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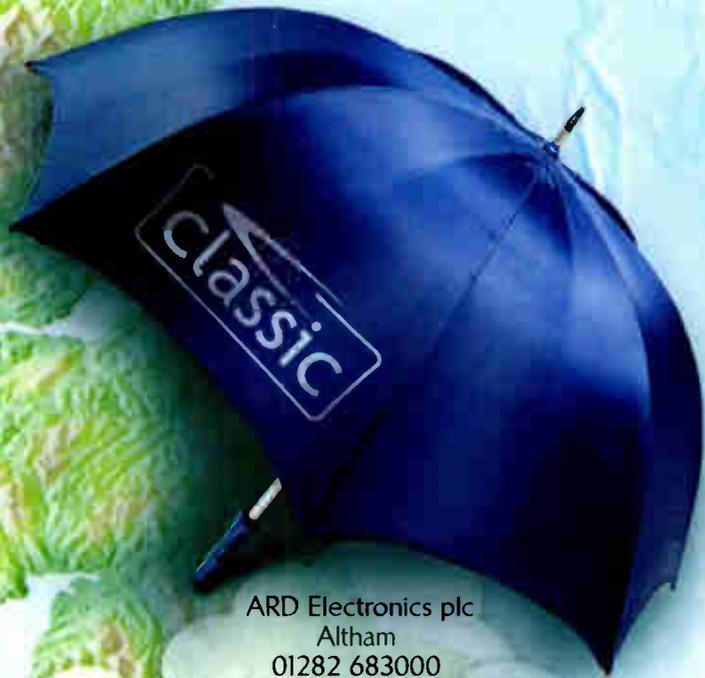
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### Editor

Martin Eccles

### Consultant Editor

John A. Reddihough

### Group Advertisement Sales Executive

Pat Bunce  
0208 722 6028  
Fax 0208 770 2016

### Editorial Office

01782 870684  
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# How we use TV

Prior to the economic downturn that preceded the events of September 11th, the US had been enjoying a prolonged economic boom. It lasted from about 1995 until 2000, during which time there was an unusually favourable combination of economic conditions: a relatively high rate of growth in economic activity year by year, a low rate of unemployment, and a low rate of inflation. Normally inflation soon takes off during a period of rapid growth: the central bank then ups interest rates, and the boom comes to an end. But on this occasion it didn't happen that way.

What could have been the cause of this highly successful half decade of economic activity, which came to an end when the boom exhausted itself rather than when the central bank called a halt? The generally accepted answer is increased productivity. If labour and capital are increasingly productive, inflation will be held in check. It seems that the annual increase in productivity in the US during the period 1987-1995 was about 1.4 per cent; during the "economic miracle" period of 1995-2000, productivity increased by something like 2.5-3 per cent a year. What led to this productivity jump? Why, all that investment in information technology and all those PCs of course.

This has been the accepted view – after all it seems obvious, doesn't it? – and has been put forward by no less an authority than Alan Greenspan, chairman of the Federal Reserve. You might call it the current economic orthodoxy. But a report just published by McKinsey Global Institute, the management consultancy group's research arm, calls it into question. The report comes to the conclusion that in most parts of the US economy substantial increases in IT investment did not lead to any improvement in productivity. While there was "a big jump in capital spending on IT and a big jump in productivity in the economy as a whole at the end of the Nineties, the actual correlation between the two is very weak" the report says.

To find out which sectors had contributed most to productivity growth, the McKinsey researchers started off with official government data from the

Bureau of Economic Affairs. Companies in each sector were then investigated to establish what produced the growth. The researchers found that nearly all the post-1995 growth in productivity occurred in six sectors: retail, wholesale, securities, telecoms, semiconductors, and industrial equipment (mainly computers). They represent just under a third of the non-agricultural private-sector economy. The other two-thirds (53 sectors) contributed only 0.3 per cent of the productivity growth. But, wait for it, they accounted for almost two thirds of the increase in

## Home access to the internet rose substantially between 1999 and 2000

IT investment! In many of them there was actually a decrease in productivity.

A number of factors contributed to the productivity increase in the six sectors that provided nearly all of it. IT investment was just one factor. For example in retailing, which accounted for almost a quarter of the total productivity increase, the main contribution came from Wal-Mart, because of its emphasis on large stores and discount pricing. Other companies were forced to follow its example. The report goes on to list economies of scale as the main contributor to increased productivity in securities, regulatory changes as the main contributor in telecoms, Intel's shorter product cycles as the main contributor in the semiconductor industry, and improvements such as enhanced software as the main contributor in the computer industry.

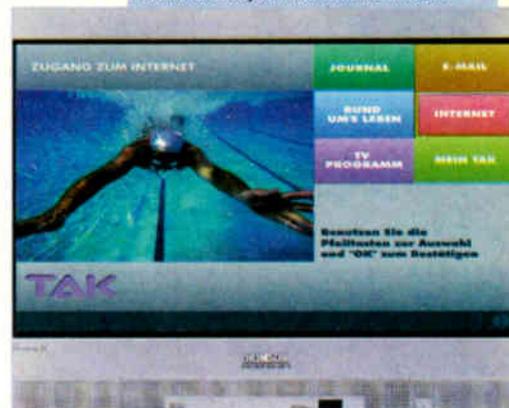
In many industries the researchers found what they refer to as the "IT paradox": although companies invested heavily in IT, there was little by way of any tangible gain. In fact there was a decline in productivity in the 53 sectors outside the leading six – a decrease of 0.3 per cent compared to an increase of 0.4 per cent during the previous eight years. A striking example is provided by retail banking: companies bought an average of two PCs per employee between 1995-1999 with no gain in efficiency.

Should we be surprised by all this? Not really. Information is helpful only if it is accurate and

relevant to particular needs. More and more information for the sake of it doesn't help: it can just cause confusion. More information contributes to productivity when, for example, feedback from the retail end of the production chain to the manufacturing end leads to more efficient working. At the other extreme, consider the vast increase in e-mailing. Does sending out millions of e-memos add anything to productivity? It can do the opposite, as more and more time is wasted by those who send and receive them.

The PC itself is a wonderful tool for doing things quickly and efficiently. But the business improvement provided tends to be one-off. Once you've computerised a process, say the accounts or laying out the pages of *Television*, what then? The big leap has been taken, and there is not much more to be gained.

It is to everyone's benefit that the McKinsey researchers have exposed the defects in some common assumptions about IT and productivity. We still can't be sure about what led to the "economic miracle" in the US. In fact it's likely that in the years to come book upon book will try to analyse the phenomenon. In all likelihood luck played a significant part: a fortunate concurrence of factors at a particular time. What we should appreciate is that there are no simple ways of guaranteeing economic advance – and that things like cable, IT and broadband will help only if properly understood and wisely used. ■



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All correspondence regarding advertisements should be addressed to the Advertisement Manager, *Television*, Cumulus Business Media, Anne Boleyn House, 9-13 Ewell Road, Cheam, Surrey, SM3 8BZ. Editorial correspondence should be addressed to *Television*, Editorial Department, Cumulus Business Media, Anne Boleyn House, 9-13 Ewell Road, Cheam, Surrey, SM3 8BZ.

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# TELETOPICS

## BBC's digital TV moves

The BBC has been holding discussions with the ITV companies and Channel 4 on establishing a joint digital terrestrial TV operation. If it goes ahead, Channel 5 would be invited to join in. The aim would be to create a company that would manage the participants' broadcast and transmission operations, enabling the free-to-air services to cut costs and promote digital TV jointly. The cost cutting would help ITV Digital, which is at present a huge drain on its owners Granada and Carlton Communications.

The joint company would develop and make available an FTA set-top box that could be upgraded for reception of the pay-

TV channels – talks have been held with Pace on this. The box would probably sell for about £100, through normal retail trade outlets, and enable some twenty channels to be received at no further cost to the viewer. A conditional-access module costing £20-£40 could be added to provide reception of the pay-TV DTT channels.

This is no doubt just what many of those who are hesitant about switching to digital TV want. It would help ITV Digital's finances immensely if the free provision of digiboxes could be ended, while for the BBC the scheme would ensure continued transmission independently of the satellite and cable companies.

The BBC has in addition been seeking to include some at present subscription UK TV channels with its FTA transmissions. UK TV is 50-50 per cent jointly owned by the BBC and Flextech, the content arm of Telewest. In practice the BBC provides most of the content.

The BBC has also been considering a digital satellite TV project that would again provide free TV once the viewer had bought a dish/STB. The move would ensure that the BBC has continued independent transmission facilities regardless of what happens terrestrially, and would provide UK-wide reception.

## Alba halts internet-TV

Alba has decided to call a halt to its Bush internet-TV service. The dial-up via TV service was started in March 2000, with a target of signing up 750,000 subscribers within a year. To date only some 170,000 sets have been sold, and the service cost Alba almost £18m to run during its last financial year.

The Bush Internet portal is being incorporated with the ITV Active portal. Alba will continue to provide an ISP service for its 170,000 registered users, but expects to sell the operation. It seems that the joys of the internet were not keenly sought after by Bush Internet subscribers, who used the service mainly to send e-mails.

Alba chief executive Daniel Harris remains convinced that there is a future for mass-market access to the internet via TV, but concludes that the Bush venture couldn't be brought to profitability within a reasonable time scale.

## Boxclever closes outlets

Boxclever is to close over 240 of its stores. When Boxclever was formed in 1999, following the merger of the Radio Rentals and Granada rental businesses, there were over 900 outlets – twelve years previously the two companies had 2,400 stores between them. The number of outlets has been steadily decreasing, partly because of its 2-4m customers increased willingness to rent and make payments via the company's call centres and the internet.

Boxclever intends to concentrate resources on its Endevo operation, which acts as a subcontractor for other high street retailers, providing delivery, installation and servicing facilities. No details of redundancies have been released – the company hopes to redeploy as many staff as possible in its call centres and Endevo operation.

## ITV via satellite

ITV has reached agreement with BSkyB to transmit ITV1 and ITV2 via the latter's digital satellite platform. ITV will pay Sky some £15m a year for access to the Sky system. A further deal covering ITV Sports is under discussion. ITV leased three Astra 2D transponders in March 2001, for ten years, and has since been carrying out tests. The new agreement will mean that ITV can be received using Sky digiboxes, with inclusion in Sky's EPG. ITV and Sky had been haggling over the terms of the agreement for over a year. Carlton Communications and Granada will benefit by some £50m a year through the 'digital dividend' – a government scheme under which companies get a rebate depending on the number of their viewers who convert from analogue to digital reception.



*LG Electronics has demonstrated a prototype 52in. table-top TV set that uses Texas Instruments' digital light-processing technology. The latter is a projection system based on the TI digital micromirror optical chip. This digital processor chip has up to 1,310,000 hinged, microscopic mirrors mounted on it: they operate as optical switches, controlled by the processor. TI has supplied over 750,000 DLP subsystems since 1996. A number of manufacturers are expected to announce new home entertainment products based on TI's DLP technology during 2002. For more information on DLP technology, visit [www.dlp.com](http://www.dlp.com)*

# Pace calls for action on digital TV

Pace says that the government's plans to convert the remaining sixty per cent of the UK population to digital TV by 2006-2010 are in jeopardy because viewers are not prepared to foot the bill for a service they do not understand or feel they need. Research carried out for Pace suggests that a third of the UK population has no idea about any of the benefits of digital TV and what it could mean for them. As a result, 92 per cent of respondents didn't believe that they should have to pay to switch to digital themselves – more than a third thought that the government should foot the bill. Pace has launched a Digital Switch Manifesto that sets out the actions it believes are necessary to ensure that the digital switchover remains a realistic goal.

The research revealed that a quarter of respondents would not be prepared to pay anything to switch to digital TV. Amongst older people, forty per cent would not be prepared to pay anything for digital TV and a further forty per cent were unsure about the costs involved. When viewers were asked about who should pay for the digital switch, the government came top of the list followed by broadcasters in general. Only eight per cent felt it was their own responsibility to pay for switching to digital TV. Half the population do not realise that a digital switchover is even a possibility during the current decade. The UK public will wait and see before buying a digital STB or IDTV set. The vast majority have

either not made up their minds or are waiting for the analogue switch-off to draw closer.

Pace says that delay will harm the UK's leadership in digital TV and also deepen the social divide, as digital technology provides a wider range of services including interactive TV and access to the internet. Pace adds that the switch to digital operation will have a favourable impact on the UK economy, not just for those involved in the associated manufacturing and distribution but also in broadcasting and advertising.

Pace urges the government to adopt a proactive stance by using public awareness and information campaigns to clarify and demystify digital TV terminology and ensure that the populace clearly understands the digital services on offer and what will suit individual needs. This would, Pace believes, lead to the delivery and marketing of more services by private-sector companies, further accelerating the momentum towards digital.

Pace urges the government and industry to collaborate on research into the possibilities of digital TV as a medium. It feels that subsidised STBs or a cheaper licence fee should be considered.

Pace's new low-cost terrestrial digital TV STB, Model DTR500, is expected to go on sale during the first half of 2002. It can be adapted for FTA and/or pay-TV reception and is about half the size of previous models.

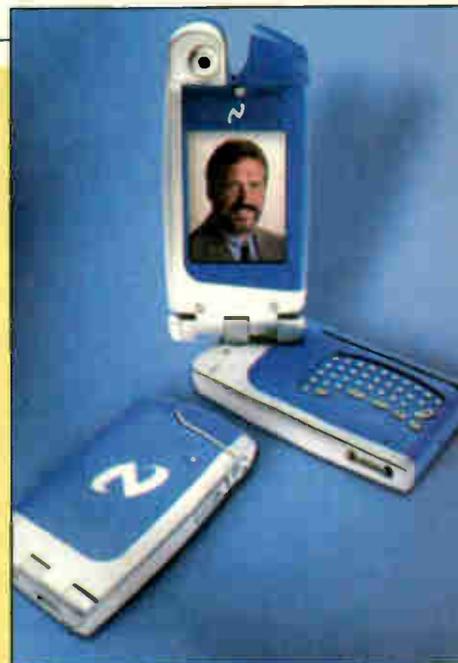
## NTL – and its towers

Cable TV company NTL has announced a 33 per cent increase in pre-tax losses during its latest financial year, to £713m. A particular problem is interest payments because of NTL's high level of borrowings (£12bn). NTL has been hoping to reduce these through the sale of its transmission towers division – the old ITA transmission network. But this is proving difficult in present media industry conditions. Earlier estimates that the business could bring in up to £1.7bn have been reduced to something in the region of £1bn. Last year NTL's towers business had revenue of £210m, an increase of 16 per cent. Transmission masts could be an

attractive proposition: revenues are expected to rise as 3G mobile services come into operation, while planning restrictions make it difficult to establish new sites.

NTL now has 1.14m digital TV subscribers, and has signed up 79,000 broadband internet subscribers. Average revenue per subscriber is now £39.50 a month, up from £35.10 in the previous year.

NTL and Telewest have agreed to develop jointly a standard for broadband TV services, enabling text, audio and video to be linked with TV programmes. Shopping, betting, games and interactive advertising applications could be included.



*National Semiconductor has unveiled a prototype hand-held device, the Geode Origami, that combines eight consumer electronic products in one unit. It's the size and weight of a small digital camcorder and folds and unfolds to provide the various functions – wireless video communication and phone, digital camera, camcorder, MP3 audio player, PDA, internet access and e-mailing. It uses Microsoft Windows OS software.*

## Latest TV indexes

The 2002 *Television Index and Directory* is now available on CD-ROM at £199. It covers fourteen years of *Television* magazine issues, from 1988-2001, with over 14,000 fault reports in full and the text of over two hundred servicing articles, with improved searching.

A full update for those with previous index CD-ROMs, including the index, fault reports text and servicing articles, is available at £46. An index only update is available for £16.

A six-month update of the index and fault reports will be available in May 2002. If you wish to take advantage of this, £10 should be added to a full update order.

For further details apply to SoftCopy Limited, 1 Vineries Close, Cheltenham GL53 0NU. Phone 01242 241 455 or e-mail [sales@softcopy.co.uk](mailto:sales@softcopy.co.uk)

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## BT broadcasting

British Telecommunications has applied to the ITC for a licence to provide TV services. The licence would enable BT to provide multi-channel TV and video-on-demand services via copper phone lines, using ADSL technology. BT has no immediate plans to launch such services.

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The data has been arranged in order by brand model/chassis and fault symptoms to provide a quick reference to numerous fault conditions on a range of models.

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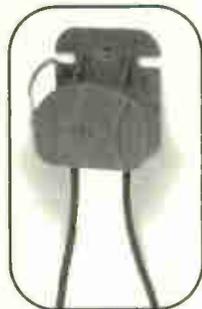
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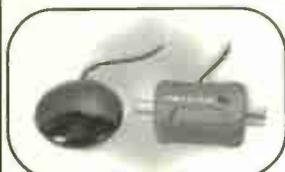
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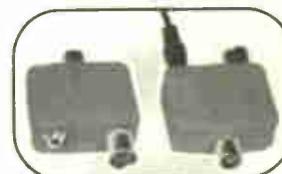
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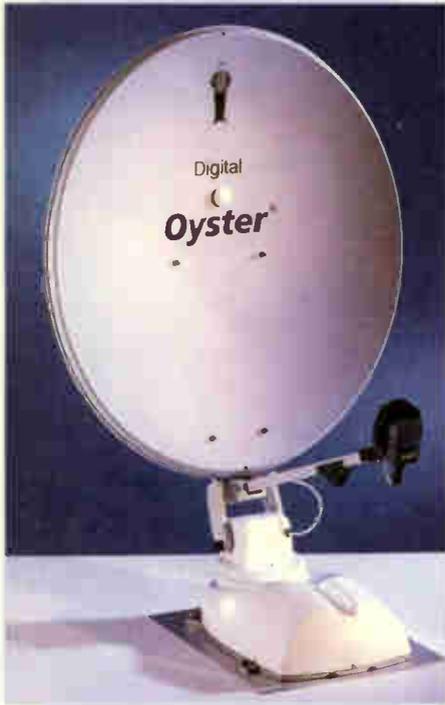
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# Tom Baker's tales

This time fitting a satellite dish to a motor home, a Ford car radio problem and a couple of TV puzzles

In previous articles I've described some of the things I have been asked to fit to motor homes. I'll continue with the same theme to start off with this month, then mention one or two other problems I've had to sort out recently.

## Fitting a satellite dish to a motor home

Have you ever tried fitting a standard domestic Sky Digital dish? When you fit these dishes for a living you can make it look so easy, but when you've not previously had anything to do with them it can be anything but easy. If there are no other dishes to be seen you first need to get your bearings with a compass. Next you must pick a clear site for the dish, watching out for trees and other obstructions. Then you have to fit the dish to the wall, securely and straight. Finally the all important thing, get your meter out and look and listen for the signal. Go inside and check the pictures, on all the horizontally and vertically polarised channels.

The task is rather more involved when you are asked, as I was recently, to fit a satellite dish to a motor home. It was a

specially-adapted system designed for fitting on caravans, boats, lorries and motor homes. The kit consists of a dish and a unique mechanism that enables the dish to be raised or lowered (for travelling) and turned from inside the vehicle.

The system comes with excellent, comprehensive fitting instructions. You shouldn't have any major problems if you read through these carefully then follow them exactly. Apart from a 38-40mm hole saw and a spirit level you don't need any special tools. Provided you make sure that you use silicone sealant where it says, to prevent water getting into the vehicle, you should achieve a successful installation with no problems at all.

A picture is worth a thousand words so, rather than spell it all out, I'll simply refer you to the accompanying photographs. The only point I should add is that you must fit the coaxial cable to the dish in such a way that flexible loops allow for dish movement, see Photo 4. I used plastic cable ties and self-amalgamating tape to hold the cable in place. There are probably better ways, but I am limited by what I carry in the van.

My only concern is that although the

*Photo 1 above: The kit of parts, showing the dish against a motor home wheel.*

system comes with a basic satellite meter to help with setting up I don't know many sites that provide totally flat hardstanding – by this I mean that if you check with your spirit level the bubble stays in the centre both front-to-back and side-to-side.

I'm sure that once you have parked your caravan or motor home you will enjoy the challenge of finding the satellite – provided the site manager hasn't put you somewhere surrounded by trees! Then, when you do finally find the satellite, you can pretend you are at home again and resume the battles about who has the remote-control handset and which channel you are going to watch.

## A Goodmans 1405R portable

When I'm not fitting things to cars, caravans or motor homes my main job is repairing TV sets, videos etc. Earlier this week a rather nice French lady came into the shop to ask if I could "attend to my terryvision, as it 'as no pitcher". It didn't take me any time to say "of course, Madam", whereupon she went outside.

## Heading south in your camper?

Robert van Reysen of Clearview provides tips for setting up your mobile dish when you head south for the Sun.

If you intend to align a satellite dish wherever you might decide to bed down for the night, it is best to use a rubber boot over the F connector with a little silicone inside to keep the moisture out. A rubber boot is easier to remove than tape should you want to use a satellite finder.

The best finders are the ones that produce a tone that increases when you pick up a signal. Another way to aim a dish accurately is by using the signal and quality bar on a Sky DiGi box. This is accessible as follows: press "Services" - "4 = System set up" - "6 = Signal test".

Note that the signal strength is not necessarily a true indicator of a signal's strength. The reading is affected by the cable length and gain of the LNB.

The quality bar is important and should normally be between mid-range and maximum. Adjusting the LNB's skew can make all the difference - especially in southern Europe. In Spain it's about 10 minutes to 12 looking at the satellite from behind the dish.

Move the dish and turn the LNB little by

little, allowing a few seconds between each turn it as it reacts quite slowly. If you do not have a compass, the horizontal position of the sun at 11 o'clock is a rough guide to where to find the Astra Digital 28.2.

Elevation changes with latitude. It is 25° for the south of England and 40° for the south of Spain. If you travel to southern Spain with a satellite dish smaller than 1.2m you will not be able to receive the 'North Beam'. To set the receiver so that it will receive the 'South Beam', press in sequence "Services" - "4 = System set up" - "0 - 1 - Select" - "2 = Default transponder". Finally, type in frequency 11720 change V to H, move down and then store it by pressing select. Presto! You will miss some channels though as they are not all on the South Beam.

If you do not use your system for a long period of time, you may get a message on the screen, simply phone the number and ask for the card to be reactivated, but it's best not to tell Sky you are using the system elsewhere in Europe!

At the time of writing, ITV 1 and 2 have just started on Astra. Hooray at last! Useful web sites are [www.satcure.co.uk](http://www.satcure.co.uk) and [www.clearview.uk.com](http://www.clearview.uk.com)

collected the set and placed it on the counter.

"Doo you want zee thingee?" she asked in her delectable accent.

My mind boggled for an instant, then I realised that she meant the remote-control unit.

"Yes please" I replied.

"I do not no iff zee battreez are any gud" she said.

Once I'd written out the fault label she disappeared out of the door, leaving behind a strong smell of some probably expensive French perfume. Phew!

Well, as I wasn't too busy I thought I'd make a really good impression and fix it quickly. I took it to the bench and, within two or three minutes of taking the back off, I thought I'd sussed it. I checked, then replaced, the 4-7Ω, 5W surge-limiter resistor R601 and the STR58041 chopper chip IC601, and fitted a new 2AT mains fuse. Then, full of confidence, I switched it on. The red standby lit up, but there was nothing else. I pressed the channel up button. Still nothing. Then I pressed channel down. Again nothing. Switch off and on a few times. No difference.

Time to investigate a bit further. The standby 5V supply was present of course, but there's a relay in the feed to the main power supply. There was voltage at one

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side of the contacts but nothing at the other side. So I carefully shorted across them. The set then burst into life, but with no channel idents or volume.

At this point a thought occurred to me. If they've gone dead while not in standby some sets will come on only via remote-

control operation. So I pointed the remote-control unit at the set and, guess what, it still didn't come on. I decided to check "zee battreez" to see if they were OK. They were. Maybe the remote-control unit didn't work. When I got the tester out I found that it didn't.



Photo 2: The dish movement control mast installed inside a wardrobe. Photo 3: The dish installed on a motor-home roof.

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Photo 4: Cable loops arranged to allow free movement of the dish.

At last I'm getting somewhere I thought. I dismantled the unit, cleaned the pads and contacts and checked for dry-joints around the LED and the crystal. Then I reassembled it and tried again. This time the number 9 and volume up/down worked, but nothing else.

I took the unit to bits again, connected my bench power supply to the battery contacts, adjusted it for 3.4V, and shorted out the standby contact with a screwdriver! This had the desired effect: the set burst into life, with a picture and sound. I decided to repair numbers 1-8 and the standby contacts with a dab of superglue and small pieces of aluminium foil. This usually works, but it's a fiddly business. In fact the repair worked beautifully.

I patted myself on the back, then reflected that it had all taken rather a long time. I couldn't justify three hours labour plus parts. She would probably tell me to "forget eet" as she "cud by anozer for zat prize".

I phoned her later to tell her that the set was ready for collection. Two days later her husband came to pick it up. Sometimes you just can't win, can you?!

### Ford 1000 series car radio

The fault with this car radio was described as "distorted sound when the engine is switched on". Not having an engine in the workshop to try it with, I had to resort to my power supply and hope for the best.

The radio came on with no distortion. Then, after a while at nearly full volume, the sound began to distort. Once the distortion had started it carried on, even at lower sound levels. I surmised that once his diesel engine was switched on and running the radio's owner would turn the volume up really loud to hear it above the engine noise.

Now these radios are the most basic ones that Ford do. They are fitted with a very small output chip. To my mind this is the worst thing to fit in a noisy vehicle. After what seemed like an age trying to locate a replacement output chip I decided to ask the chap in the scrapyards down the road whether he had any of these radios on his shelves. He had one with a damaged front panel, and charged me £10 for it. I saw him rub his hands with glee as I left the yard.

When I got back to the workshop I unsoldered the output chips and swapped them over. I switched on the faulty set and waited. The fault was still there! Time to think about it a bit more.

I should mention that circuit diagrams for these radios are about as common as rocking-horse droppings. All I could do was to use my magnifying glass to search all over the board for dry-joints or cracks. Everything was OK in this respect, but I did notice brown discoloration under the voltage-regulator chip. So these chips were swapped over. This time the fault had been cured.

Whether or not this will stop the white-van man blowing up his set again I don't know. In the meantime I'm buying in a few scrap radios just in case!

### A Tatung V21NFDO

This set was brought in because it was dead. The mains fuse had blown and, once a replacement had been fitted, everything was OK. Or so I thought.

Now I make a point of checking everything before I call the customer to say the set is ready for collection. So I switched the set on and watched some very nice young ladies in *Neighbours*. When I tried to alter the volume however all I got was a black box on the screen

where the graphics should have appeared and no sound.

After looking at the circuit diagram I came to the conclusion that the microcontroller chip was probably the cause of this. Then I checked the price and thought again!

