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TELEVISION

AND HOME ELECTRONICS REPAIR

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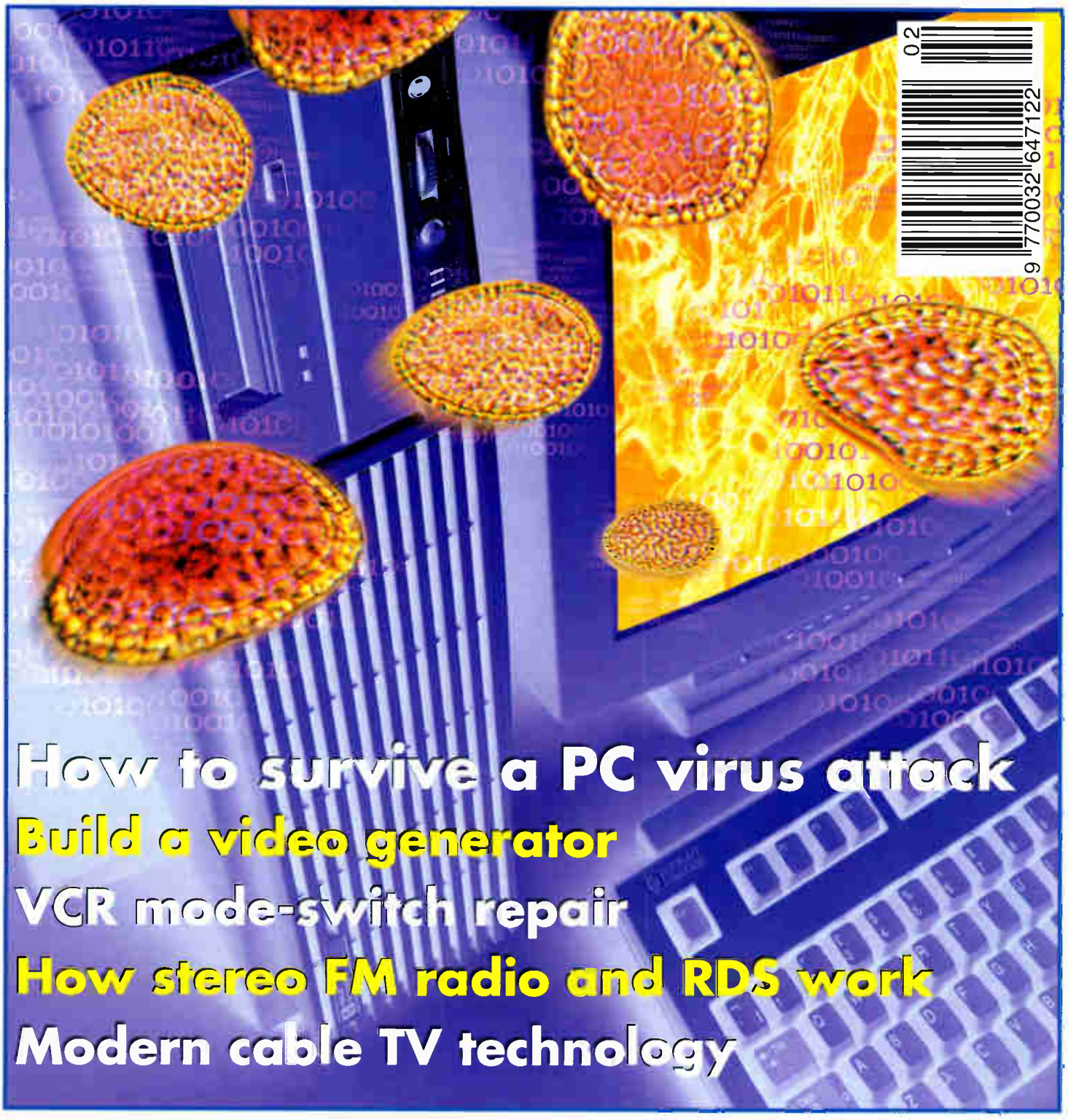

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February 2002 Vol. 52, No. 4

Picture courtesy Mark Swallow

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

Correction

The name of the manufacturer of the motor-home satellite dish mentioned by Tom Baker in his article last month (page 138) was inadvertently omitted. The dish system shown in Photos 1-4 and described in the text was supplied by Maxview Limited of King's Lynn Telephone (01553 813 300).

Next issue, dated March, on sale February 20th.

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Video/TV survey

Advances include multi-channel choice and interactive operation

There have been tremendous advances in TV reception possibilities in recent years, including multi-channel choice, interactive operation and internet access. How has the public responded to this? The ITC carries out regular research to find out, and has recently published the latest results (*Television: The Public's View 2000*, available from the ITC at £7.50). For the survey 1,173 viewers selected randomly from the electoral register then weighted to meet averaged population statistics were interviewed. The following is a brief summary of some of the findings.

The amount of TV viewing has remained virtually unchanged over the past ten years. So changes in what you can do with TV haven't increased viewing. The average amount of time spent viewing in 2000 was 26 hours per week, with most respondents devoting 15-35 hours a week to TV. The survey split viewers into light users (15 hours a week or less), average (15-35 hours) and heavy (more than five hours a day). Light users tended to be better off, younger and live in the south. Heavy viewers tended to be older, not so well off and live in Scotland, Wales or the Midlands.

There's a reasonably high degree of satisfaction with the services provided, though this satisfaction is notably higher with those who receive multi-channel services. Of the latter, 83 per cent agreed that "the television channels I receive at present give me all the choice I want". With analogue terrestrial only TV viewers, the percentage fell to 65. Heavy viewers were more satisfied than medium or light viewers, the percentages being 81, 69 and 67 respectively. Taken as a whole, 72 per cent of the respondents said they had all the choice they wanted. Most respondents (59 per cent) felt that programme standards have been maintained, a higher percentage than the year before and indeed ten years ago.

Seventy per cent of the households had two or more TV sets. Multiple set ownership was highest in households with children, especially where there were 10-15-year olds (average 2·92 sets), also in better off and in younger households. Households with multi-channel services had a higher number of sets than those with analogue terrestrial services only. Over half the children had a set in their bedroom, rising to 67 per cent with 10-15-year olds.

Twenty per cent of respondents had bought or rented a new set during the previous year. Again, this was more common where there are children and in households that have multi-channel services. At the time of the survey 16 per cent of the households had a widescreen set, twice the number in the previous year.

Home access to the internet rose substantially between 1999 and 2000, from 13 to 24 per cent (overall access, including work, college, etc., rose from 24 to 34 per cent). Most respondents used a PC for internet access and were likely to have had a PC already. But six per cent said their access was via a TV set. Domestic PC ownership has remained pretty static since 1992, when it was at 30 per cent of respondents (29 per cent in 2000). But the market has been an active one: 39 per cent of respondents said their latest PC was less than two years old, while 21 per cent said it was less than a year old. There were marked regional differences in the ownership of computers with internet access.

Just under a quarter of those with access to the internet said they used internet shopping 'quite frequently' or 'very often'. A half of all respondents agreed that interactive services such as e-mail, games and internet access were valuable, while 44 per cent agreed that interactive services such as Sky Sports Active and Sky News Active enhance TV viewing. But only 21 per cent said they would be willing to pay a 'reasonable amount' to get services such as home banking, shopping and internet use via their TV set. Just 30 per cent of the most enthusiastic group – those under 35 – said they would be willing to pay more.

There was a modest increase in those using pay-per-view TV, but use remains infrequent, with only 14 per cent saying it was more than once a week for films and only three per cent saying this of sports programmes: 43 per cent said they hardly ever/never paid for films, 56 per cent likewise for sports.

By 2000 the number of respondents with a satellite TV installation had increased to 21 per cent, while cable TV was taken by 14 per cent.

VCR ownership and use amongst respondents declined slightly – from a peak of 88 per cent in 1997 to 83 per cent in 2000. In 1984 76 per cent of VCR owners said they watched home-recorded programmes more than once a week: there was a decline to 67 per cent in 1990, 46 per cent in 1998, 39 per cent in 1999 and 29 per cent in 2000. Watching prerecorded material more than once a week has also steadily declined, from 20 per cent in 1984 to the current level of eight per cent.

The text of the report is available at the ITC website: www.itc.org.uk ■

We regret that because of a production problem the wrong text appeared on this page last month.

CORRESPONDENCE
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.

INDEXES AND BINDERS
Indexes for Vols. 38 to 51 are available at £3.50 each from SoftCopy Ltd., who can also supply an thirteen-year consolidated index on computer disc. For further details see page 248.
Binders that hold twelve issues of *Television* are available for £6.50 each from Television Binders, Pringle, Street Blackburn, BB1 1SA.
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TELETOPICS

World's first voice-operated TV set

Matsushita claims a world's first with a 36in. TV set, Model TH36DH200, that was launched in Japan at the end of 2001: it features a voice-recognition remote-control system. This new BS (broadcast satellite) digital HDTV receiver also has an electronic programming guide capability and a built-in hard-disk video recorder. The aim of the voice-recognition remote-control system is to simplify operation by enabling users to give verbal instructions to the remote control unit via a built-in microphone. The TV set can recognise from the infra-red signals transmitted by the remote-control unit the names of stations, channel numbers and various functions such as programme information, timer setting and playback from an SD memory card.

The 80GB hard-disk video recorder provides up to seven hours of digital recording/playback in the HDTV mode or up to 70 hours in the standard analogue mode. The 'track & play' feature enables a user to play back a programme as it's being recorded, while the search function can instantly locate and play a selected recording. Other features include an i.Link (IEEE 1394) interface for connection to a variety of digital AV units and SD memory card compatibility.

The price of the set is the Japanese equivalent of about £467. There is no information on a possible UK release date.

Philips has launched a 32in. widescreen plasma-display TV set, Model 32PF9964. It incorporates Philips' Digital Natural Motion, Digital Crystal Clear and Active Control technologies. The 32PF9964 comes with an e-box that houses all system connections and is designed to sit alongside Philips home cinema units such as DVD players and VCRs. In addition to handling PAL, Secam and NTSC signals, the set has a data input socket for displaying XGA, SVGA and VGA signals from a PC. Price is about £5,300.

UK ahead with digital TV

Speaking at the annual BREMA dinner late last year Lord McNally, the president, mentioned that by the end of 2001 43 per cent of UK homes would have access to digital TV services while by the end of 2006 the figure is expected to rise to 64 per cent (16 million households). The UK, he said, has an 18-month worldwide lead in the deployment of digital TV. Its nearest European rival by the end of 2006 is expected to be Germany, with some 11 million digital TV households. He hoped that the UK would do better than these forecasts, but pointed out that it would be important to appeal to households that want only free-to-view services.

Last year some 6·5 million TV sets were sold in the UK, 30 per cent of them widescreen. But nearly all the sets were analogue ones – only 125,000 integrated digital receivers were sold.

Eutelsat reports a 54 per cent increase in the number of households with digital TV in eastern and western Europe between 2000 and 2001 – to 21·7 million. The UK accounted for 35·5 per cent of the total, with France next at 17·2 per cent. Eutelsat's survey covered 38 countries in Europe, the Middle East and North Africa. 41 per cent of the TV homes (122 million) in the area covered received TV via cable and/or satellite transmission.

Stortech Electronics has introduced the Pecan range of miniature cameras, which are designed to be unobtrusive. About the size of a 50p piece, they can be installed in clockfaces, suitcases, doors etc. for discreet monitoring purposes. There are monochrome or colour output options. The monochrome versions are best suited for low-light applications as they operate at down to 0◊1-0◊2lux. All cameras provide a 1V peak-to-peak composite video output at 75W.Current consumption is 80-135mA, and there are various lens options.

For further details apply to Stortech Electronics Ltd., Unit 2, Spire Green Centre, Pinnacles West, Harlow, Essex CM19 5TS. Phone 01279 419 913. The company's web address is www.stortech.co.uk

Dolby via satellite

BSkyB began Dolby Digital 5.1 transmissions in December. The service is available for Sky+ subscribers to the Sky Premier Widescreen and Sky Box Office Widescreen channels. It's the first service to bring Dolby 5.1 surround sound to digital TV viewers in the UK. *Gladiator* was the first film of a season of 25 films to be broadcast with Dolby Digital 5.1 during December.

Dolby Digital 5.1 has been added to the specification of the Sky+ set-top box, which incorporates a hard disc for recording. The Sky+ box can transmit digital audio to an external home cinema amplifier via an optical link.

Dolby Labs says that the number of digital TV broadcasters using Dolby Digital has grown steadily during the last year, and now includes Australia's Nine Network, Network 10 and the Australian Broadcasting Corporation; Germany's ProSieben, Premiere World and media[netCom]; YLE (Finland); and Terrestrial DTV in Singapore. Over two hundred terrestrial DTV stations in the US broadcast in Dolby Digital, and various networks that include ABC, CBS, DirectTV, DISH Network (DVB), HBO, NBC, PBS, Showtime and Starz! Encore.

Home networking update

There have been a number of developments in home networking, which will enable computer and consumer electrical and electronic devices to communicate with each other, either by cable or wireless links. The Appliance Home Initiative, founded last August and supported by the Department of Trade and Industry, has been established to accelerate networked home applications and services. Members include companies in the broadcasting, home automation, public utilities, consumer electronics, manufacturing and servicing industries. IBM, BSkyB, Centrica, Pace and Orange are amongst the members. The group aims to be a prime mover in the development of home networking, concentrating on connection to the home and interconnectivity within it. Services and applications include communications, broadband access, automated meter reading, video and audio transmission, security, energy conservation, medical monitoring, safety, education and home working. The latter includes TV sets that communicate with DVD players and games consoles in other rooms. Work is proceeding on a wide-scale commercial trial.

Sony is working with AOL Time Warner on the development of a web browser for consumer electronics products in networked homes, and with Nokia on development of software that enables mobile phones and other electronic devices to communicate with each other and share information.

Samsung has started commercial installation of networked home appliances in Korea. The appliances can be controlled from a central console or via the internet. Samsung aims to attract business from apartment builders, who can use networking with internet access to add a premium to their projects.

Pace and Microsoft have demonstrated a new digital set-top box that provides wireless internet access to devices around the home, such as a PC or a personal digital assistant (PDA). The new STB, Model DL6000, uses Microsoft advanced interactive TV software. It enables a user to access the internet while other members of the household are watching TV.

There are new developments with the Wireless Ethernet (local area network) standard IEEE 802.11b, which is known as Wifi. It's fast becoming the standard for home networking. An enhanced version, 802.11g is being developed – it could be five times faster than 802.11b. Philips Semiconductors has now supplied more than six million IEEE 802.11b radio chipsets.

Philips Research has demonstrated this 51cm, 64 x 64 pixel polymer-dispersed LCD screen which could be a significant step towards cheap, flexible displays. It uses a polymer active matrix based on a polythienylenevinylene precursor, which is separated from the polymer-dispersed LCD by spin-coated polyvinylphenol. The LCD is voltage switched and can produce 256 contrast levels. No polariser or alignment layer is required.

Affordable digital radios

Affordable receivers is the key to increased use of digital radio (DAB). A new range of equipment announced by Goodmans, for sale at prices between £99 and £200, could have a considerable impact in this respect. Initial models will go on sale in mid-2002. They rely on a new DAB digital radio and audio processor chip, type DBX-1, which has been developed by national commercial digital radio network Digital One and Imagination Technologies. There are currently more than 200 radio stations broadcasting digitally in the UK.

The Goodmans range will include a hi-fi digital radio tuner, a micro system with CD and digital radio, a personal portable CD/digital radio, an in-car CD/digital radio tuner, a portable CD/digital radio with speakers and a DVD player with digital radio tuner.

Texas Instruments has also developed a low-cost chip, type TM320DRE200, for use in digital radio tuners (see Teletopics September 2001). It was used in a tiny (palm-held) unit displayed by PersTel at the Comdex show late last year. The unit had MP3 and digital radio capability and also provided voice recording and FM tuning. The design is being offered to consumer electronics manufacturers.

DVD's success

DVD players have become the fastest-selling ever new consumer electronics product in the UK. Almost three million were sold during the past three years, a total that CD players and VCRs took twice as long to reach. Sales of DVD players rose to almost two million in 2001 and are expected to double again in the present year. During 2001 the average price of a DVD player halved to about £180. They are now selling in supermarkets at about £100.

A growing number of users employ means of overcoming the built-in regional copyright protection system, enabling them to play US discs before they become available in the UK.

The success of DVD has not affected the VCR market so far – four million VCRs were sold in the UK last year.

