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Note that we are unable to answer technical queries over the telephone and cannot provide information on spares other than that given in our Spares Guide.

April issue on sale March 15th.
Next issue, dated May on sale April 19th.
The JOULE A-400 Radio Decoder

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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. DirecTV, the major US satellite TV broadcaster, is likely to merge its operation in Japan with Sky PerfectTV, the largest Japanese satellite TV broadcaster. As its name suggests, Sky PerfectTV 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 PerfectTV 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 broadcasting services. See pages 329 and 355 respectively for further details.

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 of course a result of the adoption of different transmission systems, is becoming increasingly international at all levels. This is of course a result of the adoption 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.

Spare 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.
You can search our www site for video spares, semiconductors, remote controls, satellite gear, line output transformers and CCTV components. Its simple and will only cost the price of a local call. You can order parts, enquire about parts, or simply send a message.

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4. RCPOP4 Amstrad SRD510/520/540/550/600
6. RCPOP6 Fergy RH10/851ND/851X/851K/851N/851X etc etc
7. RCPOP7 Mitsubishi CT21A5ST/XTC21G5ST/CT25A5ST etc etc
8. RCPOP8 Deca 873/32DUV954/170, 180 Series/RC70 Tatung 872/873/1/8735/8755/5973/9734/9821
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SATELLITE FAULT FINDING GUIDE

NEW EDITION No. 5

You could say that Martin Reesling doesn't know about satellite services yet, knowing what he does now has become unnecessary having been an active interest of consuming services. This is the first of a series of manuals. The book has been written and researched by Martin Reesling in depth expertise to the subject, having previously been involved with equipment reliability testing and component specification. Originally entitled Satellite Repair Manual the book has become established as a bible to escaped Rovers.

But the subject doesn't make a new model, new faults - there is always something to add. Since we now have a fifth edition which has been completely updated and now has 300 pages and a much more comprehensive guide to receive fault notes and general information. You'll find many valuable resources for meeting present service codes, starting inspiration choices to factory faults and other less well known operations, printed information on models with typical current drains. Data of manufacturers and suppliers addresses, after sale information and a section on receiver failures.

Digital receivers are now available and the manual guides a chapter to deal with these too.

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April 2000 TELEVISION

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 do repairs. And I don’t blame you.”

“I worked in electronics back in England” I said. “I’m told you do repairs to these things” he piped, as he handed me an Panasonic NVL25B and it was dead. “It’s a 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 tall, thin woman laughed.

I breathed in to speak and got the microphone treatment, so I skipped well back and gabbed “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 odd jobs.

“Do you 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 past week. “This little chap gave up the ghost yesterday. During the past week. “This little chap gave up the ghost yesterday. During the past week.”

The small woman laughed again. She looked up and so did I.

When they’d departed I connected 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, isn’t 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 some-thing would be overheating? When the set again failed I plied the board with a freezer. It made no difference.

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.
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.

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 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.
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 35 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, making the country the leader in DTT viewing. At

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.

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., Wyld’s Road, Castlefield Industrial Estate, Bridgwater, Somerset TA6 4DD. Phone 01278 424 200, fax 01278 425 644 or e-mail ambersil@btinternet.com

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. Enquiries 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.

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

Optical routing 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.

**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-
CABLE TV

Incoming optical fibre from ring circuit.

- Downstream Optical Receiver.
- Diplexer
- Downstream Network Launch Amplifier (60 - 860MHz)
- Signals on HFC network (Bi-directional)

Outgoing optical fibre from ring circuit

- Upstream Optical Transmitter/Modulator
- Upstream Return Path Amplifier 5 - 50 MHz

Incoming telephony optical fibre

- Telephone optical multiplexer and modulator
- Telephone subscriber 'copper drops'. Audio.

Outgoing telephony optical fibre

- Telephone optical demultiplexer and de-modulator and de-multiplexer

75 ohm Line

- 75 ohm branch out
- 75 ohm branch out
- 75 ohm branch out

70% tap

- 150 ohms
- 75 ohm branch out
- 75 ohm branch out

Loss: input to branch = 3.5dB
Loss: branch to branch >= 26dB
Loss: either branch to input = 3.5dB

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 supermarket 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.
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 C905 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 (680pF).