Never having been too proud to ask when stumped. I phoned Tatung technical. A very nice gentleman answered. He knew immediately what the problem was, with this and other sets that use the D2N/D4N chassis, and asked if I had a fax machine. Within ten minutes he'd sent me a sheet that told me exactly what to do. I didn't have to replace the microcontroller chip, just reprogram it.

There were two different faults, loss of graphics and loss of sound. They are not related, but are easily cured by following these simple steps:

(1) For text loss go into "parameter settings". With the set on, short out PL701. Press button P on the remote-control unit five times. This will bring up the mixed mode. Then press the V+ button to set the text contrast level. Press the remote-control unit's TV button to store.

(2) Loss of sound can be caused by a poor microcontroller reset. To check, use the remote-control unit to do a simple reset. For sound loss press balance left then balance right, then press normalise.

Both problems were solved when I'd done this. I then phoned my customer to relieve him of what I thought was a reasonable amount of cash for the job.

The moral? Never be too proud to ask someone for help, especially someone like Tatung who still believes in providing real customer service. ■

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**Mark Paul** begins a detailed investigation of the circuit techniques used in this chassis, starting with the rather unusual discrete-component chopper circuit

# Thomson's TX807 technology

The Thomson Multimedia TX807 chassis is used in a wide range of models with screen sizes from 10 to 21 in. It's basically a mono sound chassis aimed at the lower-price end of the European market, though a stereo variant (TX807CS) drives tubes up to 25 in. This article covers the basic mono version, but both have much shared circuitry.

Features of the sets include teletext; automatic or manual channel setting using frequency- or voltage-synthesis, the tuning range covering Interband/Hyperband/UHF/VHF; on-screen displays; a sleep timer; child lock; and a sharpness control. With small-screen sets the audio output is 1.2 or 3W (music power); with larger-screen models it's 6W, or 6W + 6W with the stereo version. The external sockets consist of dual scart connectors, audio and video cinch and an earphone socket.

We'll start with the power supply.

## Power supply overview

The chopper power supply is described as "free-oscillating safe intelligent" (FROSIN). Figs. 1 and 2 show the circuit. It's basically a self-oscillating flyback-converter type whose operating frequency depends on the mains input voltage and the load. Chopper transformer LP03 provides mains isolation between its primary and secondary sides. There are two versions of the power supply, to cater for the various AC mains supply voltage ranges in different parts of the world: the 'narrow-range' version caters for supply voltages between 180-265V, while the

'wide-range' version, intended for use in Asia, copes with AC inputs in the range 90-264V. The PCB is the same, but there are different versions of the chopper transformer.

The design of LP03 has made possible reduced size and cost without compromising on the core temperature. The main factor here is a minimum operating frequency, above 50kHz for narrow-range supplies and above 25kHz for wide-range supplies. In addition a tap on LP03 optimises for the two different HT voltages used with smaller- and larger-screen tubes and the different power requirements.

The highest operating frequency occurs in the high mains voltage, low-load condition. It may rise to 100kHz in both narrow-range and wide-range sets. In normal operation the frequency is about 70kHz, the power consumption then being 45W. The power supply has a digital burst mode for standby operation, reducing the power consumption to a target of less than 2W. The degaussing cut-off relay also assists in reducing consumption.

Near zero turn-on loss operation reduces the chopper transistor's power dissipation and suppresses switching noise. This calls for a high primary-to-secondary winding ratio in the transformer and an improved switching-point circuit.

An optocoupler (IP01) provides feedback regulation. IP50 (TL431) on the secondary side of the circuit senses the HT voltage (UB) and drives the optocoupler. There are three reasons for the use of optocoupler feedback:

(1) Standby operation is initiated from the secondary side of the circuit, so a feedback path is required.

(2) To stabilise the audio supply voltage (UA). This is particularly important as the supply for the microcontroller chip IR01 is initially, and in the standby mode, derived from the same source (UA). Tight regulation is required to ensure that the HT voltage is not modulated by high sound-power levels.

(3) To improve HT immunity to mains ripple. This effect is more obvious when, with a low mains-voltage condition, the field and mains frequency differ.

A discrete-component chopper control circuit is used. Careful design has enabled the component count to be kept low, providing PCB space for low-power standby and wide-range control circuitry. Because of the improved transformer design, a low-cost power MOSFET can be used as the chopper (TP20) with the bonus of a simple driver circuit.

## Basic chopper action

The mains input is fed to the bridge rectifier DP01 which charges its reservoir capacitor CP08 to about 300V. This unbalanced DC voltage appears at pin 9 of the chopper transformer LP03, as the input to the primary winding. The other end of the primary winding, pin 5, is connected to the drain of the chopper MOSFET TP20. The FROSIN control circuitry drives the gate of TP20.

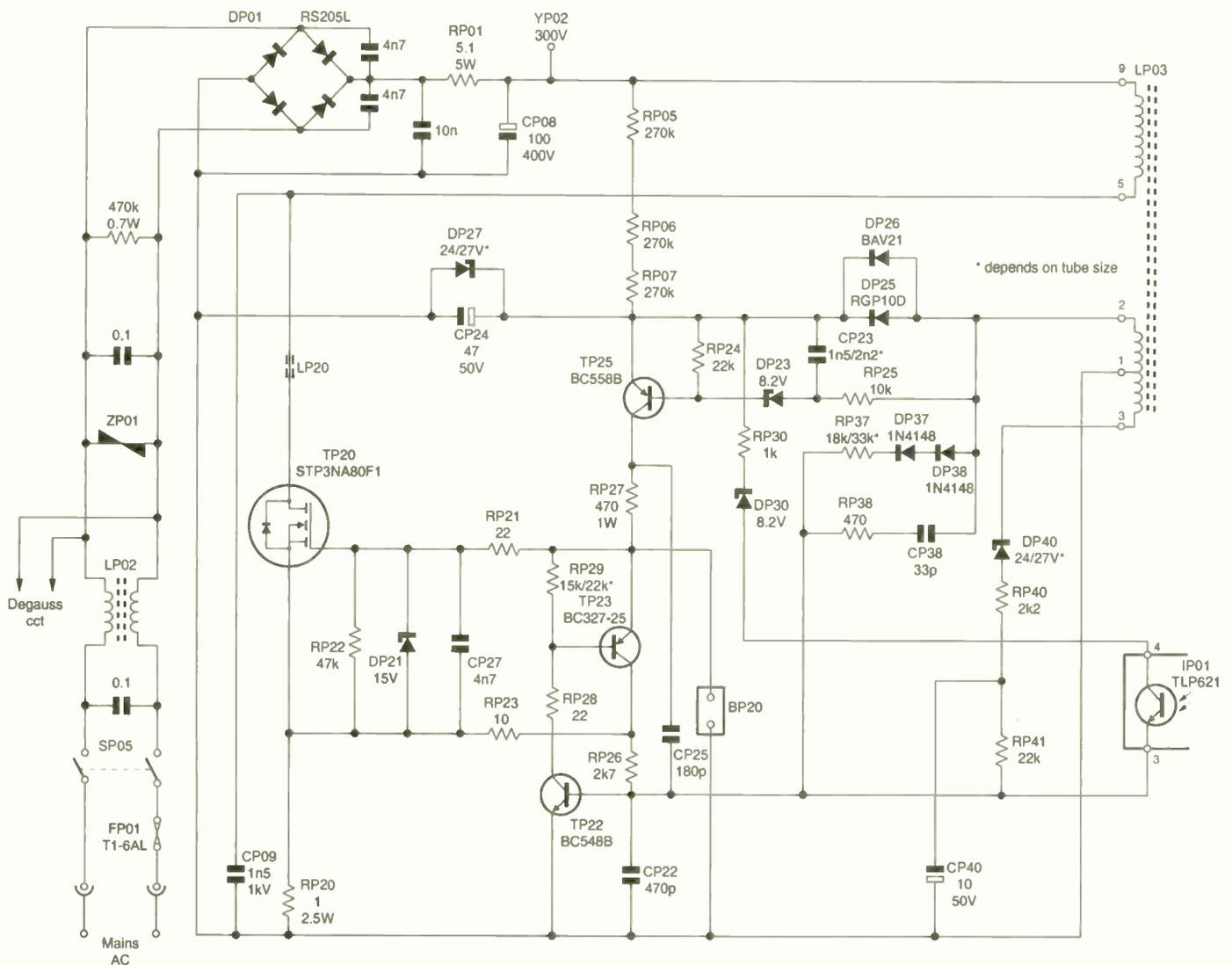


Fig. 1: Circuit diagram of the chopper power supply used in the Thomson TX807 chassis, primary side. Certain component values differ with the tube size, others with the wide-range version.

At start up the feed via RP05/6/7 charges CP24. When the voltage across CP24 rises to 8-85V, TP25 switches on, in turn switching TP20 on. The threshold for conduction of TP25 is set by the zener voltage of DP23 (8.2V) plus the emitter-base voltage of TP25 (0.65V) – note the DC path via RP24, DP23, RP25 and pins 2 and 1 of LP03. At start up the voltage at pin 2 is zero, as LP03 has yet to be activated. So the conduction of TP20 depends solely on the charge across CP24. Once the circuit comes into operation DP25 conducts to maintain the charge across CP24 and saturate TP20 in its switched-on condition. The 15V zener diode DP21 limits the gate-source voltage applied to TP20.

When TP20 switches on, the current through RP20 rises in a sawtooth manner (because of TP20's inductive load). When the voltage across it has risen sufficiently, TP22 switches on. This in turn switches TP23 on (TP22 drives the base of TP23). The two transistors form a latch. Once they have switched on, TP23 shorts TP20's gate to its drain and it switches off.

With TP20 switched off, the standard chopper power supply action occurs. The polarity of the voltages at the pins of LP03 reverses. So TP25 switches off; DP25 conducts, charging CP24; TP22/23 are held saturated by the bias via DP37/38 and RP37, charging CP22 (see following section); and energy transfer (flyback conversion) between the primary and secondary windings of LP03 takes place, activating the rectifier diodes (DP80 and DP90) on the secondary side of the circuit. CP40 in the soft-start circuit is charged by DP40. After the oscillatory phase CP22 is discharged, TP22/23 switch off and TP25 switches on to start the next cycle. But this time the regulation circuit comes into operation. We've jumped ahead of the action however.

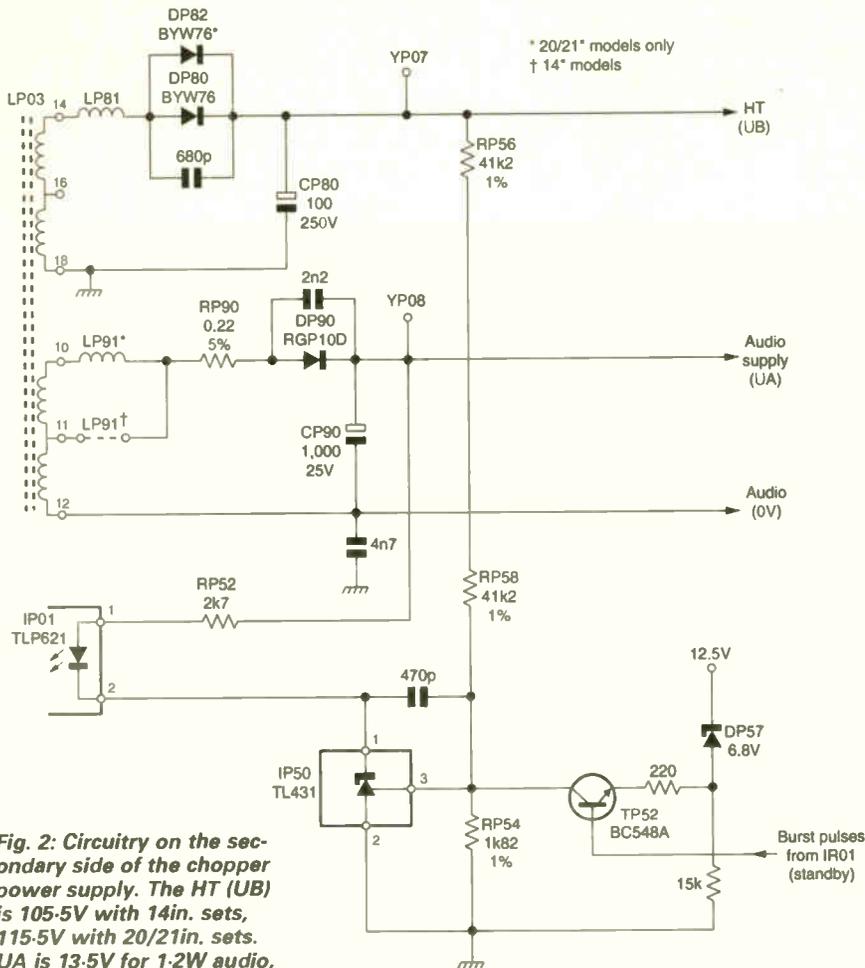
### Improved switching-point circuit

With any power-switching transistor the most life-threatening times are at switch-on and switch-off. This arrangement is no exception. To ensure minimum turn-on loss, the chopper MOSFET TP20 has to

switch on when its drain voltage is at minimum. This is called zero-voltage switching (ZVS). As with any chopper circuit, once the energy stored in the transformer has been discharged the drain of the MOSFET sees an oscillation caused by the inductance of the transformer and the snubber capacitor – in this case CP09. The drain voltage could reach 0V during this oscillation, but the actual value depends on the mains voltage. At maximum mains voltage there would be loss of ZVS. So the exact timing of TP20's switch-on point during the oscillatory cycle is very important. Circuitry is added to ensure this ZVS operation.

ZVS control is provided by diodes DP37/38, resistor RP37 and capacitor CP22, which provide an RC time-constant. This circuit holds TP22/TP23 in saturation, and thus TP20 off, ensuring that its drain voltage has fallen to zero in the oscillatory cycle before the next switch-on pulse arrives at its gate. The design of LP03 is optimised, in conjunction with the value of CP09, to assist with this.

A further circuit plays a part in ZVS



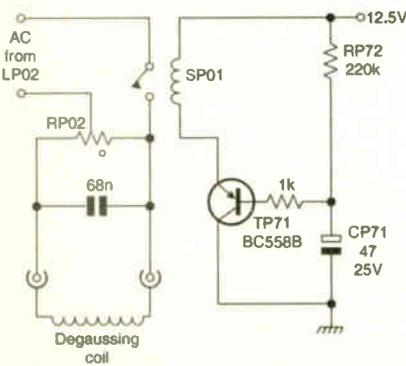
**Fig. 2: Circuitry on the secondary side of the chopper power supply. The HT (UB) is 105.5V with 14in. sets, 115.5V with 20/21in. sets. UA is 13.5V for 1.2W audio, 20V for 6W audio.**

control: CP23 introduces a delay in the switching of TP25. Working in conjunction with the circuit described above, it ensures that TP20's drain voltage falls to almost zero before switch on.

This support circuitry achieves a dramatic reduction in TP20's power losses. There is greatly reduced internal heat, which is what does the damage. The overall design has an operating efficiency of some 81 per cent.

### Soft-start

The soft-start circuit consists of CP40,



**Fig. 3: The relay-controlled degaussing circuit.**

DP40 and RP40/41, which are fed from pin 3 of LP03. As with any soft-start arrangement, the idea is to provide a controlled increase in the current passed by the chopper transistor while the load on the supply is still of very low impedance, reducing the stress on the transistor in this situation. There is in fact just a small drain current during the start-up phase. Basically, the negative voltage developed across CP40 delays the point at which the latch circuit, TP22/23, switches on and consequently the instant at which TP20 is switched off.

Initially the voltage across CP40 is zero, and TP22's switch-on time is controlled by the voltage developed across RP20. After a few cycles of operation, a negative voltage is developed across CP40 and increases, delaying the latch switch-on and thus increasing the conduction time of TP20. Once the circuit has stabilised, with nominal output voltages, the voltage-regulation loop comes into operation.

The charge developed across CP40 also provides compensation under low or high mains voltage conditions.

### Cycle of operation

We have seen how the driver stage – TR25 and its associated components – works, switching TP20 on. TP20 is voltage-

driven, with the gate drive arranged to be about 15V, which also provides enough turn-on current to charge the MOSFET's input capacitance. DP21 ensures that the gate drive does not exceed 15V. The values of RP27 and RP21 are selected to achieve the optimum turn-on speed for TP20. Together with the values of RP05/6/7 and CP24, the rating of DP23 is selected to provide a fast turn-on when the mains supply is low.

CP24 also provides the supply for the optocoupler IP01, via RP30 and DP30.

Note that TP20's switch off is controlled by the voltage developed across RP20 and the charge on CP22. The link between RP20 and the base of TP22 is via RP23 and RP26: the value of RP23 is chosen to achieve fast switch on of TP22/TP23 and in turn improved switching of TP20.

As noted at the beginning, the circuit is self-oscillating. When, after TP20's switch off, the energy in the transformer has been transferred to the rectifier circuits on the secondary side, the voltage at pin 2 decreases. Once the preset threshold has been reached, TP25 switches on again. CP23 introduces a delay as part of the ZVS control. In addition, CP22 has to discharge to switch TP22 off before TP20 can switch on again.

### Regulation

Feedback for regulation is via optocoupler IP01. The emitter of the phototransistor section of this device is connected to CP22 to provide regulation. Note the DC path from CP24 via RP30, DP30 and the phototransistor section of IP01 to CP22. DP30 helps set the regulation range, along with RP56/58/54 on the secondary side of the circuit.

In normal operation the HT and the audio supply are regulated. Voltage sensing is carried out by IP01 and the TL431 'programmable zener diode' IP50. The anode of the photodiode section of IP01 senses the audio supply via RP52. IP50 senses the HT voltage at pin 3, and controls the conditions at the cathode of the photodiode in IP01. When the HT voltage rises, the voltage at pin 2 (cathode) of IP01 falls. The conduction of the phototransistor section of IP01 will increase, thus increasing the charge on CP22. TP22 will be held on for longer, delaying TP20's switch on.

### Standby operation

When standby is selected the line timebase is switched off and the power consumption is thus greatly reduced. TP20's on time could fall below 1µsec, which would be insufficient to achieve saturation. The operating frequency would be high, with poor chopper transistor switching and thus high dissipation. To avoid this, CP38 and RP38 supply a negative current pulse to CP22. TP22 and TP23 are thus held off for a period when TP20 conducts, ensuring a

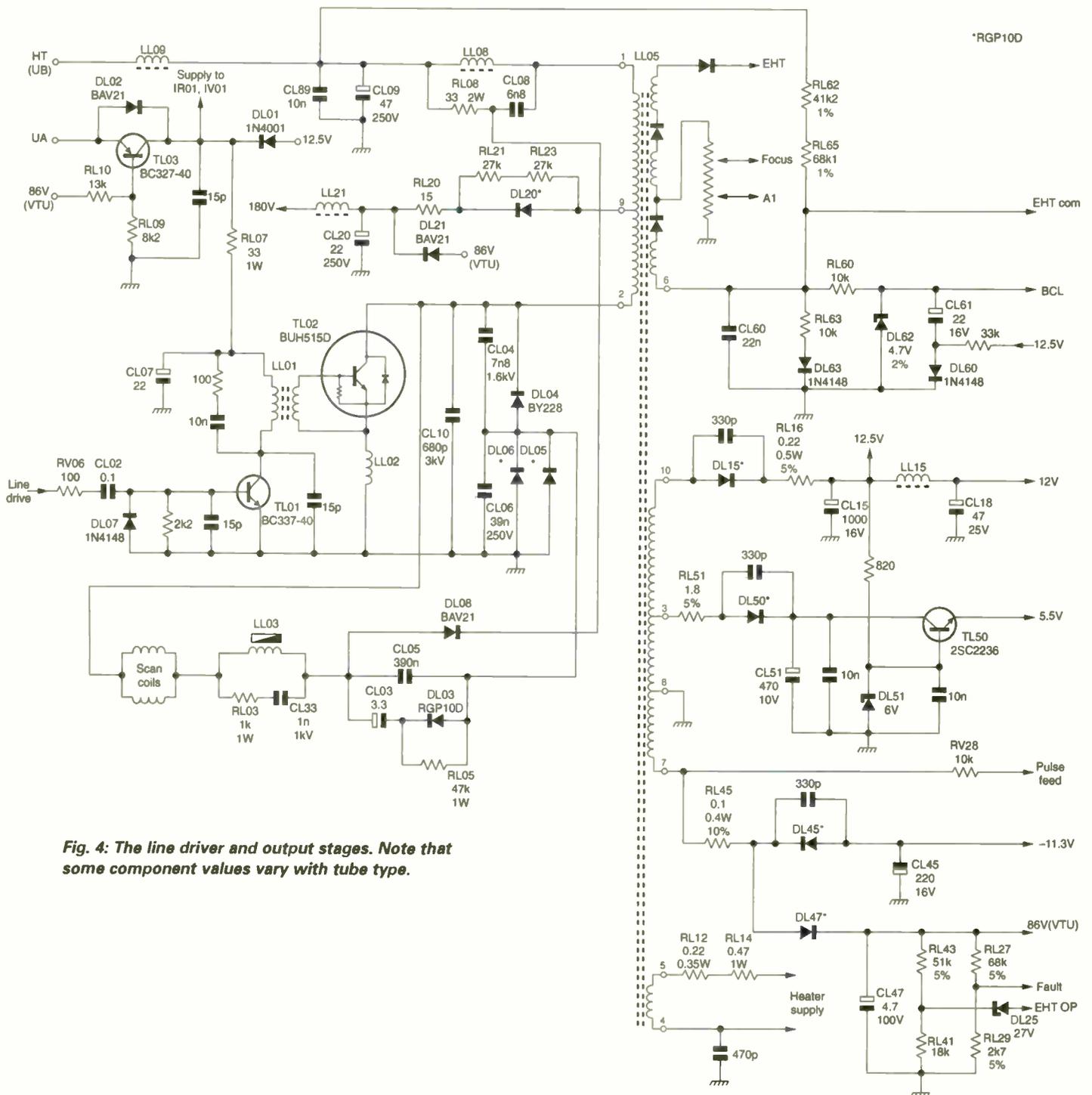


Fig. 4: The line driver and output stages. Note that some component values vary with tube type.

minimum on time for TP20.

In addition the power supply goes into the burst mode of operation. The microcontroller chip IR01 produces at pin 2 pulses which drive TR52 and thus pin 3 of IP50. When TR52 is switched on, the charge across CP22 is increased, switching off TP20. This action restarts the power supply for 350µsec approximately every 11µsec.

### Protection

There is inherent current limiting and simple but effective overvoltage protection. If the feedback regulation is open-circuit, the voltages on the secondary side of the circuit will rise. The voltage at

pin 2 on the primary side will also rise, with the result that the 24V zener diode DP27 switches on. This shuts down the drive to TP20.

Zener diode DP40 limits the conduction time of TP20 in the event of a regulation malfunction.

The charge held by CP23 delays TR25's switch on. This contributes to safety should DP37 or DP38 go open-circuit. The switching loss in TP20 would then be high, with the possibility of its failure.

### Degaussing

Relay SP01 and the associated circuitry (see Fig. 3) controls the CRT degaussing. The relay-driver transistor TP71 is

powered by the 12.5V supply from the line output stage, which ensures that there is degaussing action every time the set is switched on. SP01 is switched on for five-ten seconds after application of the 12.5V supply. When CP71 has charged TP71 switches off, the relay contacts open and the degaussing ceases. This arrangement, in conjunction with the burst-mode standby operation, reduces the standby power consumption considerably.

### Troubleshooting

If there's no 300V supply across CP08, check the mains fuse FP01 and the surge-limiter resistor RP01. Failure of FP01 can be caused by a defective degaussing

posistor, RP02. If TP20 is short-circuit, FP01 or RP01 will be open-circuit. When TP20 has failed RP20, TP22 and TP23 should also be replaced.

If the 300V supply is present but TP20 is not being switched on, check the voltage at its gate. If here is no gate voltage or this is less than 2V, check TP20 and RP20. If these items are faulty, TP22 and TP23 should also be replaced. If TP20 and RP20 are OK, check TP22/23 then RP05/6/7 and, if necessary, DP21, TP25, DP27, DP25/6, RP21 and RP90.

If the HT voltage (UB) is very low, the voltage across CP08 is normal and TP20 is switching, check IP01 and IP50.

If standby is normal but the set fails to start up, check TL03 and that there is some 9V at the emitter of TR07.

### The line timebase

The line timebase circuitry is conventional and is similar to that in the TX90 series chassis. The line drive signal is generated by the TDA8842 IF/colour decoder/timebase generator chip IV01, at pin 40. It's produced by a voltage-controlled oscillator and divider, which are controlled by the 4.43MHz crystal at pin 35. If there are no line sync pulses, the microcontroller chip IR01 is notified via the I<sup>2</sup>C bus and the set clocks down for five minutes then goes to standby. In standby the 8.5V supply to IV01 is switched off by TR08, which is controlled by pin 20 of IR01.

Fig. 4 shows the line driver and output stages. The line drive signal is coupled to the base of the driver transistor TL01 via RV06 and CL02, with DC restoration by DL07. The driver stage operates in the 'flyback' mode, i.e. energy is stored in the primary winding of the driver transformer (LL01) and is then, when TL01 is switched off, transferred to the secondary winding. Because of the opposite polarities of the primary and secondary windings, the output transistor TL02 is off when TL01 is on and vice versa.

At start up TL01 is powered from the sound supply (UA) via TL03. Once the line output stage is operating normally it produces various outputs including 86V and 12.5V. The 86V supply is applied to the base of TL03, which switches off. TL01 is then powered by the 12.5V supply. Note that the microcontroller chip IR01 and IV01 are powered from the same source. IR01's 5V supply is obtained from the regulator transistor TR01, while IV01's 8.5V supply is obtained from the switching transistor TR07. Both are fed from the junction of TL03 and DL01. This power sourcing arrangement reduces the overall consumption, prevents possible overheating of the chopper transformer LP03, and minimises the voltage dip that would otherwise occur in the UA voltage during transition from standby to on.

### Output stage

The line output stage follows normal practice. The line output transistor TL02, type BUH515D, incorporates an efficiency diode. In steady-state conditions the scan coupling/correction capacitor CL05 is charged to an average voltage roughly equal to HT via LL03, the scan coils, the primary winding (pins 2-1) of the line output transformer LL05, LL08 and LL09. When TL02 is switched on about half way through the scan, driven to saturation by LL01, the efficiency diode and the flyback tuning capacitor CL04 are short-circuited to chassis. The charge across CL05 is applied to the scan coils, and current builds up linearly. This drives the beams from the centre to the right-hand side of the screen. Simultaneously, a linear current builds up in the primary winding of LL05.

TL02 is switched off when the beams arrive at the right-hand side of the screen. As current can no longer flow via TL02, the magnetic energy stored in the scan coils and the line output transformer's primary winding collapses. The current produced by this collapse creates an oscillation between the tuning capacitor CL04 (aided by CL10), the scan coils and LL05's primary winding. This oscillation (a half cycle), with CL04/10 charged to a high voltage as current flows into the inductances then the current reversing, moves the beams from the right-hand side of the screen to the left-hand side. When the oscillation tries to reverse, with the voltage at pin 2 of LL05 about to swing negatively, the efficiency diode DL04 (and the one in TL02) switch on. The current flow via these diodes, with the inductances acting as current generators, drives the beams from the left-hand side of the screen towards the centre, at which point TL02 is switched on again.