CD playability problems

A variety of playability problems have arisen following the launch of copy-protected CDs. Music companies have been testing a variety of systems designed to prevent consumers playing CDs on their PCs and/or CD recorders. Copy-protected CDs work either by modifying the TOC, which confuses CD-ROM and DVD-ROM drives, or by adding to the disc data errors that consumer CD players ignore but make the discs unplayable by a ROM drive. At least four systems are being used, Cactus Data Shield from Israeli company Midbar, Key2Audio from Sony DADC, Macrovision/TTR's SafeAudio and Sunncomm's MediaCloq.

Music company BMG has withdrawn thousands of CDs protected by Cactus Data Shield after complaints from consumers. The music industry has been testing millions of discs secretly, but when BMG launched Natalie Imbruglia's album *White Lilies Island* it announced that the disc included anti-copy technology. Consumers complained that the disc wouldn't play on a variety of home electronic products, including PCs with Windows (Apple Macs appear to be largely unaffected), CD players, DVD players and PlayStation 2 games consoles. As a result HMV and Virgin ordered new stocks of unprotected CDs.

Despite these problems and complaints that record companies are not adhering to the CD Red Book standard, the record companies plan to launch more copy-protected titles. Universal intends to launch all its new albums with anti-copy technology later this year.

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New Arrivals !!!

TV Fault Finding Guide Part 2

This book has been introduced as a supplement to issue 7 (December 1998) and contains over 2500 additional faulty entries. This edition is not intended as a replacement for issue 7 but as an addition.

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.

Revised model/chassis listing of about 2000 models.

A5 in size with a total of 192 pages

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Matsui "Stuck in Stand By" Kit

This kit is designed to to cure the stuck in standby fault as well as other faults on the following models :

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Decca/Tatung	TVC563

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Amstrad Sky Digibox

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BC860BSMD	£ 1.00 + vat
IN4148SMD	£ 1.00 + vat

SMD Transistor Kit

This kit contains 10 of each of the following type :

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Fully compatible with Sky™ Digital Link

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10 - 24 Price : £ 5.50 + vat each
25 + Price : £ 4.50 + vat each

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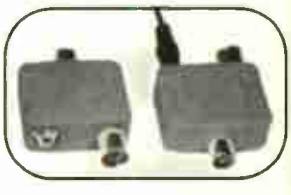
For use with aerial amplifiers and Sky™ Digibox



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Magician 4 controls upto 4 different devices including full function on Sky™ Digibox

Comes in Retail Clam Pack

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1 - 4 Price : £ 16.00 + vat **5 + Price : £ 14.50 + vat**

Sky Digital Remote Control

Order Code RCSKY

Price £ 10.75 + vat

Sky Digital Remote & TV Link Eye Combination

Price : £ 18.50 + vat

5 + £ 17.00 + vat each

Sky Digital TV Link Eye

Order Code : TVLINKEYE

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4700uF	CAP50	£3.65	2
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22uF	CAP53	£0.45	10
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47uF	CAP55	£0.85	10
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100uF	CAP56	£0.85	10
150uF	CAP57	£0.95	5
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330uF	CAP134	£1.60	10
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2200uF	CAP61	£2.45	2
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33uF	CAP141	£0.85	10
47uF	CAP65	£0.85	10
68uF	CAP142	£0.90	10
100uF	CAP66	£0.85	10
220uF	CAP67	£1.75	10
330uF	CAP68	£2.45	10
470uF	CAP69	£4.35	10
680uF	CAP70	£4.90	5
1000uF	CAP71	£5.25	10
1500uF	CAP143	£4.50	5
2200uF	CAP72	£3.25	2
3300uF	CAP144	£3.25	2
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0.47uF	CAP73	£0.35	10
1uF	CAP74	£0.35	10
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10uF	CAP78	£0.50	10
15uF	CAP79	£0.95	5
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33uF	CAP81	£0.85	10
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470uF	CAP88	£5.25	10
680uF	CAP89	£5.00	10
1000uF	CAP90	£5.40	5
100 Volts			
0.47uF	CAP91	£0.50	5
1uF	CAP92	£0.85	10
1.5uF	CAP93	£0.70	5
2.2uF	CAP94	£0.50	5
3.3uF	CAP95	£0.50	5
4.7uF	CAP96	£0.50	5
10uF	CAP97	£0.95	10
22uF	CAP98	£1.05	10
33uF	CAP99	£1.55	5
47uF	CAP100	£1.75	10
100uF	CAP101	£2.10	10
220uF	CAP102	£6.00	5
470uF	CAP103	£6.00	5
160 Volts			
2.2uF	CAP146	£0.45	10
10uF	CAP147	£1.40	10
22uF	CAP148	£1.80	10
33uF	CAP149	£2.30	10
100uF	CAP150	£3.25	5
200 Volts			
100uF	CAP151	£3.25	5

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10uF	CAP105	£2.60	10
22uF	CAP153	£2.30	10
47uF	CAP106	£4.35	10
100uF	CAP154	£4.50	5
220uF	CAP155	£2.00	2
350 Volts			
1uF	CAP156	£0.70	10
3.3uF	CAP157	£1.50	10
10uF	CAP158	£2.25	10
22uF	CAP159	£3.40	10
400 Volts			
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2.2uF	CAP108	£2.25	5
4.7uF	CAP109	£3.15	5
10uF	CAP110	£4.00	5
22uF	CAP111	£2.50	2
47uF	CAP112	£3.50	2
100uF	CAP160	£4.00	2
220uF	CAP161	£7.00	2
450 Volts			
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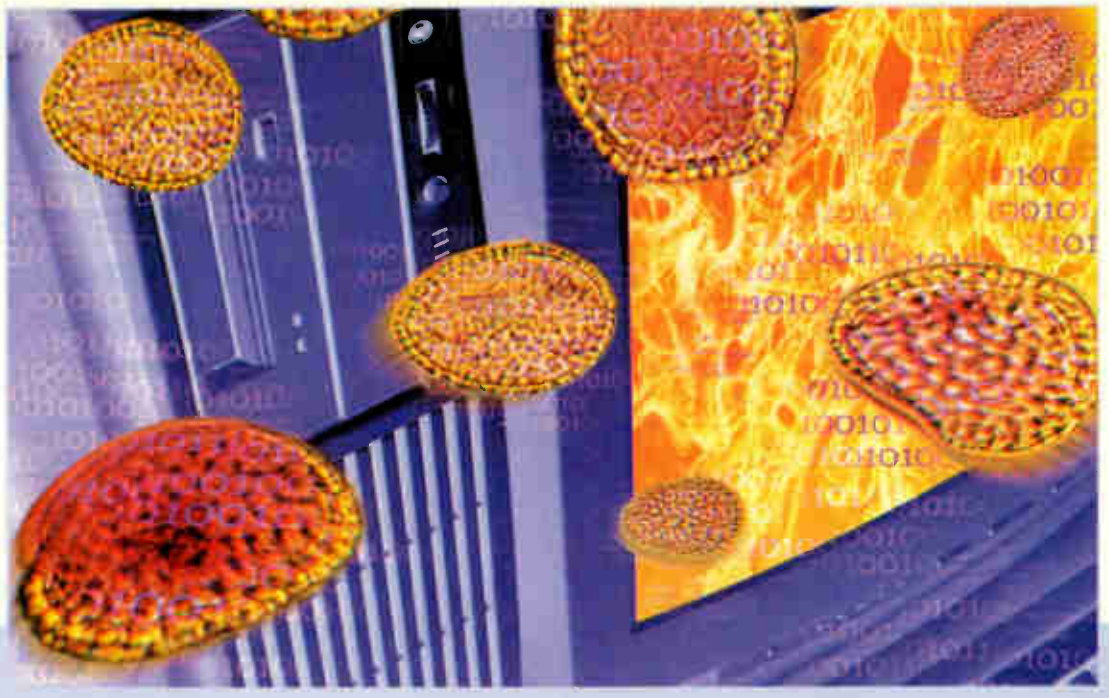


Computer users cannot afford to ignore the fact that their machines, at home and at work, can be attacked by a virus. Peter Marlow describes how he survived a recent virus attack, and gives advice on how to avoid infection and on what to do if you should get to one

How to survive a virus attack

It was about 11 o'clock one Thursday morning when my computer started to misbehave. I had been surfing the web, trying to download a piece of software to 'plug in' to my Netscape browser. Then the desktop seemed to freeze. So I restarted the computer – it's not unusual to have to restart a Windows machine! As the computer went through its start-up routine however the on-screen messages suggested that it was setting up a new piece of software. Strange, I thought.

Symptoms

When the desktop finally reappeared there was an e-mail icon on the screen. The subject of this e-mail was the title of one of my own documents. Hmm, virus I thought. I'll delete it. So I dragged it over to the recycle bin.

Then I noticed a little e-mail symbol on the taskbar, along the bottom of the screen. I tried to drag it to the recycle bin but, in doing so, I opened the e-mail. Surprise, surprise, the e-mail that I had deleted reappeared on my desktop.

Don't panic, I thought. I ran Windows Explorer to see if I had lost any files, only to find that I had gained several thousand. All the folders on drive C: had an e-mail in them, with the name of one of my documents. And all the sub-folders and all their sub-folders too. What a mess! Using the search/find file function, I located all these e-mails and deleted them.

The computer still seemed to be working, until I tried to load a file in Word 2000. A polite error message then informed that I didn't have enough memory. So I rebooted again.

I resorted to expletives when I saw that the e-mail was back on the desktop – and that all the rogue e-mails were back in my folders! This was a serious virus, but it didn't seem to have deleted any of my files – yet.

What I had failed to notice when I rebooted was that the e-mails were also appearing on the desktops of the three other computers in the network. Investigation of each machine with Windows Explorer showed exactly the same symptoms. I had that sinking feeling.

What was it?

So what virus was it? I was fortunately able to launch Internet Explorer to look for some help on the web. Meanwhile I was hoping that this was not one of those viruses that mails documents on your computer to all those on the e-mail address list.

My first stop was the Sophos website (www.sophos.com). I wasn't a subscriber but, before I set up my own business, my previous employer had used Sophos, whose headquarters are at Abingdon. I looked at the website and found a wealth of information – most of it extremely frightening!

When I read descriptions of known viruses 'in the wild' it became apparent that the one I had was called Nimda. It had not be around for long, but Sophos had

already made available for downloading a piece of software with instructions on how to get rid of it.

I had had a tip off the day before, when visiting a customer whose computers had been infected by Nimda. Hundreds of PCs had been infected. It couldn't happen to me I thought, but it had.

The antidote

The antidote software is in the form of a Zip file which contains a README.TXT file and a program. The README said that I first had to edit the AUTOEXEC.BAT file, removing a line that the virus had inserted. Then I had to run the program from the MSDOS prompt.

The program looks at every file in the computer to see if it's infected, prompting the user to delete a file if it is. I then realised how many files there are in a typical Windows computer – over 50,000! It took many hours to clean each of my four machines. An average of 3,000 infected files had to be deleted. It took until Monday evening before I felt that the machines were clean.

On Monday I also purchased Norton AntiVirus 2000. When I installed it and carried out a virus scan it discovered two other viruses in my computer. It was able to render them harmless by isolating or quarantining them.

But there was a sting in the tail. Intermittently, programs would not launch from the desktop. The only way to run them was to start Windows Explorer and double click on the EXE file. I couldn't clear this problem, and the following week I backed up my files on a network drive and reformatted the hard disk. Another day was spent putting the operating system and all my programs back on.

I survived the virus attack, but I lost about four days' work and suffered from considerable stress. I was lucky that I hadn't lost any data. So I share the experience in the hope that it will help you to avoid the same fate.

Types of virus

Not all viruses are the same. Some are malicious and delete files – some new viruses even specifically target anti-virus software! Others, called 'Worms', are benign and just gradually slow down your computer until it is unusable. The worst are 'Trojan Horses', because you often don't know you've got them. They enable hackers to steal files from your computer when you log on to the internet.

You could be attacked by this sort of bug.

Catching a virus

Most viruses are caught from e-mail attachments. One that's going around at the moment will arrive from an e-mail contact and have as the subject line just "Hi!". If you open it you will see the following text:

"How are you?

When I saw this screen saver, I immediately thought about you I am in a harry, I promise you will love it!"

It has an attachment called GONER.SCR. **Do not open it.** If you do, you will run a malicious piece of software that will delete files at random and automatically spread this e-mail to your address list. Delete the e-mail immediately.

Another virus sends an e-mail with no subject except for the word "Re:". Again, don't open it – delete it at once.

These viruses are at least easy to spot. if you know about them, because of the subject lines. But the fact that they come from what you would think are trustworthy sources makes them scary. New viruses will undoubtedly try to vary the subject line, making them harder to spot.

In conclusion

Prevention is better than cure. I hope that, by following the few simple guidelines suggested above, you will be able to avoid some of the hassle I had. ■

Editorial note: A report just published by MessageLabs, which provides anti-virus software, shows how bad the virus problem has become. According to the report one in 370 e-mails carried a virus in 2001: this compares with one in 700 in 2000 and one in 1,400 in 1999. The viruses are also becoming more varied and ingenious. The company dealt with 1·6 million viruses in 2001, compared with 184,000 in 2000.

Widespread viruses

Viruses have some bizarre names. The following is the full list of October's top ten widespread viruses, according to Kaspersky Labs:

Virus	*Per cent*
1 I-Worm.Sircam	44·9
2 I-Worm.Hybris (family)	14·6
3 I-Worm.Anset	5·2
4 I-Worm.Magistr.a	3·8
5 I-Worm.HappyTime	3·5
6 Macro.Word97.Thus (family)	2·5
7 I-Worm.LoveLetter (family)	2·5
8 I-Worm.Magistr.b	2·4
9 Macro.Word97.Ethan	1·7
10 Backdoor.Death	1·1

Video generator

Roy Harding's video test generator gives S-Video and composite outputs in either PAL and NTSC formats. There are ten different test patterns available from a test card to colour-bars, grey scale, crosshatch, centring, colour screens and flashing – all fully interlaced.

In the October 1999 issue of *Electronics World*, I described how to construct a SVGA generator for computer monitor testing using a single fast microcontroller. The design proved to be quite popular with engineers and enthusiasts, so I decided to do another project based on the same micro that provides standard TV test signals.

The Scenix controller at the heart of this generator can run at 50MHz but this project only requires it to run at a more modest 20MHz in turbo mode. There are just four ICs in the design – the controller, an Analogue Devices RGB-to-PAL/NTSC converter, a CMOS switch and a three-terminal regulator.

The unit gives S-Video and composite outputs and can switch between PAL and NTSC. There are ten different test patterns available from a test card to colour-bars, grey scale, crosshatch, centring, colour screens and flashing. All waveforms are fully interlaced.

Circuit functions

The micro is the basic building block for all the timing signals. A 20MHz crystal provides the frequency reference for the software routines that create waveforms as close as possible to the ITU-R BT.470-5 Conventional Television recommendations.

An example of the timings of a PAL video signal is shown in **Fig. 1**. I have implemented the NTSC signals at 525 lines, 60Hz for USA standards.

The circuit has just two momentary-contact buttons controlling its functions. One steps through the waveforms, the other toggles between NTSC and PAL output. Two LEDS indicate which type of output is active. The converter chip's mode-select input, pin 1, determines the mode, which is PAL for low zero.

Analogue Devices AD722, shown in **Fig. 2**, makes short work of all the digital-to-analogue conversion. Using either the 3.579 or 4.43MHz crystal for NTSC or PAL, it needs no external filters or delay lines, unlike some older devices. It also uses few external components.

The generator gives a 2V signal into a unterminated load or a 1V output into a 75Ω load.

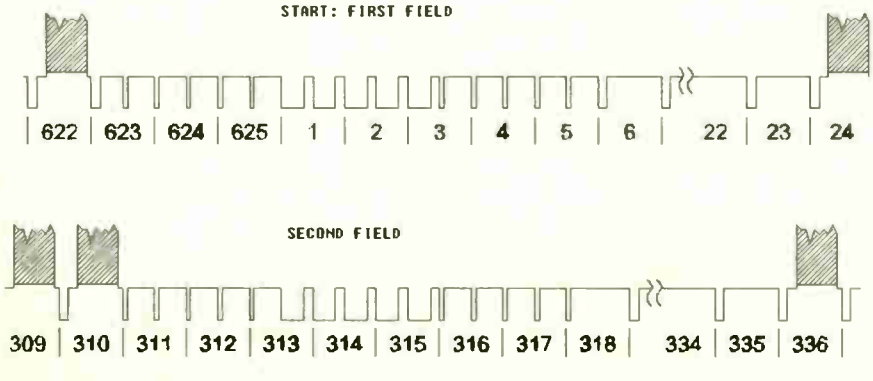


Fig.1. PAL interlaced waveforms for each field.

