TV system. 'Selected' internet data is inserted in the MPEG-2 programme data stream, which on reception is split between TV and PC systems. The PC stores and checks through the data, offering inexpensive access to specific internet sites.

Germany: All ch. E12 transmitters are being closed down to make way for DAB. ARD-1 Sonneberg moved from ch. E12 to ch. E44 last autumn.

France: The authorities have expressed concern about the slow move to digital TV and are taking steps to speed things up. DTT regulations are to be included in a new broadcasting bill. The government hopes that digital STBs will be available late next year.

Bulgaria: The Balkan News Corporation has been awarded Bulgaria's first national commercial TV licence. It will take over from the Efir-2 state channel and plans a mid-summer opening.

Satellite News

Eutelsat has ordered a new satellite which will be known initially as Newbird. Once placed in orbit at 8°W, in mid-2001, it will be known as Atlantic Bird 2. It will have 26 Ku-band transponders and will work alongside Telecom 2D (11 Ku-band transponders), replacing Telecom 2A (the Telecom satellites are being integrated with the Eutelsat fleet). Eutelsat is also moving its elderly I F5 satellite to the Atlantic Gate position at 12·5°W. This satellite is now in an inclined orbit, with a shortage of slot-keeping fuel, so use of its facilities requires an inclined tracking dish to maintain optimum performance.

This very ornate clock preceded a news item via NSS K digital capacity.

Intelsat has ordered two more series IX satellites which will operate at 29·5°W, releasing capacity that's to be transferred to a Pacific

An Arabic/English religious channel via Eutelsat W3 (16°E). The analogue transmissions are at 11·176GHz V, starting at 1600 GMT.

slot at 178°E. Another new Intelsat craft, New Intelsat-Alpha, will be positioned at 50°W. Intelsat has been carrying out tests on the interoperability of digital compression equipment. These have confirmed that most encoders/decoders can operate together, providing programme exchange between countries and continents. Ten major equipment manufacturers took part in the tests. Some equipment was found to be not fully compatible, and effort is being made to encourage compliance with a standard parameter profile.

The Japanese satellite channel JSTV via Astra at 19·2°E (10·774GHz H) is to go digital in mid-April. The present analogue service will cease at the end of the year.

The French radio/TV service RFO is to produce a combined Pacific TV channel that will include inputs from various island broadcasting services (New Caledonia, Samoa, Fiji, Tonga etc.) and be transmitted via Intelsat 701 (180°E). The local New Caledonian channel will be fed back to Paris via BT's fibre-optic cable, inserted within the Canal+/RFO digital multiplex (with other services) then sent back to the Pacific region by satellite. You can check out the TV5 French overseas channel with a free-to-air digital receiver by tuning in the new sampler digital multiplex via Eutelsat W3 (7°E) at 11·387GHz H (SR 27,500, FEC 3/4). RTP International, TV5, ZDF, RAI Uno, Fashion TV and Euronews are all to be found here, with widebeam coverage across Europe and the Middle East.

BT Broadcast Services is to provide satellite transmission facilities via Intelsat 801 for the French TF1 channel and the LCI news channel. There will in all be sixteen uplink sites – thirteen French regional centres plus Berlin, London and Rome. The TF1 SNG fleet will use the BT-provided capacity for its news-gathering operations.

Link Research Ltd. of Watford (phone 01923 800 510) is selling the Alteia PSR432, a 19in. rack-mounting professional MPEG-2 DVB receiver that can handle both the 4:2:0 and 4:2:2 digital video signal formats. The former is used for standard MPEG-2 broadcasting. The latter is used by the EBU for news distribution via Eutelsat W3 at 7°E and cannot be processed by a domestic MPEG-2 receiver. Frequency, FEC and symbol rates (1-44·5Msymbols/sec) have to be set manually. There are no domestic scart connectors in sight, but XLRs, 4 x f (IF) inputs, various serial/parallel inputs, fibre/copper, video, genlock and RS sockets etc. are provided. Unfortunately the receiver is being sold at the Lottery win price of £1,800 + VAT, so I won't be receiving any EBU feeds just yet!