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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Card holder’s name and address: (if different from the above)
Name: ____________________________
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Signature: ____________________________

EURAS International Ltd., EURAS House, 51 Bristol Road, Keynsham, Bristol BS31 2BP
In this concluding instalment Keith Cummins deals with construction and setting up. The modules and their interconnections were described last month.

Off-air test signal source

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 2, 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...
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 47kΩ
R2 100kΩ
R3 2.2kΩ
R4 47kΩ
R5 470kΩ
R6 11Ω
R7 1kΩ
R8 680Ω
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
R2 3.3kΩ
R3 1.2kΩ
R4 152, 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
D2/3 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
R3 10kΩ
R4 2.2kΩ, 0.5W
R5 68kΩ
R6 1Ω
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
CB 0.1µF, 63V disc ceramic
RA 100Ω 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 newreader, 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!
**105° C Radial Electrolytic Capacitors**

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## Satellite PSI Repair Kits

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Remote Controls

**Universal Preprogrammed Remote Control**
- Preprogrammed to cover all major brands of TV, Video, Satellites, and CD Players.
- Replaces up to 8 different remote controls.
- With teletext & fastext functions.

**Order Code**: RC9  
**Price**: £10 + vat

**Bulk Prices**
- 5 pieces: £45 + vat
- 12 pieces: £96 + vat
- 24 pieces: £168 + vat

**Wizard Universal Preprogrammed Remote Control**
- Easy to use.
- Fully illuminated keypad.
- Full learning facility.
- Modern ergonomic design.
- Replaces up to 8 different infrared remote controls.
- Pre-programmed for convenience setup.

**Order Code**: GENIE  
**Price**: £9 + vat

**Universal Brand Replacement Remote Controls**
- For all brands.
- Cordless setup.
- Teletext and Fastext.
- Programmable for the latest models.
- Replaces broken and lost remotes.

**Order Code**: RCUN01M - RCUN14M
**Price**: £10 - £16.50 + vat

**SLX4...............4 Way Aerial Amplifier**
- Designed for TV, Satellite, and FM Receivers.
- 10.5db Gain on all ports.
- Isolation between outputs > 22db.
- Separate UHF/VHF inputs.
- Noise figure < 4db.
- Digital Compatible.
- Frequency Range: UHF 470-863 MHz, VHF 47-230 MHz.
- CE and EMC Tested Certified.

**Order Code**: SLX4  
**Price**: £13 + vat

**Magician Sky Digital Remote Control**
- Operates all SKY digital TV box functions.
- Operates combinations of TV, VCR, and Cable/Satellite systems.
- Covers 1000's of popular brands.
- Full teletext and fastext functions.
- Backlit device indicator keys.

**Order Code**: MAGICIAN4  
**Price**: £10 + vat

**Solder Seal Kits / Hot Air Guns**

**SOLDER SEAL KIT**
- Don't crimp it... SOLCE! IT!!
- For quick and safe cable connection soldering, gluing, and shrinking with a hot air gun all in one action.
- Hot air gun with Piezo electronic ignition.
- Refillable with common lighter gas.
- Blows hot air up to 650°C.

**Order Code**: TOOL53  
**Price**: £13.00 + vat

**HOT AIR GUN**
- Flameless... Only hot air.
- Ideal for the following:
  - Shrinking tubes.
  - Solder seals.
  - Heating and drying.
  - Hobby & modelling.
  - Bending plastics.
  - SMD soldering.
  - Blows hot air up to 650°C.

**Order Code**: TOOL54  
**Price**: £7.50 + vat

Tel: (020) 8900 2329  
Fax: (020) 8903 6126
**Grandyata Ltd**

**Distributor of electronic components**

---

**Scart Kits / Scart Cables / Phono Leads**

**Scart to Phono Adaptors**

**Ultimate Scart Kit (Standard 11 piece kit)**
A comprehensive & practical connector kit for TV, Video, Camcorder & Hi Fi (including NICAM Stereo) connections.