Circuit elements

Power is regulated at 5V with a standard 7805 positive regulator. A switch-type input connector allows an alternative power supply to be connected. I have found the generator to consume 90mA, giving several hours use from a set of five 800mA/hr AA size rechargeable cells.

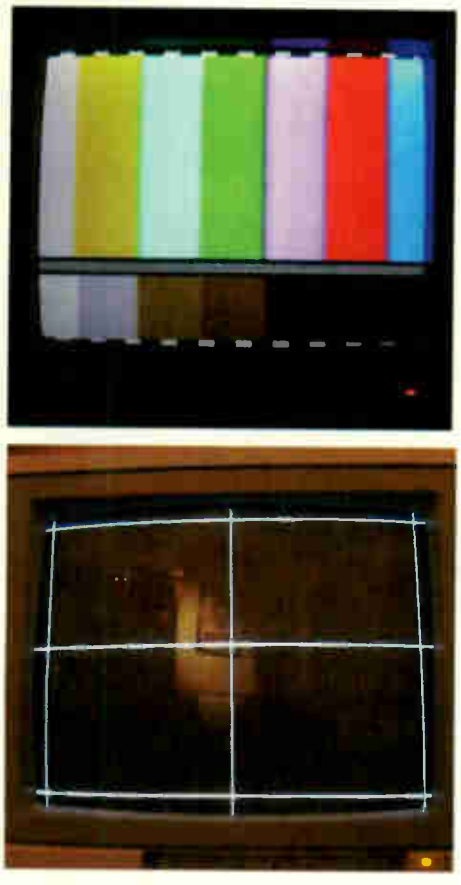
There are two main sections to the circuit – a digital section around the micro-controller and an analogue section comprising the RGB converter. The AD722 chip has separate power and ground pins for its digital and analogue sections. Careful layout design is needed to get the best out of this device.

Place separate, extra de-coupling capacitors directly by the chip power pins. You need to place a 0.1μF capacitor next to the regulator and another de-coupling capacitor and electrolytic as close as possible to the Scenix chip power and ground connections.

The oscillator on the controller uses a 20MHz crystal and this component must be a fundamental frequency type. The RGB output from the controller is at full CMOS level and must be attenuated to give a 0.7V signal into the AD722.

Two crystals on the converter are controlled by switching the Scenix's RB5 port and the 4066 analogue switch. The mode pin for NTSC/PAL is controlled by RB2, which also operates one of the LEDs.

Grey-scale output is achieved by shorting the red, green and blue signals via the 4066. Then by switching combinations of outputs plus the extra load resistor on the green divider, you can build up a useful grey scale.



Examples of patterns from the generator.

Parts list

Resistors 1/8 watt 5% carbon film:

R_1, R_4, R_6	10kΩ
R_7, R_8, R_9	1kΩ
R_{10}, R_{11}, R_{12}	150Ω
R_{14}, R_{15}	220Ω
R_3, R_5, R_{13}	75Ω
R_2	10Ω
R_{16}	270Ω

Capacitors 50V Polyester or ceramic, electrolytics 10-16V:

C_1, C_3, C_6, C_9, C_5	0.1µF
C_2, C_{10}	10nF
C_7, C_8, C_{12}	15pF
C_4, C_{11}	100µF

Other components:

B_1, B_2	Push buttons
Y_1	4.433MHz crystal PAL
Y_2	20MHz crystal, fundamental
Y_3	3.579MHz crystal NTSC
P_7	3.5mm power connector
IC_1	AD722 Analogue Devices – only available in SMT
IC_2	Scenix SX18/AC/DP 18-pin controller
IC_3	74HC4066 switch
IC_4	7805 5V positive regulator
D_1, D_2	3mm red LEDs
P_4	Phono socket

Software requirements

The whole design revolves around software running on the Scenix controller. Timing for the functions are very critical and each scan line must be balanced to within a couple of machine-code instructions or distortion of the image will result.

Button presses are checked on each frame and a software trap waits for the button to be released for the changes to take place. The first button toggles the displayed output from PAL to NTSC and the second changes the display patterns by subsequent presses of the button.

For those of you interested in the software side of the design, I have commented the listing to show the relevant sections of code. This code is available free of charge to those of you with e-mail. Ordering details are at the bottom of the parts list.

The main software loop is quite small, consisting mainly of the interlaced frame

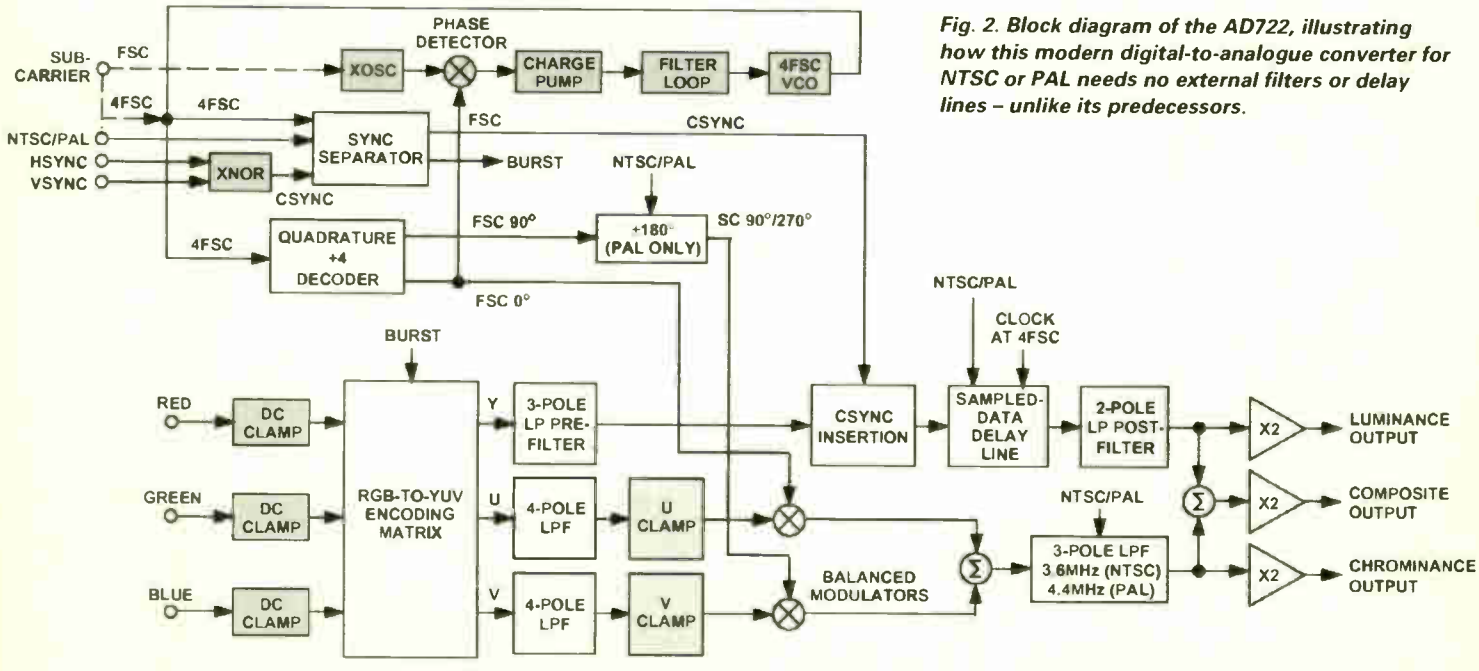


Fig. 2. Block diagram of the AD722, illustrating how this modern digital-to-analogue converter for NTSC or PAL needs no external filters or delay lines – unlike its predecessors.

building blocks for the NTSC and PAL formats. All of the display patterns are sub-routines called twice from within the main loop. As both fields are fed with the same data, flicker of the display is illuminated.

If you don't require the NTSC mode you can leave off the 3.579MHz crystal, D_2, R_{15} and button B_1 as the software defaults to PAL mode on power-up. Button checks are enclosed in the main loop as any interrupt routines badly distort the display image.

I used the port A for the RGB drive signals and the sync signal on port B. This enables you to send colour values directly to the port without having to mask the sync bits out of the equation. If you wish to add or change any display patterns to the generator it is important that you match your line length timings with the line length already used by the other routines.

Note that if you want to re-program the Scenix micro, you will need a special Parallax SX-KEY serial-programming adapter. This programming device plugs onto P_1, the four-way connector next to the micro. You will also need to remove the crystal if you want to run in debug mode. ■

Kits

Parts for the generator can be obtained from the author: Pre-programmed Scenix micro £8.00. AD722 IC, £10.00. Two-layer plated-through hole FR4 PCB, £14.00. PCB with programmed Scenix micro and AD722 ready soldered £30.00.

A complete kit of parts to build unit pictured with programmed Scenix micro and AD722 ready soldered £47.00. All orders come with free construction details. Please add £1.50 to all orders to cover carriage – overseas orders add £3.00. Send cheque or postal, international money orders to R. Harding at 43 Jonathan Road, Trentham, Stoke-on-Trent, Staffordshire ST4 8LP.

A copy of the source code for the microcontroller can be obtained by sending an e-mail with the subject heading "PAL/NTSC generator" to j.lowe@cumulusmedia.co.uk. Please don't send other queries about the generator to this address.

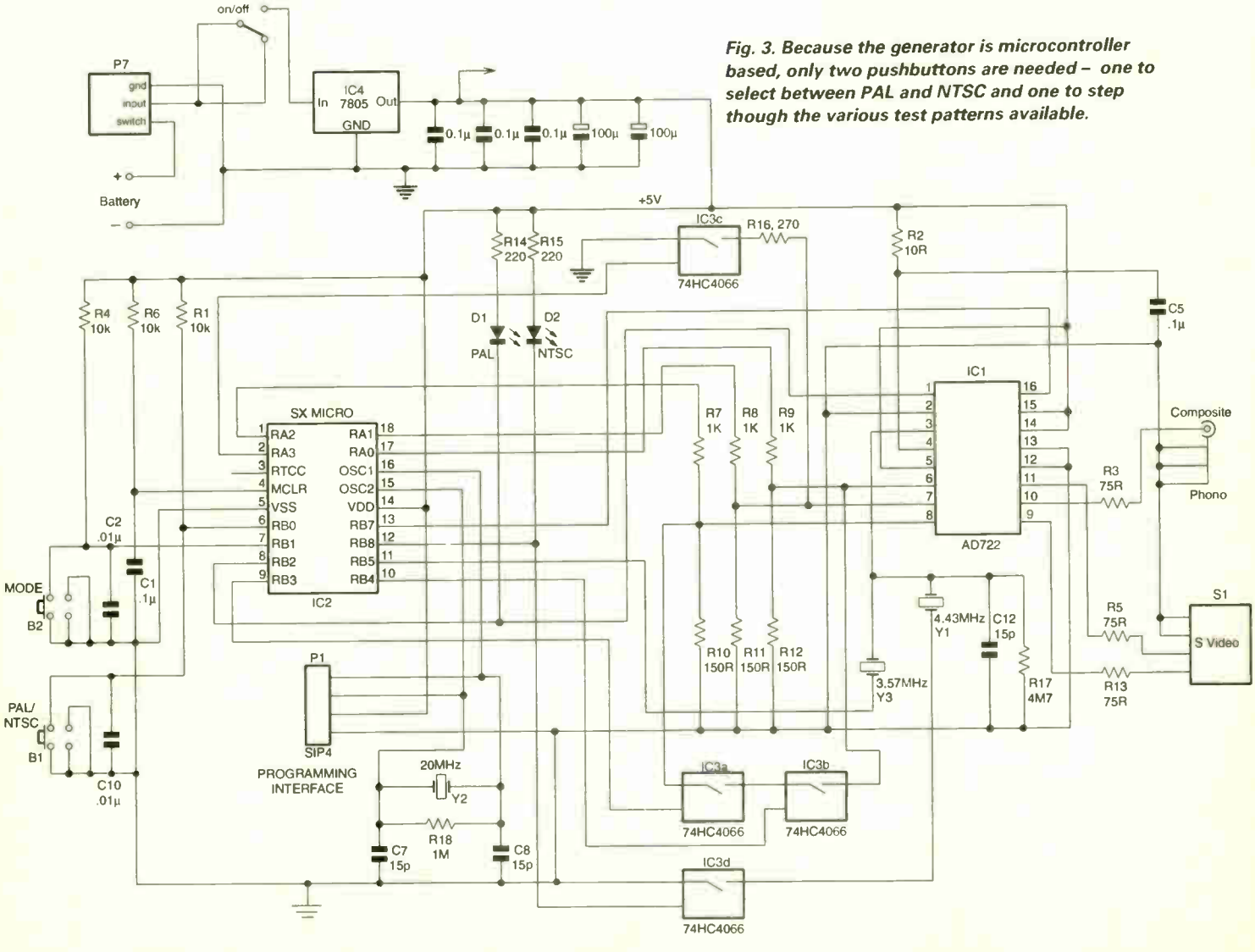


Fig. 3. Because the generator is microcontroller based, only two pushbuttons are needed – one to select between PAL and NTSC and one to step though the various test patterns available.

In this second instalment Mark Paul describes the field timebase, the tuning system, the various operations performed by the signals-processor IC, and the operation of the RGB output stages

Thomson's TX807 technology

In last month's article we looked at the rather unusual chopper power supply used in the Thomson TX807 chassis and the line output stage. This time we'll deal with the field timebase then make a start on the signals side of the chassis.

The field timebase

The field timebase circuitry is conventional, starting with a ramp generator which is in the TDA8840 IF/colour decoder/timebase generator chip IV01. It's controlled by a vertical count-down circuit, which is driven by a line-frequency signal and reset by the incoming field sync pulses. The external ramp-generator capacitor CV16 (0·1μF) is connected to pin 51: the current-reference resistor RV10 (39kΩ) at pin 52 controls the ramp generation. The field driver stage in IV01 is optimised for use with the following field output chip. There are differential field drive outputs at pins 46 and 47.

The field output chip IF01 is either an SGS-Thomson TDA8172 or a TDA9302H. See Fig. 5. Previous Thomson field output stage designs – in the ICC9 chassis for example – used an AC-coupled field scan circuit. This one is DC-coupled. The main differences lie

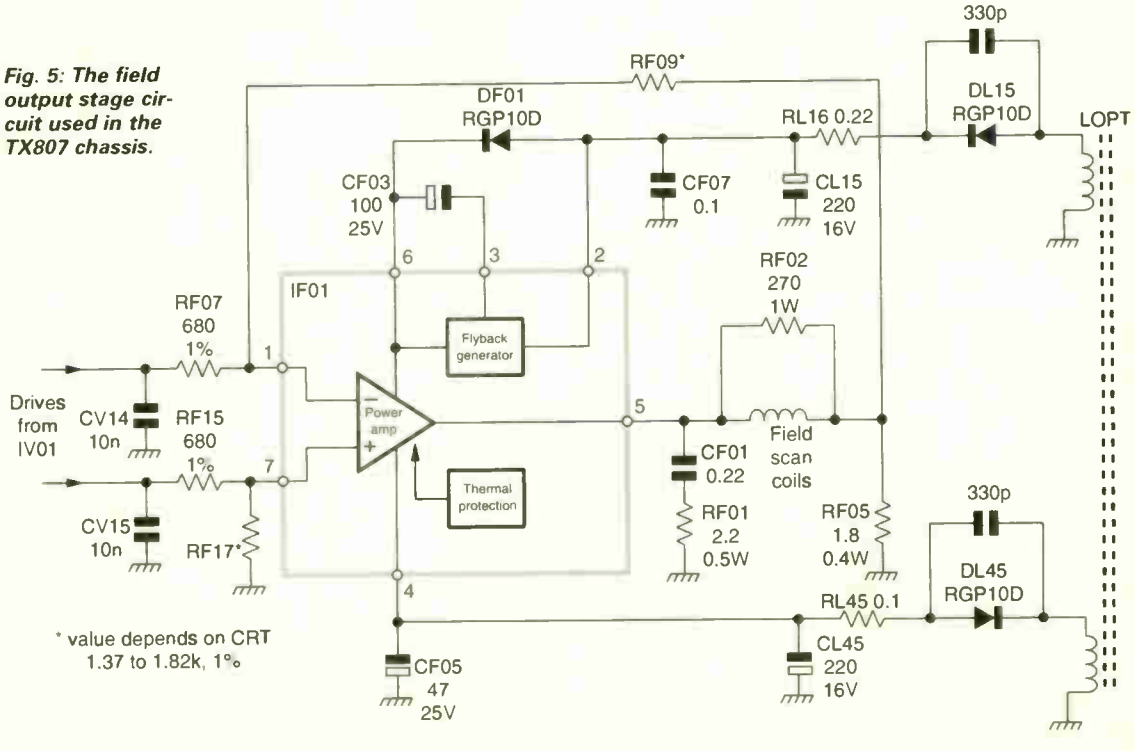


Fig. 5: The field output stage circuit used in the TX807 chassis.

in the power supply arrangements, the component count, elimination of the scan-coupling capacitor, and the reference voltage for vertical centring.