Predicting F2-layer Reception

In theory we are now approaching the sunspot maximum in the present solar cycle (no. 23). At this time there is an enhanced likelihood of receiving low VHF and low Band I TV signals over distances of many thousands of miles. During November 1999 there was certainly some success with F2 reception in W. Europe. Reception of several Thai ch. E2 transmitters has been confirmed by comparing the programme content with that of downlink signals from Thaicom at 78°E. The fact that the received programming was in this way confirmed as being of Thai origin, plus use of a scanner to measure the three video carrier frequencies (nominal, + and –) received, identified the transmitters as being TV9 Udon Tani, TV9 Songkhai and TV3 Nakhon.

A check with the Benelux DX Club's *TV Logboek* listing of F2 reception (by Joop Prosee and Ryn Muntjewerff) during the peak November period shows that signals were received from Iran, Thailand, Malaysia, China and farthest Russia. On November 18th there was weak video signal reception (programming plus text in the field blanking period) from Australia (ch. 0 – 46·25MHz). No scanner frequency measurement is available to confirm carrier offsets. Oddly there was no report of African ch. E2 reception (ZTV Zimbabwe is common via F2 or evening TE) or New Zealand ch. 1 (45·25MHz). ZTV might be off air until the late afternoon. New Zealand TV is very rare.

The propagation pattern over the 24-hour period has been described in these pages before (see page 242 February for example). I don't consider that the present solar cycle has been all that wonderful. During good solar cycles sunspot counts rise to 250 plus. January 2000 had a predicted, smoothed count of 144 or so.

Fig. 1 shows F2 propagation predictions compiled by Herman Schoemaker of Veldhoven, reproduced here by courtesy of the Benelux DX Club. They relate more to F2 conditions as experienced in the Netherlands. The graphs plot frequency vertically and time during the 24-hour period horizontally, the highest line in each graph showing the expected daily MUF (maximum usable frequency). Some days it will be higher, on others lower. With India, Indonesia, Hong Kong and Japan, to the east, the highest peak is from 0800 on to mid morning. To the west (USA) the peak is in the late afternoon. New Zealand provides an odd response: the signal arrives via a more northerly path with a peak at about 0845-1000 GMT in the UK. My own Australasian reception has been at around this time, and Ryn's November 18th reception of ch. 0 was at 0925-0930. The longer paths require much higher levels of F2 layer ionisation, the result being a much shorter peak-MUF time.

Other BDXC loggings during November 1999 confirm the predictions. Reception from Thailand, China and Malaysia is confined to 0845-1130 and from the Gulf to 0840-1330. Distant Russian ch. R1 signals may arrive from 0810-1100. They often climb out of the noise to become very strong in just a few minutes: the decline at F2 termination is more prolonged.

Once the basics are understood, the DXer can exploit the possibilities of really long-distance TV reception. A scanner is perhaps an essential tool, enabling the first hint of weak AM video to be detected, with the bonus of accurate frequency measurement to help with source identification. A signal that is audible using a narrow-bandwidth scanner must rise to a very high level before an image will appear on a TV screen – even when a narrow IF bandwidth DX-TV receiver is used. Good F2 hunting!