**Order Code**
- PLG27
- PLG26
- PLG25
- PLG24
- PLG23
- PLG22
- PLG21
- PLG20
- PLG19
- PLG18
- PLG17

**Price**
- £10.00 + VAT

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**Phone to Phone Leads**

**Order Code**
- PLG29
- PLG28
- PLG27
- PLG26
- PLG25
- PLG24
- PLG23
- PLG22
- PLG21
- PLG20
- PLG19
- PLG18
- PLG17

**Price**
- £9.00 + VAT

---

**Scart Adaptor Kit**
(Economy 5 piece kit)
An inexpensive but versatile connector kit for TV, Video, Satellite, Hi Fi & some Camcorder connections.

**Order Code**
- PLG1

**Price**
- £4.50 + VAT

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**Transistors / Linear IC's**

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Japanese Transistors, Diodes, Voltage regulators, LEDs, Triacs, Thyristors...etc

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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 disk control unit type ACU512 or ACU812 for use with the Nokia SAT1700 Mk II satellite receiver. Phone Andy on 0122 567 8645.

Wanted: Circuit diagram for the ADE Logic 4 alarm security control panel, photocopy OK. D. Lee, 16 Devonshire Place, Cloughton, Birkenhead, Cheshire CH43 1TU.16.

For sale: Panasonic RQ-DP7 portable DCC player, ex-demo model, boxed as new, with all accessories etc., £50. Contact Ancurm Electronics on 01382 451 511.

Wanted: M520165PC 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 dsmith@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 3U1. 01902 880 803.

Wanted: A T900514-036 chip (1501) for the Hitachi TV Model C21P819 and a ZC84328P chip (IC7) for the Ferguson TV Model 51P7. Mick Pope, 76 Barkby Thorpe Lane, Thurston, 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 BS681, 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, Disky1000, 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: Circuit diagram (photocopy OK) for the Sharp Model C3705 for the Orion combi unit Model 200S video projector. Ian McKeever, 4 Castleview Park, Derry BT48 8DL. 01504 353 613.

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 TX100 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.

BACK ISSUES

We have available a limited stock of the following back issues of Television:

1997
January, February, March, April, May, June, July, August, October and December

1998
January, February, March, April, May, June, August, September, November and December

1999
January, February, March, July, September, October, November and December

2000
January, February and March

Copies are available at £3.50 each including postage. Send orders to:

Reed Business Information Ltd.,
Television Back Issues,
Room L302, Quadrant House,
The Quadrant, Sutton,
Surrey SM2 5AS.

Make cheques/postal orders payable to Reed Business Information Ltd.
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.
Then it was dead!

Fact it wasn't, because when I along announced that it was dead. In positioner ("antenna control unit") Nokia ACU5152 http://www.satcure.co.uk/digibox.htm site:

...box is available at the following web and Digitech on 0161 654 6664.

Further checks showed that there was no output from the 7805 regulating. After putting on my safety spectacles I reapplied power.

When I measured the diodes in the IA04 can go short-circuit, so I started to carry out some checks in this area.

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.

**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) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (1)

(25) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (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’ 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 earthing links 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. Pinn 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 pin Cushion 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 (RGP306) can also fail, though this doesn’t happen as often. The 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 2SC2898 line output 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 sides 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 330µF) or noisy presets (VR301 50kΩ, VR302 100kΩ and VR313 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.

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 MC6803, which sits next to the only socketed IC in the unit (the EPROM U55).

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:

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

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

<table>
<thead>
<tr>
<th>Input to IC401</th>
<th>Brightness level</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>V0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

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, Q66 (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 theLOPT. 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 reflow 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 tag-board 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!

Beberapa 104010
There was no display and the monitor made screeching and chattering noises. The 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 29JS56N, 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 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.

Apricote 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 re-soldering 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.
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, caravanners 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 lain 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, Middlesex 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, Haslemere, Middlesex TW14 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, Middlesex HA8 7EB.
020 8951 4323 Fax 020 8951 4174.