IF01 requires both positive and negative supplies, at pins 2/6 and 4 respectively. This approach has two advantages. First, chassis potential can be used as the scan 'centring' reference. This eliminates position shift with temperature drift and makes the setting less sensitive. Secondly there is no need for a scan-coupling capacitor with its inherent non-linearity. The need for DC feedback to compensate for this non-linearity is removed, reducing the component count and further reducing the possibility of position shift with temperature drift.

Field scan geometry is adjusted via the I^2C bus, operating within IV01. Field slope, height, shift and scan-correction are all adjusted by software, further reducing the component count. Anti-breathing compensation is provided by feedback from the earthy end of the EHT generator section in the line output stage (LOPT pin 6) to pin 50 of IV01, thus tracking the beam current.

The field output stage in IF01 is configured as a differential amplifier which is driven by the ramp and bias currents supplied by IV01, I + Ir and I – Ir respectively at pins 46 and 47. There's feedback from the output to the input via RF09 to set the gain: the current-sensing resistor RF05 develops a voltage proportional to the deflection current.

CF01 and RF01 form a zero-pole compensation network to increase the amplifier's phase margin while maintaining the bandwidth. RF01 is fusible to prevent overheating should CF01 go short-circuit. RF02 is connected across the field scan coils to damp out line-frequency effects caused by the proximity of the line-scan coils. CF03 is the boost capacitor to provide the increased voltage required for the flyback.

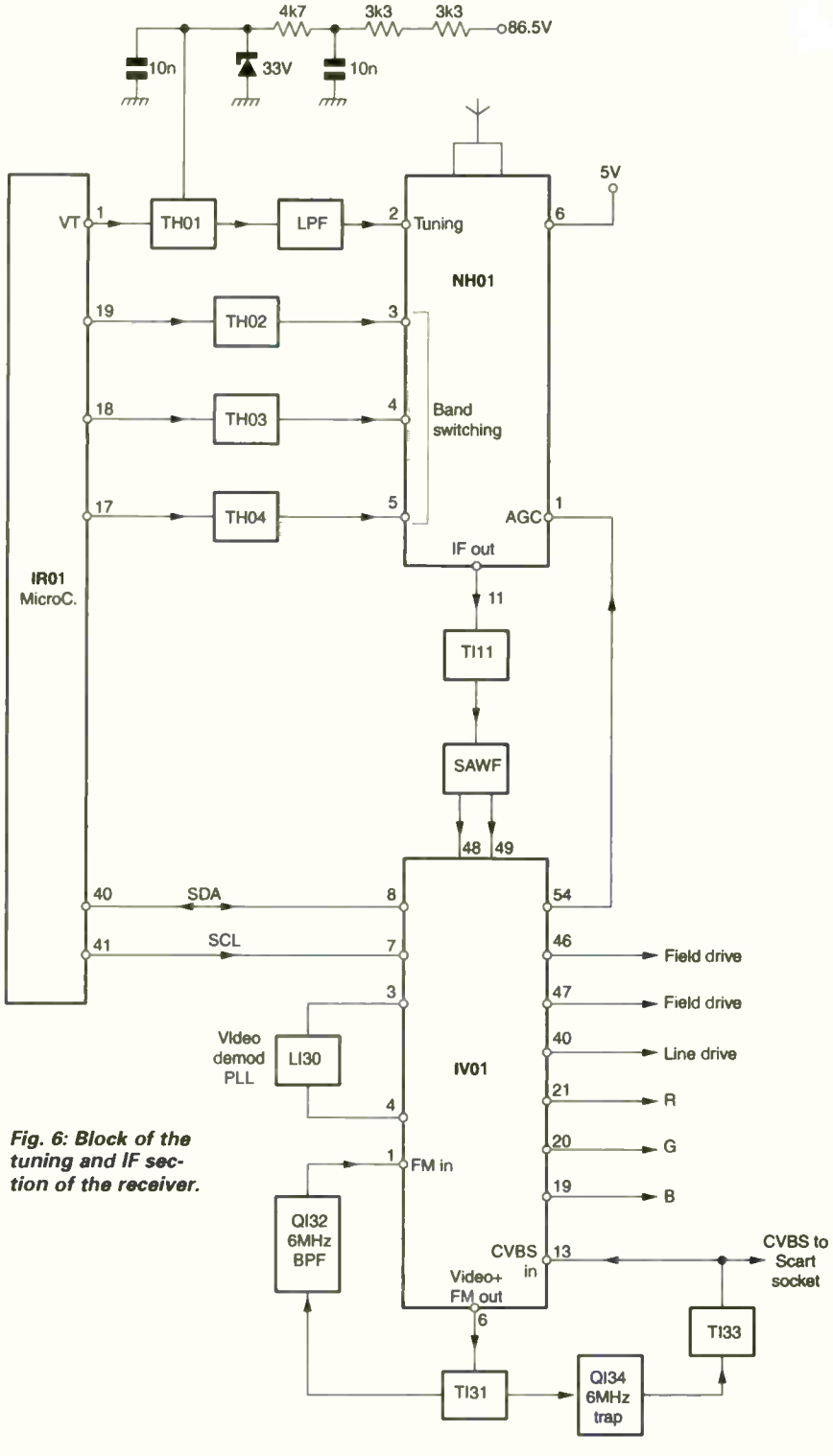


Fig. 6: Block of the tuning and IF section of the receiver.

The tuner

The TX807 chassis is designed for use with either a voltage-synthesiser or a frequency-synthesiser tuner, by using the relevant options provided on the main PCB. Tuner types CTT5000 and CTT5045 use FST and VST respectively. The following notes refer to the CTT5045 tuner, which conforms to world-standard terrestrial tuner pin connections and mechanical size. It incorporates Band I/III/UHF switching, with separate dual-gate MOSFET RF amplifiers (type S595TR). These are self-biasing. This is followed by a Philips TDA5736T mixer-oscillator chip, which has separate mixer inputs and VCOs. This arrangement provides good image rejection and selectivity, low noise, good input matching and easy alignment.

Fig. 6 shows the tuning and IF amplifier arrangement. When a particular channel is selected, the microcontroller chip IR01 produces at pin 1 the relevant PWM output. This is fed to the base of transistor TH01, whose collector is connected to the stabilised 33V tuning voltage supply. Its output is smoothed by an *RC* low-pass filter and fed to pin 2 of the tuner to bring in the required channel.

In the channel search mode, IV01 informs IR01 via the I^2C bus when a channel has been found. There is

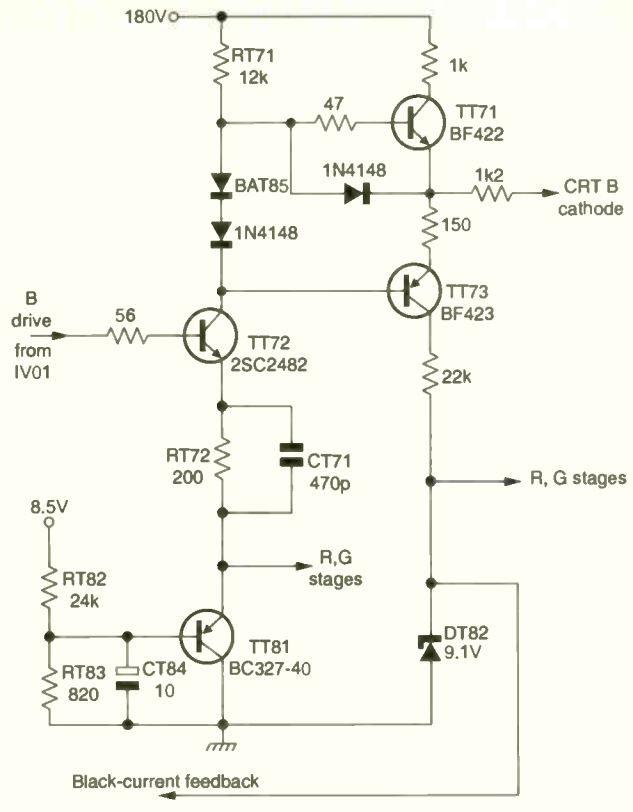


Fig. 7: RGB output stage circuitry, ten-transistor version.

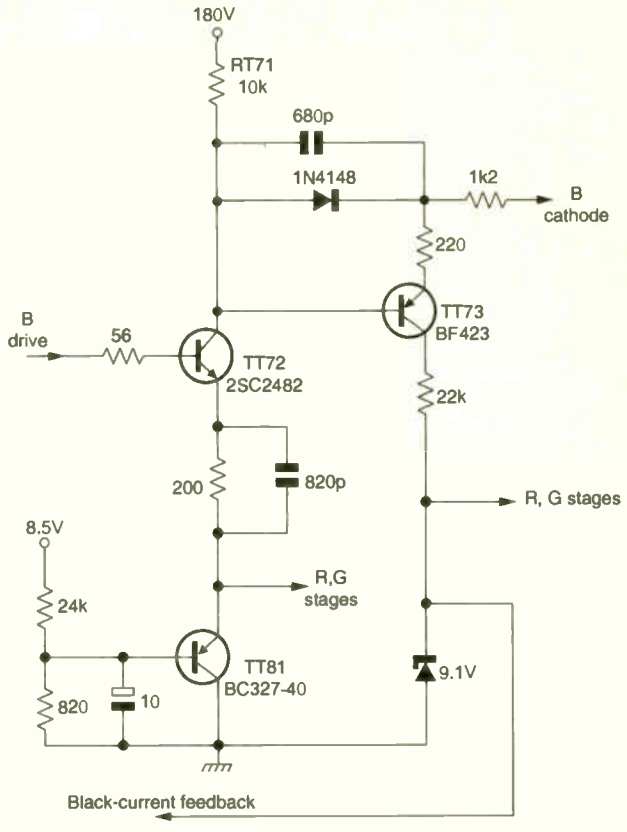


Fig. 8: RGB output stage circuitry, seven-transistor version.

then a slowing down in the varicap voltage change, with the system automatically fine-tuning for optimum signal capture.

The transistors, varicap diodes, other diodes, resistors and ceramic capacitors in the tuner are all of the surface-mounted/flat-chip type. The tuner is powered at 5V and has a total power consumption of about 375mW.

IF circuit

The tuner produces its IF output at pin 11. There is provision for IF filtering to suit various TV transmission standards, with switching where multi-standard operation is required. Items that are not required for a particular market are omitted. Thus Fig. 6 shows the UK arrangement, for standard I.

The tuner's output is fed via transistor TI11 to the bandpass-shaping SAW filter QI30, which provides a differential IF output for pins 48 and 49 of the TDA8840 IF/colour decoder/timebase generator chip IV01.

The demodulated output from the IF section of IV01 exits at pin 6 and is then fed via the buffer transistor TI31 to the 6MHz intercarrier sound BPF QI32 and the 6MHz trap QI34. QI32's output is fed to IV01's FM sound input pin 1. QI34's output is fed to a further buffer transistor TI33 then to IV01's CVBS input pin 13. A feed is taken from the emitter of TI33 to pin 19 of the scart socket as a CVBS output.

The signals processor chip

There are various versions of the Philips TDA884X IF/colour decoder/timebase generator chip, TDA8840 for PAL only decoding, TDA8841 for PAL/NTSC and TDA8842 for PAL/Secam/NTSC decoding. We have already mentioned it in connection with the IF amplifier and timebase generator sections of the chassis. It has a high degree of integration, incorporating the following functions as well: colour signal decoding with a built-in chroma delay line, audio processing with volume control, CVBS and RGB switching, black stretch and CRT black-current stabilisation. It requires an 8·5V supply, at pins 12 and 37. All controls and set-ups are carried out via the I^2C bus, with the SDA connection at pin 8 and the SCL connection at pin 7. Pins 10 and 11 enable S-video signals to be fed in, chroma at pin 10 and luminance at pin 11.

On-screen display and teletext RGB signals, also scart RGB inputs, are fed in at pins 23, 24 and 25 respectively. When these inputs are required, a fast-blanking input at pin 26 rises to 4V to cut off the off-air signals. In the European version of the chassis the black-level of the inserted RGB signals is clamped by external transistors, TV03, TV05 and TV07; clamping is carried out during the burst-gating period, triggered by TV08.

The chip has alignment-free internal luminance and chroma delay lines and a chroma trap, implemented as gyrator circuits that are tuned by tracking with the 4·43MHz oscillator. The chroma trap in the luminance signal path is bypassed by a 110nsec delay when S-video inputs are selected, to compensate for the delay introduced by S-chroma decoding to R – Y and B – Y. In Secam versions the centre frequency of the trap is set to approximately 4·2MHz for improved suppression of the modulated colour subcarriers.

The chroma section of the chip incorporates an ACL (Automatic Colour Limiting) circuit that can be switched via the I^2C bus. It prevents over saturation when signals with a high chroma-to-burst ratio are received, and is gated so that only the chroma and not the burst signal is reduced. Thus ACL operation does not affect colour sensitivity. The burst PLL detector has two gain modes to provide a good catching range when the PLL is not locked and low ripple voltage with good noise immunity once the PLL has locked. The colour-killer circuit switches off the R – Y and B – Y demodulators when the input signal is very low (reduced chroma and burst amplitude): a built-in hysteresis prevents on/off switching with low, noisy signals.

The chip's RGB outputs appear at pins 21, 20 and 19 respectively and are fed to the CRT base PCB circuitry. One trick with the TDA8842 is that the colour-difference signal matrixing adapts automatically to the decoded standard (PAL, Secam or NTSC).

The contrast and brightness controls, along with the peak-white limiter, operate on both internal and external RGB signals. The RGB outputs have their own separate gain controls to obtain the correct white balance and compensate for different CRT phosphor efficiencies. The nominal output amplitude is about 2V black to white at

nominal input signal and control settings.

Beam-current limiting to protect the CRT and line output transformer is applied to pin 22. Sensing is at the earthy end of the EHT section of the LOPT, see Fig. 4 in Part 1 (January). As the voltage at pin 22 falls, the contrast level and subsequently the brightness is reduced.

Black-current stabilisation

IV01 has an automatic black-current stabilisation loop which adjusts the black-level of its RGB outputs to the cut-off voltages required at the CRT's three cathodes. Since there is no current when a cathode voltage is at the cut-off point, the loop stabilises at a very small cathode current. This 'black current', at the three cathodes, is measured within IV01 and compared with a reference current to adjust the black level of the RGB outputs.

The black-level loop is active during the four lines at the end of each field-flyback blanking period, lines 20-23 and 333-336. The CRT's 'leakage' current is measured during lines 20 and 333. During the next three lines the cut-off current (black level) of the three guns is adjusted. The nominal black-current value is 10μA. Feedback for control is to pin 18 of IV01. The ratio of the 'black currents' for the three guns tracks with the white-point adjustment automatically, so that the background colour is the same as the adjusted white point.

CRT base PCB

The CRT base PCB incorporates the RGB output stages, which take the RGB outputs from IV01 and drive the CRT's three cathodes. It also provides focus, first anode and heater supply connections for the CRT. The 180V supply required for the RGB output stages is derived from the line output stage, as described in Part 1.

20 and 21in. models have ten transistors in the RGB output circuitry while smaller-screen sets have seven. Since the output stages are identical, only one will be described. Fig. 7 shows the ten-transistor version, Fig. 8 the seven-transistor version.

The component reference numbers in Fig. 7 refer to the blue output stage. Transistor TT72, type 2SC2482, is a high-voltage device with low capacitance to provide a bandwidth of greater than 2·7MHz. The gain is set so that its output can reach 120V when the drive from IV01 is adjusted for maximum. CT71 is incorporated to improve the HF response – by reducing the negative feedback introduced by RT72. The emitter-follower TT71 improves the signal transition time.

Each of the three-transistor output stages sits on a reference voltage provided by the emitter-follower TT81. This determines the DC working point of the three RGB amplifiers. The reference voltage is set by the potential divider RT82-83, which is fed from the stabilised 8·5V supply.

TT73 provides feedback for the black-current stabilisation circuit. DT82 is included to provide over-voltage protection.

The seven-transistor version is the same with the omission of the emitter-follower TT71 and some component-value changes. See Fig. 8. ■

Next month Part 3

The concluding instalment in this series will deal with the microcontroller circuiry, teletext and the audio output stage.