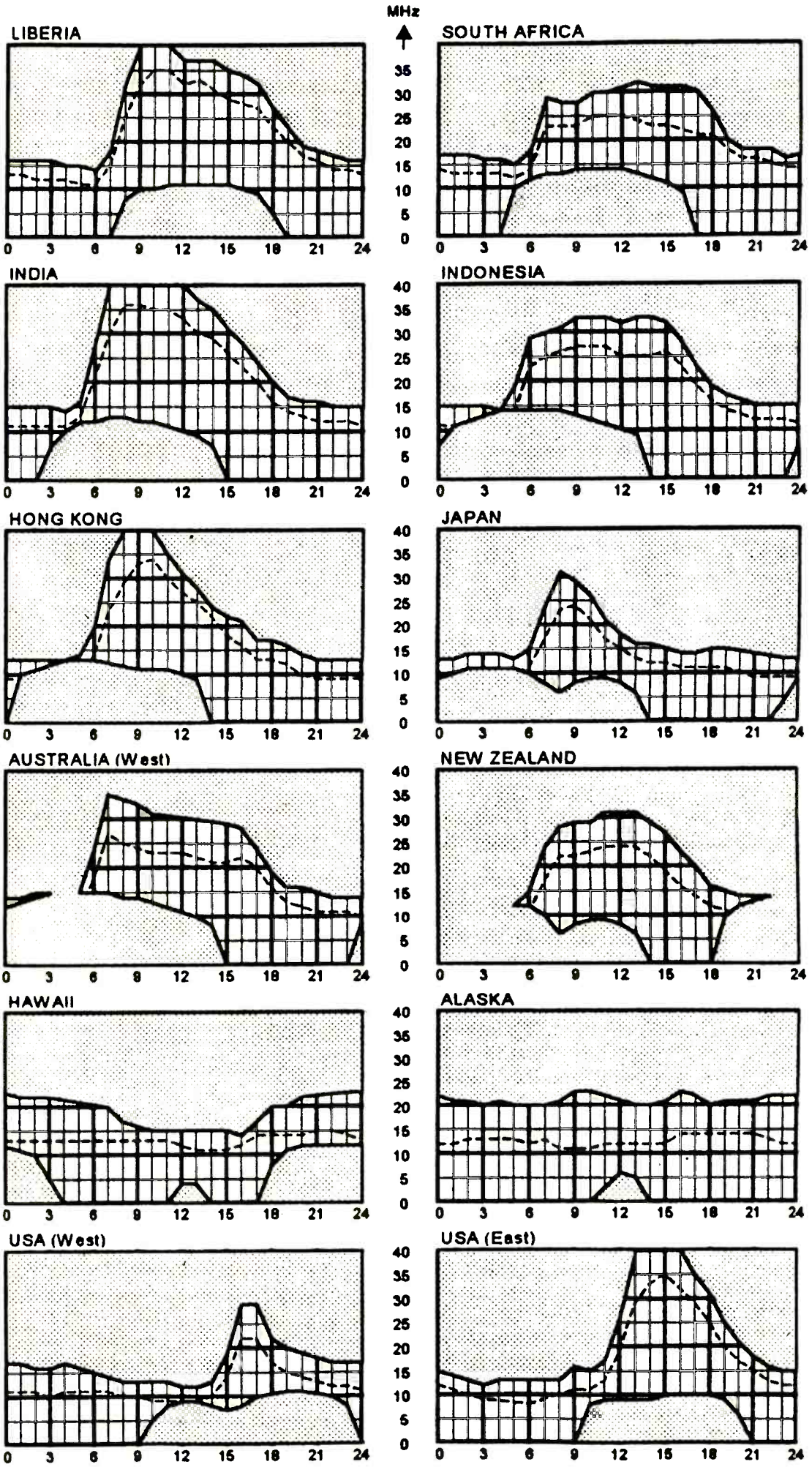
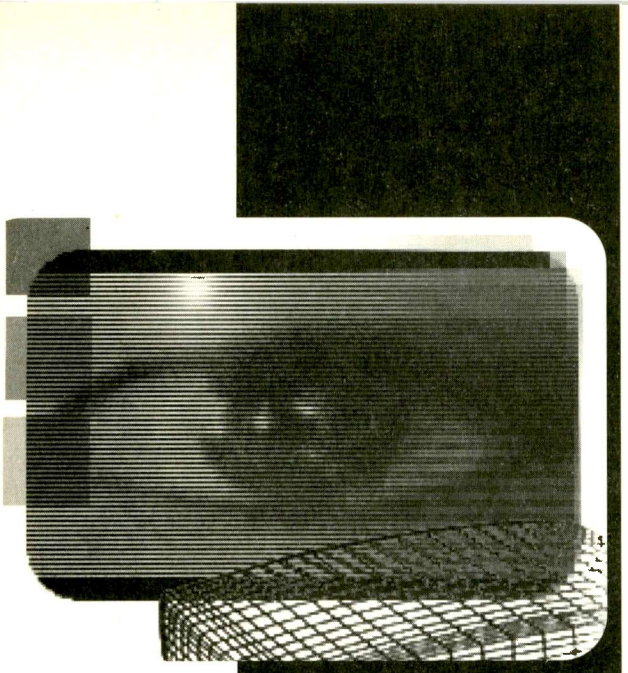


Fig. 1: Frequency/ time charts that predict reception via the F2 layer. Reproduced with permission from the Benelux DX-Club journal. Our thanks to the Club.