Alba
Radio Ltd., 12 Thames Road, Barking, Essex IG11 OHZ.
Spares for Alba, Bush, Roadstar and some Goodmans and Hinari models. Some Brother microwave, Dirt Devil and Power Devil spares.

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

B65 5YL
01254 683 000 Fax 01254 683 010
e-mail: sales@ard-plc.co.uk

Ariovis
See Comet Group plc.

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

Beovision/Beocord
Bang and Olufsens UK Ltd., Unit 630, Wharfdale Road, Winnersh, Wokingham, Berks RG41 5TP.
0118 925 2532 Fax 0118 925 2500.

Binitone
Electronics plc., Unit 1,1 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.

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, Neasdon, London NW10 0JF.
020 8439 1266 Fax 020 8439 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
Ltd., Component House, Faraday Drive, Fulwood, Preston, Lancs PR2 9PP.
01772 654 455 Fax 01772 654 446.

Dirt Devil and Power Devil spares.

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
Spare available from Hayden Laboratories Ltd., Hayden House, Chiltern Hill, Chalfont St Peter, Gerrards Cross, Bucks SL9 0UG.
01753 888 447 Fax 01753 278033.

Diamond Television
15/15a Rodbourne Road, Rodbourne, Swindon, SN2 2AG.
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- HINARI
- INDEST
- ITT
- KIMARA
- NIKKA
- MASTUI
- MURPHY
- OSAKI
- NORDENDE
- LOEWE-OPTA
- PANASONIC
- PYE
- PHILIPS
- SANYO
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- SHARP
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Dual See Wizard Distributors.
Dynatron Pre-1981 sets, see Philips Service; post-1981 sets, spares from SEME.
Eltfone Electronics Ltd., 4 Beresford Avenue, Wembley, Middlesex, HA0 2HZ.
020 8902 6222
Fax 020 8903 5011.
GenServe (GTS) Ltd., Bridgemead Close, Westmead Industrial Estate, Westmead, Swindon, Wiltshire 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.
GoldmanSee 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, Lancashire PR2 5BD.
01772 470 480/1/2
Fax 01772 654 803.
Spares for Decca, Finlandia, Granada, Rediffusion, Sanyo, Toshiko 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.
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.
HR5 Electronics Ltd., Medca 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.
JTT Spares available from GenServe Ltd. See also CPC, Chas Hyde and Wizard.
JVC [UK] Ltd., JVC House, JVC Business Park, Priorsley 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, Hitherholme, Halifax HX3 8EF.
01422 203 676
Fax 01422 203 674.
Spares for Crown Corporation, Harwood, Kyosho and Sansyang products.
Konica Plane Tree Crescent, Feltham, Middlesex TW13 7HD.
020 8751 6121
Fax 020 8755 0681.
Korting See SEME.
KSA Wholesale Components, 582 Green Lane, Small Heath, Birmingham B9 5SQG.
0121 777 2834
Fax 0121 777 7487.
Authorised spares distributor for Aiwa, Kenwood, Philips, Philix, 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 4DL.
01753 500 400
Fax 01753 517 445.
See also A.R.D., Electronics, CPC and Willow Vale.
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
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Osume See CPC.

Pace Micro Technology plc., Victoria Road, Saltaire, Shipley, West Yorkshire, BD18 3IF.

Panasonic (UK) Ltd., Panasonic House, Willoughby Road, Bracknell, RG12 8FF.

Philips Service Centre, 420/430 London Road, Croydon CR9 4QX.

Pioneer (GB) Ltd., Pioneer House, Hollybush Hill, Stoke Poges, Slough SL2 4GP.

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.

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Samsung Euro Service Centre, Unit A, Stafford Park 12, Telford Shropshire TF3 3BJ.

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Fax 00 353 757 1031.

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

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Fax 0145 02520.

Skantic Spares available from GenServe Ltd. and CPC.