Test Case 470

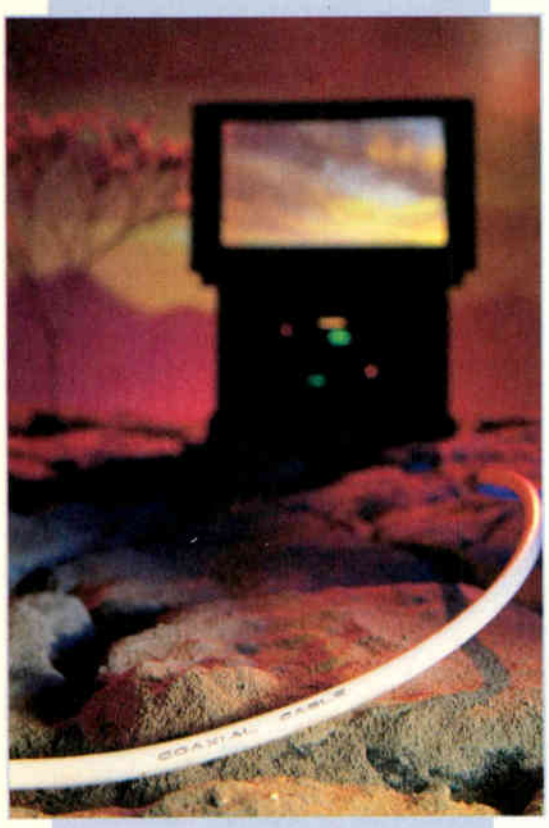
The Test Case workshop once dabbled in satellite TV installations. Indeed it had many set-top boxes out on rental before digital broadcasting got under way. Most of these STBs now sit forlornly in the workshop, gathering dust. In the present era, the fee paid to dealers by Sky for signing up new customers and rigging up dishes is so miserly that this part of our business has been almost entirely abandoned. The satellite department, consisting of Cathode Ray when he's not attending to many other things, now undertakes only 'bespoke' dish installations for what might be called blue-chip customers: people who care about the workmanship and the materials used, and who may have special requirements – multi-outlet systems, concealed or disguised dishes, and so on. They pay more than the £40 Sky charges for a 'standard' installation, and in return get a proper job done!

So it was that Ray found himself at the mock-Georgian house of Mrs Marriot-Turnbull, in the fashionable and genteel surroundings of Spa Close, Horsebridge Wells. Mrs M-T had decided to add digital TV to widen her viewing experience, but there was no possibility of terrestrial DTV reception at her location, and no way would the lady spoil the appearance of her house with the addition of a satellite dish at the front or side. She required the "wretched thing" to be on the rear wall or in the garden, and had been upset by the coarse language used by the representative of Stick-em-Up aerials when he told her that what she wanted was not possible because her house pointed south.

Ray found that the back garden consisted of a patio. It was so small that even a rear-wall mounting for the dish would not provide a view over the roof. He mentioned the possibility of a painted dish. Not a chance! Was this going to be one of those rare situations where satellite reception would not be possible? No! Ray shone, both with his idea and its implementation, the latter aided in the final stages by Real Technician and Madam's handyman. What did Ray do? And how much money do you think changed hands? All will be revealed later.

Ray's second call that day had been to Mr Wainright, whose newly-installed IDTV set was giving trouble. He had arranged for an aerial 'upgrade', which had been carried out by the agents of ITV Digital, and had purchased a new Sony digital receiver from the Test Case showroom. So it was an under-guarantee call. The picture and sound were fine with analogue-signal reception, but at certain times of the day with digital reception the picture would break up into frozen streaks or mosaics while the sound crackled and dropped out. At worst this might happen at intervals of a few minutes.

Well, it didn't take Ray long to suss out that the problem was caused by interference from the central-heating boiler in the adjoining kitchen: when it was switched off, the symptoms disappeared. Ray knew that terrestrial DTV is vulnerable to impulse interference, and vaguely remembered some suggested cures. What was the best cure in this case? For the solutions to these problems, see page 248



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

Modern cable TV technology

Broadband cable routes use fibre-optic cables that carry digital signals modulated on up to a hundred different light frequencies in the infra-red region. The fibre itself is very slender, only 125µm in diameter – see Fig. 1. An outer protective coating, coloured for ease of identification, brings the overall diameter up to 250µm. With some cables the inner core of the fibre is only 10µm in diameter (single-mode fibre) while with others the core has a diameter of 50µm (multi-mode fibre). These two basic types have different applications, as we'll see later.

Fibre-optic transmission

Fibre-optic transmission operates on the principle of total internal reflection within the core of the fibre, i.e. the light does not pass through the core boundary. The beam may travel along the boundary, or travel along the core by being continually reflected at the boundary. It's a bit like projecting a tennis ball down the inside of a sewer pipe – the ball rebounds off the wall from time to time as it travels to the far end. The losses introduced by this medium (glass fibre) are very low, between 0·15-0·35dB per kilometre, which is minuscule in comparison with coaxial copper cable. The bandwidth is also far greater. A good coaxial copper cable will attenuate the signal by about 6dB per 100 metres at 1,000MHz. It's bandwidth is also 1,000MHz. With fibre the theoretical bandwidth is 20THz (20 million MHz). Fibre-optic cable has the additional advantages of being inert to electrical fields and intrinsically safe in hazardous environments.

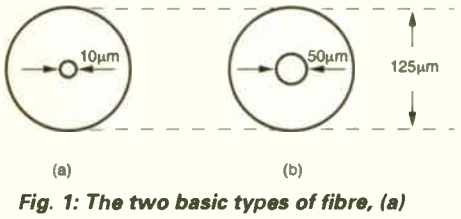


Fig. 1: The two basic types of fibre, (a) single-mode and (b) multi-mode.

There are three infra-red light bands, which are referred to in terms of wavelength rather than frequency. The shortest wavelength band, 850nm, is used for local-area networks (LANs). The other bands, 1,310nm and 1,550nm, are used for medium- and long-haul routes and cable TV.

These light bands are based on the light source, which is a laser. Semiconductor lasers with an output between 1-40mW (continuous power) are used. There are two main types, the directly-modulated laser and the YAG laser, which requires an external modulator – Fig. 2 compares the two main types of laser transmitter. YAG stands for Yttrium-Aluminium-Garnet, which means rare-earth doping of the laser crystal to enhance the output.

Light enters the fibre via a conical coupler that concentrates the beam to suit the fibre in use. Single-mode fibre has the greater bandwidth because it supports only one mode of light propagation. Multi-mode fibre supports several propagation modes, with the result that a signal arrives at the receiver via paths of different length. This restricts the bandwidth because of pulse stretching.

Broadband cable TV

Thus single-mode fibre is used for very wideband applications, including cable TV. A CATV network head-end, which contains all the signal processing equipment for programme transmission and reception, feeds a fibre-optic network that consists of a giant loop of cable to link all the franchise areas, see Fig. 3. The loop returns to the head-end, and consists of fibre pairs that transmit in both clockwise and anticlockwise directions. Each pair of fibres has a downstream and an upstream path to provide two-way interactive operation. If the cable TV operator provides a telephone service, the fibres carry these signals as well. The 'fibre ring' is classed as self-healing – in the event of a break in the cable at any point the local head-ends (network hubs) can obtain the same set of signals by changing over to another pair. Virtually seamless changeover is achieved, with viewers noticing only a slight on-screen flick.

Various signals can be added or dropped at the hubs, a suitable selection for the local region being extracted and passed, often via a secondary fibre ring, to the optical nodes. Here the optical signals are demodulated back to RF for onward

distribution via coaxial copper cables to the cable TV customers.

Signal processing

TV, radio and data signals, both analogue and digital, are modulated on to RF carriers at the master (network) head-end. The analogue TV carriers conform to a universal plan, with an 8MHz spacing between each one. With this system any beats caused by intermodulation distortion in network amplifiers are also spaced 8MHz apart. With any beats present close to or at the vision carrier frequency their visibility is greatly reduced, because with an analogue transmission the majority of the power is concentrated in the region of the carrier. Thus the wanted-to-unwanted signal ratio is high.

The digital signals fed downstream from the master head-end use QAM (Quadrature Amplitude Modulation). This is a development of QPSK (phase-shift modulation) that also enables the amplitude of the I and Q (in-phase and quadrature) carries to be modulated. For cable TV operation, 64 phase and amplitude states are used (64QAM), see Fig. 4. Each signal occupies a standard 8MHz channel bandwidth. The entire range of TV channels, downstream telephony carriers, control and data and radio signals is assembled into the 65-860MHz spectrum, amplified and then fed to the modulator stage of a fibre transmitter. Thus the beam of infra-red light transmitted via the fibre loop carries the entire CATV RF spectrum.

Nodes

A photodiode biased at the centre point of its linear illumination/current characteristic is used to demodulate the optical signals at each node, recovering the RF signals for local distribution via coaxial copper cable. The high-frequency capability of the pin diode makes it a suitable choice for this application.

Networking

Modern cable networks carry optical signals deep into the areas covered, leaving only final distribution at RF via coaxial copper cables. As a result there are large numbers of small distribution networks that operate at RF. This way of building a network provides good results because the RF sections are fairly short. Even the best cable network amplifiers contribute some noise and distortion, which increases with the number of amplifiers used in tandem. As a general rule, no more than four amplifiers should be used in cascade.

Networks that employ both optical fibre and RF coaxial copper cabling are called HFC systems (Hybrid Fibre Copper). Fig. 5 illustrates this.

Customer tap-off

The RF cable signals are connected to a customer's home via an isolator that blocks DC and low-frequency AC. The purpose of the isolator is two-fold: it prevents dangerous voltages that may arise from connection to faulty, live equipment getting back into the network, and it stops the flow of earth currents caused by potential differences between separate earthing points. The latter can cause corrosion problems in connectors and other cable joints.

For access to the TV channels the cable TV company supplies a set-top box which acts as a converter and descrambler. Moreover each STB is initialised on installation in accordance with the

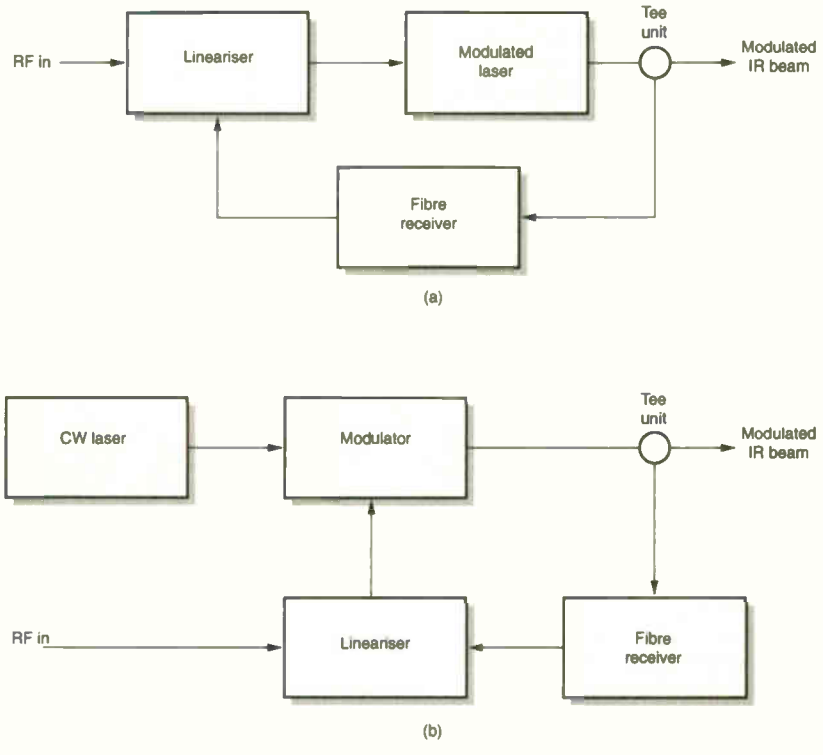


Fig. 2: Block diagrams of the two main types of laser transmitter, (a) DFB laser and (b) YAG laser.

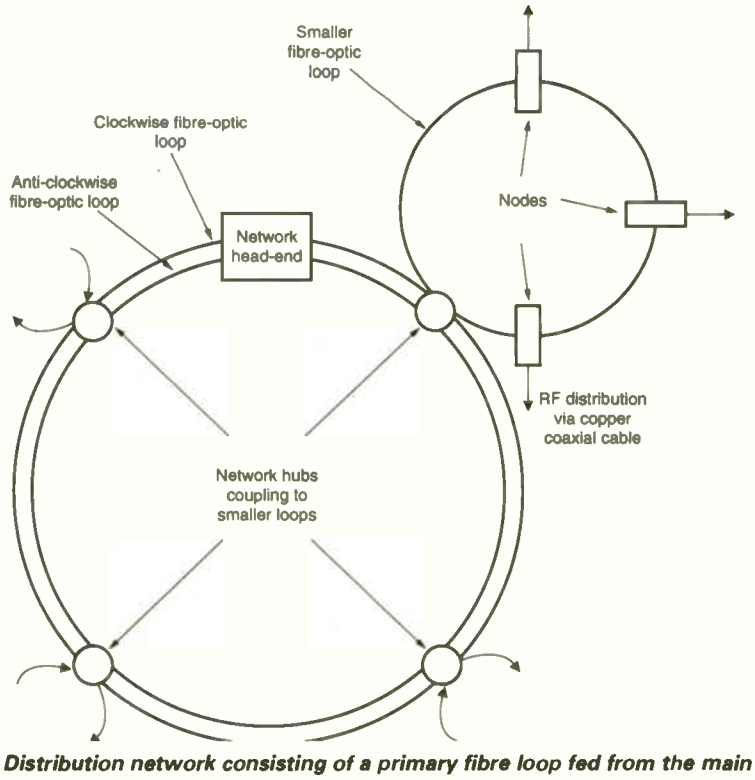


Fig. 3: Distribution network consisting of a primary fibre loop fed from the main head-end, hubs and local distribution nodes.

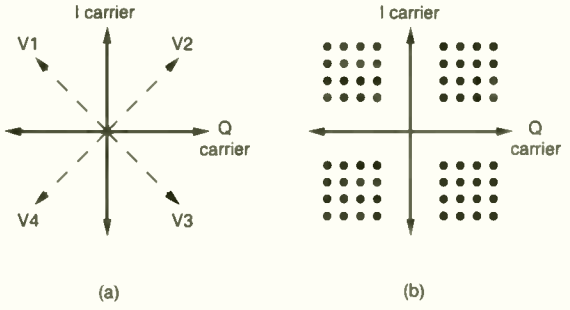


Fig. 4: QPSK and 64QAM modulation. (a) With QPSK two carriers, I and Q, can be modulated to produce four vectors (V1-4). The technique can handle four 2-bit codes. (b) 64QAM: each of the 64 dots represents the end point of a vector produced by phase and amplitude modulation of one or both carriers, I and Q.

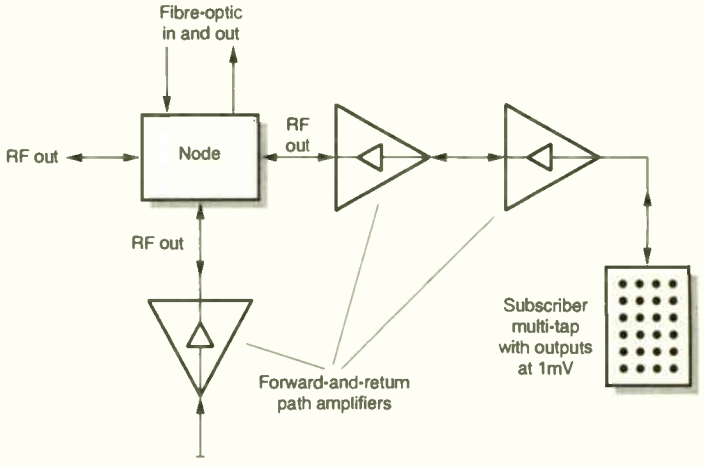


Fig. 5: Typical HFC network.

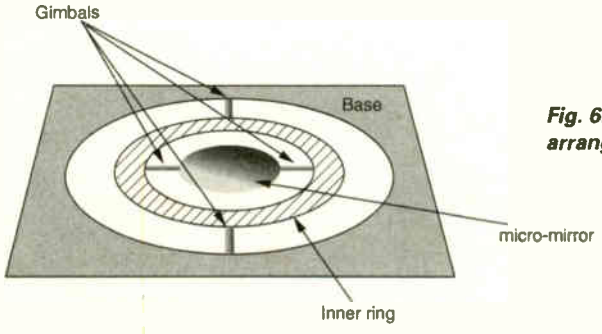


Fig. 6: Basic MOEMS arrangement.

customer's selected programme package. The process is known as "getting a hit": it releases all the channels required and paid for by the customer and, for security purposes, notes the serial number of the allocated STB. The latter is generally pre-programmed. With a digital network most STBs installed today are capable of interactive operation.