TV Fault Finding

Reports from
Kevin Green, TMIIE
Derek Bogiscin
Gerry Mumford
Pete Gurney, LCGI
Stephen Leatherbarrow
Colin J. Guy and
Denis Foley

Panasonic TX21S3T

This was a nice little problem. After an initial inspection the set was switched on and greeted us with a high-pitched whistle, as if the line output transistor was short-circuit. Some checks in the line output stage proved that there were no shorts, but the line drive waveform was in a sad state. A check at pin 9 of IC601 produced a reading of only 3·7V instead of 8V. The cause of the trouble was D861, type 1SS133T-77, which had developed high forward resistance. **K.G.**

Sharp DV3760H (4BSA chassis)

This set seemed to have a tripping problem, with the LED on the front panel flashing. The fault was intermittent. After many tests I found that D602 (1N4936) in the power supply was breaking down under load. It's the rectifier for the 13·5V supply, on the secondary side of the chopper transformer. **K.G.**

Sony KV25F2

There was an unusual problem with this set: it whistled quite loudly, but only in the standby mode. A clue was that Q601 was getting quite hot. The cause of the fault was that C604 (100µF, 50V) hadn't been fitted during assembly. **K.G.**

Sony KVE2542U (AE2A chassis)

This set would start up briefly then shut down and flash its stereo LEDs to indicate a field fault. Checks in the field output stage revealed that the supplies, including flyback boost, were present but the output ramp was flattened at one end. To keep the set on I shorted across the collector and emitter of Q1501 in the protection circuit, as its wasn't being driven as it should be to keep its collector voltage low. What appeared to be CRT current sensing lines could then be seen half way down the screen, while slight movement of the chassis would switch between this and a normal picture.

Checks between pin 3 of connector CN0526 (SAW+) and pin 4 (GND) showed that there was a positive DC shift in the waveform when the fault occurred, but a scope connected to the other end of this lead, at PCB M, showed that there was no change here. I found that the chassis connection was going high, to about 30Ω. The cause was the crimped chassis-connection wire in the plug at the PCB M end. It was loose. Once it had been soldered everything was OK. **D.B.**

B&O 8902

When this set was first switched on the sound was muted. Normally this condition lasted for only a few minutes, and once the sound came up it wouldn't mute again until the set had been switched off and left for some time. Checks around the mono audio detector chip IC3 on the tuner/IF PCB showed that the mute connection (pin 5) was being activated with a DC level of 11V. This feed comes from TR10, which turns on when pin 7 of the line generator chip IC5 goes low – pin 7 is a muting output.

The cause of the trouble was a dry-joint at pin 5 of IC5. It links a 220nF capacitor to a coincidence detector within the chip. The other pins were also going dry. Once this IC had been resoldered there was correct operation of the set. **D.B.**

Goodmans 1410 (Ferguson TX805 chassis)

This smart portable was stuck in standby. When I removed the back I could just hear a slow ticking noise. The combined power supply-line output stage (Wessel circuit) is not easy to work on, but as various cold checks failed to reveal anything amiss a new transformer (Samsung type FCV-1410E12) was fitted. This cured the fault.

When you replace the transformer it is very important to route the white-coloured single wire that's connected between resistor JV33 and chassis between the main body and the core of the transformer, i.e. inside the O core. It's used as a pick-up to feed line pulses to the microcontroller chip IR01, via transistor TR09. If the wire isn't routed correctly the result is sound with a blank raster (no video). Guess how I found out! **G.M.**

Tatung E Series Chassis

This large-screen set was totally dead with the 3·15AT mains fuse FS801 blackened. The fuse had blown because two limbs of the discrete diode bridge rectifier D801-4 (type BY127MGP diodes) were short-circuit, along with the 10nF, 2kV transient suppression capacitor C805, which had split open. In addition the surge-protection thermistor R802 had arced across and burnt up – this was

probably the initial cause of all the destruction. **G.M.**

Beko 19321N (AT3 chassis)

This smart Nicam set appeared to be dead but was tripping. As no shorts could be found on the secondary side of the power supply, attention was turned to the primary side where R111 (820kΩ, 0·5W) and R112 (330kΩ, 0·5W) were both found to be open-circuit. It was strange but fortunate that these two resistors had failed together, as just one of them failing would have resulted in a much more expensive blow up.