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

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<thead>
<tr>
<th>Name</th>
<th>Address</th>
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<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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Specifications

Switch position 1

<table>
<thead>
<tr>
<th>Bandwidth</th>
<th>DC to 10MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input resistance</td>
<td>1MΩ - i.e. oscilloscope i/p</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>40pF + oscilloscope capacitance</td>
</tr>
<tr>
<td>Working voltage</td>
<td>600V DC or pk-pk AC</td>
</tr>
</tbody>
</table>

Switch position 2

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

Switch position 'Ref'

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

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or e-mail: linda.payne@rbi.co.uk

<table>
<thead>
<tr>
<th>Company name</th>
<th>Web address</th>
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<tr>
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Michael Dranfield describes a unit that provides automatic timer-controlled switching between the outputs from two video cameras with scart output connectors.

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.

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.
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.

<table>
<thead>
<tr>
<th>Parts list</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
</tr>
<tr>
<td>C2</td>
</tr>
<tr>
<td>C3</td>
</tr>
<tr>
<td>C4</td>
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<tr>
<td>C5</td>
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<tr>
<td>R1</td>
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<tr>
<td>R2</td>
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<td>R3</td>
</tr>
<tr>
<td>R4</td>
</tr>
<tr>
<td>R5</td>
</tr>
<tr>
<td>D1</td>
</tr>
<tr>
<td>D2</td>
</tr>
<tr>
<td>D3</td>
</tr>
<tr>
<td>Tr1, 2</td>
</tr>
<tr>
<td>IC1</td>
</tr>
<tr>
<td>RLY1</td>
</tr>
</tbody>
</table>

Miniature type with single-pole changeover contacts
Twin outlet scart splitter box. From CPC, part no. AVSA4

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ONmail
ONdigital's e-mail service ONmail is due to become available at about the time this issue goes for press. A modern 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 radio newsletter can obtain the entire archives to date on CD-ROM for just £5 plus VAT from SatCure, PO Box 12, Sandbach, Cheshire CW11 7XUA (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, Swindon, Wiltshire SN5 8RW. 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.

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 \( I = C \frac{dv}{dt} \), 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.

<table>
<thead>
<tr>
<th>Dielectric</th>
<th>Minimum film thickness (microns)</th>
<th>Dielectric constant at 23°C</th>
<th>Max. temp. (°C)</th>
<th>Dissipation factor at 100kHz (%)</th>
<th>Insulation time constant*</th>
<th>Capacitance change at 60°C (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester</td>
<td>0.9</td>
<td>3.3</td>
<td>125</td>
<td>1.7</td>
<td>25k</td>
<td>+1</td>
</tr>
<tr>
<td>Polycarbonate</td>
<td>1.5</td>
<td>2.8</td>
<td>125</td>
<td>1</td>
<td>25k</td>
<td>-0.2</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>4</td>
<td>2.2</td>
<td>100</td>
<td>0.02</td>
<td>100k</td>
<td>-1</td>
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<tr>
<td>Polystyrene</td>
<td>4</td>
<td>2.5</td>
<td>85</td>
<td>0.02</td>
<td>100k</td>
<td>-0.2</td>
</tr>
<tr>
<td>Polyphenylene sulphide</td>
<td>2</td>
<td>3</td>
<td>150</td>
<td>0.12</td>
<td>10k</td>
<td>-0.2</td>
</tr>
<tr>
<td>Paper</td>
<td>7</td>
<td>5.5</td>
<td>100</td>
<td>2</td>
<td>15k</td>
<td>+1.2</td>
</tr>
</tbody>
</table>

*C x R (insulation) secs.

Frquency 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.

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.