Two-way operation

Modern networks allow for two-way operation, with the downstream signals in the region 75-860MHz and the band from 5-65MHz set aside for upstream transmission. Upstream or 'return-path' working calls for good RF engineering standards because of the beat products that can arise at the lower frequencies. They are caused by 'common-path distortion', which occurs with corroded joints, poor earths and any non-linear device that carries both upstream and downstream signals.

Noise is also a problem with the return path, because all the noise-producing branches of the network come together at the head-end. The effect is called 'noise funnelling'. Because of it, QPSK modulation is used for upstream signals.

Cable operators nowadays offer a telephony service, which is sometimes a POTS (Plain Old Telephone System) that's been overlaid on the TV network. More often the telephone audio signals get only as far as a node, where they are digitised into 64kbits/sec streams, multiplexed with others, then carried via RF or optical cables to the exchange, or 'switch' as it's beginning to be called.

Special modems are used with cable networks: they operate at much higher data-transfer rates than the 56kbits/sec standard with ordinary twisted-pair telephone circuits. These modems are really data transmitter/receivers that act as translators for computer data going out to the network and coming in from it. Communication is via the return path for outgoing data, with the incoming low-VHF data signals carried by the downstream path.

Domestic fibre

As the reach of optical networks grows, optical signals will arrive at the kerbside, probably the house or office, and will eventually go right into the STB. Over the next five years cable TV customers can expect to see fibre optics getting ever closer. An experiment is at present being carried out in Sweden with fibre connections to some 5,000 subscribers. For computer users the advantage will be very great speeds, with up to 20Mbits/sec being feasible. Modems for fibre can be expensive because of the need for a laser transmitter in each one and optical filtering to combine the signals on IR wavelengths. No doubt the price will fall or some technological advance will make it all happen.

Routeing

The immense bandwidth in the optical region enables very high communication speeds to be achieved. But until a couple of years ago optical-signal routeing was difficult and expensive. The method used involved signal demodulation to RF, routeing at RF, then remodulation for onward transmission via fibre. This was inconvenient but had the advantage, not always necessary, that the optical signal was regenerated at a considerable power level. The demodulate-switch-remodulate method was also slow.

More recently, developments in optical switching have speeded up the process and eliminated the need to revert to RF. This has come about thanks to a device called the MOEMS (Micro Optical Electro-Mechanical Switch). Basically it consists of a micro-mirror mounted on gimbals so that it can be moved in any direction to reflect an IR laser beam emerging from one fibre straight into another one. See Fig. 6.

Present models can switch 256 incoming beams to 256 outgoing fibres. Units can be stacked in arrays to provide greater capacity, and are quite small – typically 25 x 25mm. To achieve the routeing required, MOEMS are controlled by microprocessors. The micro-mirrors themselves have very low mass, and can be set very quickly by the control system. Routeing information is contained in the data packets that comprise a transmission.

Fibre cables

Fibre cables normally consist of a bunch of fibres, often up to 144, in one sheath, colour-coded for identification. Because the cables have only sufficient length to enable them to be handled fairly easily when supplied on drums, lengths have to be joined or 'spliced'.

Splicing cable is a tricky job. The cable has to be spotlessly clean, and cut so that the end is a perfect right-angle to the line of fibre. The two ends then have to be fused together, using a high-precision fusion splicer. Despite the practical difficulties – working in the back of a truck, often in unsuitable circumstances – a high success rate is achieved.

Fibre cables are now the backbone of our telecommunications infrastructure. They operate at phenomenal speeds, are almost impossible to tap, and can be used to provide a vast range of services.■

WHAT A LIFE

A capstan motor repair then the story of Donnie, a contrast between two trades. Don Bullock's servicing commentary

A couple of months ago I mentioned a problem that you can get with certain Hitachi VCRs, e.g. Model VT530E. The symptom was picture freezing every few seconds when the machine has been on for half an hour or so, the cause being the capstan motor. Ron Mitchell in Aberdeenshire recently contacted me about the fault – he trades as Newtonhill Electronics. Paul and Steve have replaced several of these motors.

A capstan motor repair

According to Ron the trouble is that grit gets past the shaft seal and causes friction. The motor then draws excessive current via its drive chip, which runs hot. Being servo-controlled, the motor's speed remains constant – apart from the brief stopping – until the chip's heat-induced demise. Ron used to replace the complete motor but has now adopted the following procedure.

Dismantle the motor, remove the bearing, and clean it with WD40 before polishing it with Duraglit. Apply a light coating of oil to the bearing, then reassemble the motor. Ron says he has carried out many of these repairs with no bounces, even after more than a year. He adds "I'm glad it works so well, as many people balk at paying any more than £30 for parts and labour for a VCR repair these days".

My thanks to Ron, for his e-mail and our subsequent conversation. It recalled to my mind the following story of a chap I used to know.

Donnie and the nasty car

Are you sitting comfortably? Then I'll begin.

Once upon a time there was a bright little schoolboy called Donnie, who was *very interested* in resistors and condensers and crystals and bits of wire. He spent all his time trying to make clever things, and one day succeeded in making a crystal set that *really worked*.

"What a *wise and clever* boy!" said all the grown-ups who knew him. "He'll go a *long way* and make a *lot of money*."

In the fullness of time Donnie grew up, and *so many* people sought him out to do their *electronic repairs* that he could give up his 'proper' job. It wasn't long before he thought it would be nice to change his bicycle for a car, so that he could give a faster service. So he bought himself an old car, and cleaned and polished it *every day*.

But the car turned *nasty* on him. It took to cutting out as he was negotiating *very busy* roundabouts. This made him late for his service calls, and one day one of his customers stamped his foot and called him a nasty name. So he took his car to an *expert* at the local garage.

"It probably needs a good service" the expert said. And Donnie believed him. He could tell by his face that he was *very clever*.

"Call when you've a hundred and ten pounds to pay for the service" the expert said.

Now Donnie didn't have *anything like* that much money. So he *worked and worked* at his repairs until he did. Then he called on the *clever expert*, paid him all his money and collected his car.

But two days later the car did *exactly the same thing* at the same roundabout. So he took it back to the expert, who just about managed enough interest to talk about it.

"Can't be the plugs" said the expert, "'cos we replaced 'em last time. Must be the spark leads or the distributor cap. Call for it when you've earned another thirty pounds."

Donnie *worked and worked* some more, paid the expert another thirty pounds, and collected his car.

Two days later it did exactly the same thing again at the same roundabout, and Donnie took it back to the expert.

"Hm . . . " said the expert, "the ignition sometimes gives trouble with these cars. So does the coil. We'd better change the lot. Call for it when you've another hundred and twenty pounds."

Donnie *worked and worked*, and eventually had enough to pay the expert another hundred and twenty pounds. He collected his car once more and departed.

But the trouble still hadn't been cured. Two days later the car did the same thing at the same roundabout.

This time the expert serviced the carburettor, cleaned out the fuel pump and flushed out the fuel tank and pipes. "Come and collect it when you've another sixty pounds" he said.

Donnie *worked and worked* until he was able to pay the sixty pounds. Then he jumped into his car to drive away. But instead of *moving* it *cut out* again.

"Hm . . . " said the expert, "perhaps a *valve* is cracked or seating badly. Leave it with me."

Well Donnie couldn't do much else. So he left the car there and walked home. Later on he phoned the expert, who said he was stumped, wanted another thirty pounds for his time, and advised Donnie to take his car to the *Main Agent*.

"We shall want two hundred pounds to replace some more parts" said the Main Agent. "But we can't *guarantee* this will cure the trouble, because it's so *intermittent*."

At this Donnie lost his *presence of mind*. There was a *very pretty* car for sale on the Main Agent's forecourt. He traded in his *nasty* car and quite a lot of money for the new one.

"How nice to have a car that works" he thought as he drove to his workshop to try to *make up* some of the money he'd spent.

The Roughneck's TV

As he started, Mr Roughneck came in. He was a huge bear of a man with a *heavy* gold neck chain and an *even heavier* gold wristwatch. He carried a 26in. Ferguson TX100 set as though it was an *empty box*.

"I'm *mentally challenged*" he bawled, "so I works on an off-shore oil rig. Two weeks on and two weeks off. They pay me thirty eight thousand a year." Then he pointed to the TV set. "This set kips losing its colour. There's lots of *electronics wizards* on our rig. They reckons it's the *tube*."

"I doubt that" said Donnie, "more like a *decoder problem*, I'd say."

"The wizards on board would know better" said Mr Roughneck. "them's *whizkids* with *university degrees*." And off he prowled.

When Donnie switched the set on he found that the picture was noisy and watery, but it improved as time went on.

He took out the chassis, looked at it, and saw lots of dry-joints in the chopper and line output stages. He decided to resolder every single one. Then he looked for the cause of the watery picture, and found that some of the electrolytics in the power supply had fallen in value. So he fitted replacements.

But he had to run the set for two full days before the colour dropped out, for just one second. He used a magnifying glass to find some tiny dry-joints at the pins of the colour decoder chip and some of its peripheral components. Then he noticed that the joints around the field output chip looked dry and dusky, so he resoldered them as well.

He boxed the set up and tested it for two days before he phoned Mr Roughneck.

"It wasn't too much of a problem" he said, "just some dry-joints in the colour circuitry. For good measure I've resoldered some dry-joints in the power stages as well, and replaced some electrolytic capacitors to

cure the watery picture when you first switched on."

"Watery picture?" bawled Mr Roughneck. "I never noticed no watery picture. Any'ow, 'ow much is it?"

"Twenty one pounds" said Donnie, feeling apprehensive.

Later on Mr Roughneck came to collect the set. "So there wasn't much wrong, eh?" he growled, "what did you do, swap one of the boards?"

"No" said Donnie, "there's only one main board in this set."

"No wonder it was easy to mend" said Mr Roughneck, "there's dozens of boards in the equipment on our rig. That's why our boys get the mega-bucks, see. They golla be really clever. *Really clever*! In a different class to the likes of you."

As he left, Donnie *wished and wished* that instead of being a TV engineer he'd been a traffic warden, a pop song shouter or a counsellor of sappy prats.

Follow up

One evening, about a week later. Mr Roughneck phoned again. "This telly's still going to black and white" he shouted, "you sure you *did anything* to it?"

"Bring it in tomorrow, Mr Roughneck" said Donnie, "we open at nine."

But Mr Roughneck brought it along at seven. Donnie was still in his pyjamas, shaving.

"Give us a hand to get it outta the car" bawled Mr Roughneck, "I can't hang about. On my way to the *football match*, and I wants to beat the rush-hour traffic."

Donnie, half shaved and lathery-faced, went out to Mr Roughneck's car. It was parked half way up the road. As soon as Donnie had the set in his arms Mr Rougneck sped off, leaving Donnie to carry it back himself.

He soak tested the set for two days, after which the colour dropped out – for half a second. Donnie spent hours and hours with a meter,a scope, a can of freezer and a hairdryer, monitoring waveforms and applying freezer and heat to the chroma circuitry to make the colour drop out again. But it wouldn't. It remained in glorious colour throughout.

He decided to fit a new decoder chip, a new crystal and various other components. Then he soak tested the set for a full week before phoning Mr Roughneck to tell him it was OK.

"Have you done the job *properly* this time?" Mr Roughneck growled when he called. "I'm getting *tired* of this you know." He carried the set off to his car without even asking whether there was anything more to pay.

A week passed, then the phone rang again. "This is Mrs Roughneck, and I een't very 'appy. The telly's still going to black and white. I phoned my husband on the rig last night and he's hopping mad with you. Said you needs a good hiding. Either you fix it properly, he said, or he'll give you what for *and* 'ave his money back. And this time *you* come and fetch it."

So Donnie did, and after hours of work with perfect waveforms the colour dropped out long enough for him to see that when the fault was present the sandcastle pulses were distorted. Replacing the sync and timebase generator chip, which produces the sandcastle pulses, made no difference. He eventually traced the cause of the trouble to the SAW filter – a fault he'd never encountered before or since.

When Mrs Roughneck called she just told Donnie to carry the set to her car, which she'd parked even farther away than Mr Roughneck. There was again no mention of payment.

Four months later

Four months went by and Donnie had almost forgotten about the Roughnecks and their troublesome set. Then the phone rang and it was Mr Roughneck.

"This telly's now even worse" he ranted, "no colour, no picture, no sound. Just a squeaking noise from the back. Your name's muck on our rig. You don't know *nothin'* about tellys. They said to tell you it's the valve or the transformer. I'd do it myself if I 'ad one of those meter things. But I ain't, and I'm on my way in with 'im."

He duly barged in and dropped the set on the counter. "You must 'av left something unplugged or disconnected" he said as he stormed off, "now look, this time I wants 'im right, or else. I bin very patient with you, but when I gets mad I gets mad."

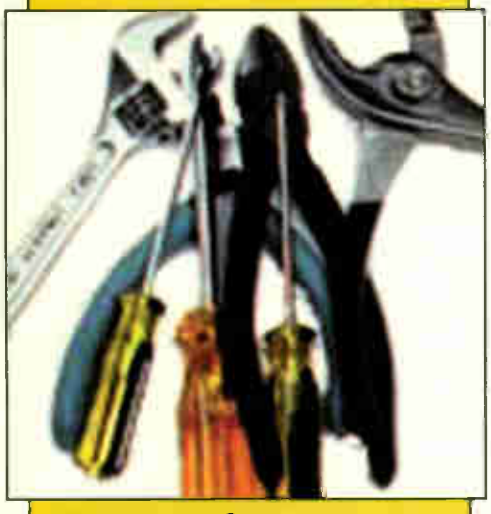
Donnie found that the line output transformer had failed. He phoned Mr Roughneck to tell him, and explained that as this was in no way connected with the colour fault it would be chargeable.

"But the set ain't bin right since you first done 'im" Mr Roughneck bawled, "how can the transformer have failed? You completely overhauled the set yourself only a couple of weeks ago. Nobody's touched 'im since. Explain that!"

Donnie finally exploded. "I'm a TV engineer, not a clairvoyant" he shouted back. "And if you're too thick to understand what I'm talking about, take your set to the flaming whizkids. Or throw it into the sea. Or find another mug, because I've had enough. Just take it away."

A vacuum cleaner query

Finally, a query from Greeneyes. She's delighted with her new Dyson DC03 upright vacuum cleaner. It cleans the carpets very well indeed, but doesn't seem to be very good at picking things up off our tiled floor. Things like dead flies and the tiny berries that track into the house from the garden path. The machine converts to cylinder-type action, but this is a bit of a business. Who knows their Dysons? Should it, as an upright cleaner, pick up things like flies in its stride? Or is it so sweet and gentle as to be above such chores? ■



Service Casebook

Michael Maurice

Sony KVM2151U (BE2A chassis)

This set was dead, and spectacularly so. The cause was the STR54041 chopper chip IC601. It had been replaced before, but the previous engineer had fitted one of dubious quality. This had failed and had a big crack in it. The associated BC637-16 current limiter transistor Q601 had blown its top. The surge limiter resistor R601(3·3Ω,10W), the start-up resistor R611 (120kΩ) the mains input fuse F601 and the plug-top fuse had all failed.

Fortunately I had all these items in the van and was able to rebuild the power supply before the customer's eyes. Use only a genuine Sony chip in the IC601 position.

Kenwood DP730 CD player

The customer said this CD player wouldn't play some discs. So I ordered and fitted a new laser unit. As it still skipped when playing one or two of the customer's discs I thought I would be clever and tweak the four presets for focus and tracking control. This was a big mistake! No matter what I did, I couldn't get the machine to work.

Eventually I had to phone Kenwood Technical, where a very helpful chap said he would fax me the setting-up instructions from the manual. This enabled me to realign the machine, after which it worked perfectly.

Ferguson 51K7 (ICC5 chassis)

The 1·6AT mains fuse FP05 had blown and on investigation I found that the 10nF, 250V mains filter capacitor CP02 had split in half. A new capacitor and fuse restored normal operation – for five minutes, after which the fuse flashed and the set went off. The cause this time was the degaussing posistor RP01. A new fuse and posistor restored operation for a lot longer than five minutes.

Mitsubishi CT29B2STX (Euro 12 chassis)

There were two faults with this set. The main one was field collapse because of a faulty output chip. But the customer said there had been a problem with the picture geometry at the top and bottom of the screen before this occurred.