When the set was being soak tested it started to produce various intermittent faults, such as no video, or lines scrolling up and down the screen, or no response to remote-control commands. The cause turned out to be poor connections in the socket in which the microcontroller chip IC901 sits. I've had this fault previously with this chassis. As the IC tends to run quite warm, it's wise to upgrade this socket to a high-quality 'turned-pin' type. This will prevent further problems **G.M.**

Ferguson T14R (TX805 chassis)

This set powered up but there was no picture. When I advanced the setting of the first anode control a blank raster appeared. A valuable clue was that there was no OSD either, which led me straight to the RGB output stages on the CRT base panel. I found that the 12V base bias was missing because RT40 (68kΩ, 0·5W) was open-circuit. It forms part of a potential divider, with RT42, that's fed from the 150V line. **G.M.**

Goodmans 2180

There was partial field collapse – in fact only about an inch of vertical scan in addition to the usual bright horizontal line. The chassis uses a discrete transistor class B field output stage, where checks showed that the 2SC2073 npn transistor Q212 was open-circuit. A replacement restored the full scan, but the top was folded over with flyback lines visible. The cause was a dry-joint at D206, which is also in the field output stage. **G.M.**

Toshiba 2500TBT

The field scanning was extremely distorted: the bottom of the picture was missing and the top was stretched. At first glance it looked as if the field output IC was faulty, but checks showed that the DC conditions at its pins were all correct. There are no linearity controls in this chassis, so attention was turned to the feedback loop where C317 (2·2µF, 50V, 105°C) was found to be very unstable thermally. It read correctly when checked with a capacitance meter, but the ESR meter pronounced it open-circuit. A replacement plus resoldering the usual crop of bad joints completed the repair. **P.G.**

Mitsubishi CT25AV1BDS (EE3 chassis)

This TV/satellite receiver was dead: it had apparently taken longer and longer to come on and had eventually died. My first move in this situation is to check the chopper transistor's base drive coupling capacitor C914 (47µF, 35V) as it often dries up. It showed the usual signs of leakage. I fitted a replacement and, at switch on, expected to find that the set worked. But it was still dead.

Voltage checks showed that the power supply was working. The outputs were correct, with the exception of the 5V supply from the TDA8137 regulator chip IC951. Its input at pin 1 was slightly low with plenty of ripple present. The 1,000µF, 16V reservoir capacitor for this feed, C955, had dried up. An ESR check produced a reading of 95Ω.

I decided to replace all the electrolytics on the secondary side of the power supply, using low-ESR types. **P.G.**

Samsung CI5373T

I've had several of these sets in with the same basic problem. The power supply is in the trip mode because of a short across the HT line. The culprit has in each case been DZ801, an R2K type protection diode that's supposed to go short-circuit in the event of excessive HT voltage.

Recently a few of these sets have come in with a stable supply but output diode failure. In all cases there appears to have been gradual failure, with the PCB scorched slightly around the diode and the solder at the ends breaking down because of heat. Replacement has in every case cured the fault, but in addition I usually replace C851 (22µF, 63V) on the primary side of the power supply for improved reliability. **P.G.**

Sony KV27XRTU

The complaint was no picture and a strange noise, though the sound was normal. A quick check revealed that the noise came from the line output transformer while the absence of a picture was caused by no first anode voltage at the CRT base. When I traced the first anode supply back to source I came to the safety resistor R807 (1kΩ, 1W) which was open-circuit. The rectifier diode was OK, and there were no obvious shorts, so a replacement resistor was fitted. At switch on the cause of the original resistor's failure was obvious. Because of a slight spillage on the PCB, the first anode voltage was tracking to chassis via the secondary winding of the line driver transformer.

I cleaned the board carefully to ensure that no tracking could occur. There was a good picture when I switched the set on again, and the noise had vanished. **P.G.**

Hitachi C2118 (G7PS Mk II chassis)

This set was dead with the overvoltage diode ZD903 short-circuit. In a case like this I usually remove the line drive by shorting the line output transistor's base and emitter and use a bulb as a dummy load to determine where the fault lies. At switch on the HT was excessive at 160V, and didn't vary much when the HT preset VR901 was adjusted. The cause of the problem was quickly traced to R909 (39kΩ, 0·5W), which is in series with VR901. **P.G.**

Ferguson ICC9 Chassis

This set would only sometimes come on, and then only from cold. If it came on it would work for a period then either trip or go completely dead. This was accompanied by the red LED flashing in sympathy or no LED light at all. The cause was eventually traced to TP78 (BC848B) in the power supply trip circuit. **S.L.**

GoldStar CIT2172

The customer control levels, particularly contrast and brightness, had to be reset at every switch on. I found that all levels except contrast could be stored to suit the customer. GoldStar technical said that

the contrast cannot be preset: this was strange as it was clearly set at a very low level. I was then told to change the value of R520 to 18kΩ, which restored the contrast to acceptable levels. **S.L.**