The network RL05, DL03 and CL03 suppresses oscillations that would be caused by the sudden load changes on the transformer. These could cause undesirable effects similar to horizontal phase modulation, particularly visible as a 'mouse-teeth' effect on a cross-hatch pattern. DL08 shifts the picture horizontally for correct centring.

LL03 is the line linearity coil. A close analysis would show that the voltage across the scan coils is higher during conduction of the efficiency diode than during conduction of the output transistor. This would make the picture appear more cramped on the right than on the left. The linearity coil corrects this by presenting a higher impedance during conduction in one direction than the other. RL03 and CL33 damp the coil to prevent ringing.

The diode modulator – DL04, DL06, CL04, CL06 – is included to minimise breathing caused by poor EHT regulation. Compensation for breathing is achieved by using the modulator to vary the voltage across the coupling capacitor CL05.

During the flyback, the voltages generated across LL05's secondary windings are rectified to produce various supplies – EHT, focus, first anode, heater, 12.5V etc. The 180V supply for the RGB output stages is derived from a tap on the primary winding, with the rectifier DL20 conductive during the forward scan: this improves the regulation in comparison with flyback conduction. Protection against overloads or short-circuits is provided by various fusible resistors.

### Beam-current limiting

To avoid stress to the tube and the line output stage the average beam current is limited to a specific value that depends on tube size and type. Again, this is standard practice. Beam current is monitored at the earthy end of the diode-split EHT generator, i.e. at pin 6 of the line output transformer, across CL60. During normal operation the voltage at this point is set by the bias from RL62/65. If the beam current exceeds a certain value, the voltage at this point swings negatively. This voltage is smoothed by RL60, CL61 and DL60 and applied to pin 22 of IV01, reducing the contrast and thus the beam current.

### Protection

Should the 180V supply fail, maybe because CL20 goes short-circuit, DL21 will reduce the 86V supply. RL45 could well then go open-circuit. This prevents TL02 overheating in the absence of video drives. RL21 and RL23 provide a discharge path for CL20 when the power supply is off. In the event of line output stage failure while operating, say because of a dry-joint, connector problem etc., the 86V supply again falls. Either of these two events will be sensed by the potential divider RL27/29, whose junction is connected to pin 16 of the microcontroller chip IR01. This will revert the receiver to standby operation via I<sup>2</sup>C bus control of IV01. With the line drive shut down, the risk of fire because of arcing is prevented.

The 'signal' produced at the junction of RL27/29 is called 'fault'. A fault-trip sequence is initiated when the voltage here falls below 1.8V. The sequence is standby 6secs, on 6secs, standby 6secs etc. until the fault is cleared. In the event of the 86V supply rising by about 40 per cent the fault signal voltage will rise to 4.2V, which results in the same trip sequence. The reversal to on prevents false triggering because of a CRT flashover, arcing, noise etc. ■

### Next month

The next section of the receiver to be investigated will be the field timebase.

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# An optocoupler go/no-go checker

Ian Field presents a simple circuit that enables optocouplers to be tested by providing visual light flashes via an external LED

**W**hile checking through a Philips L6.2 chassis that for some reason refused to start I came to a suspect CNX82A optocoupler. In this chassis mains isolation is provided by both the chopper and the line output transformer, so the line drive coupling has to be isolated. This is what the CNX82A does in the L6 series chassis, rather than fulfil its more common role of providing regulation feedback between the secondary and primary sides of the chopper circuit.

I usually test an optocoupler by carrying out a digital multimeter diode check on the two pn junctions in the phototransistor section, to confirm that they are intact, then switch to the resistance range to check for reverse leakage: after that I carry out the same checks on the LED section (the forward voltage for the LED is usually between 0.992-1.024V). This suffices as a quick test. But despite the L6's PCB and circuit diagram suggesting otherwise, the CNX82A is a four-terminal device – there's no external connection to the base of the phototransistor section. So simple tests for the integrity of the phototransistor section are not possible.

In fact the only way to test this type of optocoupler is to drive the LED section and pass current through the phototransistor section to confirm that it's capable of switching. In the past I've used a breadboarding module for this purpose, but what I really needed was something more convenient, permanent and reliable. Hence this project.

## Circuit description

The simplest circuit I could find to pulse an LED is based on the use of a programmable unijunction transistor (PUT). This device is similar to the silicon controlled switch (SCS), which was widely used in field oscillator circuits in early solid-state colour receivers – examples are the BRY39 and BR101. The PUT has only three instead of four connections however (it has no cathode gate connection).

I happen to have a hoard of PUTs, but these devices are nowadays hard to find. The solution is to use a pair of cross-coupled complementary pnp/npn transistors. Almost any small-signal types can be used, e.g. 2SA733/2SC945, BC212/BC183, BC107/BC177, BC148/BC158, BC548/BC558 etc. Alternatively an SCS could be used – just leave the cathode gate disconnected.

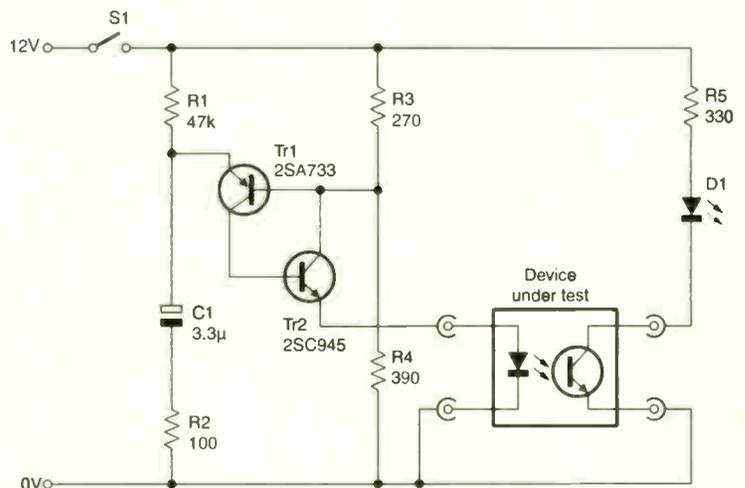


Fig. 1: The optocoupler go/no-go tester circuit. A suitable PUT or SCS could be used in the oscillator circuit in place of the complementary transistor pair TR1-2.

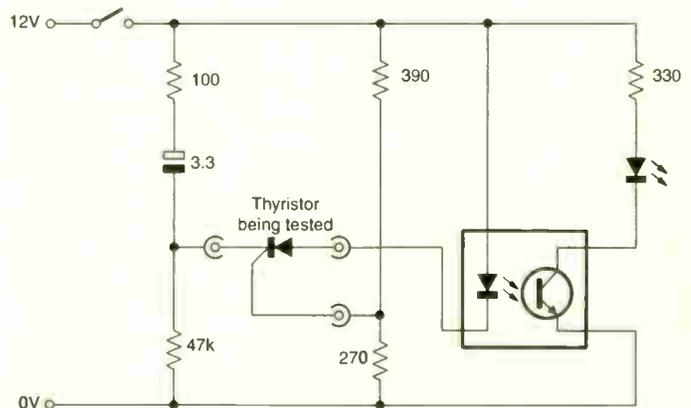


Fig. 2: This 'upside-down' version of the circuit enables small thyristors to be checked.

Fig. 1 shows the optocoupler go/no-go checker circuit. A cross-coupled pair of complementary transistors (Tr1-2) is used as an oscillator to drive the LED section of the optocoupler being tested. The phototransistor section of the optocoupler is connected to an external LED (D1), which will give a visible indication (flashing) if the device being tested works.

The common feature of a pair of cross-coupled complementary transistors and an SCS is the four-layer pnpn structure. In Fig. 1 the collector of each transistor is connected to the base of the other one. Thus the collector current path for each transistor is via the base-emitter junction of the other one, and if either transistor is switched on both transistors rapidly saturate. They remain in this state, in exactly the same manner as a thyristor, until the current is reduced below the hold-on level.

R1 and C1 provide a slow time-constant. At switch on, C1 charges via R1 and R2. The voltage at the emitter of Tr1 rises, and when it exceeds the voltage at the base, set by the potential divider R3-R4, Tr1 and Tr2 switch on. C1 is then discharged via the LED section of the device (optocoupler) under test. Once C1 has discharged, there is insufficient current to keep the two transistors switched on (the value of R1 is high enough to ensure this). So they switch off and the cycle begins again.

The monitoring circuit is simplicity itself, consisting of a LED (D1) and a current-limiting resistor (R5). As the switching current produced by the phototransistor is very low,

typically 1-2mA, it's essential to use a low-current, high-intensity LED. R2 limits C1's discharge current to a safe value, and also lengthens the current pulse slightly to ensure that the monitoring LED D1 remains on long enough to be seen.

### Use

One precaution should be mentioned: hot-plugging is not advisable. The on/off switch S1 should be used to disconnect the 12V supply while the device under test is fitted. Otherwise C1 will charge to almost the full 12V instead of the voltage at the junction of R3/4 plus 0.7V. This might damage the DUT.

While this circuit was devised to enable optocouplers with no phototransistor base connection to be tested, it is equally suitable for testing other types. But remember that thyristor, diac and triac output type optocouplers may latch instead of pulsing. I have not encountered one of these devices in a monitor or TV power supply however. Should I do so, I may add a means of switching off the latched output.

### Thyristor checker

As a matter of curiosity, I wondered whether a thyristor could be made to oscillate by adapting the circuit so that it was 'upside-down', see Fig. 2. It works! So, by providing a socket for the device under test, small thyristors such as the 2N5061, BT149, BT169, BR103 etc. can be checked in this way. They are quite often used in TV/monitor overvoltage and safety shutdown circuits. ■

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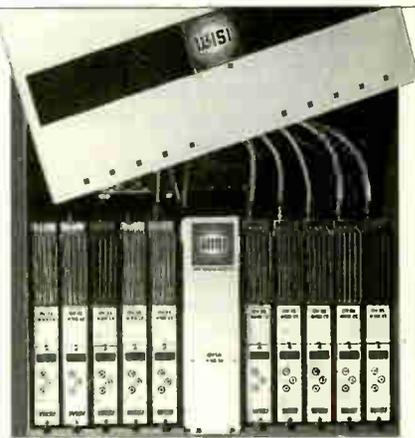
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# WHAT A LIFE

Some audio equipment, VCR deck and monitor problems. A wet TV set. Failure of the keyless chuck in Bosch electric drills. Don Bullock's servicing commentary

It was as black as night, well almost. When we opened the shop the other morning. The sky was dark, and the breeze was giving way to a gale.

Our first customer was Warder Phil. He's a quiet fellow who seems to spend a lot of his time giving practical advice to those incarcerated in the local goal – the bad, the mad and the sad as he puts it.

"Seems we're in for a wet and windy day" he said. He'd brought with him some Technics audio equipment – an SLDH501 mini system and an SLPG480A CD player. "This one's mine" he said, pointing to the mini system. Plays CDs perfectly for a while then stops. Nothing we do makes any difference."

"Sounds like Don" came the comment, in a silvery voice, from the back room. Greeneyes feeling clever again.

I thought for a second about a suitable reply, then heard the chink of tea cups. I decided against it. "What about the CD player Phil?" I asked.

"Only plays the first track" he said. "Belongs to one of the inmates. Unlucky chap. Shouldn't really be inside. Name's Walter Doolan if you want to put something on the job sheet."

As Phil left Greeneyes came in with a tray of tea and some chocolate biscuits. "Good" I exclaimed, "I like those biscuits."

"Not for you" she said, "they're for Paul. You know you're on a diet."

"Am I?" I queried.

"Well, just look at you."

I picked up my mug and suffered alone.

## Mr Flighty

"Har, har, slacking again" broke in a loud and too-confident voice, "not another tea break. Don't know how you tolerate it, my dear."

I looked up. It was Mr Flighty showing off in front of Greeneyes. She was grinning as though she found him funny. Silly girl.

"What brought you here?" I enquired.

"Me legs!" he bellowed, "har, har. Never a dull moment. Hear that?" he said to Greeneyes, who smiled happily.

He placed a GoldStar PW9041 video recorder on the counter and started to sing.

"My eyes are dim I cannot see, I have not brought my specks with me . . ."

I waited patiently for him to stop.

"Did you get it, Donny boy?" he asked. "Dim, see. The display is dim."

I wrote 'Mr Prat, dim' on the job card and bade him good day.

As he departed there was a flash of lightning, a clap of thunder and a down-pour. He was getting soaked. Serve him right.

## Workshop expertise

Meanwhile Paul had been taking a look at the Technics audio equipment. The SLHD501 mini system played for about five minutes then died. He decided to carry out some checks on the various supplies and found that the output from the 7.8V regulator transistor Q405 was slightly low. The cause turned out to be R443, which with a zener diode provides the base bias. It had risen in value from 6.8Ω to 17Ω. There was no more trouble once a replacement had been fitted. It's a safety component rated at 0.25W.

The SLPG480A CD player also had a power supply fault. C11 (2,200μF, 16V), the reservoir capacitor for the +10V supply, had gone low in value. A replacement restored normal operation.

I took a look at Flighty's GoldStar VCR, whose display was indeed dim. It seemed to me that I'd had this fault before. Hadn't the cause been a capacitor in the power supply? I checked with the notes we keep on our workshop PC. Yes, there it was: C25 (100μF, 10V). A replacement restored the display's brightness.

## The Red Lion

The phone rang. It was Len, the landlord of the Red Lion. "Is that Steven?" he asked.

"No, this is Paul. Steven is at home, finishing his new conservatory roof. Can I help?"

"Hope so" Len replied, "old Boney Twait has brought a computer in and has pretty well sold it to me. But as I was

handing him the loot the monitor died. Is it something you can deal with?"

We decided to go together. The bar was crowded. Paul who, like his brothers, is about six inches taller than me peered about for Len. A girl in an apron, on our side of the bar, looked his way and called over.

"Is your's a pint?" she said.

"Of course" Paul replied, "and one for my Dad here."

The girl stopped and looked at him. "I'm not talking you" she said. "I'm talking to my husband, right behind you."

We looked round and saw a big, bearded fellow, about six feet square. Fortunately he looked peaceful.

Then we managed to catch Len's eye, and looked at the monitor. It was a Mitsubishi Diamond and was dead all right. We decided to take it back to the workshop, where Paul carried out some checks in the power supply. He discovered that the zener diode D904 was short-circuit. It was also dry-jointed. He replaced it and switched on. Fortunately the monitor sprang to life. Paul decided to take it back to the Red Lion.

## The Major and the wet set

As he departed Major Hagger drew up outside in his Jaguar. A second later he was at the counter, holding a Sony KV21FV1U combi unit as if it was a giant stink bomb.

"A present to my darling daughter from her specimen of a boyfriend, Captain Pimm-Browne" he barked. "Started off full of life then fizzled out. Course they do, these Military College fellows. Paps. No substance. He bought the set from that tall thin chap at Snoddies, but he's no match for their antics. In my day I would pray for shifty rogues like that to show up before me, so that I could straighten them out. But enough of Pimm-Browne and his problems. This set. Worked all right, then started stoppin'. Not good enough. Fix it then ring me. Right?" At that he was gone.

As he left Steven squelched in. He was carrying a soaking wet TV set. "Spent all morning sealing my new

roof" he said, "then this cloudburst flooded through it and soaked the television set. It wasn't switched on of course."

"Get it on to the bench and I'll save its life" I said. "Meanwhile there's a job for you to do. The Major's Sony combi unit."

"What's up with it?" he asked.

I drew myself up as best I could.

"Keeps stoppin'. Not good enough. Fix it. Ring him. Right?" I said.

Steven's Hitachi set, a Model C2546TN, was thoroughly wet. Greeneyes got me a roll of kitchen paper which I used to remove all the moisture I could see, paying special attention to the line output and chopper transformers and to all cans and components that could harbour moisture. Then I propped up the chassis in the cabinet and placed the bench hairdryer underneath it, switched on at the lowest heat setting. I slipped the set under the bench for a long, warm snooze.

### Deck problems

Steven had got the Major's Sony KV21FV1U combi unit up on his bench. Sure enough the tape mechanism was intermittent. But after an hour's checking he was no further forward.

Then the delightful Tamara Lee swayed in, carrying a Sony video recorder – an SLVE280. "Oh Mistel Booyock, this machine, it's so unkind to me. Filst, he do what I want, then he stop. It makes me so upset."

I assured her that we would be able to fix it, and she left. As I stood looking at her recorder Steven shot across and snatched it. He pushed the Major's dismantled combi unit along to Paul's part of the bench and started to work on Tamara's recorder.

"I know these well enough" he said. "you get a fair bit of trouble in the power supply. Let's see now."

Meanwhile Paul had returned. "Huh, that's great!" he exclaimed, looking at his bench. "Someone's pulled a Sony combi unit apart and dumped all the bits on my bench. I'm scared to death of them even when they are intact and untouched."

"They're quite easy really" Steven said, "I've only put it aside because this job is more urgent."

Paul settled to the combi. After a few minutes he started to box it up. Seeing this, Steven spun round.

"What was it then?" he asked.

"The take-up spool's optocoupler, PH452" Paul replied. "Thought it would be. How are you doing with the Sony video?"

"Well, I've found the voltage I want, but it disappears before it gets to where I want it. I wish I had a circuit diagram."

"Try the 1A circuit protector PR512"

Paul suggested. "They're always giving trouble in these machines. Sony uprated it to 2A a while back. That's what I usually fit."

"Ah, yes, that's what I was thinking"

Steven said as he moved to the circuit protector, which was open-circuit. A replacement restored normal operation.

"Tamara will be pleased" he said.

"Don't forget the Credits" Paul added.

### Problem with an electric drill

Is anyone out there the proud owner of a Bosch PSB500RE electric drill with keyless chuck? If so, the best of luck! I bought one a while ago because I was fed up with losing the chuck key of my old Black and Decker, and snagging my fingers on an ill-fitting one I always seemed to find instead.

The Bosch, with its keyless chuck, was wonderful to use – though I did wonder why the chuck, the business end of a power tool, was skirted with a soft black plastic skin. Then, after the first week or two, the chuck jammed open as I was replacing a drill. I tried tightening it but couldn't. So sprayed its inside with WD42 and tried again. As it remained jammed I took it back to the dealer.

"Bosch wouldn't regard this as an in-

guarantee fault" he said, "the chuck is slightly marked. They'd claim misuse. I daren't send it."

"How much is a new keyless chuck?" I asked.

"Sixteen pounds" he replied, "and we'd have to get one."

I put the useless Bosch in the shed and returned to using the Black and Decker one. After all it's a perfectly good drill. I'd only retired it because I wanted the keyless chuck the Bosch boasted.

After a week or two I so missed the keyless chuck that, although it went against the grain, I went back and paid up for a new one. Once again the drill was a joy to use. Greeneyes also liked using it, in the garden, to drill little holes for hooking up her shrub branches on the walls. But the new chuck jammed open on her too.

This time I sent it back to Bosch with an explanatory letter. It was away for a month, but eventually came back at no charge. I was delighted – until I opened the package. The keyless chuck had been replaced with a conventional one. And, for good measure, there was no key.

Not that I wanted one. The Bosch is back in the shed, and I'm using the Black and Decker again. I wonder what the problem is with the keyless chucks? ■

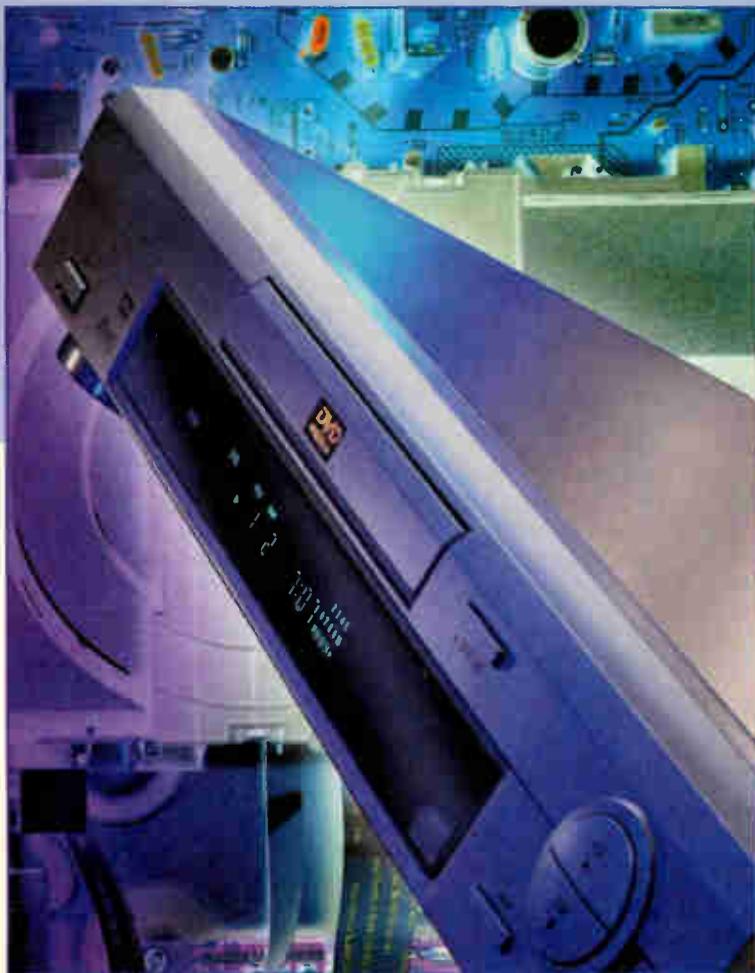
## Book review

**Digital Television by K.F. Ibrahim, published by Pearson Education Limited, Edinburgh Gate, Harlow, Essex CM20 2JE at £19.99. Paperback (card covers), 197 pages.**

It is surprising how much information Mr Ibrahim has managed to pack into this modest-sized book. It means, amongst other things, that you don't have to wade through masses of largely irrelevant information to get to what, as a practising technician, you need to know. Too many textbooks get bogged down in arcane theory before they get to practical matters – in this case the signals and waveforms, coding/decoding processes and so on. It also means that Mr Ibrahim has been precise and to the point in his treatment of the many matters covered in the book.

While digital TV has been with us for some time there has, to date, been little need for most service engineers to get involved. This has been because of the 'free' digiboxes and the way in the broadcasters have been involved right up, almost, to the TV screen. But this situation is likely to change. As things develop, digital TV equipment will leave the in-guarantee period and require attention from general service practitioners. You will then need to be clued up about the various systems in use, satellite and terrestrial, and how they function. This is the ideal book to use, both as an introduction and a handy reference.

The book covers pretty well all aspects of digital TV technology as this stands at present. It takes you through the basics, without making life too hard. For example the account of the discrete cosine transform, which is basic to MPEG signal compression, is the clearest I've come across. Once the basics have been dealt with there are practical descriptions of receiver systems, with plenty of diagrams, waveforms and some circuits. This is followed by sections on interactive TV techniques, power supplies and receiver system testing. The book is well organised, well illustrated and has a very helpful index. I'd have no hesitation about recommending it. J.A.R.



# DVD

## player servicing

**In this concluding instalment in his series K.F. Ibrahim lists basic DVD player faults, their likely causes and describes how to go about fault-finding. The copyright protection systems in use are also explained**

K.F. Ibrahim is Senior Lecturer at the College of North West London and is author of several books, including *Digital Television* and *Television Receivers*.

**W**hen checking a DVD player to establish the cause of faulty operation it's helpful to have in mind an overall picture of the various sections of the machine. For this purpose Fig. 21 shows the basic sections of a player in block diagram form. It's also important to understand the start-up process and playback initialisation that occur.

### The start-up process

A DVD player is either in the on or the standby mode. When a player is switched on from cold, it cycles through a standby/on/standby sequence. It goes into the standby mode first, normally indicated by illumination from a red LED. In this mode the power supply, of the chopper type, produces the ever/always voltage, e.g. Ever 3V, to supply the microcontroller-based user interface. All the other supply lines are switched off.

The Ever voltage, or a special DC signal, is detected by the microcontroller chip, which sends a control signal back to the power supply to tell it to switch on the other DC supplies. The player thus goes into the on mode, which is normally indicated by illumination from a green LED. In this mode the system-control microprocessor chip and all the other sections of the player are powered. The microprocessor chip then carries out a set of routines to test and initialise all the other sections of the player. This process is known as the start-up program or routine.

Once the start-up routine has been completed, the user-interface microcontroller chip switches its control signal to off and the power supply returns to the standby mode. It remains in this state until a front-panel or remote-control handset button is pressed. When the standby/on button is pressed the player goes into the on mode, indicated by a green LED and the display of a logo or a message on the front panel and/or the TV screen.