The field output chip often fails because of trouble in the power supply. Whenever I get a call to one of these sets I always check the power supply, whatever the fault. C906 (47µF, 63V) and C909 (upgraded to 10µF, 63V) should be replaced and, on the secondary side, any capacitors that are leaking.

Another cause of field output chip failure is trouble with the flyback boost capacitor C452 (220µF, 35V). It's situated under a hot resistor and is next to a heatsink: double trouble! You often find that it's leaking.

The original chip is no longer available. Instead you get a kit which consists of a new IC, four resistors, a capacitor and a length of wire. Full instructions are included – their clarity depends on the source of the kit. Field scanning was restored once I had fitted a kitand a new flyback boost capacitor, and had attended to the usual power supply problems.

I was then left with the picture geometry fault. 29 and 33in. sets that use this chassis require north/south correction. The circuitry is on a separate board which is bolted to the chassis near the LOPT. The cause of the trouble was here: Q4009, which regulates the –30V supply, was open-circuit. A BC640 proved to be a suitable replacement.

Hitachi CPT2188

This set came from another dealer who thought that the cause of no power was the on/off switch. He couldn't be bothered to fit a replacement. Instead he cut all the wires and bypassed the switch. The result was a set that came on, produced a picture but no sound. So he brought it to me. It baffled me for a few minutes until I realised that when he bypassed the switch he joined all the wires across, live to live, neutral to neutral and, wait for it, the switch's momentary contacts.

This is where the problem lay. Momentary contacts are supposed to connect momentarily. A replacement switch, connected correctly, cured the fault – and made the set safe again.

JVC HRD755

When play or record was selected the tape would start to load up then unload. A worn loading belt or block I hear you say. Not this time. The drum wouldn't rotate because it was partially seizing. When I dismantled the motor I couldn't find the cause here. It seemed that the upper drum's bearings had dropped slightly and were seizing on the lower drum. So I dismantled the drum and added a very thin shim. When it was reassembled the motor turned freely.

This lovely old VCR was restored to correct operation once I'd reset the tracking and checked through the tape path. Although JVC wouldn't have approved of my repair, it was either that or writing off the machine as a new lower drum is prohibitively expensive.

No sound

I was asked to look at a Mitsubishi VCR with the complaint no sound. But when I played a tape the sound was present. The customer also had a Sky digibox, which was connected to the TV set and the VCR via scart leads. It transpired that

when she played tapes she switched the TV set, which is fitted with the Tatung B chassis, to channel 0. This is where the problem lay.

The TV set produced Nicam stereo sound all right, but not mono sound. As the sound processing ICs are now either not available or very expensive, the customer decided not to proceed with repair. Instead, I showed her how to switch the TV set to scart input (labelled CVBS 1). She was perfectly happy with this solution.

Sanyo CBP2872 (ED1 chassis)

The trouble with this set was no colour. If you went into the set-up mode you could adjust the oscillator so that the colours ran through, but as soon as you came out of the service mode the set would revert to black-and-white.

A call to Chas Hyde's Sanyo Technical Advice line produced the suggestion that the fault might lie in the MCU2600 master clock chip or its associated crystal. But replacements made no difference. Where to go next?

There are three chips in the digital video processing section of the chassis, a video coder unit (VCU), a PAL video processor unit (PVPU) and a digital transient improver (DTI). Any of them could have been the cause of the trouble, and fault finding in this area is not particularly easy.

I then recalled a similar fault I had had with a Salora M chassis, at one of the ex-rental wholesalers. In that receiver the colour couldn't be set up because someone had swapped a PVPU2203 for a PVPU2204. Taking a chance and explaining to the customer what I was going to do, I ordered a new PVPU2204.

Bingo! Once the replacement had been fitted it was possible to set up the circuit, restoring full colour.

Sharp 66AS-05H (4BSC chassis)

The set was dead with just a ticking noise from the power supply. The usual cause of this is failure of the line output transistor because of a dry-joint on the connector PCB for the scan coils. Once these repairs had been carried out the set worked, but a couple of hours later the customer phoned to say that the set had again failed.

This time the set wasn't tripping and the line output transistor was OK. But there was no line drive. The cause was the MC44002 jungle chip IC800. How do you explain that the two faults are not connected?

Hitachi C2846TN

There were two faults with this set, field collapse and no sound. After attending to the usual dry-joints at the regulators IC950, IC951 and IC952 I found that R710 (2Ω) in the supply to the field output chip IC601 was also dry-jointed. Once this had been put right there was a picture but still no sound.

The cause of this was the EEPROM chip, which had become corrupted as a result of the dry-joints at the regulators. A replacement, part no. E730045, restored the sound.

Note that the value of R710 varies with tube size. ■

Repairing VCR mode switches

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

The mode switch, which is also known as the rotary- or slide-encoder or cam switch, is the most unreliable item in a VCR deck. A few decks use optocouplers to indicate to the microcontroller chip the status of the mechanics, but the vast majority employ a mode switch in one form or another. When it fails, the symptoms can be many and various and are often intermittent. They include scrunched tape, a jammed mechanism, failure to achieve one or more functions, shutdown, mistracking, mechanical oscillation, slow rewind and other problems.

Checking and faults

A DC-coupled oscilloscope connected to the mode-switch contact leadouts can give a clear indication of its condition. A defective mode switch is revealed by hash and glitches in the waveform as the deck is cycled through the different functions. The basic cause of the trouble is seldom wear: it arises because of old grease, dirt and oxides on the surfaces of the switch segments and the multi-contact wiper that brushes over them.

Before you reach for the phone, keyboard or pen to shower the editorial department with protests, I know perfectly well that mode switches should be replaced rather than refurbished and would not advocate repair when a replacement is available. It's not an expensive part. There are, on the other hand, times when repair may be necessary. The switch may no longer be available or be hard to obtain; it may be part of a much larger and more expensive assembly; the job might need to be done at minimum cost and delay; or, as with some old Sanyo and other decks, it could be that gaining access to the top of the switch and its solder joints is simply uneconomic in terms of labour time.

How to go about it

It's not difficult, with experience and practice, to overhaul a mode switch. Provided the job is done properly, I've found it to be 100 per cent successful. The first step is to dismantle the switch, separating its rotor (or slide) and contact surface. With the rotary type this involves carefully pulling away the rotor plate, which is 'clicked in' at its centre. Slide switches, for example those used in earlier JVC decks, have plastic click-latches at the sides: these break easily if care is not taken. The wipers and contact base are then revealed. Fig. 1 shows a typical example.

The base will often be found to contain a gooey, yellow grease. Remove this, using a small piece of soft toilet tissue rotated by your fingertip. Do it twice or thrice, changing the paper each time. At this stage you will probably see dirt or oxides on the contacts. Clean it off with a cotton bud soaked in isopropyl alcohol, rubbing hard. In stubborn cases it may be necessary to use a fibre pen to get the contacts really clean and shiny – if you have to do this, ensure that the switch is thoroughly washed through with alcohol afterwards.

Attention can then be turned to the rotor's wiper fingers. They are very fragile, so great care is needed here. Wash off any grease, using a small, fine paintbrush and alcohol. Then clean them with more alcohol and a cotton bud, supporting them from below while wiping from their anchored ends towards the tips. Turn or change the bud often. The wiper tips usually have tiny domes on them: it's here that the surface must be clean.

The next action is to retension the sprung fingers. Fig. 2 shows how this is best done. Use a finger nail, screwdriver or whatever to prevent strain on the plastic rivet heads that anchor the wiper to its disc, while bending the fingers upwards with a penknife blade or something similar. Make sure that you keep the blade parallel and at right-angles to the wiper's fingers. Don't push them too far: an additional 10° or 15° is usually about right to ensure good contact without excessive wear.

I avoid the use of any sort of grease before reassembly, and use a squirt of

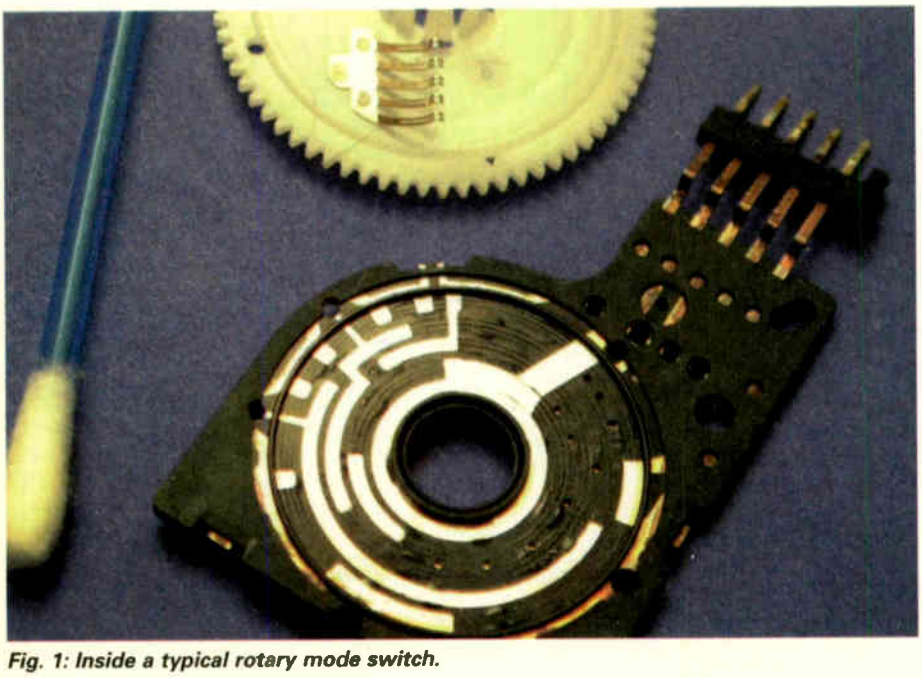


Fig. 1: Inside a typical rotary mode switch.

Philips switch cleaner from an aerosol as a parting shot, so to speak.

The switch can then be clicked together with assurance that it will work reliably. I've not had any comebacks.

Broken flaps

Having got into what some readers might regard as bodgery, I'll follow up with a tip on repairing cassette flaps. Clumsy or abusive users very often break off one of the plastic shafts on which the flap swings. Even more than with mode switches, a replacement may not be easy to obtain. I've repaired flaps successfully on many occasions by melting in a new metal spigot.

Place the damaged flap in a mini-vice, between soft surfaces to prevent further damage. Use a tiny drill (<1mm) or, sometimes better, an 0·75 or 1mm jeweller's flat-bladed screwdriver rotated between your fingers to bore a pilot hole into the end of the top edge of the flap, in the centre of the scar where the shaft has broken. Take a piece of stout copper wire from, for example, a 30A mains cooker cable and push it gently, held by pliers, into the hole while heating it with a soldering iron near the point of entry. Remove the heat as soon as possible, then cut the new shaft to the correct length. With some VCRs it may be necessary to increase the diameter of the new shaft to make it fit well into the eye of the plastic front-cover moulding. Use ordinary plastic sleeving to do this – oil it first if necessary.

It's much better to replace the flap if possible. With a rental VCR, a broken flap can make the difference between having to scrap the machine or putting it back to further profitable hire, so repair may well be worthwhile. Again, I've yet to have this type of job bounce back on me. ■

Fig. 2: Retensioning the wiper blades – take great care over this.

FM stereo radio tends to be taken for granted, so much so that many technicians have little understanding of what it involves. **Keith Cummins** describes the technology, including decoder circuit operation and the radio data system (RDS) that was added in the Eighties

FM stereo radio and RDS

FM stereo radio transmissions have been available in the UK since the Sixties. They have become part of everyday life, so much so that the technology is taken for granted and little understood. This article describes the basic Zenith-GE system, which became a world standard (including the French for once!), and also takes a look at the basics of RDS (Radio Data System), a later development that was added to FM stereo transmissions in the Eighties.

Precursors

Before FM stereo became available there was FM mono, which provided a better audio bandwidth and interference immunity than AM radio broadcasting on the medium and long waves. The FM audio bandwidth was 15kHz, which compares with 4·5kHz for the AM broadcasts. Because the maximum FM deviation was 75kHz, the receiver bandwidth needed to be at least 150kHz, which is why FM was transmitted at VHF where there's enough 'elbow room' for the signal.

One potential problem with FM is the fact that the noise level increases with the square of the bandwidth. A process called pre-emphasis is used to improve the signal-to-noise ratio: it increases the level of the higher audio modulation frequencies to compensate for the higher noise level. The pre-emphasis characteristic is defined as being identical to the admittance-frequency curve of a parallel resistance-capacitance network with (for the UK and Europe) a time-constant of 50µsec. If you do the sums, it works out at a lift of 3dB at 3·18kHz and 6dB per octave thereafter. At the receiving end a series *RC* network with a 50µsec time-constant restores a level frequency response while reducing the upper (15kHz) audio noise by 13dB.

A 20·5MHz band, from 87·5-108MHz, is assigned to FM transmissions by international agreement. This has been adhered to by all except some Eastern European countries prior to the break up of the Soviet Union – they used frequencies around 65MHz.

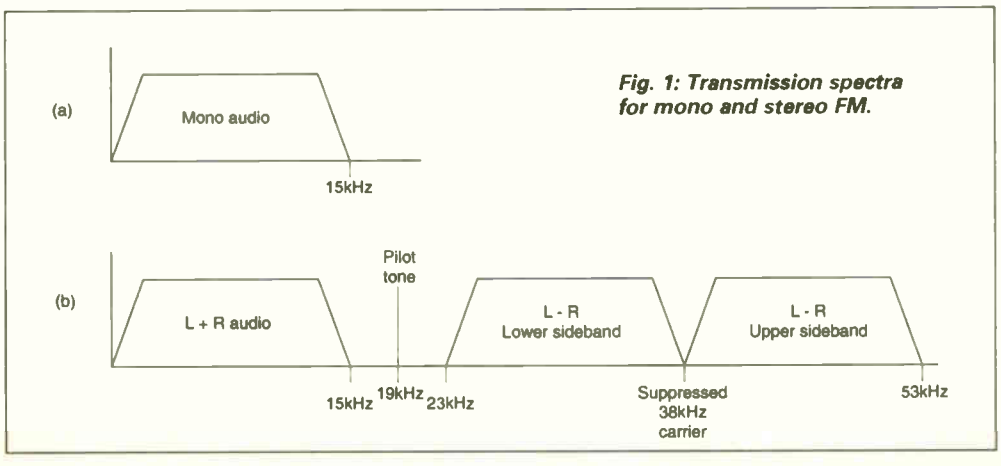


Fig. 1: Transmission spectra for mono and stereo FM.

Advent of stereo

It was only a matter of time before methods were sought to enable stereo signals to be broadcast. There

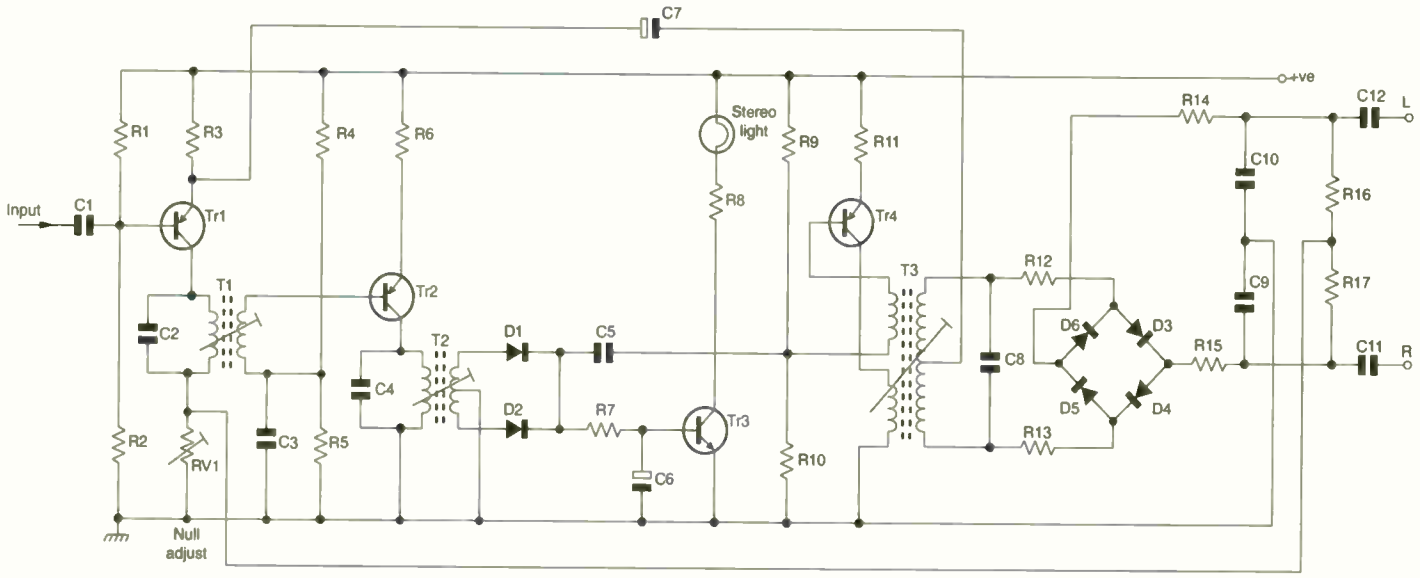


Fig. 2: Typical early stereo decoder circuit, simplified.

was insufficient bandwidth at the time in the AM bands, and no technically viable method of transmitting AM stereo was available or, because of the bandwidth limitations, considered desirable. It was therefore decided that the possibility of transmitting stereo within a single FM channel should be investigated.