Ferguson ICC9 Chassis

A fault we seem to get in batches is failure of the surface-mounted transistors TP66 (BC858B) and TP69 (BC848) in the secondary protection circuit. The set trips but there are no obvious faults. If removal of TP66 results in normal operation, replace these two transistors. Leaks that disappear or temporarily seal-up on application of a soldering iron can be very frustrating/confusing. **S.L.**

Hitachi C2114T

Loss of signals/functions was caused by failure of IC001 (new type TMP47C1237N/N155). This later type must be fitted whenever IC001 fails. A kit, part no. A523217, is available: it consists of the IC (part no. 2001787) and four links (part no. H163020). First delete diodes D021 and D022 and links J015C and J015D. The latter link is beneath IC001. Fit two new links in place of the two diodes and the others in positions J015A and J015B – the latter is also beneath IC001. We obtained our kit from CHS. **S.L.**

GoldStar CF28C22F (PC33J chassis)

The height was very low with a degree of instability. The cause was FR301 (1Ω) in the field output stage supply circuit. It read 30Ω and the voltage across it was 9V. **S.L.**

Ferguson D59N (ICC9 chassis)

This set was stuck in standby. The cause was traced to the 9V regulator IP03. The regulator itself was OK but it had no earth connection. This should be via DP83 (LL4148) which was open-circuit. **S.L.**

Ferguson S59N (ICC9 chassis)

The BUH517TH line output transistor TL19 was short-circuit. When a replacement was fitted it became very hot very quickly and threatened to go the same way. The line driver stage in this chassis is unusual: there's no transformer, a complementary-symmetry transistor arrangement being used instead. Replacing the 2SC2655 npn transistor TL61 in this stage restored normal operation, though it measured OK when checked with a tester. **C.J.G.**

Philips GR1-AX Chassis

There was no chopper action with the HT line sitting at about 8V. R3613 (120kΩ) in the start-up/chopper FET bias circuit was high at about 500kΩ.

In another of these sets, though this time with a Pye badge, the chopper circuit was again inactive with 15V present on the HT line. This was another FET drive circuit fault: zener diode D6610 (BZX79-C10) was leaky. **C.J.G.**

Hitachi C2509T (G7PSL chassis)

This set suffered from field jitter when hot. The fault could be instigated by warming the field output area of the PCB with a hairdryer. Unfortunately cooling almost any component in the area would clear the condition. The 1N4002 flyback boost diode D601 was eventually proved to be the cause. **C.J.G.**

JVC AV25S1EK (MXII chassis)

There were what looked like flyback lines at the *bottom* of the screen, and it was obvious that someone else had been trying to find the cause of the fault. Replacing the TDA3654 field output chip IC441 and the various electrolytics in the circuit made no difference. I eventually discovered that increasing the value of C442 (feedback between pins 5 and 3 of the chip) from 150pF to 470pF cured the fault. **C.J.G.**

Panasonic Alpha 2W Chassis

There was a loud whistle accompanied by horizontal lines on the picture. The electrolytics proved to be blameless: a replacement STR50401 chopper chip restored order. Use a genuine Panasonic replacement. In this chassis some pattern ones explode after running for a few minutes! **C.J.G.**

Goodmans GD2580 (Ferguson TX92 chassis)

The left-hand inch or so of the picture was brighter than the rest, the effect being more noticeable with dark scenes. Teletext was not affected, which ruled out the video output stages and their supply. A check on the CVBS waveform showed that it had a definite peak just after the sync pulse, so attention was turned to the supply rails. No line-frequency waveforms could be found anywhere however. I eventually discovered that decoupling the tuner's 12V supply pin improved but didn't cure the condition. A new tuner cleared the fault. **C.J.G.**

GoldStar CI20A80 (PC31A chassis)

This set would trip momentarily during bright scenes – turning up the first anode preset made the effect worse. Tests proved that the cause of the fault was in the power supply, though it ran all right with a 60W bulb as a dummy load. It seemed that a sudden change in the load rather than the actual value of the load was the cause of the trouble. The electrolytic capacitors were all found to be OK. It was while I was checking the high-value resistors in the power supply that I came across the cause of the fault: R802, which should have read 680kΩ, was actually 68kΩ. It looked to be the one originally fitted. A replacement cured the fault. **C.J.G**

Philips G110 Chassis

The symptoms with one of these sets were lines on the picture, parts of the picture blanked out and no teletext. Fortunately I had another one in the workshop and was thus able to make comparisons and swap over the teletext panel. The cause of the problems was the SAA5231 teletext processor chip IC7830 – make sure that the mask number is correct. **D.F.**