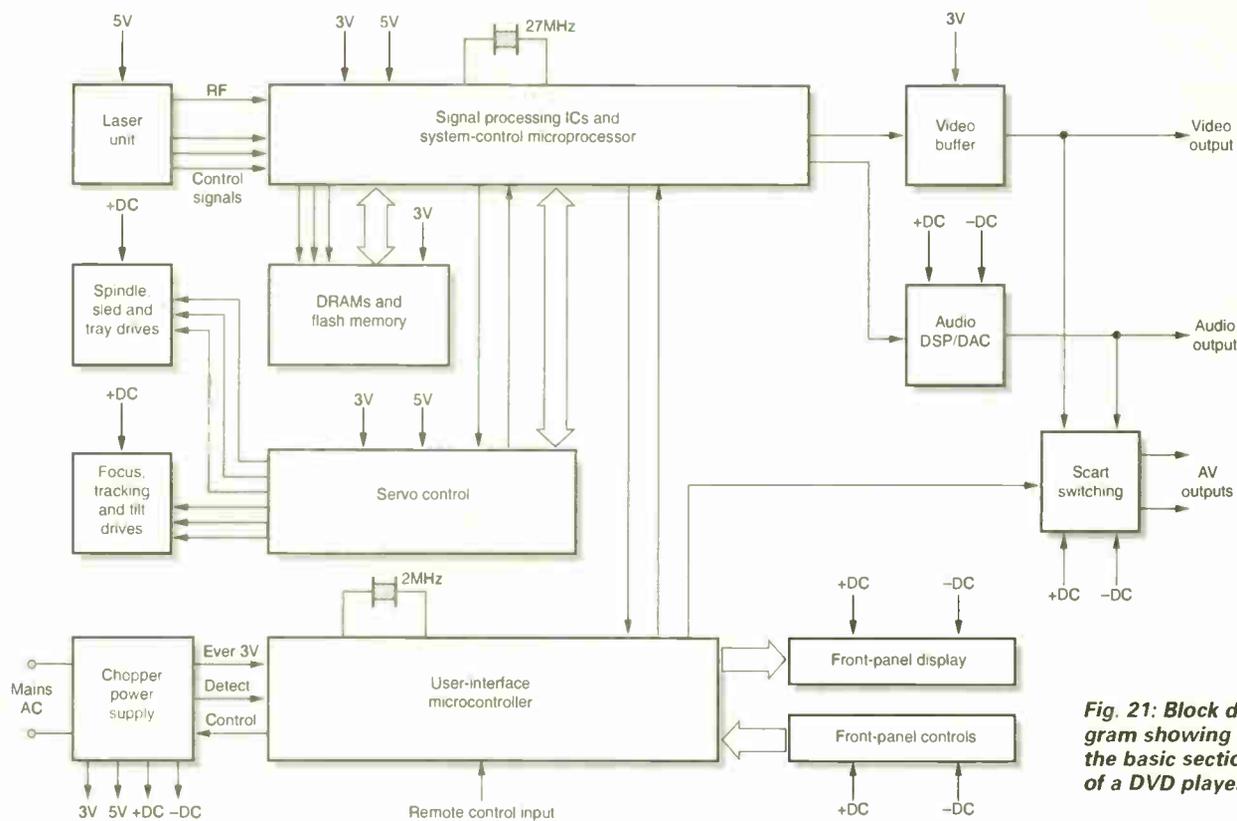
### Playback initialisation

When the tray is closed, or when playback is selected, a set-up routine starts. This identifies the type of disc and sets up the two-axis actuator for correct focus and tracking. The following activity will be observed:

- (1) The spindle motor rotates the disc at a relatively high speed.
- (2) The laser beam is directed on to the disc – the reflected beam is detected by the photodiodes.
- (3) The sled motor moves the laser unit away from the centre of the disc, in one or two steps. At the same time the two-axis actuator moves the objective lens up and down to achieve focus, a process known as 'focus search'. The laser unit's movement across the disc gives rise to a tracking error (TE) voltage. If this is low, 0.4V or less, the inserted disc is a DVD. A CD disk, with its longer pits and wider track pitch, will produce a higher TE voltage – about 2V.
- (4) Once correct focus has been achieved the laser unit moves back to the inner part of the disc to read the first sector and produce an RF signal. This signal's bit rate is used by the RF processor chip to set the spindle motor to the correct speed for playback to take place.

### Single-/dual-layer disc detection

The difference between a single- and a dual-layer disc



**Fig. 21: Block diagram showing the basic sections of a DVD player.**

is indicated by the intensity of the reflected beam. During the focus-search process the reflected beam produces what is known as the pull-in (PI) signal. If this is high, about 1V, the disc is highly reflective and is thus a single-layer type. If the PI signal is low, at about 0.5V, the disc is a dual-layer (less reflective) type.

### Fault finding

The following is a summary of basic faults and possible causes.

**The spindle motor speed increases and decreases several times then the motor stops. 'No disc' is displayed:** These are the classic symptoms when there is no RF signal. There are several possible causes, including focus failure, tracking failure or laser unit failure. Use the self-diagnostic routines (see later) to identify the type of fault – focus, tracking or laser power.

The FE (focus error), TE (tracking error) and RF signal paths can be examined, from the RF amplifier right through to the two-axis actuator drives, during the period when the spindle motor is turning and the laser unit is searching for focus. The laser beam and the two-axis actuator should also be checked. Before suspecting faulty chips, check the continuity of relevant fusible resistors in the supplies.

**The spindle motor ticks a few times in an attempt to turn, then stops:** Failure of the spindle or sled motor drives are possible causes. Check the error signals and motor drive signals.

**Stuck in standby:** This symptom can be the result of a partial failure of the power supply (no switched DC lines) with only the Ever voltage line(s) present. The start-up sequence will not take place, and the power LED will remain at red.

The first step is to determine whether the cause of the fault lies in the power supply or outside it. Some power supplies can be forced into the on mode by overriding the control signal from the user-interface microcontroller chip. This is done by using a 100-500Ω resistor to link the Ever 3V supply to the control signal line. If the power supply remains in the standby mode, the cause of the fault is within the power supply. If the power supply then switches to the on mode, the fault is outside the power supply.

Listen and watch for activity during the start-up and playback initialisation processes. This may well provide clues as to the cause of the malfunction.

The stuck in standby condition could be caused by failure of one of the processing or decoding chips (RF amplifier and processor, A/V decoder, etc.). The system-control microprocessor chip will detect such a fault during the start-up routine (or when a function is selected by the user) and will switch the power supply to standby via the user-interface microcontroller chip and the control signal.

Stuck in standby could also be caused by a faulty user-interface microcontroller or system-control microprocessor chip. You should of course check the supply

lines and resets and relevant crystals before condemning either of these chips.

### Power supply failure

The chopper power supply in a DVD player provides a number of outputs. The following are typical.

**Ever 3V:** For the user-interface microcontroller chip.

**Switched 3V, 5V:** For the laser unit and processing etc. chips such as the RF amplifier, RF processor, A/V decoder, system-control microprocessor, memory chips and servo controller.

**Switched +/- DC:** Higher voltages (in the region of +10V and -10V) are required to drive the spindle, sled and tray open/close motors, power the front-panel control switches, front-panel display, audio output section and scart switching.

The symptoms produced by power supply failure vary from one DVD player to another, depending on circuit design. Typical symptoms, causes and fault-finding steps include the following.

**Disc doesn't rotate, no video, no audio:** Total/partial power supply failure. Does the player revert to standby? If so, check for partial power-supply failure – check the various DC outputs. Otherwise, check for total power-supply failure. Check the mains fuse, the chopper device etc., then if necessary carry out more detailed

voltage/component checks. Use an isolation transformer to power the unit when carrying out voltage checks.  
**Disc rotates fast, no video, no audio, no front-panel display:** Failure of one or both of the higher DC voltages (e.g. +10V, -10V). Check the higher DC voltages. If present at the power supply, check the subsequent paths.

**Disc rotates normally, no video, no audio:** Partial power-supply failure. Does the player revert to standby? This should be the case, indicating possible partial power-supply failure, but it depends on circuit design. Override the control signal to switch the power supply to the on mode and check the DC outputs. If they are all present and correct, the A/V decoder chip is suspect.

### Self-diagnostics

DVD players generally incorporate a comprehensive software routine for self-test and adjustment. The routine is carried out by the system-control microprocessor chip, with test and adjustment options as well as the results of tests displayed on the screen. The self-diagnostics enable the user to set up the player, check the servo functions including focus and tracking, check the spindle, sled and tray motors and the memory chips. Failures are

indicated on the screen, sometimes with special codes to specify the faulty item.

The self-test routine can of course be used only when the power supply, the system control, the user interface, the remote-control unit and the front-panel and video displays are functioning normally.

### The DVD-Video copyright protection system

There are two ways in which copyright protection is provided: regional codes that restrict use to various parts of the world, and copyright protection provided by the software/hardware combination.

**Regional copyright protection:** To control the use of DVD-Video discs geographically the world is split into six sales regions. The DVD-Video system presets, in players and discs, the ID numbers for the region in which playback is permitted. A sales region ID number is registered in each player. When a region ID number is recorded on the disc, at the request of the copyright holder, the disc cannot be played should the player and disc ID numbers be different. There may be cases where the disc ID set-up can be adjusted to permit playback in two or more regions. With older material playback may be permitted in all regions. The regions are as follows:

- 1 The USA, Canada.
- 2 Europe, Middle East, Egypt, Saudi Arabia, Iraq, Iran, South Africa, Japan, S. Korea.
- 3 S.E. Asia.
- 4 Australasia, Mexico, the Caribbean, S. America.
- 5 Russia, the Indian sub-continent and the rest of Africa.
- 6 China.

**Copyright protection by software/hardware combination:** This is to prevent illegal duplication. The system works with both the current analogue interface and the future digital interface. For digital duplication protection, an advanced encoding technology called CGNS (Copy Generation Management System) exercises digital data recording/playback management in co-ordination with software and hardware in computer and various other fields. DVD players are not equipped with a digital video output. If the micro-vision signal is added to the analogue video output signal normal image quality reproduction will not be possible. Copyright-free discs can be freely duplicated. ■

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# PERIFELEC

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The panoramic field strength meter MC30A combines in one instrument all the functions necessary for installing and checking TV or satellite reception, both analogue and digital. The visualization of the spectrum and the picture allows the carrying out of all the necessary adjustments with this one instrument. The high technology used in the MC30A allows a range of possibilities unheard of in a instrument in this price category.

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# Test report:



# Swires Digi-Sat 2001 meter

If you're involved in digital satellite tv installation and fault finding – or if you're thinking of turning your hand to it – take a look at **Nick Beer's** review of a brand new test meter.

Swires Research,  
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I find the Confederation of Aerial Industries Trade Fair each June one of the highlights of the engineering year. There is always an interesting mix of exhibitors and seminars. And each year Swires Research is present – at the same spot in the hall! The company's products seem to be mostly aimed at the cable TV market, in which I'm not involved, but I nevertheless always visit the stand as the equipment is interesting and well engineered. This year however there was a new product for digital satellite TV installers. It caught my interest, and we now own one.

For a number of years we've used the Sky meter – the bright-yellow, bone-shaped one with a rather limited battery life. At the time it was acquired there was little choice

at the basic end of the market, and our need was urgent. It's performance is perfectly satisfactory, but it does cuff batteries (or rather their charge), and ours had recently become unreliable in this respect.

We don't actually carry out installations ourselves, subcontracting this work out, but we do all the maintenance – even if the system fails the day after its installation. Our sites are all domestic, with at most two points – no SMATV. What we need therefore is a meter that enables us to make sensible measurements and realign dishes.

## Description

The Swires meter is larger than the Sky one but feels no heavier and is

comfortable to hold. The carry case is well-designed – the holes and flaps are exactly where they need to be, and there's an integral ladder hook that's brilliantly simple.

The display, a more than adequate two-line backlit LCD, and the input F connector are at the top. See Photo 1. There are just five buttons, which are in fact a membrane. Although membranes can get cut or, in time, holed, this approach means that the meter is easy to keep clean, water doesn't get in and operation is light and easy. The buttons have a very positive feel, giving one confidence that they will remain reliable during many years' service.

## Operation

Operation is simple enough. The button you use to switch on also enables you to sequence up through the nineteen pre-programmed satellite positions. There's another button for sequencing down. The tone button switches on or off an audible means of checking the signal strength and peaking the signal. Use of the tone means that you don't need to look at the display. The off button does just that! Once the satellite you are after has been selected, the menu button is used to obtain either a basic signal-quality assessment (good, marginal or fail), or a more precise display that shows the signal-to-noise ratio (top line) and bit-error ratio (bottom line).

The nineteen pre-programmed satellite positions are listed in Table 1. They are referred to as the 'prime satellites listing', and cover most requirements. The transponder frequencies and polarisations have been selected so that a reading

Table 1: The prime satellites list.

Satellite	Position	Freq. (GHz)	Pol.
Astra 2A	28.2°E	11.720	H
Eurobird	28.5°E	11.688	H
Hot Bird	13°E	12.168	H
Thor	1°W	12.456	V
Telecom 2B/D	5°W	12.668	H
Telstar II	37.5°W	11.561	V
Hispasat	30°W	11.517	H
Sirius	5.2°E	12.415	H
Kopernikus	23.5°E	11.530	H
Eutelsat 2F4	7°E	11.387	H
Eutelsat 2F2	10°E	11.013	V
Eutelsat 2F1	16°E	11.023	H
Intelsat 705	18°W	10.978	H
Intelsat 604	60°E	11.473	V
Turksat	42°E	11.046	H
Astra 1E	19.2°E	12.051	V
Astra 2B	28.2°E	12.207	V
Hot Bird	13°E	12.245	H
Eurobird	28.5°E	11.585	H

The 22kHz tone is on at 11.668GHz and above, off below this frequency.

should be obtained only when the dish is pointing at the required satellite. The final three positions listed should not however be relied upon for giving the correct satellite position.

For dish alignment or signal level measurement you first select the satellite required from the prime satellites list, then connect the meter to the LNB – there is no need for separate line powering. The meter initially displays a satellite's orbital position. There is then a bar-graph display on the second line of the LCD, with a figure in brackets beside, to indicate signal strength. A dish can be peaked while you monitor this, with or without the tone to assist. Once this has been done, or if you just want to check the signal, you press the menu button.

On first press you are provided, after a brief period during which the display says "thinking", with the verdict: good, marginal or fail. This is adequate if you have no need to assess the signal. A second press on the button gives you the SNR in dB and the BER. The meter is thus ideal for both installation work and fault finding.

Fig. 1 shows the measurements on which the fail, marginal and good verdicts are based, the BER figure being after QPSK demodulation. The sense of this assessment is admirable: the SNR fail figure is taken as 5dB, knowing that some receivers will work down to 3dB.

### Verdict

Having used this meter for over two months I can honestly say that we are pleased with it in every respect. Operation is clear and fast. The instruction booklet makes the basis of its assessments clear. It's best to familiarise yourself with this, but you won't come unstuck if you simply go by the meter's verdicts.

What about that vital matter, battery life? With a meter that's used intermittently, it is difficult to be precise about this. What I can say is that we have never been let down, and that we have been able to use it for reasonable periods of time throughout a day without the persistent worries we had when using the yellow bone!

Our outside staff, after complaining for many months about the previous DSAT provision, are delighted with the Swires meter. I could give you no better endorsement than that.

### Offers

The basic price of the meter in the UK is £240 plus VAT. There are optional extras – a carry case and a car charger. There have been launch offers, with the case included in the price. Check with Swires for the latest deals. Satellite Planner software is also available: this uses a dongle and a PC to update and edit the prime satellites list. Address and contact details are shown opposite. ■

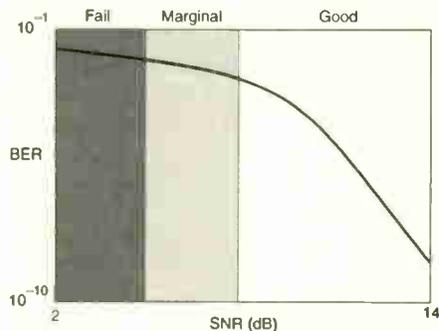


Fig. 1: Signal assessment is based on the signal-to-noise ratio and bit error ratio.

## Are you equipped for Digital Satellite? Our Digi-Sat is!



The Digi-Sat 2001 Meter can be hooked onto ladder rung or satellite dish arm to give a safer working environment.

Type : Digi-Sat 2001



- NiMh batteries give 3 hours continuous operation. Rechargeable from 240 volt mains or vehicle with optional lead.
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- Weighs less than 1.2Kg - complete with batteries.
- 13 volt / 18 volt +22KHz Tone.
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# Chime prioritiser unit

**The need was for an invalid attention system that indicates whether the call is urgent or not. This prioritiser circuit, designed by Keith Cummins, works with a bought-in chime unit to fulfil the requirement**

A few months ago I was asked if I could provide a two-level chime call to help an invalid. The first press on a remote button would produce a quiet chime and flashing LED, indicating a request for non-urgent attention, while a second press would produce a loud chime, indicating the need for urgent attention.

## System operation

As wireless door chimes are readily available and there was no point in reinventing the wheel, I decided to modify a bought-in system. The purchased package consists of a battery-powered transmitter with push-button assembly and a separate chime unit that plugs into a 13A mains socket. The manufacturer quotes an operating range of 50ft maximum, which is adequate for most applications.

The push-button unit can be at the bedside or attached to a wheelchair. The chime unit is situated in an area frequented by the carer. If the call is non-urgent, a quiet chime will be produced. This will be heard by the carer if nearby. If the carer is away from the unit a flashing LED will be seen on his/her return. If the situation is urgent, the

patient presses the button a second time. This produces a loud chime, audible over a wide area. The LED continues to flash and, whichever level of need has been indicated, the carer has to press a reset button to cancel the flashing and also re-establish the 'quiet-chime first' condition. All button presses after the first one produce a loud chime – until the system has been reset.

The chime unit used is the Lindam LD22 (Argos number 870/3141). The prioritiser unit to be described is housed in a small plastic box which is connected to the plug-in chime unit via a length of four-core telephone cable.

## Modification

The modification required to the Lindam unit is minimal, see Fig. 1. The signal line from the chime electronics board is disconnected and instead linked to the prioritiser unit. The grounded side of the speaker is used for the 0V connection. A 12V supply is taken from the cathode of one of the rectifier diodes, which are readily accessible and easy to identify since the anodes are connected to the secondary winding of the mains transformer. The fourth conductor in the link cable connects the chime output from the prioritiser to the speaker.

## Prioritiser circuit

Fig. 2 shows the circuit of the prioritiser unit. The chime-in line is connected to the chime output via R1, the attenuating resistor that determines how quiet the chime will be. With the value specified, 1k $\Omega$ , the attenuation is 40dB. I suggest that this resistor is mounted on pillars so that its value can be changed if necessary to produce the degree of attenuation required. Alternatively you could fit a 2k $\Omega$  preset potentiometer in this position. After the first chime, relay RLA's contacts close, shorting out the attenuating resistor to provide a full-volume chime.

The 12V supply obtained from the chime electronics board is quite rough and contains 100Hz ripple. This doesn't

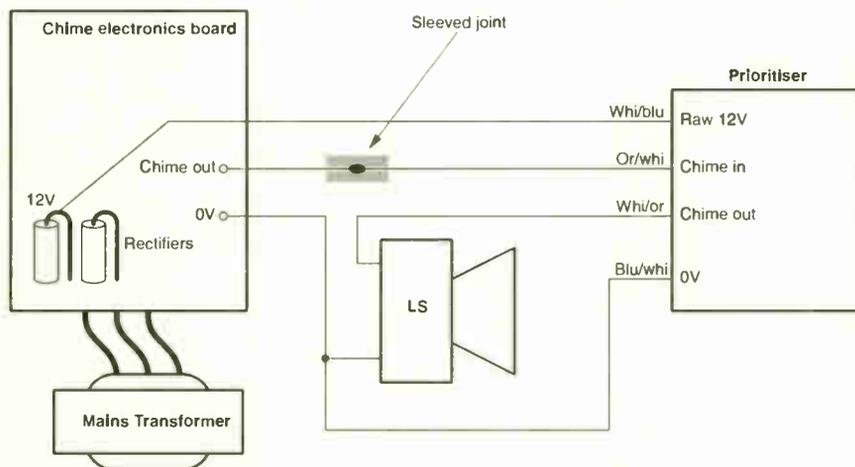


Fig. 1: Modification and interconnections to the chime unit.

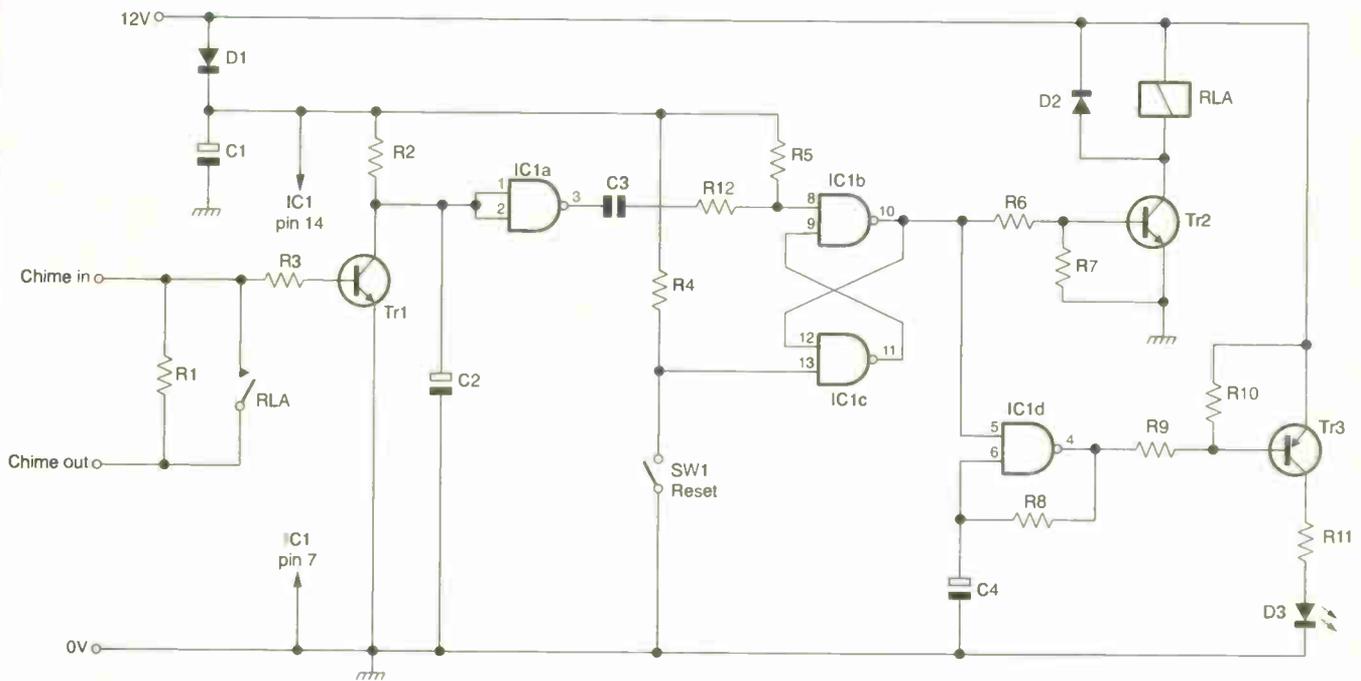


Fig. 2: Circuit diagram of the chime prioritiser unit.

matter as far as the relay and LED circuits are concerned, but the rest of the circuitry needs a smoother supply. Fortunately the consumption is very small, so the use of diode D1 enables the DC-plus-ripple to be peak rectified to charge C1.

Most of the action centres around IC1, a 4093 CMOS chip that contains four two-input Schmitt NAND gates. The circuit works as follows, starting in the middle. IC1b/c form a latch, which we'll assume has just been reset by pressing the reset button SW1. C2 has been charged via R2, so the input pins of IC1a are high. Consequently its output pin 3 is low. Pins 8 and 13 are both high. Pin 10 is low, so Tr2 is switched off and the relay is not energised. The low at pin 5 (IC1d) ensures that pin 4 is high, so Tr3 and the LED are also off.

At the first push of the remote call button the chime signal is applied to the base of Tr1 via R3. Every positive half-cycle switches it on, so that C2 is rapidly discharged. Pin 3 of IC1 goes high, and the transition is coupled by C3 and R12 to pin 8. This makes no difference, as pin 8 is already high. C3 discharges via R12 and the internal protection diode in IC1.

When the chime has finished C2 recharges via R2, the result being a rapid transition at pin 3 of IC1 from high to low. This transition sets the latch, with pin 10 going high. Tr2 turns on, energising RLA to short out R1. All

### Components list

R1	1kΩ	C1	220µF	16V Al electrolytic
R2	1MΩ	C2	2.2µF	35V tantalum
R3	10kΩ	C3	10nF	63V ceramic
R4	100kΩ	C4	1.5µF	35V tantalum
R5	1MΩ	D1	1N4002	
R6	10kΩ	D2	1N4148	
R7	3.3kΩ	D3	Red LED	
R8	1MΩ	IC1	4093	
R9	10kΩ	Tr1	ZTX450	
R10	3.3kΩ	Tr2	ZTX450	
R11	470Ω	Tr3	ZTX550	
R12	100kΩ		All resistors 0.3W, 5%	

RLA 12V reed relay (Maplin JH13P)

SW1 push-to-make non-locking switch (Maplin FF98G)

PX1 ABS box (Maplin YU52G)

Stripboard, connecting wire, terminal pins, 14-pin IC socket etc.

subsequent chimes will therefore be loud, until SW1 is pressed to reset the latch.

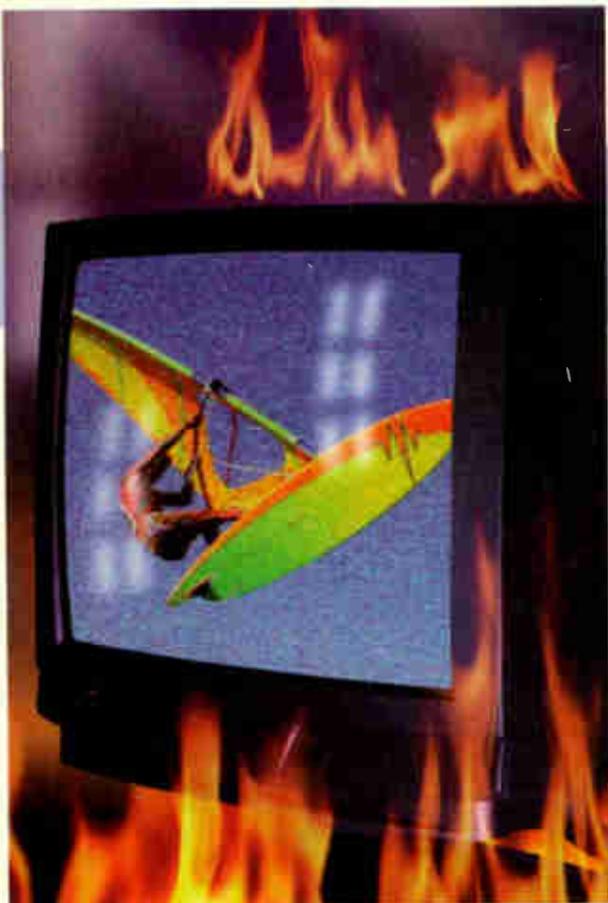
Pin 5 of IC1 has also been driven high by the latch. IC1d then operates as an oscillator, timed by C4 and R8. This switches Tr3 on and off alternately and the LED flashes until the latch has been reset.

### Construction

The layout is not in any way critical. I built the prototype on stripboard, which

was slotted into the plastic box specified in the parts list. It's a good idea to use the lid of the box as the bottom, with the reset button on top, so that a simple downwards press resets the unit without having to hold it. With the lid at the bottom all the wiring can be contained within the box. The LED can then be positioned at the opposite face to the cable entry.

The prototype has provided trouble-free service since October 2000.



# The TV fire hazard

Why do TV sets occasionally burst into flames, and what can be done about it? **Denis Mott** maintains that the cause is generally dry-joints, for reasons that are not fully understood. There are nevertheless various steps that can be taken to reduce the dangers

**A** number of articles have appeared in *Television* in the past on the subject of fire hazards with TV sets. But a recent event brought me back to the subject and reinforces my view that we must not be complacent about the safety of TV sets – and other domestic appliances. Last summer the West Yorkshire Coroner's Office asked me to provide expert evidence in connection with the sudden death of an elderly lady. A TV set was suspected of being the cause – it had caught fire. Would I help by providing advice on how this could happen?

## Investigation

I arrived at the scene with a colleague and the coroner's officer. After a brief run-down on the circumstances we started work. The set had been produced by a well-known manufacturer and was about three years old. It had burnt out totally: the cabinet, the PCB – even the tube was wrecked. It was obvious that the TV set had been the cause of the fire, as the only other damage was to the carpet in the immediate area of the set, smoke damage in the room, and the deceased who had died of poisoning after inhaling smoke and soot from the fire.