<table>
<thead>
<tr>
<th>Dielectric</th>
<th>Construction</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester</td>
<td>Metallised, wound, 100V DC, 27.5mm pitch</td>
<td>4V/μsec</td>
</tr>
<tr>
<td></td>
<td>Metallised, wound, 63V DC, 5mm pitch</td>
<td>110V/μsec</td>
</tr>
<tr>
<td></td>
<td>Foil, wound, 100V DC, 27.5mm pitch</td>
<td>10KV/μsec</td>
</tr>
<tr>
<td></td>
<td>275V AC wound with metallised paper, 15mm pitch</td>
<td>1.5KV/μsec</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>Metallised, layer</td>
<td>10V/μsec</td>
</tr>
<tr>
<td></td>
<td>Metallised, wound, 160V DC, 27.5mm pitch</td>
<td>15V/μsec</td>
</tr>
<tr>
<td></td>
<td>Foil, wound</td>
<td>10KV/μsec</td>
</tr>
<tr>
<td>Polycarbonate</td>
<td>10mm pitch leads, 100V DC</td>
<td>60V/μsec</td>
</tr>
<tr>
<td></td>
<td>27-mm pitch leads, 100V DC</td>
<td>9V/μsec</td>
</tr>
<tr>
<td>Polyphenylene sulphide</td>
<td>Surface mount 25V</td>
<td>30V/μsec</td>
</tr>
<tr>
<td></td>
<td>Surface mount 160V</td>
<td>70V/μsec</td>
</tr>
</tbody>
</table>
VCR Clinic

Reports from
Philip Blundell, AMIEEElec
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 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 JV45 respectively. P.B.

Panasonic NVF65
There was bad patterning on the E-video, the result being poor recordings. Checks 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 5LVE700
There were two faults with this Nicam VCR. First tape chewing and terrible tracking. The cause of this was the take-up tape guide backing 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 CPI 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, reloch 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 snappped, 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 NV145
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 STR1106 chopper chip. M.M.

Bush BT1430
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.
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.

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. Od. (£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 dryers, 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 Parn 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 transmitters 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-speed 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 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...
In 1969 I went to work for a leading TV repair company. Of course, we didn't have the vast amount of equipment that is available today. The company had a large stock of oscilloscopes and other test equipment, but it was mainly used for repair work. We had to be able to repair any type of TV set, from the basic Baird to the more advanced Phillips models.

One of the main tasks I had was to diagnose problems with the TV sets. This involved using oscilloscopes to check the signal levels and waveforms. We also had to be able to identify the problems and suggest a repair solution.

The company had a large stock of oscilloscopes, including some very old models. We had to keep them all in good working order, which was not always easy. Some of the older models were not very reliable and would often break down.

Another task I had was to help customers with their TV sets. We had a large number of customers who brought their sets in for repair, and we had to be able to provide a good service. We had to be able to identify the problem and suggest a solution, and then repair the set quickly and efficiently.

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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 a shop without paying for it. You cannot remove the equipment, 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 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
LETTERS

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. Naive 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, Broadband 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 Goodrich. Then, in 1990, my first set was a Trinitron colour set, purchased 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 as £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 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. People who own monster sets expect them to be repaired as cheaply as they would like their two-bob televisions 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 and 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 to 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 TV 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 I was looking for 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 vividly 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.

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 Metal Rectifiers (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 there!) 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 1A486/100 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