Matsui 1492

The problem with this set was intermittent loss of sync. The composite video signal goes to the sync separator in IC201 (TA8691) via the teletext daughter panel. Remove this panel and check for dry-joints at pins 4 and 8 of connector CP851. **D.F.**

Toshiba 2527DB

There was reduced height with cramping at the bottom of the picture. After replacing the field output chip IC301 and various associated electrolytics I turned my attention to the TA8859P deflection distortion correction chip IC302 and its associated circuitry. C322 (2·2μF, 50V) in the ramp circuit (pin 15) was faulty. For good measure I also replaced C317 (220μF, 16V) which decouples the 12V supply. **D.F.**

Answer to Test Case 448

– see page 345 –

In retrospect TechnoCrat deserved to have this job bounce, with such a casual approach to fault diagnosis during repairs two and three – indeed there had been no attempt at tracing the true cause of the failures, just a series of wrong guesses! On the machine's last visit to the bench (yes, this one was the last!) it was put on soak test and, within an hour, the fluorescent display panel began to flash brighter than normally while continuing to give correct indications. An oscilloscope connected across a 1Ω resistor in series with Z802 revealed that current pulses which peaked at 400mA or more at erratic intervals were present, and that as time went on the pulses became more and more frequent.

The scope was then used to monitor the 'ever +6·6V' line that feeds the DC-DC converter module. This produced a surprise: the voltage kept jumping up to 15V. So attention was turned to the power supply and, specifically, the STK791 chopper chip IC801. When TechnoCrat checked its case temperature he literally burnt his finger. In the device's hot-and-bothered state the internal chopper transistor was erratically shorting across.

A new IC restored normal, reliable operation.

NEXT MONTH IN TELEVISION

Free satellite listing

A separate chart with next month's issue provides transponder frequency listings for the main satellites receivable in the UK.

3D LCD video system

Philips has developed a 3D video system that relies on software for image preparation and an LCD with a lenticular lens arrangement for the display. It's relatively simple and inherently robust. Clarence Cartwright describes the principles and operation of the system.

Servicing in-car audio equipment

Today's in-car audio products are very sophisticated, with one or more microcontrollers in charge. There are four-channel audio amplifiers, which are sensitive to incorrect connections and are thus vulnerable. You will find considerable scope for repair work in this field. Colin J. Guy describes the equipment and the problems you can expect.

Test report: ProVision 8 CCTV

Eugene Trundle assesses a modular CCTV surveillance system that could open up new opportunities for technicians and independent dealers.

Toshiba service briefs

Know-how from Toshiba Technical on TV and video products.

Thyristors and triacs

Mike Rutherford takes a look at the operation of these useful devices and describes some typical applications.

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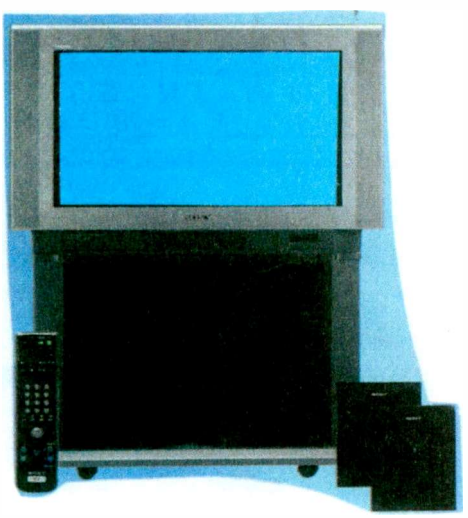

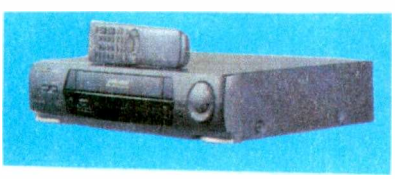

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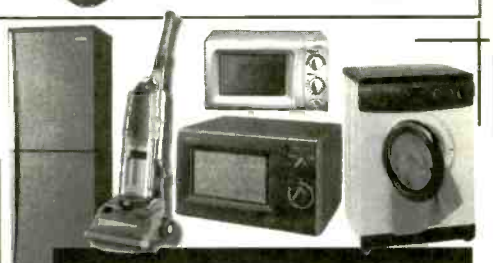

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