How could this occur? Apparently the deceased had phoned her daughter in the early evening to say that the TV set had gone bang. Quite rightly, her daughter had told her to switch it off and unplug it. As there were no other signs of trouble – smoke etc. – her daughter said she would call round in the morning. Some time later

the TV set had burst into flames. Why?

Because of the damage to the set it was impossible to say. The power supply and line scan stages had been totally destroyed, and the heat generated by the fire had resulted in the cabinet burning and the CRT imploding. With knowledge gained from other set fires or possible fire situations however I was able to come up with a plausible explanation for the coroner.

## An explanation

When I arrived at the scene I noticed that the mains plug had been disconnected from the socket but was not as sooty as I would have expected. My conclusion was that the set had not been unplugged but put into standby, allowing the power supply to continue to work.

Set manufacture has improved since the Sixties. Great strides have been made in component safety and fire resistance. But fire resistance doesn't mean "will not burn". It means that the part is resistant to fire until an upper temperature limit has been exceeded. So how does a TV set built during the last three years, with all the usual precautions, destroy itself?

It has been noted recently that if a dry-joint in the line output stage causes arcing the line output transistor will not necessarily fail, especially if the impedance presented to the transistor is maintained. This can occur if the dry-joint is in the deflection-yoke circuit. But once arcing starts, carbonisation develops radially, increasing the low-resistance area. Thus we have arc-

ing that maintains itself and increases in area. The temperature developed can be very high. Eventually, as the heat builds up, the cabinet may start to melt and subsequently ignite. Remember that it's made of fire-retardant, not non-inflammable, material. And until recently the cabinet front was not included in the fire-retardant material requirements, only the back.

We deduced that the deceased had probably tried the TV set again, and that the component which had gone bang started to arc. The rest we do not know. But we feel that the deceased, who was slightly confused, may have left the set on, thus allowing a fire to start.

I disagreed with the investigating fire officer, who suggested that the chopper power supply could have been the cause of the fire. As I've never seen a chopper power supply cause this type of fire, I thought it unlikely. I am sure that the set was brought out of standby and left on. As I mentioned earlier, the mains plug had been removed from the socket. But this could have been done in an attempt to put the fire out, before the deceased was overcome. By this time the fire would probably not have needed any more energy to maintain combustion.

The final verdict from the coroner was accidental death. But was the death preventable?

## Fire prevention

In the late Eighties I was employed by NEI to evaluate components for inclusion in current TV sets or the production of

new ones. I also conducted safety evaluations of complete sets for other customers, to BS415 or, later, IEC65.

Amongst other things this involved testing samples of plastics and PCB materials for fire retardancy. Most PCB material used today is marked FR3 or FR4, which means that it is fire-retardant to standards laid down by the industry.

The frequent testing of plastics involved cutting a sample into 25mm strips and marking them at intervals. If the burning rate was below a certain set standard, the sample was passed. One sample I tested however gave off very noxious smoke and soot, so thick that it blocked out the light in the test chamber. But as it burnt slower than the set limits, it was passed. I did however comment about the possibility of serious health hazards should the material catch fire.

It's possible to produce a TV set in which dry-joints would not develop. But the cost of manufacturing such a set would make it prohibitively expensive. Adding fusible resistors in more circuits is again not cost-effective.

I have a theory that high voltages cause

degradation of soldered joints. In most cases dry-joints occur in circuits that carry high pulse voltages – in chopper power supply and line output stages. Does the high voltage cause migration of lead or tin molecules, leading to a dry-joint? When a new PCB from the production line is examined the joints are seen to be perfect, but after a few months' use dry-joints appear.

The industry doesn't seem to be inclined to investigate this. It would cost a great deal of money, and making sets more reliable may not be on the agenda. But it could explain the majority of set fires in recent times. The heat generated by components can also cause dry-joints of course, but nowadays the allowable temperature rise of a PCB is laid down in IEC65, so newer sets should not have many hot spots.

### Standby

Whenever I visit a customer these days and find that the set is in standby I always point out strongly that this is inadvisable. Sets should be switched to standby for temporary reasons only, such as answering

Denis Mott is Repair Department manager at Key Electronics Ltd. The above are his personal views.

Readers interested in this subject should also refer to Michael Maurice's article *TV sets that catch fire* in the February 2001 issue of *Television*.

the phone etc., not left on all night.

Another aspect of keeping a set in standby is that the degaussing circuit doesn't work, causing purity problems. I feel that keeping sets in standby is the cause of 99 per cent of purity problems.

And of course a set consumes power whilst in standby. This has to be paid for. Users tend to switch their sets off once this has been pointed out to them.

### In conclusion

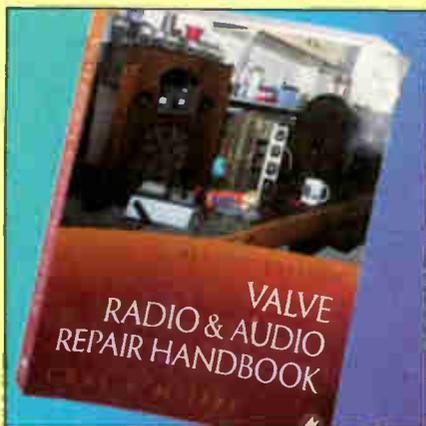
There will probably always be the occasional TV set fire, hopefully not with the disastrous consequences in the case mentioned above. But service engineers can make it less likely by checking for dry-joints whenever a set comes in for repair. ■

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# DX and Satellite Reception

Terrestrial DX and satellite TV reception reports. Broadcasting and satellite band news. A new DX-TV receiver design.

**Roger Bunney** reports



*Europe\*Star-1 at 45°E carries many live news reports from Islamabad. This one was for Korean Broadcasting.*

**G**ood analogue DX-TV reception news: F2-layer propagation has been active and has produced some interesting signals. The MUF (maximum usable frequency) was rising in early October, with morning levels reaching about 43MHz on the 8th. The first ch. E2 (48-25MHz vision carrier) F2-layer signals, unidentified but most likely to be from the Middle East, were received on the 12th, 16th and 18th, between 0900-1200. On the 20th Paul Barton (Harrogate) logged reception of both the Syrian and two Iranian ch. E2 transmitters. Then from the 25th through to the 30th Cyril Willis (King's Lynn) received Arabic transmissions daily, at times from about 0900 until past midday. The 26th produced a ch. R1 signal with VITS. It's thought that this could be China ch. C1, though the time (1215, 1115GMT) is a little late for an F2 skip from China.

Then big news on the 27th, with video buzz at 46-175MHz and strong video pictures. This was definitely ch. A0, Australia. The time was 0730GMT. On the same day, between 0745-0815GMT, vision carriers were heard at 45-8375MHz and 45-52MHz. Definitely New Zealand ch. 1, but this time no pictures were seen. The 28th produced scanner-level ch. A0 carriers at 46-17MHz and 46-175MHz, plus the more regular Arabic ch E2 signals. Chinese-looking people were seen at 1050GMT on the 29th, a ch. R1 signal, and there were Arabic ch. E2 signals. Lower-level F2 signals were noted on the 30th and 31st in chs E2 and R1. I hope to be able to identify specific transmitters by next month, from the accurate offset information provided by Cyril Willis.

Here in Romsey there was early-morning F2 reception in chs. E2 and R1 from about 0720GMT over the period October 28th to November 1st. The 2nd was dead. A pity that work gets in the way of DX catches after 0830 daily!

Sporadic E conditions were also fairly active during the period, the log being as follows:

4/10/01	Canal Plus (France) ch. L2.
20/10/01	RTP (Portugal) chs. E2, 3.
21/10/01	RAI (Italy) IA, B; TVA (Italy) E3-; Tele-A (Italy) E2-; TVE (Spain) E2, 3.
27/10/01	TVE E2, 3.
28/10/01	TVE E2, 3.

Unidentified ch. E3 signals were received on the 3rd, 8th and 18th.

Tropospheric conditions were excellent over the 12-13th, with Band III/UHF reception in the UK from France, Germany and the Benelux countries. Peter Schubert (Rainham) logged the local Dutch TV station TV Gerderland on ch. E35.

There were spectacular sky lights on the 27th, during the Orionids meteor shower. A loud explosion and massive burn at 2030 hours left a trail that took half an hour to decay. There had previously been excellent Band I MS TV reception on the 21st.

Overall, October was a pretty good month!

## Satellite sightings

News continues to be dominated by the consequences of the terrorist attack on the US in September. On October 28th I watched a Family Memorial Concert from the site of the World Trade Towers via NSS K (21-5°W), at 11-487GHz H (SR 5.632, FEC 3/4). In the Middle East and Afghanistan there was a period of military build-up initially, then the bombing began. Many broadcasting companies have established satellite uplink bases in the region, mainly at Islamabad, though units have also been in operation at Quetta and Peshawar. APTN's uplink at Dushanbe, Tajikistan, active at the end of September, seemed to go very quiet in early October: the equipment may have been taken to the front line facing the Taliban in north Afghanistan, as uplinks have been seen from this area.

The first intimation I had of the start of the bombing was on October 7th, while I was watching downlinks via Europe\*Star-1 (45°E). A reporter talking informally to an out-of-shot engineer

commented that there were high-flying aircraft above, at a time when overflying of Islamabad was not permitted. About four hours after hearing this the UK TV networks announced that the bombing had started. The following day I checked Europe\*Star-1 for activity in the Telecom band (12.5-12.75GHz) and found three signals: at 12.523GHz V (encrypted, actually MPEG-4:2:2); at 12.541GHz V (an NTSC test pattern); and at 12.605GHz V. The latter was the most interesting, identifying itself as UKI-685 SKY NEWS 420 in NTSC. On the 10th this Sky News feed carried a very long, edited videotape package for CNN, with shots from the USS Enterprise showing the crew, airmen and support operations – the uplink was actually aboard the carrier.

A few days later the anthrax nightmare started. On the 18th in the early evening CBS Newspath was running rehearsals on tape – VT running forward and reverse etc. This was via NSS K at 11.489GHz V (SR 5,632, FEC 3/4). But the sound channel carried what appeared to be a staff meeting, with questions from worried staff now that anthrax had affected one of their colleagues. The voice of presenter Dan Rather was clearly heard, speaking emotionally and in a supportive way to the CBS staff around him – it was his secretary who had been struck by anthrax. During the next few days NSS K carried many network reports from the US on the increasing number of anthrax cases, with various official statements.

Pentagon wires were hot with military presentations on the air bombardment. One 'reporter to camera', with a live White House video inlay behind, was unaware that, over his right shoulder, security personnel could be seen on the roof of the White House installing defensive/protective equipment between chimneys and other structures.

Perhaps the most dramatic newsfeed I saw was on the 21st, for Sky News, via Europe\*Star-1 at 12.523GHz V (5,622 + 3/4), the colour bar identification being 'Khuj A Bahuddin'. The camera picture levels seemed to be fluctuating then, during a wide shot, the reason became apparent – a lantern was providing the light. The location was near the front line in north Afghanistan, in a ruined building. Signals were present briefly then the report went off, I suppose to preserve power and not attract the attention of the Taliban. Roy Carmen (Dorking) reports that a CBS camera crew humped a satellite uplink across the rough terrain of north Afghanistan, with signals being relayed via Eutelsat Sesat (36°E) at 11.475GHz H (9,740 + 3/4). The pictures were apparently equally dramatic but, despite regular monitoring, I never saw a sparkle of a signal at this frequency.

In spite of all this normal life continues. While scanning Europe\*Star-1 on October 3rd I came across a high-level downlink service identified as 'Newsforce LF7'. Not the war front this time but the relaxing sight of cricket from Zimbabwe. It was a one-day match in the 'Old Mutual OD1 Series', seen being played on the green, well-watered turf in Harare, the link being for Sky News Sports. This was one of several matches seen during the month.

Most sat-zappers use dishes of about 90-100cm diameter. But Edmund Spencer (Littlehampton), no stranger to these pages, has been successfully receiving quality newsfeed pictures from both Europe\*Star-1 and NSS K using his dented, hand-positioned old 60cm Amstrad dish!

### Broadcast news

**UK:** The e-commerce minister Douglas Alexander is considering amendments to the radio spectrum regulations to allow use of certain parts of the spectrum without a licence for commercial telecom services. He suggests that this would open up a "wealth of innovative ideas in the radio technology market". Free use with no regulation or control would contradict the whole idea of the Radiocommunications Agency, which at least maintains spectrum standards for users and their equipment.

An updated listing of all RSL-TV channel allocations, transmitter sites and applicant information can be seen at [www.itc.org.uk/division/eng\\_div/transx/r\\_s\\_l.htm](http://www.itc.org.uk/division/eng_div/transx/r_s_l.htm)



**Wrong line standard! CNN wants 525-line NTSC not 625-line PAL.**

**Asia:** The Burmese MRTV-3 channel is now carrying English-language programming three days a week. The channel is transmitted terrestrially across Bruma and via satellite to SE Asia.

Ekushey-TV in Bangladesh has been ordered to close down following the discovery of administration problems.

**Europe:** NOS-Holland is to launch a government-financed news channel that will broadcast from 0600-1800 local time, starting

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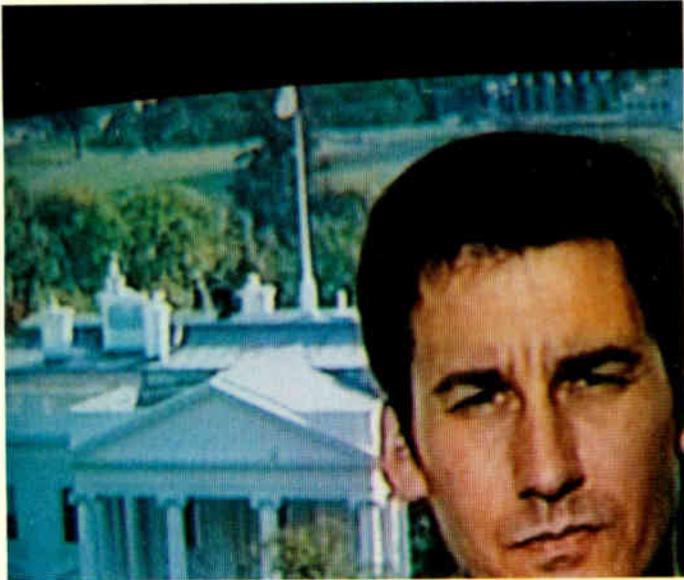
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**News report to Europe using a BT Washington feed via NSS K at 21.5°W. The background is a live inlay of the White House. Note security men in black overalls installing equipment by the chimney left of the flagpole.**

on September 1st 2002. Full 24-hour operation should start by 2005.

The Polish TVP TV network intends to open a 24-hour news channel which will replace the present entertainment service Trojka-TV, providing a rival to the commercial TVN-24 channel.

Canal Plus France is to open a sports news channel, Sports+, by the end of September 2002. It will also be available via satellite transmission.

### Digital terrestrial TV

The Modern Times Group (MTG), which was awarded a Swedish DTT licence, has offered to return it to the government provided the Teracom group frees MTG from any earlier contract liabilities. Interesting that the most popular commercial TV channel, TV4, was not awarded a DTT licence in the first batch of allocations. DTT has been in operation in Sweden for two and a half years but fewer than 100,000 subscriptions have been taken up.

Antenna Hungria is to start experimental DTT transmissions and hopes to be on-air in early 2002.

The French DTT 'auction' has been put back until early February 2002. France's major established national TV networks consider that the commercial success of the proposed DTT

system is doubtful. The government wants the first 22 commercial DTT services to be on-air by the end of 2002. A further eleven DTT licences are available for phase two of the allocations. The Culture Ministry maintains that the government's DTT timetable is still on course.

Russia and China are to co-operate on DTT research and development.

### Satellite news

Eutelsat's Atlantic Bird-1 is to be launched in early 2002, to take up position at 12.5°W. It will have similar coverage to Atlantic Bird-2 at 8°W.

Korea Digital Broadcasting has been awarded a licence to transmit via KoreaSat-3. The plan is to use at least six transponders to provide DTH broadcasting.

The Chinese communications ministry has decided against any further increase in the activities of offshore broadcasters – at present over twenty such broadcasters have access to the country via cable systems and DTH satellite broadcasting. No licences to transmit to China via satellite will be issued in 2002.

The Indian Raj Television Network, which provides the Tamil-language Raj TV satellite service, is building a major teleport that will be capable of uplinking at least twenty TV channels. It should be in operation in late spring 2002. At present Raj TV broadcasts via the Thaicom-3 satellite, with uplinking from a Bangkok teleport.

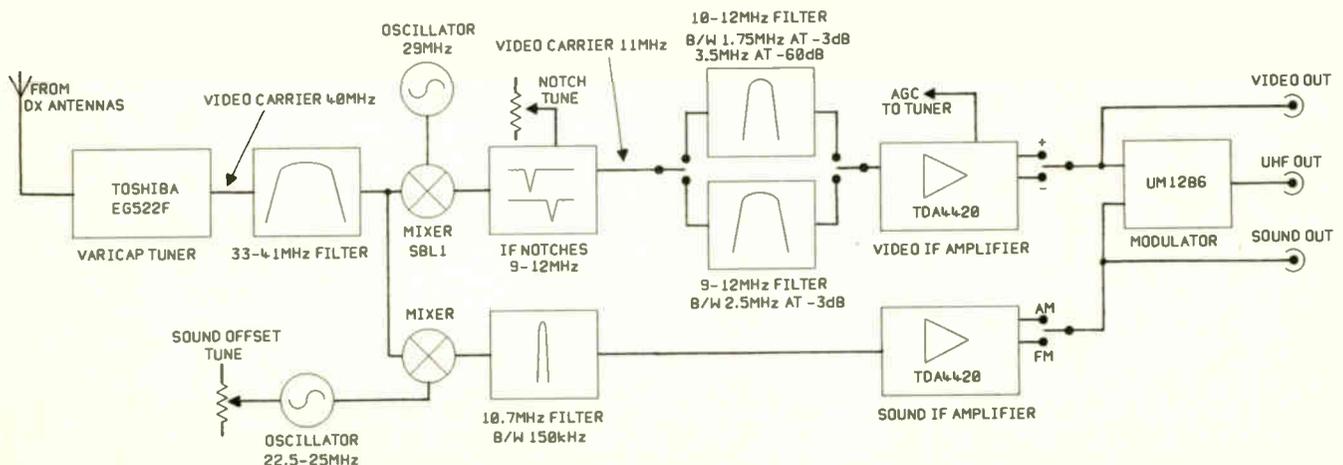
ARD and ZDF are to create a new commercial TV channel, Deutsche Fernsehen, for expatriates living and working outside Germany. Start up is planned for spring 2002. It's hoped that the operation will be profitable within five years.

The Saudi Arabic Radio and Television (ART) group has under consideration an English-language TV channel that would present the Arabic viewpoint on world affairs, with transmission via European-area coverage satellites including Astra.

### A new DX-TV receiver design

I was delighted to hear from Paul Barton (Harrogate), a TV-DXer of long standing, who has come up with a new DX-TV receiver system designed to meet the problems we encounter today when trying to resolve weak analogue TV signals. Fig. 1 shows the receiver in block diagram form. A prototype has been developed, and works well. Paul has given detailed consideration to interference problems, in particular the 49MHz clutter that spreads all over ch. R1 (49-75MHz video).

The following is a brief description of the receiver's operation. The input from the DX aerial is fed to a standard Toshiba varicap tuner whose output is bandpass filtered (33-41MHz) and passed to mixer SBL1. This works in conjunction with a 29MHz oscillator to provide an output at 9-12MHz. The



**Fig. 1: Block diagram of Paul Barton's new DX-TV receiver.**

reason for this second IF conversion is to provide a signal that's better suited to the bandwidth shaping which follows. To start with there is notch filtering: two filters can be tuned across the 9-12MHz pass band. Though based on previous Band I filter designs, use at the much lower IF provides sharper notches. As an example of use, the filters can be tuned 500kHz apart and you'll still get video through the middle! By tuning the filters to the high and low ends of the IF bandpass, additional bandwidth reduction is achieved. As an example of this use, it's possible to separate RAI ch. 1A and the TVA and TVE services on ch. E3. This is followed by selectable bandpass filtering, either 10-12MHz or 9-12MHz. A narrower bandwidth reduces the noise. The output from the following TDA4420 IF amplifier can be switch-selected for either positive- or negative-going video.

On the sound side the signal is tapped off prior to SBL1 and fed to a separate mixer for down-conversion to 10.7MHz in conjunction with a tuneable oscillator (22.5-25MHz). The TDA4420 chip used as the sound IF amplifier can handle AM or FM, with switched selection of the output.

The receiver provides baseband video and sound outputs or a

UHF output from the UM1286 modulator.

Paul has under consideration another project, to deal with hash from baby alarms at several discrete frequencies in the 49.8-50MHz region. Thoughts are to provide suppression at -70dB while still allowing the 49.75MHz carrier through. My own experiences with single-frequency problems suggest that a phasing system works well but, when you are faced with a multiplicity of signals such as baby alarms on a housing estate, you are in a no-win situation.

You might ask whether all this design effort is worthwhile in view of the moves to ever more digital broadcasting and the prospect of no analogue transmissions in just a few years' time. I'd answer with a guarded "yes". While many West European countries are moving to DTT quite fast, the move is slower in East Europe - the analogue closure is not due in Russia until 2015 for example. Ch. R1 will certainly still be around for several years into my retirement!

My thanks to Paul for letting us know about his receiver design activity. I hope to be able to report further on this and his new concept for a 21st century receiving system. ■

# 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:** FM/AM 9101 sound board for the Ferguson ICC9 chassis, with ITT MSP3410 chip. Reasonable price paid for working board. Phone 01702 523 872 (Essex).

**Wanted:** Circuit diagrams for the Nikkai Baby 10 TV set and details of the Michael Dranfield switch-mode regulator conversion, or a PCB. Also various other bits, especially the potentiometer panel. David Benyon. Phone 01288 353 373 (Bude, Cornwall) or e-mail david.benyon@lineone.net

**Wanted:** Any information on the 21in. Pye Studio type 56K. Problem is that it won't stay in tune. Ken Simmons, 5 Orchard Close, Littleport, Ely, Cambs CB6 1NU.

**Wanted:** I have a Salora 25M9C (M series TV chassis) that appears to be 'locked up' - none of the front-panel or handset controls has any effect. Can anyone lend me a service manual to photocopy, or alternatively does anyone know the pinouts of the microcontroller chip IC1, which is marked SALO-12, 69/02 and 0066? This IC no longer seems to be available. Can anybody supply one? Roger Burchett, 12 Ormonde Road, Hythe, Kent CT21 6DN. Phone 01303 267 969.

**Wanted:** Does anyone have any circuit diagrams or, better still, full service manuals for the following: tachograph testers made by Leslie Hartridge from 1975, tachograph programmers made by Jaeger and tachograph drive units ('Runrigs') made by M.C. Bignell for Smith's Industries? Any help would be

much appreciated. B. Church, Bridge Mills Service Centre, Unit 5, Bridge Mills, Rochdale Road, Edenfield, Lancs BL0 0RE. Phone 01706 826 344/827 742 or fax 01706 824 251.

**Wanted:** Circuit diagram or service manual for the radio/14cm mono portable Model W5503, badged "E++S" Germany (made in China). There are two ICs, types CD7313 and CD515CP, and the PCB is marked SWJ-55C3-III-B. Does anyone know a source for the ICs? P. Guarini, 31 Aldgron Avenue, Rawmarsh, Rotherham, South Yorkshire S62 7DE. Phone 01709 371 188.

**Wanted:** Working CD PCB for the Aiwa Model NSX-999. The PCB is number 84-ZG1-602-319. Mark Saunders, 15 Park Villas, Ashington, Northumberland NE63 8HT. Phone 0777 316 2028.

**Wanted:** Circuit diagram, spares etc. for the Grundig Video 2000 Model 2 x 8 Stereo 2280a. Require sequence control PCB type no. 27504-063. Alan Stubbins, 7 Church Road, Saxilby, Lincoln LN1 2HH. Phone 01522 702 601 evenings/weekends.

**Wanted:** Circuit diagram for the Cambridge power amplifier Model P110. Good photocopy OK. Though old, the amplifier is well built and to date has been extremely reliable. Steve Roome, 22A Lyndhurst Drive, Leyton, London E10 6DJ. Phone 01992 566 115 (Chapman Electronics, direct line) daytime or 020 8539 5876 evenings.

**Wanted:** New or used XC44000P or

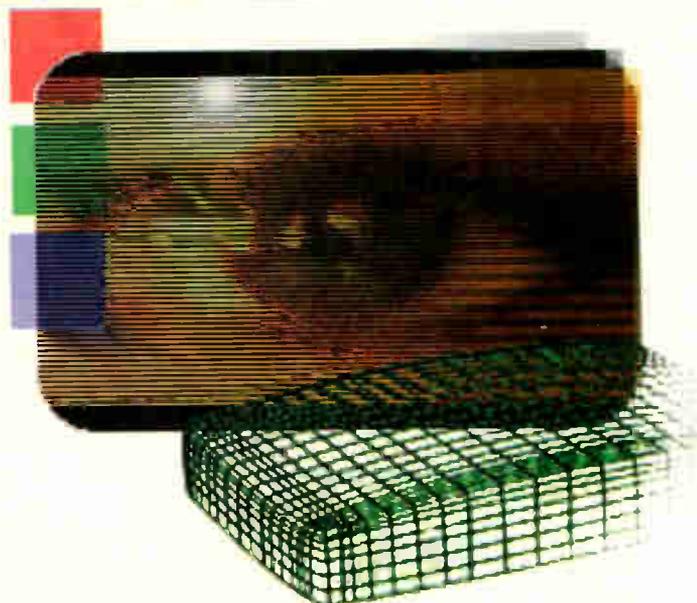
MC44000P processor chip for certain Mitsubishi TV models. Roger Scales, 17 High Street, Bridlington, East Yorkshire YO16 4PR. Phone 01262 602 584 or 07808 070 479.

**Wanted:** I have a Clarion car CD autochanger unit, Model CDC634/ FMC200, that doesn't work. The only clue is that ER9 shows in the display. Can anyone suggest a cause of the trouble? Chris Plaice, 58 Lan Coed, Winch Wen, Swansea SA1 7LL. Phone 01792 310 575.

**Wanted:** Regulator switching transformer T602, part no. 1-413-053-11, for the Sony Model KV2704UB, or a complete power-supply panel (F2). Also require a Discatron record player, letter-box type. H.F. Judge, 8 Fontenoy Road, London SW12 9LU. Phone/fax 020 8673 8577.

**Wanted:** I have a low-brightness problem with a couple of Philips TX3 monochrome portables. Extensive tests have failed to reveal the cause but there's a clue in that the collector voltage of the video output transistor is a bit high. Does anyone know if there were any official modifications to deal with the problem? R.E. Bailey, 22 Grebe Close, Waterlooville, Hants PO8 9UT. Phone 02392 783 811.