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 Matsui 9000. 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-suiss-c.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 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.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Pol</th>
<th>Channels and EPG numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.720 (1) S</td>
<td>H</td>
<td>BBC 1 England and Northern Ireland (101), BBC2 (102), BBC Choice (160), News 24 (507), BBC Knowledge (553),</td>
</tr>
<tr>
<td>11.740 (2) S</td>
<td>V</td>
<td>Living (112), Challenge (121), Bravo (124), Trouble (607), TVX Cable Travel Shop** (not in EPG – see 11.954GHz H)</td>
</tr>
<tr>
<td>11.758 (3) N</td>
<td>H</td>
<td>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)</td>
</tr>
<tr>
<td>11.778 (4) N</td>
<td>V</td>
<td>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.</td>
</tr>
<tr>
<td>11.798 (5) S</td>
<td>H</td>
<td>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.</td>
</tr>
<tr>
<td>11.817 (6) S</td>
<td>V</td>
<td>UK Gold (109), UK Gold 2 (110), UK Style (148), UK Arena (151), UK Horizons (544), UK Play (644),</td>
</tr>
<tr>
<td>11.837 (7)</td>
<td>H</td>
<td>Premier (301), MovieMax (308), CNBC (510), Box Office 1-5 (701-705), Sky 1 Cable feed (not in EPG),</td>
</tr>
<tr>
<td>11.856 (8)</td>
<td>V</td>
<td>Premier 2 (302), MovieMax 2 (309), Sports News (413), National Geographic (538), Box Office 6-10 (706-710),</td>
</tr>
<tr>
<td>11.876 (9)</td>
<td>S</td>
<td>Discovery Channels (531-535), Animal Planet (550),</td>
</tr>
<tr>
<td>11.895 (10) S</td>
<td>V</td>
<td>Paramount (127), Sci Fi (130), Nickelodeon Junior (606), MTVs (631, 632, 633 and 638), VH1s (635-636), Prime TV (not in EPG),</td>
</tr>
<tr>
<td>11.914 (11)</td>
<td>H</td>
<td>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.</td>
</tr>
<tr>
<td>11.934 (12) N</td>
<td>V</td>
<td>Premier 4 (304), MovieMax 4 (311), Sky Sports in pubs (401-3), Box Office 16-20 (716-720),</td>
</tr>
<tr>
<td>11.954 (13) S</td>
<td>H</td>
<td>Travel* (653), TVX (977), Testcard** (not in EPG).</td>
</tr>
<tr>
<td>11.973 (14) S</td>
<td>V</td>
<td>Sony Asia (670), Music Asia** (677), Zee Bangla (678), Bangla TV (679), Pakistanti TV (680), Asia 1 (682), Minaj (695), Channel East** (688).</td>
</tr>
<tr>
<td>11.992 (15)</td>
<td>N</td>
<td>Open shopping.</td>
</tr>
<tr>
<td>12.012 (16) N</td>
<td>V</td>
<td>Open shopping.</td>
</tr>
<tr>
<td>12.032 (17) S</td>
<td>H</td>
<td>Open shopping.</td>
</tr>
<tr>
<td>12.051 (18) S</td>
<td>V</td>
<td>Travel* (181), TCM*** (327), CNN* (513), Cartoon Network (601), OVC UK* (650), Shop* (656), CNN Radio** (not in EPG).</td>
</tr>
<tr>
<td>12.070 (19) N</td>
<td>H</td>
<td>Cinema (315), Sky News* (501), Cartoon Network + 1 hour (602), Box Office 21-25 (721-725),</td>
</tr>
<tr>
<td>12.090 (20) N</td>
<td>V</td>
<td>Sky 1 (106), Disney (115), Cinema 2 (316), Business (480), Box Office 26-30 (726-730),</td>
</tr>
<tr>
<td>12.110 (21) S</td>
<td>H</td>
<td>U Direct Films (800-811), Classic FM* (916), Classic Gold* (919), The Mix* (920), Planet Rock* (921), Core* (922). All '900' chs radio,</td>
</tr>
<tr>
<td>12.129 (22) S</td>
<td>V</td>
<td>Ch. 4 Wales/SAC (184), BBC Parliament* (508), SAC 2* (519), Simply Money* (522),</td>
</tr>
<tr>
<td>12.148 (23) N</td>
<td>H</td>
<td>Granada Plus (118), Bloomberg (504), Nickelodeon UK (604), Box Office 31-35 (731-735), Box Office 70 (770), Info ch. (999).</td>
</tr>
<tr>
<td>12.168 (24) N</td>
<td>V</td>
<td>Sky Travel (145), Tara (178), MUTV (410), Box Office 36-40 (736-740), Playboiy/Adult (974), Info ch.** (998).</td>
</tr>
<tr>
<td>12.188 (25) S</td>
<td>H</td>
<td>Music Choice 1946/7/8** (851-886). Three music channels addable in extra channels, non-encrypted,</td>
</tr>
<tr>
<td>12.207 (26) S</td>
<td>V</td>
<td>Sky Sports Extra (404), Sports News (413).</td>
</tr>
<tr>
<td>12.226 (27) N</td>
<td>H</td>
<td>Breeze (138), Men and Motors (139), Racing ch. (416), History ch. (541), Computer ch. (547), Box Office 41-45 (741-745), Midnight Blue (980).</td>
</tr>
<tr>
<td>12.246 (28) N</td>
<td>V</td>
<td>Ski 1 cable (not in EPG), MovieMax (308), CNBC (510), Box Office 1-5 (701-705). Some duplication with transponder 7.</td>
</tr>
<tr>
<td>12.266 (29) N</td>
<td>H</td>
<td>MovieMax 5 (312), Fox Kids (611), Box Office 49-53 (749-753), Retail info Ireland (997).</td>
</tr>
<tr>
<td>12.304 (31) N</td>
<td>H</td>
<td>Open shopping.</td>
</tr>
<tr>
<td>12.324 (32) N</td>
<td>V</td>
<td>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.</td>
</tr>
<tr>
<td>12.363 (34) S</td>
<td>V</td>
<td>National Geographic + 1 hour (598), Nickelodeon Replay (605), Box Office 754-758 and 765-768.</td>
</tr>
<tr>
<td>12.382 (35) N</td>
<td>H</td>
<td>Sports Extra (404), Eurosport (419), Fox Kids (810), The Box (841), God Ch.* (891), Box Office Preview (700), Box Office 46-48 (746-749),</td>
</tr>
<tr>
<td>12.460 (39) N</td>
<td>H</td>
<td>Sports 2 interactive cricket and various sports tests (402).</td>
</tr>
</tbody>
</table>