**Wanted:** Someone to repair a Sony C20 or C30 Betamax VCR. Ideally in the Clapham area, but anywhere in SW or central London convenient. F.R. Fleuret, 6 Lydon Road, London SW4 0HW. Phone 020 7622 2147.



## TV FAULT FINDING

Reports from  
**Glyn Dickinson**  
**Steve Hague**  
**Mike Leach**  
**Philip Salkeld**  
**Robin Beaumont**  
**Chris Dakin**  
**Graham Boor**  
**G.W. Roper**  
**Mark J. Leach and**  
**Adrian Farnborough**

We welcome fault reports from readers – payment for each fault is made after publication. See page 170 for details of where and how to send reports.

### **Bush 1433 (11AK20 chassis)**

We've had several of these sets with the complaint reverting to standby or going off completely, sometimes after a tap on the board. A dry-joint of course, but where? In each case removing the IF shielding plate and resoldering the regulator chip IC802 and the jungle chip IC401 has cleared the problem. G.D.

### **Sharp DS/ES chassis**

These chassis are a welcome backwards step from the CS chassis. Sharp must have listened to the curses emanating from many a workshop, as they use a larger, more conventional PCB with a sensible complement of surface-mounted devices. The circuitry is similar in many areas however. The most common trouble is a dead BUH515 line output transistor because of a dry-joint at C608 or C613. If you are unlucky, the power supply will be damaged as well. In this case replace Q701 (2SK2605), Q702, Q703 (both BC338), D712 (15V zener diode), D713, D730 (both 1N4148), C713 (68nF) and R716 (0.47Ω or 0.22Ω), and check whether any of the rectifiers on the secondary side of the transformer are short-circuit. Most of these items are identical to those supplied in the CS chassis kit. G.D.

### **Goodmans W288NS**

This widescreen set was about eighteen months old. It had come via another

engineer, who had replaced the line output transformer. The fault symptom was that the width closed in gradually, followed by line output transistor failure. I checked the tuning capacitors, then studied the line drive waveform, which had an unwelcome negative-going spike on it. I replaced most of the components in the line drive circuitry before condemning the line driver transformer T2. A replacement borrowed from another set proved the point.

As has been mentioned in these pages before, Comet will not supply this part. In fact the helpful man thought it was probably not available even to their privileged engineers! As there was no option, I cleaned and resoldered the leadouts. This restored cool running in the output stage with full width. G.D.

### **Tatung B1 chassis**

These sets often come in with lack of width and incorrect line frequency. The cause is corrupt EEPROM data. To set the values, move jumper plug PL704, which brings up the service mode. Scroll down to value 07, using buttons 3 (down) and 2 (up) on the remote-control handset, and set it using balance + and -. A typical value is about 28. A picture should now be visible. If the geometry values are affected, height should be 09, linearity 0A, vertical positioning 0C and width 0E. Press store on the front panel before moving the jumper back (early copies of the manual omitted this step).

The cause of the corruption is often that R814 (75kΩ, 2% or better) in the power supply has changed value with the result that the HT voltage is high. Recently however we have had a faulty degaussing resistor cause the problem. It's best to replace both these items.

If you don't have the correct handset, a Philips unit will do – provided it has a balance control. G.D.

### **Toshiba 145E7B**

I look after a number of these sets at a holiday park. If the SR2M over-voltage diode D808 has gone short-circuit, the STR50020 chopper chip will need to be replaced – it tends to become leaky when hot. C813 (47μF, 63V), which is mounted in a pool of glue, can also be the cause of this symptom.

If the STR50020 chopper chip is short-circuit and the replacement overheats, with low HT, the small chopper transformer T802 is suspect. This item is not exactly cheap! G.D.

### **Goodmans GD2592 (Ferguson TX92 chassis)**

This set was dead with a blackened fuse. The chopper FET TP16 was short-circuit,

and the cause seemed obvious – a huge dry-joint at the capacitor (CP13) in the snubber network. I cleaned and resoldered this, replaced the FET and the TDA4605 control chip, and checked all the high-value resistors in the circuit. But when I switched the set on I was rewarded with a bright flash from the fuse as the new FET expired.

After numerous inconclusive checks and not a few component replacements in the primary side of the power supply I eventually found that the BY399 HT rectifier DP51 was short-circuit. A replacement restored normal operation. In theory this type of power supply should simply refuse to work when there's a short-circuit at the secondary side. And what about that dry-joint? S.H.

### **Hitachi C2586TN**

This was a fault you might come across once in a lifetime. It seemed that the CRT was faulty, as the first anode control on the line output transformer just couldn't be set up correctly. Whenever you got the display almost correct, the picture would go bright green and the set would shut down to standby.

Many things were tried – various items on the CRT base panel, and around the jungle chip on the main PCB. Eventually the cause of the trouble was traced to a faulty diode in one of the lines that feed RGB from the text/microcontroller section to the tube base panel. It was D8, in the green drive. The circuit diagram shows it as an ordinary diode, but in fact it's a 3.3V zener diode.

Watch out for this one. I went down many different garden paths before solving the problem. M.L.

### **Sony KVE2932U (AE2 chassis)**

There was excessive width with EW problems. The width could be varied using the service menu but not by enough. Checks showed that the -7.4V supply was poorly smoothed, the cause being C819 (470µF, 16V). A normal picture appeared once it had been replaced. M.L.

### **Hitachi C2976TN**

This set had received attention from "a bloke down the road" who had tried to fix it. The set was dead with just the standby light on. The LOPT was shiny and new, the field output chip was also new, and a lot of soldering had been carried out on the underside of the deflection PCB. The cause of the dead problem was straightforward: C703 (10nF, 2kV) in the line output stage was badly bulged. A replacement produced a picture, but there was field scanning in only the bottom half of the screen – the top half showed just a few flyback lines.

Several DC voltages around the field output chip were high, which suggested that it wasn't drawing a lot of current. The field drive was present at pins 1 and 2, but the waveforms looked poor and cramped. When I disconnected them from the output chip they returned to normal. This suggested a drive problem, so I traced back to the source on the signals panel and replaced the TDA9160A chip IC501. That cured the field scanning problem.

I then had to redo the soldering that had been done previously and redress all the leads with cable ties, as the original cable clips were missing. Customers often tell us that their sets have already received attention, but these "blokes down the road" remain very elusive. M.L.

### **Philips 29PT828C/05 (L2.2AA chassis)**

This set was dead with the 5A fuse in the mains plug open-circuit. I feared the worst, but there were no obvious short-circuits. So I fitted a new fuse and switched the set on. The mains rectifier's reservoir capacitor (220µF, 385V) started arcing. After fitting a replacement I switched on again. Was I pleased when the set worked! These are not my favourite sets. P.S.

### **Bush 2164NTX**

Shorted turns in the line output transformer is a common fault with these sets. The symptoms are a dead set with the green LED flashing. CHS stock the transformer, the order code being ALB586. P.S.

### **Grundig ST70-700NIC/FT (CUC2030 chassis)**

This set came in with line collapse because of a dry-joint at the scan coil plug. When I resoldered this I found that there was lack of width and EW bowing. Tracing back through the circuit I came to R55006 (5.6Ω, 0.5W), which was open-circuit. There were perfect results once this item had been replaced. P.S.

### **Sony KV25X5U (FE1 chassis)**

I've had several cases where the set has been dead with the LED flashing four times. If the 9V supply is present at pins 33 and 44 of the jungle chip IC301, look no farther than R546 (47Ω, 0.5W) which goes open-circuit. It feeds the 135V supply to the line driver stage. P.S.

### **Sharp 51DT-25H**

When switched on from cold this set behaved strangely, for example there was lack of height, no video and tuning drift. A phone call to Sharp provided the answer. There's an NV memory modification, as follows. Fit two zener

diodes, D510 and D511, part no. RH-EX0404BM22; fit a coil, part no. VP-CF120K0000, in place of link J122; and fit another zener diode, D403, part no. RH-EX0412BMZZ. Fortunately the circuit reference numbers are printed on the PCB. P.S.

### **Bush 1434 (11AK20 chassis)**

The set shut down with a ticking noise. Cold checks brought me to D604 (BA157) which was short-circuit. A replacement restored normal operation. This could be a common problem: I've since had two more of these sets with the same fault. P.S.

### **Samsung CI533CN (S51A chassis)**

This set worked all right with inputs via the scart socket but there was no RF signal. As the supplies at the tuner all appeared to be correct, I ordered a new tuner. But the fault was still present when it had been fitted. A phone call to Samsung technical produced the answer. Order the service manual (first issue free) and go into the factory setting menu. There's a list of adjustments. I was offered further help if this didn't clear the problem, but there was no need to go back. P.S.

### **Philips 32PW9543/05 (MD2.25E chassis)**

The customer complained about generally poor definition. In particular when he used his DVD player for audio the on-screen display was decidedly fuzzy. I often 'borrow' a Sky digital receiver when investigating faults like this: the blue and yellow captions are clear, and the option to toggle between RGB and PAL is useful. When I did this I found that the definition was poor in all modes. The DVD player was checked with another set and found to be satisfactory.

A useful feature with this chassis is the operating hours counter, which you access via the service mode. The set had been used for nearly 5,000 hours, which is a lot for a two-year old, so suspicion fell on the tube. A replacement improved matters, but not as much as I had hoped.

So what can affect the definition in both the RGB and PAL modes if the CRT and focus circuits are known to be OK? These widescreen sets are fitted with SCAVEM (scan-velocity modulation), a circuit that slows the line scan down briefly during fast video signal transitions to make them appear sharper. A small amplifier on the tube base panel drives a coil on the neck of the tube. I disconnected the coil while watching the on-screen captions. There was no difference. I then checked the SCAVEM

amplifier and found that the BD140 transistor Tr7140 was short-circuit base-to-collector. There was an excellent picture once a replacement had been fitted. **R.B.**

### **B&O Beovision MX4500**

I've had a couple of these sets recently with poor FM sound – vision buzz and white noise spoil the usually excellent performance. Don't waste time with ceramic filters or trying to retune the detector coils. The cause of the fault is C176 (10µF) which decouples pin 3 of the TDA4445 first sound detector chip I171. It's under the screening can that covers the tuner section of the main PCB. You could get the same fault with other sets that use this chassis. **R.B.**

### **Sharp 66FW53H (DA100 chassis)**

This set appeared to start up then dropped back to standby. It repeated the cycle indefinitely. I checked the protection circuits for fault indications but found no clues. So I decided to override the switch-on signal from the standby processor by shorting pin 15 of IC702 to chassis. The set then started up and produced a picture, though only limited functions were available.

To confirm my suspicions I spoke to Sharp technical, who agreed that the NVROM was likely to be the cause of the problem. When I replaced this minute, surface-mounted 8-pin chip the set came to life. All that remained was to reprogram all the picture geometry, tuning and customer control settings.

Approved Sharp service agents can download most manuals from the website. Having realised the limitations of this service however Sharp will supply paper circuit diagrams only, at very reasonable prices. Part numbers and a vast range of other technical tips are on the website. **R.B.**

### **Panasonic TX33PF10 (Euro-5 chassis)**

I've had two of these sets in recently. The first one had low, unadjustable sound with the AV channels, the second one had sound but nothing on the screen. Running a 'self-check' cured both faults. To run a self-check you press the -/V button on the set while at the same time pressing the remote-control unit's 'status' button. To exit self-check, use the power button to switch the set off. Then, when the set is switched on again, it will go into the set-up mode after which everything should be OK. **C.D.**

### **Nokia ST51A1 (Stereo chassis)**

The complaint with this set was no sound. It would sometimes come on if the set was switched off and on several times. When I looked at the circuit diagram I saw that there are a couple of muting

transistors, VA60 and VA61. They are of the surface-mounted type. As I've had problems with this type of transistor in Ferguson sets, I decided to replace them. This restored good sound. **C.D.**

### **Matsui 1476**

The power supply was ticking and the set was otherwise dead. This indicated an overload. On inspection I found that C412 (470µF, 16V) and C414 (100µF, 35V) near the LA7837 field timebase chip IC401 were both leaking badly. After cleaning the board, fitting replacement capacitors and resoldering some dry-joints the power supply still ticked. When the field timebase chip was removed the power supply worked correctly. A new LA7837 chip restored full operation. **C.D.**

### **Toshiba 28W8DBA**

The customer complained that this set would switch itself off intermittently, with the red LED flashing, and had poor colour. When I called the cause of the trouble was obvious: there was no red in the picture. A quick check showed that there was no voltage at the tube's cathode – it had developed an internal short-circuit. A new tube restored good colour with no more tripping out. Fortunately the set was still under guarantee. **C.D.**

### **JVC CS2190EK (BXII chassis)**

This set would run for about twenty minutes then go off with just the LED alight. Voltage checks revealed that in the fault condition the 115V supply (B1) was missing. I checked the voltages around the two transistors in the B1 supply switching circuit and found that Q924's emitter was at 88V instead of 115V. The feed is via an N5 circuit protector (CP901), which had developed a resistance of several ohms. A replacement restored reliable operation. **C.D.**

### **Panasonic TC14S1R (Z5 chassis)**

This 14in. set belonged to a member of the local CID. According to the rap sheet it was dead. On investigation I found that the mains fuse F801, D807, D808 and the chopper chip IC801 (STR51203M) had all failed. It's advisable to fit a chopper chip obtained from Panasonic. **G.B.**

### **Tatung T21TD50 (D chassis)**

This 21in. set had no green in the display. Checks on the CRT base panel showed that R932 (100kΩ) on was open-circuit. As a result there was no feedback/bias at the base of the green driver transistor TR931. As a precaution I also replaced R922 and R912 in the B and R output stages. **G.B.**

### **Hinari CT16**

The owner wanted to get this dead 10in. set going again if possible and economical. It didn't take me long to

discover that there was a faulty rectifier diode in the line output stage, D552 (ERD29-06). A BYW95C seems to work happily in this position. **G.B.**

### **Panasonic TX25MD4**

This set would revert to standby after a few seconds. I managed to establish that the power supply lines were all present and correct and that the line timebase was working, but there was no field output. When I used a magnifying glass I found that there were virtually invisible rings around all the legs of the field output chip IC451. Resoldering cleared the fault. **G.W.R.**

### **JVC AV25VM1EK**

There was top and bottom cramping (about an inch) with bright white line scanning. The screen would flash and then go blank. If the setting of the first anode control was increased a green raster with field flyback and horizontal scan lines appeared.

The TDA8350Q field and EW output chip IC401 was suspect, and had a low voltage at pin 11. A replacement chip produced a perfect picture. **M.J.L.**

### **Mitsubishi CT25M3LTX (Euro 14 chassis)**

Field collapse is common enough with these sets. The usual cause is that the safety protector Z551 or 0.82Ω resistor in the 27V supply to the field and EW output chips has failed. In some sets Z551 is 2A, in others 1.6A. The protector or resistor is connected to pin 3 of the LOPT. This time however the AN5521 field output chip IC451 had failed, with the circuit protector intact. The replacement, and yet another one, failed within two days. Scope checks failed to reveal anything amiss so, for want of any better ideas, I decided to replace the reservoir capacitor for the 27V supply. It's C560 (3,300µF, 35V). A 2,200µF, 35V capacitor was fitted, as 3,300µF is not an easy value to obtain. Some months have passed since this repair was carried out, so the replacement capacitor seems to have done the trick. **A.F.**

### **Toshiba 2573/2873DB**

The problem with this set was excessive width because of no EW modulator operation. I checked for a field waveform at pin 4 of the TA8859 chip Q302 and found it missing. A new IC restored correct scanning. **A.F.**

### **Mitsubishi CT2145BM (Euro 6 chassis)**

It's unusual to have no colour with this chassis. Scope checks showed that there was no chroma at pin 3 of the TDA3565 colour decoder chip IC252. This suggested a fault in the bandpass transformer LO601, which was open-circuit. **A.F. ■**

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# MONITORS

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and  
Ian Field**

We welcome fault reports from readers – payment for each fault is made after publication.

Reports can be sent by post to:

Television, Fault Reports,  
Anne Boleyn House,  
9-13 Ewell Road,  
Cheam,  
Surrey SM3 8BZ

or e-mailed to:  
tessa2@btinternet.com

## Viglen Envoy15-DS V5AV01

There was no blue in this monitor's display, but none of the usual suspects were to blame. The cause turned out to be C417 (100nF ceramic), which was leaky. It's used for blue signal clamping by the LM1282 video preamplifier IC. Identical clamp capacitors are used in the other two channels, so this fault could occur in any channel. G.M.

## Viglen CM700

There was excessive width and EW bowing. The cause was the SF35 pincushion modulator diode D804, which was very leaky. A replacement diode restored correct geometry. G.M.

## LG520si

The complaint was excessive height. The customer adjustments for width, height, phase, pincushion correction etc. are by means of four buttons at the front, two for selection and two for actual adjustment. When vertical amplitude was selected there was no height alteration, though the other adjustments all worked. Fortunately the chip that controls these functions, IC401, had some of its pins labelled. Pin 40 is the relevant one for height. When height adjustment was selected the voltage at this pin would vary from 0V to 5V, from one extreme to the other of the pulse-width modulation. When I followed the print from this pin I came to resistor R709 (10kΩ), whose far side was held at almost 0V all the time. The cause was an 0.1μF disc ceramic capacitor, C709. When checked it produced a 300Ω resistance reading. Adjustment could be made once this item had been replaced. I.B.

## IBM 07G9961

If the monitor is dead with a high-pitched whistle from the chopper power supply, the line output transistor Q306 is probably short-circuit. It's type SGSIF444 or S2000AF. The usual cause of its failure is the line output stage tuning capacitor C313, which goes short-circuit or becomes dry-jointed at one of its legs. A.R.-W.

## IBM 6540-02N

Loss of one of the primary colours is usually because the relevant output transistor on the tube base panel has failed. The transistors are marked SD1609, which really means 2SD1609. A BF459 is a suitable replacement. A.R.-W.

## AOC CM336

If the display closes up, as though the monitor is suffering from line phase drift, as the temperature inside the case increases replace Q852 (2SC945 or

BC639) and the 8.2V zener diode ZD851. The 31kΩ phase and F/V presets, which are at the front left of the chassis looking from the back, will then require readjustment. A.R.-W.

## Nech CM1450MCLR

The screen flooded red in the high-definition mode only. I removed the CRT base PCB screening, which is soldered at the four corners and in the centre of the PCB, then inspected the PCB. As there were no signs of any dry-joints I decided, to save time, to replace all three transistors in the red channel – BF432, 2SC1823 and 2SD1609. They are not expensive. This cured the fault. A.R.-W.

## Acorn AKF60

This is a cost-reduced version of the Microvitec Series 13 chassis (Model 14VLN2D), which was covered by Russ Phillips in the May 1998 issue of *Television*. Small component changes in the power supply and line output stage are noticeable. But Russ omitted to tell us how to take the thing apart (remembrances of the IBM 8500 PS2 monitors)! First unscrew the two Torx screws that hold the case bottom/front, and the single Phillips screw that holds the back, by the mains and signals input cables. Then insert a meter probe in the two pinholes about two inches from the left and right edges at the top of the case, and press down to release the internal top catches.

If there's no screen display but the front LED is on, the power supply is working, there is EHT, and a vertical line (no line scan) can be seen when the setting of the first anode potentiometer is advanced, replace the BUH515D line output transistor (TR203) and the usual cause of its failure, tuning capacitor C216 (3.3nF, 1.6kV). This capacitor is behind relay RL500. It goes either low-capacitance or open-circuit. A.R.-W.

## Proview PK770

There was reduced width in all modes, more noticeable in some. In the modes where the lack of width was least apparent the OSD width settings had been set flat out by the customer in an attempt to solve the problem. When you get this fault, check for dry-joints at the soldered connections to relay RL601. In one case I've come across a set of the relay's contacts was open-circuit. A.R.-W.

## Proview/Essex PV848F-G2E

If the monitor is dead, check for a dry-jointed, virtually hidden wire link located between the mains rectifier's reservoir capacitor and the degaussing posistor. When this particular monitor was on test

however the brightness level seemed to increase the longer it was on. The 10kΩ feed resistor and the ceramic decoupling capacitor in the CRT's first anode circuit checked out OK, but green gunge was spotted holding down a wire link on top of the A1 connection on the CRT base. It produced a reading of 2-6MΩ to chassis depending on the pressure applied to it. Correcting this cleared the fault. A.R.-W.

### **Hewlett-Packard Pavilion D5259A**

This monitor produced a perfect 640 x 480 display, but in all the high-resolution modes there was a narrow, folded display with excessive height. While I was taking measurements around the capacitor-switching MOSFETs in the scan coupling section the prod slipped and the monitor packed up completely!

The damage was in the B+ PWM circuit, where Q440 (2SK2679) and D442 (HER305) were both short-circuit. Unfortunately the 2SK2679 isn't just any old MOSFET. It has a low drain-source resistance when switched on, and is also fast. As I didn't have one in stock, I had to search through the data sheets to find a suitable type that I did have. A 2SK1507 did the trick. The HER305 is mounted with a pair of hefty ferrite beads, and since B+ flyback diode failure isn't all that common I suspect that it was struggling before the accident. As is often the case, it is switching speed rather than current or voltage that causes the problem. A look at the data sheets revealed that the higher-voltage rectifiers always have the slowest Trr figures! You can get around this by using lower-voltage devices in series, so I tried three BYV28-200 diodes. The combination worked well – and the original fault had been cured. I.F.

### **CTX 1785XE**

Line output transformer failure can sometimes be difficult to diagnose with certainty. Occasionally a replacement proves that the fault lies elsewhere, which is an expensive mistake to make. The line output stage design in this monitor is not wildly unusual, and the symptoms it provided left little doubt that a new LOPT was required. At first the circuit configuration was a little puzzling. It is one of those in which the line output transistor is in series with the HT feed to the LOPT, while the line driver transformer has an emitter tap on its secondary winding. The upper part of the line driver transformer's secondary winding provides the output transistor's base-emitter drive. The emitter current flows

through the lower part of the winding, providing 'regeneration'. It's like a blocking oscillator arrangement, and is used to speed up the movement of minority carriers in the output transistor's base-emitter region.

If the LOPT breaks down in operation, the transient rise in the output transistor's emitter current can drive the 'autotransformer' arrangement so hard that it blows the transistor's base-emitter junction. If you then replace the transistor (2SC5296), it will attempt to drive the LOPT and the fault current will activate a variety of safety trips, leaving little in the way of symptoms to diagnose.

One of the things switched off is the B+ regulator at the chassis end of the LOPT's primary winding. This can be temporarily replaced with a 330Ω, 10W resistor. It's possible that the fault condition also shut off the line drive, and that line output stage oscillation was maintained by the driver transformer's secondary winding doing the blocking oscillator bit, providing sufficient drive to confirm that the LOPT was in fact the cause of the failure. I.F.

### **Compaq Presario 1725**

The model number started with 320, but the rest was unreadable because someone had peeled off part of the information panel with a sticky label. Initial checks revealed that the 2SK2048 chopper MOSFET and the 4AT mains fuse had both blown. During an examination of the chassis I noticed that C951 in the STR83145 auto mains voltage switch circuit had been replaced with two 10μF, 250V electrolytics twisted together. The data sheet shows that this capacitor is for the latch timing circuit that prevents inadvertent switching to 110V during 'brownout' type power supply disruptions.

Whoever had fitted this bodge could be forgiven for thinking that the ripple is at 100Hz (full-wave rectified mains), but in fact the SRT83145 chip contains a 15kHz oscillator to drive the triac gate. So the doubled ESR of a pair of electrolytics in series is definitely not a good idea! Personally I don't trust these auto mains voltage switches, but most failures are caused by the small, high-voltage electrolytics.

On this occasion the customer was happy to authorise complete removal of the auto-110V switch. When the customer wants it retained, an attempt should be made to replace as many as possible of the smallest electrolytics with Mylar or polycarbonate capacitors. Once the modification to the mains input circuit had been completed, I powered up the

monitor with the MOSFET removed and a 60W bulb across the blown fuse. As all the pulses around the UC3842 chopper control chip looked about normal, I decided to replace the MOSFET and the fuse. The fuse blew instantly, but the MOSFET was undamaged. Further checks revealed that one of the two mains-input reservoir electrolytics was short-circuit – a typical result of inadvertent activation of the auto 110V switch! I.F.

### **CTX 1565D**

This repair turned out to be less eventful than expected, considering the wild and highly entertaining light show produced when the monitor was subject to the slightest movement. Apart from the fact that the CRT PCB and CRT base socket were about to part company, it looked as if the RGB output transistors might drop off first! The only real problem was the reluctance of the component leads to accept fresh solder. A quick scrub with a steel-wire brush soon fixed that. I.F.

### **PVS/LVI Magnilink X14**

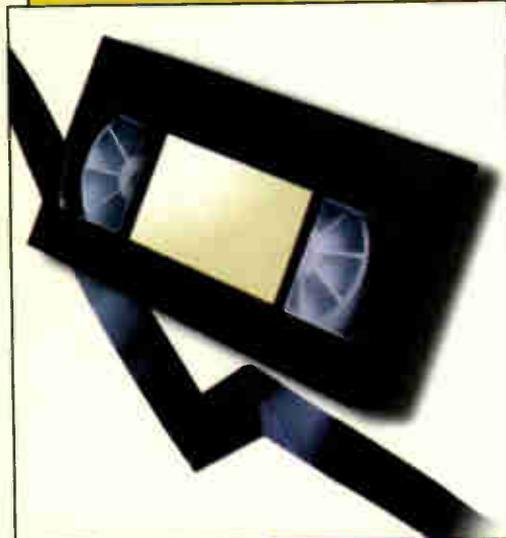
This low-vision microfishes's display unit is a converted Philips L6.1 chassis. There was a horizontal line across the screen. The usual cause of this is a faulty heatsink washer on the BD137 transistor Tr7402 in the vertical output circuit. The fault burns out the fusible 1Ω, 0.25W resistor R3427 and the BYD33G rectifier D6420.

The first thing I noticed when I opened this unit was that the CRT's Aquadag earthing strap was off. In addition to the usual stock-fault damage described above, the 1.5Ω, 0.25W fusible resistor R3404 had burnt out and the other output transistor was also damaged.

Most of the replacements required were easy to find, but when it came to the BD series transistors no one who listed them actually had any in stock. Official alternatives are the BD136/137, BD228/229 or BD137/238. I eventually found a BD238 for the pnp device but the nearest I could find for the npn one was a 2SD669A. I.F.

### **Apricot XJ49905/Viglen CA1426LT**

These two monitors are very similar and, apart from having Trinitron CRTs, are similar to the AST LR14. This one had been put in the skip by the owner of a disposals warehouse. It had a blown mains fuse, the cause being nothing more serious than a short-circuit diode in the mains bridge rectifier circuit. I replaced all four diodes, because one of the others always fails soon afterwards if the three survivors are left in. I.F. ■



## VCR CLINIC

Reports from  
**Eugene Trundle**  
**Ronnie Boag**  
**Geoff Butcher**  
**J.S. Ogilvie**  
**Bob Flynn**  
**Graham Boor and**  
**John Coombes**

We welcome fault reports from readers – payment for each fault is made after publication. See page 170 for details of where and how to send reports.

### JVC HRJ600

This VCR was labelled “dead”. It showed no signs of life. Having checked that the mains fuses were intact, I replaced C12 on the primary side of the power supply. The result was a bird-like squawk at switch-on but nothing more. Cold checks revealed that zener diode D35 (16V) was short-circuit, for no apparent reason. A replacement restored normal operation. **E.T.**

### LG AF999NI

The problem with this VCR was deck shutdown when fast forward or rewind was selected. On investigation I found that the reel-drive clutch failed to lock because its internal retaining claws were broken. The part number for this assembly is 4265R-0002A. **E.T.**

### JVC HRJ665

This machine came in dead. The cause turned out to be the 15V zener diode D5301 on the secondary side of the power supply. **R.B.**

### Toshiba V226

There was no playback or E-E sound, though record was OK. The cure was to replace IS001 (type BA7795LS). **R.B.**

### Sanyo VHR776

Replacement of Q5001 (2SK1460) restored this dead machine to life. **R.B.**

### Goodmans VN9000

This machine suffered from various intermittent faults such as not accepting a tape, failure to thread up, failure to eject a tape, intermittent display, etc. On inspection I noticed that D820, near the power-supply module, had obviously been running hot – the PCB was discoloured. It's a 16V zener diode which is connected across the 12.4V supply, presumably for protection, so it shouldn't normally pass any current at all. When I opened the screened PSU module I found that C23 (100µF, 10V) had also overheated, and was open-circuit.

I replaced these items and also C13 (47µF, 16V), on the primary side of the power supply, and C26 (22µF, 50V), both of which tested poor. The power supply then produced the correct output voltages, and normal operation was restored. **G.Bu.**

### Philips 14PV170/05

This televideo unit would load a tape, but when any function was selected it would run normally for a second or two then stop and eject the tape. This suggested reel sensor trouble. So, as it was difficult to operate the deck and carry out measurements at the same time, I crossed

my fingers and replaced the sensor. Unfortunately the fault was still present, but I was convinced that missing reel pulses were the cause. I eventually found that the 10nF ceramic surface-mounted capacitor C2458, which is connected to the reel-pulse line on the main PCB, was leaky – it measured 500Ω. A replacement solved the problem. **G.Bu.**

### Goodmans SD7700

If the complaint with one of these machines is intermittent sound, check or replace the 6MHz filters in the IF can. **J.S.O.**

### Orion D1000

If the complaint is odd functions, unplug the cassette housing connector. If the machine then works correctly, check/replace as necessary the sensors on the cassette housing. **J.S.O.**

### Goodmans PX2400/TX1200

I've had several cases where the tuner has been unsteady. In this event check the 30V supply. If it's low at 25V, replace C803 (100µF, 50V). **J.S.O.**

### Sony SLVE210 etc

If the machine jams when it laces up, check the tape-tension band. It usually sticks to the supply reel, which therefore doesn't operate correctly. The cure is to replace the band. **J.S.O.**

### Toshiba V229B

If the complaint is spooling out tape, remove the deck and check the centre clutch assembly. The top gear can split and jam up against the reel-drive gear assembly. **J.S.O.**

### Sony SLV615

This VCR carried out all functions correctly except when it was asked to pause in playback. Having paused, it would refuse to resume play. A new mode switch assembly cured the problem – presumably it had a dead spot.

Incidentally if, while you are working on one of these VCRs, you find that none of the front controls work don't panic – put the bottom cover back on! **B.F.**

### Philips VR422

This Turbo deck machine was OK mechanically but there was nothing in the way of playback or E-E pictures, or even the test words. The cause was traced to resistors R3147 and R3151, which are both 6.8Ω, 0.6W (part number 4822 050 26808).

The cause of their failure was rather obscure: because there was too much equipment on top of the machine the top cover had shorted out to the main board! **B.F.**

### Akai VS425

The symptoms were a hum bar on the E-E picture, a noisy capstan motor, and stopping after a few seconds in play. Sounds like a power supply problem, and so it is. Replace C2 (2,200 $\mu$ F, 25V). **B.F.**

### Ferguson FV22L

When this machine ejected a cassette there would sometimes be a small loop of tape hanging from it. Although it appeared to be OK, the take-up main brake was sufficiently worn to be the cause of the problem. Replacing it and the take-up sub brake assembly cured the tape looping. **B.F.**

### Goodmans GVR3450

There were no functions and no display. It wasn't a power supply fault but a system control problem. The cure was to replace crystal X701 (4.19MHz). **B.F.**

### Ferguson C3615UT (type 441B)

This television unit wouldn't accept a tape. All was well when I tried loading a tape manually however. I didn't have a service manual, but the obvious thing seemed to be to look at the voltage

supplies to the mechanics. A check on RW002 (1 $\Omega$  safety resistor) on the VCR PCB showed that it was open-circuit. It was not discoloured. A replacement followed by a long test proved that the unit was now operating correctly. **B.F.**

### Bush VCR3402

There was a hum bar on the E-E picture and the E-E gain seemed to be low. Correct operation was restored by replacing C803 (100 $\mu$ F, 50V). **B.F.**

### Philips Turbo Decks

A problem I've had with several of these decks is a tape locking up without warning – usually after the machine has been asked to wind or rewind. The cure is to replace the pressure roller assembly. **B.F.**

### JVC HRJ610

The owner of this machine found that it was dead when he returned from holiday – there had been a power cut while he was away. The cure was to replace C12 (2.2 $\mu$ F) in the power supply. **G.Bo.**

### Panasonic NVG21

This old-timer was dead with only the tape LED alight. The machine was in

pristine condition and had obviously seen little use. Capacitor checks in the power supply showed that C18 and C23 were faulty. Replacements restored normal operation. **G.Bo.**

### Toshiba V426

The owner of this VCR complained that the display was very dim. If the lights were all switched off you could just see the clock. The cure is to replace CP041 in the power supply. For reliability, replace CP007 and CP008 as well. **G.Bo.**

### Ferguson FV67HV

The cause of no results was traced to CP11 (220 $\mu$ F, 25V) in the power supply. It had a high ESR reading – 28 $\Omega$ . **J.C.**

### Philips VR668

The display was very hard to see but all the machine's functions worked correctly. A check on the negative supply to the filament showed that it was very low. The cause was zener diode D6070 (BZX79-B10). **J.C.**

### Mitsubishi HS841V

If there are no functions and no display, check whether C9A3 (1,000 $\mu$ F, 16V) in the power supply is open-circuit. **J.C. ■**

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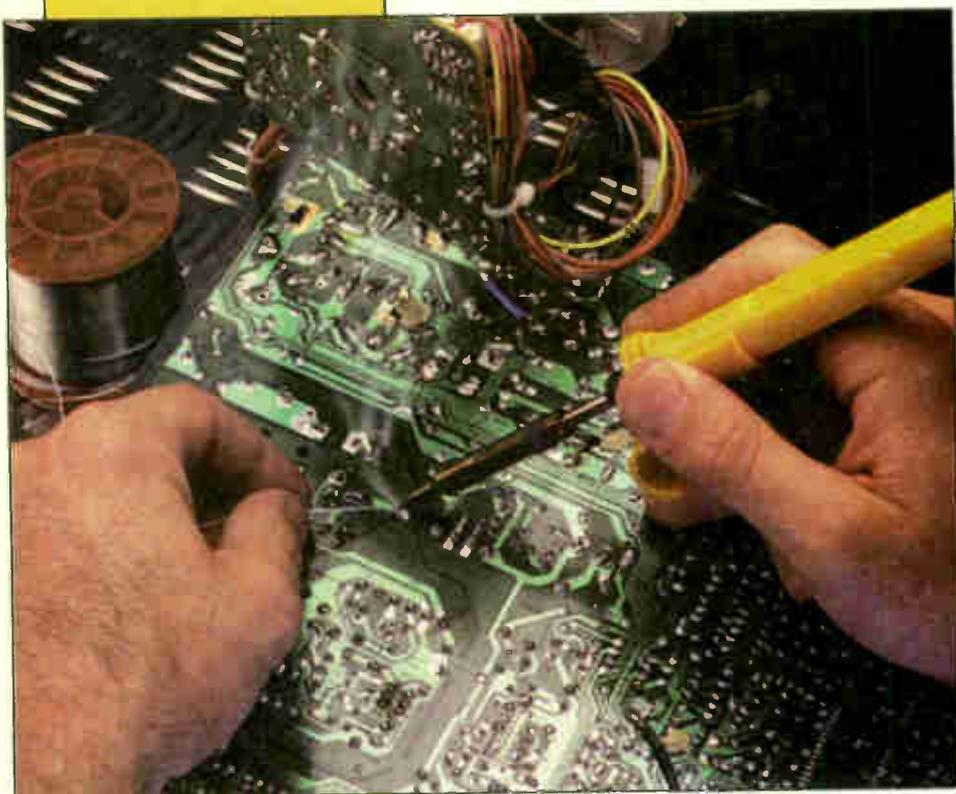
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# JACK'S WORKSHOP

Jack Armstrong

## Sony VTXS750U digibox

This Sky digibox was brought in for repair with the fault symptom stuck in standby. John Oakley of Burwash TV Service phoned to tell me the story. He found that the cause was a short-circuit diode, D809. It's type ED01, which is a surface-mounted device. John used a BYD33M as the replacement. It's been working away happily for several weeks

If you have any questions about SkyDigital problems or Apple Mac computers, or need spare parts for either, please visit the web site at:

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Information and spare parts for analogue satellite receivers can be found at

<http://www.netcentral.co.uk/satcure>

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<http://www.satcure-focus.com>

now, so it appears to be suitable in this position. An ordinary rectifier diode was tried initially, but burnt out after a day or two. A 'soft, fast-recovery' type diode seems to be required here.

## The Panasonic digibox

This digibox apparently switches itself off if you press the channel up or down button repeatedly and quickly. My guess is that the cause is a software fault, which may have been cured by the time you read this.

Another symptom you can get with the TU-DSB30 is that it remains in standby forever. It's cause could be a power supply fault, trouble with a crystal, or a defective processor chip. Unfortunately I haven't had one of these digiboxes in the workshop recently to investigate. I'd be grateful to anyone who can throw any light on these problems.

## Amstrad DRX100 power supply

Just for fun I thought I would sit down and sketch out, by tracing through the PCB, the power supply circuit used in the Amstrad DRX100 digibox – a number of faults in this area have been reported in previous issues. Fig. 1 shows the result of my efforts: sorry I'm not sure about the exact arrangement of the windings on the

secondary side of the chopper transformer. The circuit seems to be a simplified version of one used in a Samsung VCR. Some of the components are a bit obscure, but I've shown the designations as best I can.

As you can see, the circuit is fairly conventional. It's based on a power MOSFET chopper transistor, which is incorporated in the 1L0380R chip IC1S1, and a chopper transformer that provides mains isolation. R2 is the start-up resistor, with D6 taking over the supply for the chopper chip once the circuit gets going. R1, D5 and C6 form a snubber network.

Protection at the input consists of the fuse F1, a VDR to short out voltage spikes and a thermistor (TH1) which provides switch-on surge limiting. Bridge rectifiers D0-3 charge the reservoir capacitor C3. There's a double suppression coil to remove interference that might get in or, caused by the chopper action, get out.

The chopper chip has a feedback pin for regulation purposes, feedback coming via the C317 optocoupler chip. The cathode of the diode section of this device is controlled by a KIA431A programmable zener diode which, at its gate, monitors the 5V supply. The only other chip in the circuit is a 7812 voltage regulator.

D7 and D8, which produce the 5V and 3.3V supplies respectively, are beefy TO220 size rectifiers. These supplies both provide about 0.5A, for the tuner and the microcontroller circuitry, so large rectifiers are essential here. The other rectifiers seem to be either Schottky or soft, fast-recovery types.

The power supply is reasonably reliable. But Relkit 34 and the 1L0380R chip are available from SatCure ([www.satcure.com](http://www.satcure.com)) if required.

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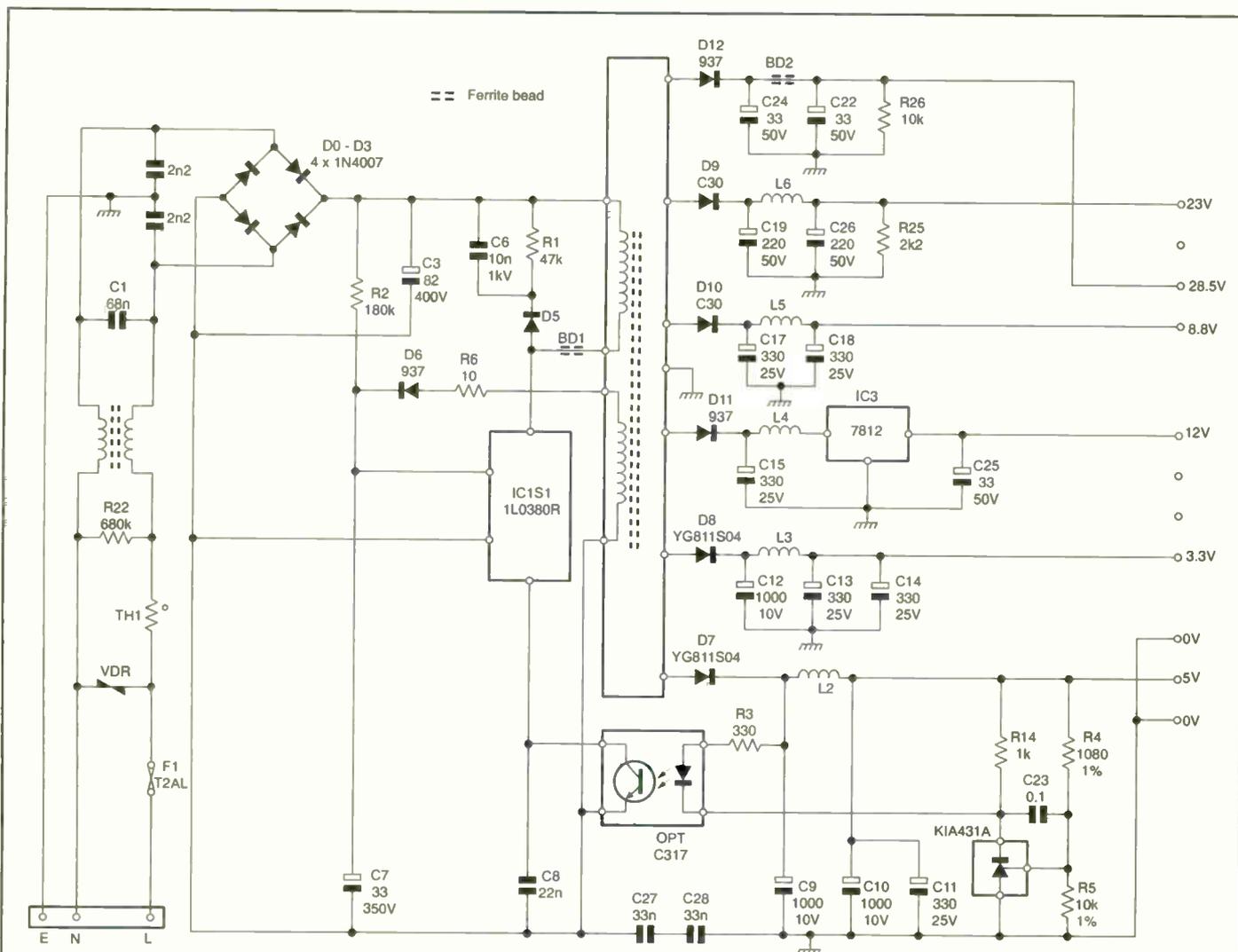


Fig. 1: The chopper power supply circuit used in the Amstrad DRX100 digibox.

## Test Case 469

The rain lashed against the windows of the Test Case workshop. Sage, glad that there was a radiator close to his bench, thought about Doc Colin with sympathy. He was probably struggling down a garden path somewhere, with a big telly in his arms and water streaming down his face. But Sage had done his fair share of field work in earlier days. Hadn't he worn out a Morris van and a Ford Escort over the years? Hadn't he been the darling of housewives and old ladies in Downhurst and Northfield, with his little tray of tools and his box of valves?

Anyway, he had troubles of his own right now. Every nook, bench and cranny in the workshop was occupied by soak-testing equipment: VCRs that were reputed to produce snowy pictures from time to time, TV sets that were alleged to blare out their sound suddenly, DVD players whose pictures were supposed to freeze after ten minutes but had been running perfectly for four days, and so on.

Desperately searching through the repair rack for something he could get on with, he came to a VCR with a label that said no deck functions. He took it to his bench, hooked it up and switched on. The cassette he inserted went in and down, but the tape wouldn't lace up. After a couple of seconds during which the loading motor strained away, the deck shut down – apparently jammed – though it was willing enough to eject the cassette after being reset by the standby key.

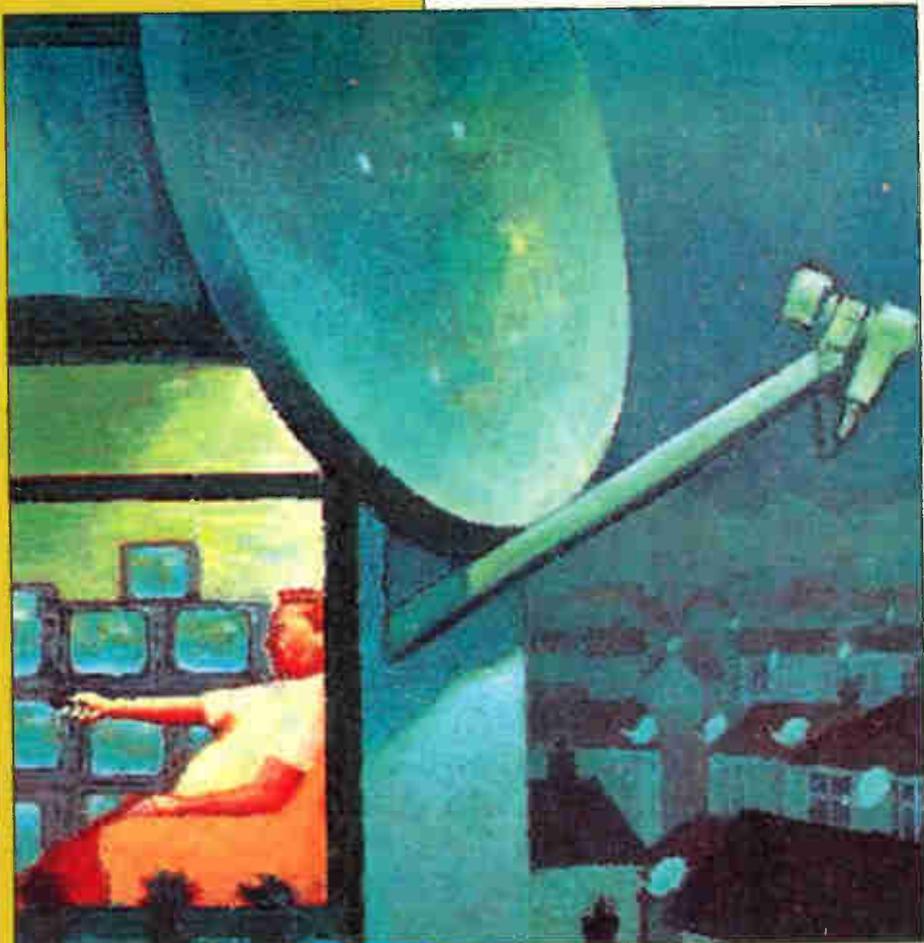
In an earlier model it would have been easy enough to turn

the machine upside down, remove the bottom cover, and see what was happening. But not here. This was a later design with mid-mounted tape deck: the deck had to be removed from the single PCB to gain full access. Maybe the reels were jammed, or the loading belt was slipping? Again no: with the brakes held off, the spool turntables were found to be free to rotate. In a further test it was noticed that the drive pulley didn't turn, despite much effort from the loading motor, when the deck advanced to the tape-threading phase.

Sage removed his E180 test cassette and replaced it with a clear plastic test shell – the sort you can see through. The threading action then went ahead smoothly and quickly, and a touch on the play key got the capstan, pinch roller and take-up spool turning as they should. Sage pulled back the tape-feed tension arm and found that the supply spool turntable rotated freely when it was moved by a finger. This was odd! Out came the clear plastic cassette shell and in went a 'modified' cassette, one which had had its spools removed. Once again the loading arms glided out and the machine went into the play mode happily.

What was happening here? Just in case his test cassette was faulty, Sage picked another one from the shelf, this time a new, blank E240 type. The original symptom was back again.

Sage scratched his head. Was he losing his grip at last? He went off to the little kitchen out back to brew some coffee. As the kettle came to the boil it dawned on our video wizard that he had missed something obvious. What was it? Maybe you got there before him! If not, turn to page 184 for the solution.



# SATELLITE NOTEBOOK

Reports from  
Christopher Holland

## ITV's satellite tests

ITV has leased three Astra 2D transponders, 49 (10.832GHz H), 53 (10.891GHz H) and 54 (10.906GHz V). Intermittent tests on all three were seen during October. Initially the only pictures seen were via transponder 54. They consisted of an aerial view of a castle, see Photo 1, from a tape loop that lasted for a few seconds. The three ITV transponders were

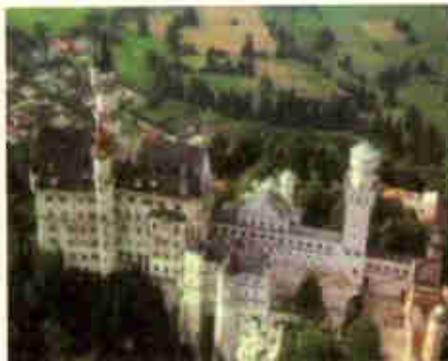


Photo 1: The Castle picture used during initial ITV tests from Astra 2D.



Photo 2: These colour bars were transmitted during the first days of ITV testing after permanent transponder activation on October 31st. Note the block of sixteen squares, with one missing, at the top left-hand corner. The white lines at the top and bottom of the bars moved rapidly across the screen, presumably to indicate that the signal was live.

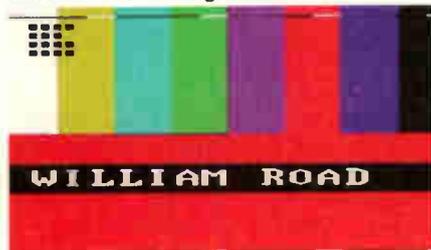


Photo 3: As Photo 2 but note different missing square in block at top left.

activated on a permanent basis on October 31st.

Tests have continued to the time of writing, in mid-November. To store the signals with a digibox, go to the 'add channels' menu, then enter the frequency and polarisation along with the symbol rate (22,000) and the FEC (5/6). Store in the 'extra channels' menu. The first days produced, on all active channels via each transponder, colour bars with the identification 'William Road'. An unusual identification (see Photos 2 and 3) consisted of a missing square within a group of sixteen squares at the top left-hand side of the screen. When these signals were stored as 'extra channels' the digibox produced ITV programme data, and information on the current ITV programme appeared when the information button on the digibox's remote-control unit was pressed (see Photos 4 and 5).

After a few days the colour bars changed to live programme tests, with the same squares at the top left-hand side (see Photo 6). But, as this photo shows, the Sky Digital clock was at times running a few hours slow when you went over to any of the ITV transponders.

All the channels are encrypted, but can be received with any viewing card. Possibly, once the correct region for a particular viewing card is placed on channel 103, out-of-area ITV reception will be blocked.

The present ITV regional line-up on the three transponders is as follows. It could well change.

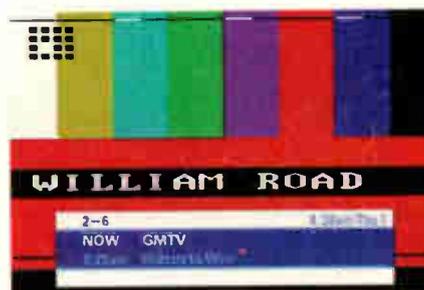


Photo 4: Once the ITV colour-bar test signals had been stored as 'extra channels', the digibox produced programme data when the remote-control unit's information button was pressed.



Photo 5: Another example of programme information obtained after pressing the remote-control unit's information button.



Photo 6: A live programme ITV test. Note that the Sky clock is running slow.

Transponder 49: Carlton/LWT; Central: HTV Wales; HTV West; West country.

Transponder 53: Anglia: Border England; Border Scotland; Granada; Meridian: Tyne Tees; Yorkshire.

Transponder 54: Channel: Grampian; Scottish; Ulster.

### Norwegian TV confusion

For several years Mr Hansen had been receiving NRK TV International via Intelsat 707 at 1°W. It's a Norwegian digital pay-TV service intended for expatriates living in other parts of Europe, and uses the Scandinavian Conax conditional-access system. The problem was that his Nokia 9600 box would no longer receive the signal.

I'd come across this problem before. So I removed the Conax conditional-access module (see Photo 7) and viewing card (see Photo 8) and programmed the 9600 to carry out a new installation, wiping all the old channels from its memory. After entering the characteristics of the required signal (11.677GHz H, SR 26,000 FEC 3/4) I received a message telling me to insert the card and CAM. When I did this there was a picture for a few minutes, then the 9600 reverted to the 'no signal' message. I checked back to the installation menu and the 'advanced channel search' option, which displays the characteristics of the channel to which the receiver is currently tuned, and found that it had corrupted the channel settings by moving the received frequency from 11.677GHz to about 10.800GHz! Becoming somewhat annoyed with the receiver, I removed the CAM and card again and reinstalled the Norwegian channel's settings, this time keeping the card and CAM well away from the receiver.

The 9600 then held its tuning memory (there are some free-to-air radio stations that can be heard without the CAM or card) throughout a prolonged soak test, during which the receiver was switched off and on many times. By luck I had another 9600 in the workshop. I put the card and CAM into this one, tuned it to the Norwegian channel, and gave it a soak

Table 1: Latest digital channel changes.

Channel and EPG	Sat	TP now	Frequency (GHZ)/pol
Auction World (651)*	EB	D7S	11.585/H
Bangla TV*	EB	D12S	11.680/V
Classic FM (856)	2B	32	12.324/V
Classic Gold (859)	2B	32	12.324/V
Hot Amateur (991)	EB	D11S	11.662/H
Red Hot All Girl (992)	EB	D11S	11.662/H
Red Hot Films (989)	EB	D11S	11.662/H
Red Hot Euro (990)	EB	D11S	11.662/H
Simply Music (650)*	2B	37	12.422/H
Sky News Radio 2*†	2B	32	12.324/V
The Mix (860)	2B	32	12.324/V
UK Food (149)*	2A	6	11.817/V

\*New channel. †Sky News Radio and Sky News Radio 2 are encrypted channels for feeds to broadcasters, and are not available to normal domestic subscribers. TP = transponder, 2A = Astra 2A, 2B = Astra 2B, EB = Eurobird.

test. There were no problems. After a couple of days the card and CAM went back into the original 9600. During a long soak test everything behaved impeccably. Mr Hanson has not reported any further problems.