* Frequency in GHz. Transponder number in brackets. N = north footpring, 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 can be used 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), SAC 2 (519), Simply Money (522), QVC (560), Shop (565), 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 SAC on 104 and Ch. 4 on 184 (in other areas the numbers are reversed and SAC 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.

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.

It's 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, Pasadena) 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 Bergamo 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 Armando (31.5°W) at 3.990GHz H, 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 pixelation. Sky Sports News was found at Intelsat 801 (31.5°W), another marginal signal with colour bars and a rolling ident “BT-TESS-34”. Frequency was 10.995GHz V, SR 5.632, FEC 3/4, VPIID 308, APID 239.

President Clinton and his wife Hillary 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, live interviews for ABC News, USA. Conference topics included Nazi war crimes, Latvian atrocities,

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 broadcasting bill. The government has 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.

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.

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.

Another new Intelsat craft, New Intelsat-Alpha, will be positioned at 50°W. Intelsat has been carrying out tests on the inter-operability 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 Altea 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 with 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 of 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 Yedhoven, reproduced here by courtesy of the Benelux DX Club. They relate 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 predicted 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. 1 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. RI 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.
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 30kΩ. 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. The customer control levels, particularly contrast and brightness, had to be reset at every switch on. I decided to replace all the electrolytics, and use a bulb as a dummy load 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.

**Goldstars 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 (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 TDA1137 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 C1537ST**

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 D2801, 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 over-voltage 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 TMP47C1237N1155). 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 link 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 GRI-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 IN4002 flyback boost diode D601 was eventually proved to be the cause. C.J.G.

**JVC AV2551EK (MX1111 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.

**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 PC851. D.F.

**Toshiba 2527DB**

There was reduced height with cramping at the bottom of the picture. After replacing the field output chip IC302 and various associated electrolytics I turned my attention to the TA8859P deflection distortion correction chip IC302 and its associated circuitry. C322 (2-µF, 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 1 µF capacitor 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 46.6V’ 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.

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

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**FACTORY GRADED (MINT)**

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**NEW HIGH STREET RETURNS**

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**Lava Lamps, Table Lamps, Floor Lamps, Touch Lamps, etc.**

**MR CAR SUMMER TITS**

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**Trimmers, Foot Spa, Phones, Car Battery Chargers, Audio Karaoke, Massager, Facial Saunas, etc.**

**R.C. Toy Cars**

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<th>Reference</th>
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<td>1.6±0.8</td>
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**Features**

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<th>Reference</th>
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**Features**

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