The cause of the problem is a mystery. Does a power surge produce the initial problem, then the memory corruption take a while to work itself out of the system?

### Digital channel update

The latest channel changes between multiplexes and channel additions at 28.2°E are listed in Table 1 – the EPG number is shown after the channel name. Rapture TV (461) is no longer transmitted. The Student Broadcast Network has been assigned EPG no. 894. A test card is being transmitted at 11.527GHz V (transponder D4S – Eurobird). ■

Photo 7: The Conax conditional-access module.

Photo 8: Viewing card for NRK TV International.



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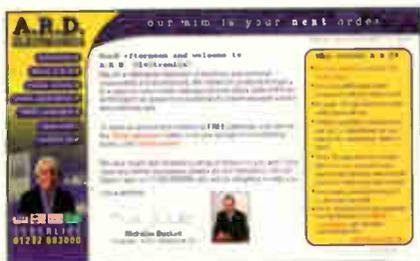
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Here are some frequently asked questions about servicing consumer electronic equipment, with a US bias. But there's some good material on monitors and CD players and CD-ROM drives. (thanks to David Edwards for this information)

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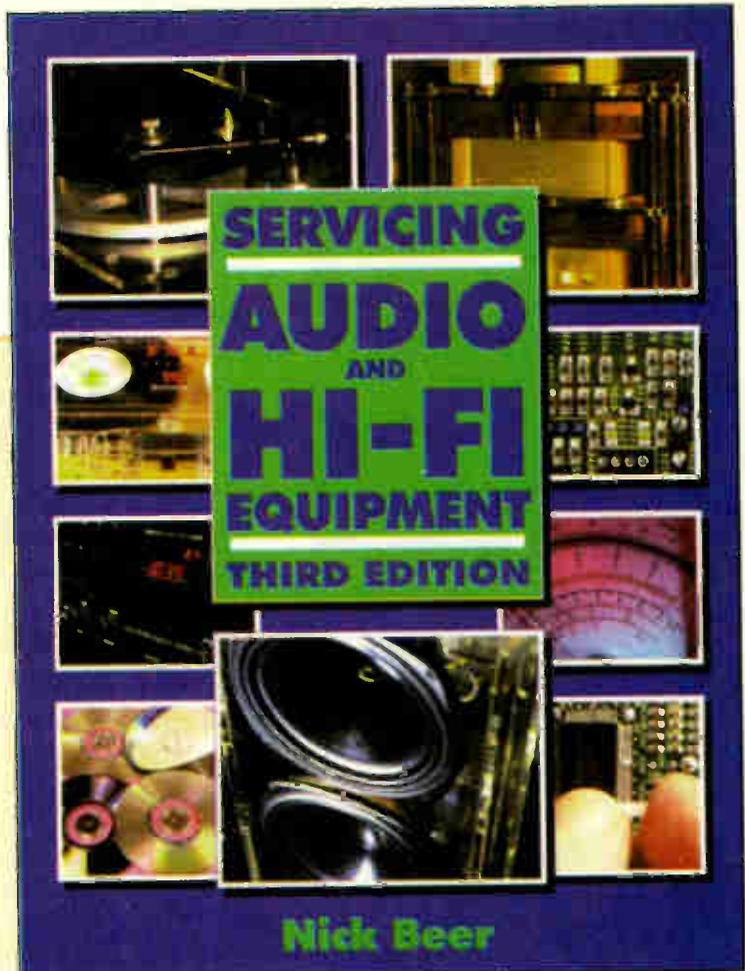
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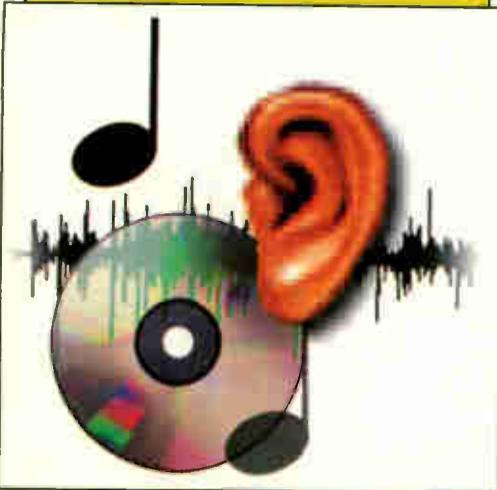
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# AUDIO FAULTS

Reports from  
**Nick Beer**  
**Robin Beaumont**  
and  
**Russell J. Fletcher**

We welcome fault reports from readers – payment for each fault is made after publication. See page 170 for details of where and how to send reports.

## **Sony TCKE230**

The problem with this brand-new cassette deck was intermittent failure to erase. A colleague had found that flexing the audio board (behind the mechanism) made the erase bias come and go, but he had been unable to find any dry-joints or PCB cracks.

I flexed the board while using a scope to monitor the FE bias. It didn't vary in level – but did disappear completely. The DC conditions remained perfect when the bias disappeared: it seemed that an AC fault was causing complete failure to oscillate, which suggested a defective capacitor. The culprit turned out to be C252, a 6,800pF surface-mounted component. It was cracked at its end cap, but the crack could be seen only when a microscope was used. **N.B.**

## **Aiwa LCX155EZ**

This mini system would work for a few minutes then go to standby. It could always be restarted, and would then work for a while longer. A clue was provided by the tuner section: it never remembered the last station tuned, and always cleared the memory of presets. This suggested a reset problem.

The service manual was downloaded from the Aiwa website and consulted. The reset transistor for the front panel microcontroller chip is Q201 (type DTC124XK), whose base is pulsed by C202, a 1µF surface-mounted ceramic capacitor. On test it proved to be slightly leaky. For good measure I also replaced the transistor, using the similar BCR141. **R.B.**

## **Bang and Olufsen Beosound Century**

This high-quality audio system could just be described as portable – there's a handle on top. It has nice B&O touches like the CD cover, which opens at the wave of a hand. The customer's complaint was "poor CD playback". As I could find nothing wrong I asked for a demonstration, which turned out to be opera – at full volume!

There was clearly a problem: severe mistracking produced unpleasant-sounding results. While I was trying to decide how to open the case a colleague from the local B&O dealer called in. He told me about the transit screws in the CD section. They had never been released when the equipment was installed. A simple adjustment restored full performance. Another problem solved without removing the case. **R.B.**

## **Sony HCDED1**

A common fault with this mini audio unit is failure of the filament lamp behind the

LCD – it goes open-circuit. Replacement is not so simple, because the front panel has to be completely dismantled and the lamp teased out from behind the plastic film diffuser. Don't be tempted to remove the LCD from the panel, as its legs fit very tightly in the print and it's likely to be damaged. Remember to refit the connector to the cassette playback head, otherwise there will be no sound from the tape. The lamp's part number is 1-517-743-11. **R.B.**

## **Sugden A21 and A48**

Despite their excellent pedigree these hi-fi amplifiers (late models) often come in for service with the complaint "noisy during operation". The item that causes the trouble is the Lorlin function switch, which is a sealed type with silver-plated contacts. The contacts tarnish, and switch replacement is the only cure. It's a pig to get at!

A replacement, already mounted on the sub-PCB, is available from Sugden (Audio Synergy). Unfortunately it's the same type! The switch is also used in **Musical Fidelity** and **Audio Innovations** amplifiers, amongst others sold in the high-end section of the market. **R.J.F.**

## **RCF DCA250**

Total loss of output with no sign of any active-device failures is a complaint you sometimes get with this professional rack-mount amplifier. The cause is failure of the protection relay – the coil goes open-circuit. **R.J.F.**

## **Hitachi HA12 amplifier**

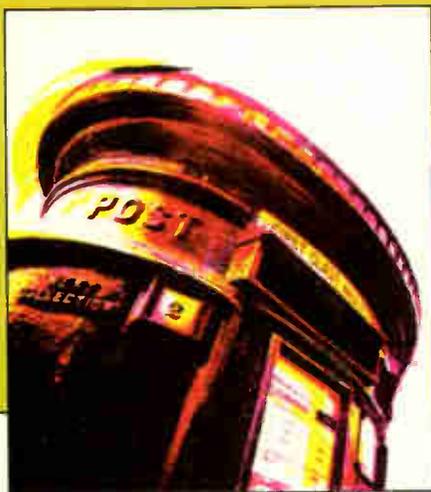
The complaint with this amplifier was "no output from one channel, other channel crackling". With this type of amplifier I go straight for the hybrid STK output module and ask questions later! The module was an STK463 in this case. A replacement cured both faults. **R.J.F.**

## **Rega Planar turntables**

If you get one of these excellent turntables with a report that says "running slow", check whether the ball bearing is still present in the centre bearing of the hub. If it's missing, drop in a 6mm cycle bearing. If lubrication is required, use a little light machine oil. **R.J.F.**

## **NAD 402 tuner**

The fault report said that there was intermittent operation, but when I powered the unit there was no response at all. Checks in the power supply revealed a regulator chip that wasn't working. A new 7812 restored normal operation. **R.J.F. ■**



# LETTERS

## DTT problems

I'm glad someone has got ITV Digital to work satisfactorily (Mike Bellis, Letters November). He obviously doesn't use text much (slow, minute content compared with analogue, and no sound from the programme you were watching) or subtitles (no colour differentiation between speakers). And he appears to be one of the lucky ones with his signal quality. Sadly I've wasted something like £200 trying to get it to work.

ONDigital (as it then was) didn't want to know when I told them, foolishly, that I already had a wideband fringe array installed for Channel 5, because I'm "out of area". Nor would they take the box back and refund the subscription when I told them that it wouldn't work satisfactorily. Our local 'best' aerial contractor spent over half a day installing a much taller mast for me (I'm too old for roof climbing) and replacing cable to get above

## Surveillance camera + modulator

Other readers may be interested in my recent experiences with a Response surveillance camera, which is available from outlets like B&Q at about £20. Despite its low cost it produces very good monochrome pictures. Connection to the unit is by RJ45-type telephone cable, and it's intended for use with equipment that has a scart socket. A problem arose when, instead, I tried to use one with an RF modulator. Although audio from the internal microphone was present, there was no video. The camera worked with a direct scart connection, and signal-generator tests proved that the modulator was OK. So neither unit was faulty.

After some investigation I found that, when checked with an oscilloscope, there was only noise between pins 19 (composite video output) and 17 (video earth) of the scart connector. But when this was connected to a VCR a signal appeared! I then found that unless pins 4 (audio earth) and 17 are connected the camera section doesn't work. In most TV and video equipment the earth return pins are all connected to a common point, but in the RF modulator I was trying to use (made by Micromark) they weren't. The cure of course is simply to link these pins together, either in the scart plug or the modulator. Other types of RF modulator may have similar scart wiring.

Mark Davies,  
Merthyr Tydfil, Glamorgan.

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the official 'threshold' carrier-to-noise ratio. And this was after waiting for several weeks – "we're full up with upgrade work for ONDigital". I'm sure he didn't charge me enough.

Despite all this the picture still pixellates, tears across, freezes and even displays the dreaded red dot. The sound pops and bangs, vanishes and emits eldritch shrieks. Nicam sound works. ITV Digital sound doesn't.

Why does this happen? The signal display on the box is well 'into the green', though it does flap up and down. Except on Christmas Day, when it nearly worked properly. Could all this trouble be caused by long-distance reflections from aircraft taking off and landing at Stanstead, as far the other side of the Sudbury transmitter as I am from it here (about 15 miles)? How many people's aerials can see aircraft near airports?

As to picture quality, there's no video noise with good sources and there's no local ghosting (with analogue reception the Town Hall clock causes permanent ghosting, construction cranes cause temporary ghosting). There's no patterning when Continental interference is present (perhaps two or three days a year), and sometimes no subcarrier patterning (see later). But that's all the good one can say

for it. The pictures are noticeably less sharp (RGB via scart connector) than with analogue transmissions – and that's using an old JVC fine-pitch 28in. set without the comb filter. Carlton Cinema is a joke: a postage-stamp picture which is even fuzzier if you switch manually, as they run permanently in the widescreen mode though most of the films are 4:3. No proper 16:9 (i.e. anamorphic) display and only a 400-line picture instead of 600 lines. The box is a pig. It fails to hold its settings, most often falling back to composite from RGB – this produces subcarrier patterning. No S-video output. The data rates are too low, the result being that detail is lost with movement, to catch up later. And friends of mine who live in fringe-reception areas or are served by relays have their analogue transmissions degraded by digital noise.

So ITV Digital is not for me and, probably, many others. It may fool punters whose colour TVs look like dirty aquariums but, if I am going to pay more, I want DVD quality, even DVD+, not something worse than we have now. SkyDigital seems to be a better proposition – I'm tempted by the radio (not by DAB – too many horror stories about that too). But this is no-no until ITV is on Sky.

What *Television* should do is to collate experience of digital TV reception and provide hard evidence to the government before we lose our satisfactory analogue services. If, as an individual, you write to the minister concerned all you get is a standard letter – "no switch off until XX per cent of households have digital" and "there's going to be an experiment with free digital sets". I know that the trade doesn't like it, but with analogue TV a state pensioner can replace a colour TV set for not much more than a week's money (only 20 per cent of Mike's £395), and a VCR similarly. I can't see that happening with digital. Nor is the trade going to get much in the way of pickings from digital TV if it ends up as a subscription service with 'free' (i.e. rented) boxes or 'free' sets supplied (and replaced by?) the agents of the broadcasters.

Dick Oliver,  
Colchester, Essex.

## Tube repair

An Alba Model 4859 had failed when fourteen months old, and the supermarket from which it had been bought refused to do anything about it. The set's owner, a friend of mine, was so disgusted that he bought a new set of different make and passed the 4859 to me, in case I could repair it.

The picture had disappeared though the sound was OK. At first I thought it might be a tube heater problem, but the cause was a 3k $\Omega$  interelectrode leak between the first anode and an adjacent electrode. As a result, the first anode voltage had fallen to about 10V.

A replacement tube was not a viable solution, but I was reluctant to dispose of such a new set. As I'd nothing to lose, I decided to try to burn away the internal leakage path. I disconnected the tube base, connected one of the offending tube pins to chassis, then connected a well-insulated wire to the focus pin on the tube base. Finally, using rubber gloves, I carefully arced the high voltage to the tube's other offending pin.

When I disconnected the bodge and reconnected the tube base there was normal operation with a very good picture indeed. It's worth a try.

*David I. Scott,*

*Solihull, West Midlands.*

## Malicious web site

Readers should beware of a malicious web site that offers technical advice when details of the fault condition are typed into the boxes provided. The answer is always the same, starting with words to the effect "you must be joking - give away our secrets..." On exit from the site the enquirer is further insulted by the message "sorry about that, but you don't get anything for nothing in this world".

The address to avoid is [www.expertservise.co.uk/ldbbase.htm](http://www.expertservise.co.uk/ldbbase.htm)  
*Name and address supplied.*

## An Amstrad CTV3021N

I am sometimes asked to buy no longer required TV sets that I don't usually want. One genuinely emigrating person offered me an approximately three-year old Amstrad CTV3021N Nicam set for £30 however. As it was working well, I felt I had nothing to lose. It proved satisfactory as a loan set for about a week, with the prospect of sale, after which it was reported to be dead. A bit disappointing, but it was probably repairable while still leaving a margin to cover a pasty for tea.

I didn't have a circuit diagram but soon found that the BUZ90A chopper transistor was short-circuit. So I ordered some, along with some TDA4605-3 chopper control chips. One of each brought some life back to the chopper circuit but, as the input from the variac was increased, pop went the weasel. I

## Problems of the analogue switch-off

Having been involved with the TV servicing trade for over 35 years, I have seen many changes. From 405 to 625 lines, VHF to UHF reception, mono to colour, the advent of teletext, video recording, DVD players and camcorders, satellite and now digital TV. With the early changes, viewers were not put to inconvenience or expense: most 405-line sets had become 'life-expired' before the close of the service. But, with the government and the trade pushing for complete shut down of our analogue services by 2010, has anyone thought about the number of TV sets and VCRs that are not going to be life-expired by then? As a result of advances in electronics technology, the lifetime of equipment has increased significantly.

Most homes now have more than one TV set. In households with children/teenagers the number of sets is more likely to be three-four or more. In addition there could well be two-three VCRs. To convert them all, as many as six-seven digital boxes would be required.

I cannot for the life of me see every household being given the number of boxes it would require to maintain its present viewing habits. So either viewing habits are going to have to change, or users are going to have to fork out to buy a new digital TV or converter for each set in use. Maybe this is why the trade is so keen on an analogue shutdown.

The problems are being passed on to viewers. They are promised "perfect" pictures and sound. This could be true for those lucky enough to live within a good reception area. What about those who use a loop or set-top aerial that's good enough for analogue reception but would not be adequate for digital reception? What about caravanners, who travel to distant locations but still rely on TV? I cannot see a digital solution to this one.

Has anyone considered mini portable TV appliances such as the Walkman type? These will not be life-expired. As far as I know, there are no digital equivalents to the 14in. portable, the VCR or the Walkman TV. If and when they appear, the cost is likely to be horrendous and performance marginal-to-poor in weak-signal areas.

The headlong rush to digital has not been thought through by those responsible. All they seem to be interested in is selling the 400MHz of air space that will be freed when the analogue system is closed down, while the industry is rubbing its hands with glee at the prospect of all those new digital-ready units to sell.

What are the pluses of digital terrestrial transmission? A few more channels, more cash for the government and another 'golden widget' for TV manufacturers. On the minus side, everyone will have to renew their equipment whether life-expired or not; poor or no reception for many; and increased consumption as digital processing requires far more power. Flat panel displays remove the need for deflection power, but still require considerable drive power - and their cost is enormous.

*Denis Mott,*

*Huddersfield, W. Yorkshire.*

then realised that I had been sent basic TDA4605s instead of the -3 version, which I think can run faster. More hopes were dashed when a -3 type didn't solve the problem. I removed and tested the chopper transformer for resonance and it seemed to be OK. Time to invest in a manual.

CPC lists it but told me it was obsolete! I thought I might carp to Amstrad about my three-year old set being obsolete, not mentioning that I was in the trade (have you noticed how you often get more help if you pretend to be a retail customer?!). Amstrad came up trumps, sending me a manual in the next post free of charge. Well done.

Now I could make some progress. I had difficulty reconciling the chopper transformer connections however. The one in the set seemed to differ from the arrangement shown in the circuit diagram. But it had passed the ringing test. I decided to carry out some resistor checks and found that R4 (270k $\Omega$ ) was faulty. Once this had been replaced the blow-ups

ceased. It's connected to pin 3 of the TDA4605-3 chip and, just to make life simple, is shown as 220k $\Omega$  in the circuit diagram and the parts list! Presumably this is the resistor J. Lesurf mentioned as R108 in his letter in the August issue (R108 has a different value and is in a completely different part of the circuit).

I'm still puzzled about the transformer however. Are there perhaps different versions? Can anyone throw any light on this?

*Peter Hanlon,*

*Milverton, Somerset.*

## Internet forum

Readers might be interested in a new internet forum which has just opened. It includes discussion groups for TV/VCR, satellite TV, terrestrial TV, electronics, car problems, DVDs and other topics. Go to:

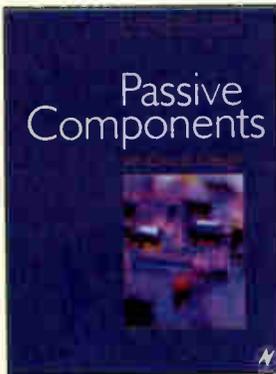
<http://www.gasbags.net>

It's free to join! ■

*Martin Pickering, B.Eng.,*

*Sandbach, Cheshire.*

# BOOKS TO BUY

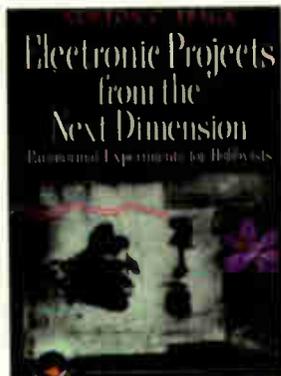


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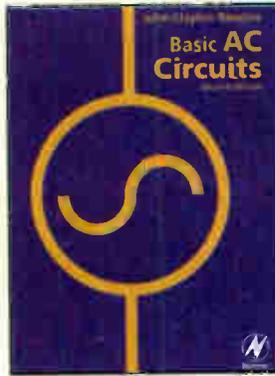


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Although paranormal studies are considered esoteric, Electronic Projects from the Next Dimension teaches the technical skills needed to make devices that can be used in many different kinds of experiments. Each section indicates how the circuit can be used in paranormal experiments with suggestions about procedures and how to analyze the results.

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# DVD

**Fault reports from  
Geoff Darby and  
and Nick Beer**

We welcome fault reports from readers – payment for each fault is made after publication. See page 170 for details of where and how to send reports.

## **Panasonic DVD-A160**

This DVD player would run for hours and hours (and hours and hours and hours!) and then just die – no display, no functions and no standby light. The + and -11V standby supplies continued to be present however, but the others were inhibited by an active power-off signal from the system control at pin 14 of the PSU connector. If the player was left for just ten minutes with all power removed, it would come back on again and run for hours.

No amount of freezer would bring it back on quicker, and no amount of heat would make it fail quicker. This suggested that the cause of the fault was underneath the PCB. But once the PCB/deck/PSU had been removed from the case the player wouldn't go wrong at all! After a couple of days playing continuously it finally did fail, and was brought back to life by freezer applied under the PCB, confirming my suspicion.

The component at the centre of the assault from my can of freezer was IC5002, which is near the front. It's a three-legged device that looks like an oversized surface-mounted transistor. A touch on it with the tip of the soldering iron produced the fault immediately, while a single spot of freezer on it restored correct operation.

IC5002 is the reset generator for the 'operation microcontroller' IC6001. When it failed, IC6001 was put in a permanent reset condition. Replacing IC5002 cleared this troublesome fault. G.D.

## **Sony DVP-S336**

This DVD player would intermittently produce a 'C13' error message when a disc was inserted. Officially, this means 'dirty disc', but I think it's just a generic 'unable to read the disc' indication. There was no improvement when I used the electronic-screwdriver mode to set up the

servos etc. automatically, while the data stored in the EEPROM was about right.

Eventually a replacement optical block and a re-run of the electronic-screwdriver set-up cleared the fault. In these players the optical block is actually a complete deck assembly, type KHM220AAA RP. G.D.

## **JVC XV-M557GD**

The only sign of life came from the standby LED, which was glowing rather dimly. When the power button was pressed all that happened was that the LED's glow became even dimmer. A few checks quickly revealed that the B5V supply was low at about 4V. It's derived from the M9V supply via the 78M05 regulator IC953. The M9V supply was also low, and a scope check showed that it was very noisy. All this was cured by replacing the supply's reservoir capacitor C979.

When I checked it with a capacitance meter the reading was 795µF, instead of the somewhat unusual marked value of 820µF. But a check on its ESR showed that this was way out at 15Ω. This confirms what has been said in the past about ESR being a better check than capacitance when the state of an electrolytic capacitor is being assessed. G.D.

## **Panasonic DVD-A360**

The customer complained that this fairly new DVD player wouldn't play certain discs: a copy of Komodo was supplied as an example. When the machine was checked it played all the test discs and various movie titles without any problems. Single- and multi-layer discs were tried. The player hadn't been modified, and the jitter rate fell within the specified 12 per cent for this model. Nonetheless the supplied multi-layer disc wouldn't play, though it did play when inserted in the ten or so other machines I tried. When the Komodo disc was inserted, the faulty machine simply kicked and the on-screen message "cannot play this type of disc. please insert another type" appeared.

My instinct was to replace the optical unit, but I decided to have a quick word with Panasonic technical support. I was told that IC3001 had been the cause of some odd faults. I had already read this at the web site, and felt that the symptoms didn't match the problem I had. So, at the risk of looking silly, I ordered a new optical unit and fitted it. This cured the fault. The interesting thing is that with the new optical unit the jitter rate had fallen to 8.5 per cent.

If I had had another identical machine with which to check the jitter rate and found that it was 8.5 per cent or thereabouts, rather than having to rely on the figure given in the manual, I would have been a lot more confident about ordering a replacement optical unit. I'll know next time! N.B. ■



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Input capacitance	12pF if oscilloscope i/p is 20pF
Compensation range	10-60pF
Working voltage	600V DC or pk-pk AC

**Switch position 'Ref'**

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

## Answer to Test Case 469

- page 175 -

While turning the puzzle over in his mind, Sage realised that the mechanism became jammed only when reels of tape were present. Now every VHS cassette incorporates a pair of internal ratchet brakes which permit the spools to turn in the direction that reels the tape in, but not in the opposite direction. Tape spillage is thus prevented. These internal cassette brakes are released by a post on the deck. It penetrates the cassette shell as the cassette is lowered on to the deck. How many hundreds of times had Sage released this brake when dealing with cassettes: checking for damage, splicing tapes, or replacing plastic spools? Sure enough the brake-release pole was missing in the faulty deck. It had somehow broken away from the deck plate, and was found rattling around inside the machine. As luck would have it the pole was made of plastic rather than metal, which could have done more mischief down on the PCB.

How did it get broken? Heaven knows! But the customer had a little boy of two summers. Maybe Josh had fed something into the cassette slot, though there was no incriminating evidence with this machine . . .

Happy Christmas Sage! You're not the first or the last one to be flummoxed by something that, with hindsight, seems blindingly obvious. Happy Christmas Doc Colin! Where would the consumer electronics business be without stalwarts like you?

## NEXT MONTH IN TELEVISION

### Mode switch repair

The mode switch is the most troublesome item in a VCR deck, and should preferably be replaced when suspect. This is not always feasible however. Eugene Trundle describes a reliable repair method – and includes a repair tip on broken flaps.

### FM stereo radio and RDS

FM stereo radio tends to be taken for granted, so much so that most technicians have little understanding of the technology involved. Keith Cummins describes the techniques used, including decoder circuit operation, and also covers the radio data system (RDS) that was added in the Eighties.

### How to survive a virus attack

Peter Marlow on what to do when your PC is attacked by a virus – his office network was recently subject to a nasty attack. Also general information on how to provide protection.

### Modern cable TV technology

Optical-fibre cable technology has revolutionised communications. J. LeJeune describes the current state of broadband working with particular reference to TV applications.

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HEAD-VSR1500 = ORION D2096	£5.00
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POWER SUPPLY & REG - TYPE STK 5343-VP9501	£8.00
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Fit most new TV's	£5

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MATSUI 1500	
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ORION D1096	
ORION D2096 ETC	
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4700	£5.00
6000	£15.00
6800	£4.00
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RC202	£4.00
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