A prerequisite was that the transmission method had to be compatible, i.e. a mono receiver could receive a stereo broadcast as if it was a mono signal, with imperceptible reduction in audio quality. The Zenith-GE system was devised in the US to meet this requirement. As its name suggests, it was the result of co-operative development by the two companies. Because the system was so successful, it was adopted worldwide.

There's a price to be paid however: the system introduces a 22dB deterioration in the signal-to-noise ratio, which means that a higher aerial signal level is required to obtain the same signal-to-noise ratio as with a mono signal. Most of you will probably have experienced noisy FM stereo reception, and will know that in this situation the signal-to-noise ratio can be improved significantly by switching the receiver to the mono mode. The reason for this will become clear later.

Basics

Fig. 1 shows at (a) the transmission spectrum for a mono FM signal and at (b) the transmission spectrum for stereo FM. The mono part of the transmission is still present in the stereo version: it consists of the left and right channels added together (L + R) and divided by two. The bandwidth of this part of the transmission is limited to 15kHz. An unmodulated pilot tone is transmitted at 19kHz, at a level of –20dB relative to the signal required to produce the maximum ±75kHz deviation of the main carrier. At 38kHz there's a suppressed amplitude-modulated subcarrier*, whose symmetrical sidebands carry a difference signal which is obtained by subtracting the left and right channels and again dividing by two, i.e. (L – R)/2. The bandwidth is ±15kHz, centred on 38kHz, so the overall difference signal occupies the frequency range 23-53kHz. A mono receiver will not respond to the pilot tone and the difference subcarrier, simply reproducing the sum signal as mono sound. Thus compatibility is maintained.

Once you have the sum and difference of the left and right signals, the original L and R information can be recovered by simple mathematical manipulation. Think for a moment about two figures, say 12 and 2. The question is, which two numbers when added make 12 and when subtracted leave 2? You can do it in your head. The answer is 7 and 5. The stereo decoder has to carry out a similar manipulation.

To put it algebraically, we have (L + R)/2 and (L – R)/2. Adding these gives us (L/2) + (L/2) + (R/2) – (R/2) = L. Then, if we reverse the phase of L – R and make the equation (L + R)/2 minus (L – R)/2 we get (L/2) – (L/2) + (R/2) + (R/2) = R.

So simple processing can be used to recover the original L and R signals. I'll describe the basic circuit that achieves this later, after explaining why the 38kHz subcarrier is suppressed and why there's a pilot tone.

*With FM the deviation is proportional to the amplitude of the modulating signal.

The subcarrier

Consider the situation where L = R, i.e. the sound is coming from midway between the stereo speakers. The signal is effectively a mono one, and L – R = 0. Thus there's no modulation of the L – R subcarrier which, being suppressed and having no modulation sidebands, simply vanishes. This means that in the mono state no subcarrier energy is used and the difference signal is significant only when the difference between the R and L channels is large.

The most dramatic and unlikely situation would be the very odd one where L = –R or R = –L. In this case the mono sum signal L + R vanishes, which means that a non-stereo receiver would be silent! The broadcasters could not allow this, so the difference subcarrier always represents a lower energy level than the sum signal, especially as the subcarrier is suppressed. This helps maintain mono compatibility.

The pilot tone

The pilot tone has two functions. One is as a 'flag', to indicate that the transmission is a stereo one: it's the pilot tone that turns on the

stereo light. Secondly and most importantly, the pilot tone provides the means of recovering the difference subcarrier modulation.

To do this the missing 38kHz subcarrier has to be regenerated in the receiver. So the 19kHz pilot tone is passed through a frequency doubler to produce, or synchronise, the 38kHz carrier needed for demodulation of the difference signal.

The relative phasing of the pilot tone and the subcarrier is important and is defined in terms of L and R, so that if L is positive and R is equally negative the subcarrier crosses the zero line in a positive direction each time the pilot tone passes through zero. The phase tolerance is ±3°.

Noise level

Earlier I mentioned that stereo transmission incurs a degradation of the signal-to-noise ratio compared with a mono transmission, and that the noise level with FM increases with the square of the bandwidth. For mono the bandwidth is 15kHz, while for stereo it widens to 53kHz.

For a first-order approximation we can write

$$20\log_{10}(15/53)^2.$$

So the change in signal-to-noise ratio, in dB, is –21·92dB, the minus sign indicating deterioration. Peter Eckersley, the first Chief Engineer of the BBC, put this well when he commented "the wider you open the window, the more dirt blows in!".

SCA

Before providing a description of the basic FM stereo decoder I should mention SCA, which stands for Subsidiary Communications Authority. This function is part of the Zenith-GE system as used in the US and consists of a further subcarrier at 67kHz, frequency modulated by a maximum of 4kHz with ±3·5kHz deviation and 150μsec pre-emphasis. This narrow-bandwidth audio channel is used for distribution of Musak to hotels and supermarkets and is sometimes called Storecasting. I have not heard of the system being used in the UK. It has been used for radio paging in some areas of the USA.

Stereo decoder operation

Today FM stereo decoders (or FM multiplex decoders as they are alternatively called) generally reside inside a chip. If the stereo radio chip fails you replace it, end of story. It was not always so of course: early decoders used discrete circuitry. Fig. 2 shows a typical, simplified circuit to illustrate how the decoder works.

C1 couples the stereo input signal to Tr1, which is basically an emitter-follower with a 19kHz tuned circuit, C2 and T1, connected in series with its collector. The tuned circuit picks out the pilot tone, which is amplified by Tr2 then passed via T2 to the full-wave rectifier circuit D1, D2. When a pilot tone is present, filtered (R7, C6) DC from D1 and D2 turns Tr3 on and the stereo lamp lights.

The ripple at the cathodes of D1 and D2 is at 38kHz. This signal is used to synchronise an oscillator circuit which consists of Tr4 and T3, providing a switching signal for the diode ring demodulator D3, D4, D5 and D6. The stereo signal's L + R and L – R components are fed via C7 from the emitter of Tr1 to the centre tap of T3's secondary winding and then to the diode ring. A clever thing happens here. The diode ring action simultaneously demodulates the subcarrier and demultiplexes the L + R and L – R signals. So the L and R signals are recovered in one hit. They are de-emphasised by R14/C10 and R15/C9 respectively and fed out via C12 and C11.

In the absence of a stereo signal Tr4 and T3 oscillate unsynchronised and continue to switch the diode ring which produces L + R (mono) at each output.

What about the feedback from R16/R17? Because bandwidth limitations at the transmitter cause attenuation of the subcarrier harmonics, the received L – R signal is reduced by a factor of $2/\pi$. To compensate for this, the L + R signal is reduced accordingly by introducing a partial cancelling signal, which is set by RV1 for optimum channel separation – with this type of circuit about 30dB.

Chip-based decoders use a phase-locked loop to regenerate the suppressed subcarrier, and typically achieve a 50dB channel separation which is consistent and largely independent of any setting up. The output from a 76kHz master oscillator is divided by two to provide 38kHz. A further division by two produces 19kHz, which is frequency and phase compared with the transmitted pilot tone to provide AFC for the master oscillator.

RDS

Many tuners and car radios now include RDS (Radio Data System) facilities. The system provides identification of transmissions, types of programme and time. It also enables a car radio to change frequency automatically to maintain optimum reception of a given programme while driving through different transmission areas. The system is complex: the European Standard EN50067 "Specification

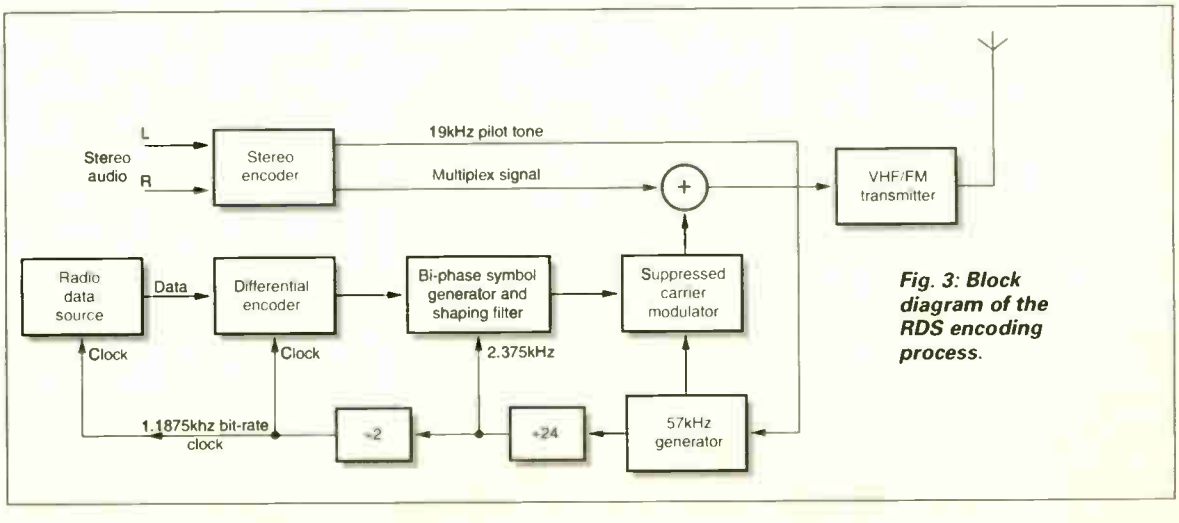


Fig. 3: Block diagram of the RDS encoding process.

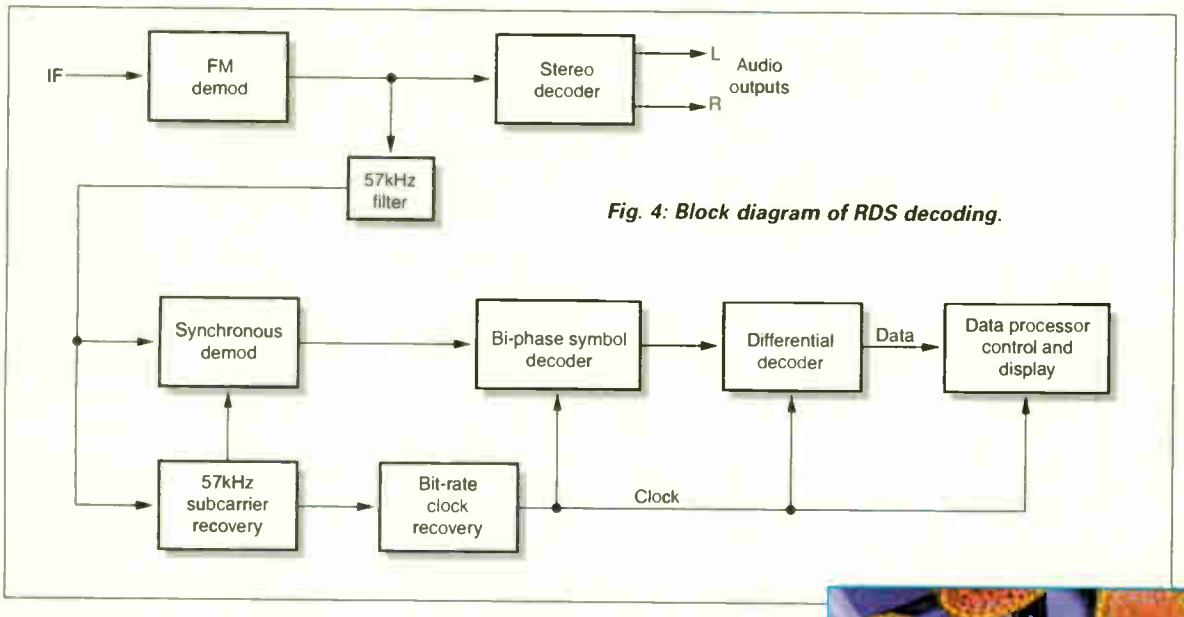


Fig. 4: Block diagram of RDS decoding.

of the Radio Data System (RDS) for VHF/FM sound broadcasting in the frequency range from 87·5 to 108·0MHz" is a weighty document that runs to 132 pages. Furthermore copyright is involved, so my description of RDS must be confined to the method of modulation, data recovery and the basic coding involved.

RDS uses a second subcarrier at 57kHz, locked to the third harmonic of the 19kHz stereo pilot tone. The 57kHz subcarrier is also suppressed. Its sidebands contribute a maximum deviation of the main VHF carrier of ±2kHz. The maximum permitted deviation of the overall multiplex signal remains at ±75kHz. The suppressed subcarrier is amplitude modulated by a shaped and bi-phase coded signal which is derived from the radio data source.

Fig. 3 shows the transmission system in block diagram form. The signal from the data source is differentially encoded, such that when the input data level is zero the encoder's output remains unchanged from the previous output bit and when an input one bit appears the new output bit is the complement of the previous output bit. The receiver decodes the data by applying the reverse process, and the data is correctly decoded whether or not the demodulated signal is inverted.

The power of the data signal around the 57kHz subcarrier is minimised by coding each data bit as a bi-phase signal. This prevents disruption by crosstalk in phase-locked loop stereo decoders.

The 57kHz generator is locked to the 19kHz pilot tone. Its output is divided by 24 to produce 2·375kHz and then by two to produce the 1·1875kHz bit-rate clock. The 2·375kHz signal is used for bi-phase generation.

A typical decoder block diagram is shown in Fig. 4. Note that because this is a digital system the 57kHz signal is embedded in the bit stream, from which it can be recovered, rather than employing the third harmonic of the pilot tone. The rest of the circuit is basically complementary to the transmission chain shown in Fig. 3.

The transmitted coding pattern consists of four data blocks that each contain 26 bits. Each block consists of a 16-bit information word, with the remaining 10 bits constituting a checkword for error correction. The first block in each group of four always contains a programme identification code. The first four bits of each second block comprise a code that specifies the application of the group. The remainder of the data provides specific information, e.g. type of programme, traffic announcement, frequencies, time etc., and alternative frequency details. The level of functionality provided would not be viable without the use of LSI chips dedicated to the system.

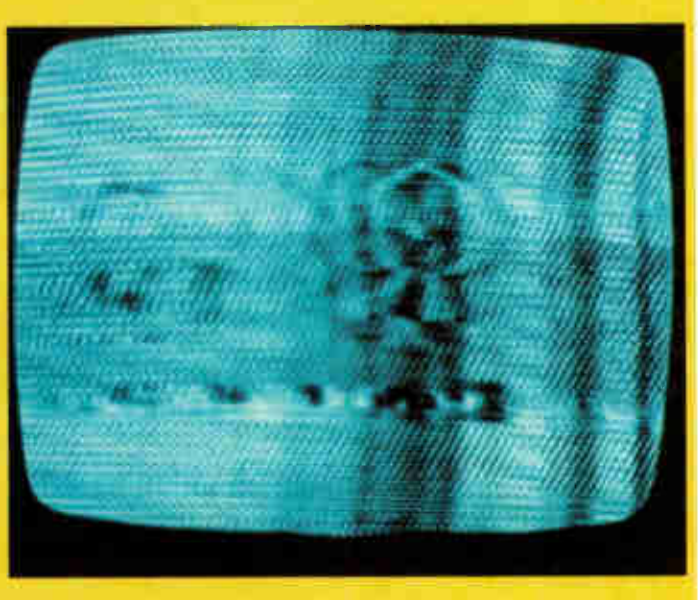
From the servicing point of view it's a matter of checking and replacing chips. In all likelihood the precise nature of a fault may never be known. Such is the complexity we now have to live with, be it car radios or digiboxes!

Acknowledgement

My thanks to David Thorpe, Engineering Field Officer for the Radio Authority, for his assistance in providing information that enabled me to write this article. ■

DX and Satellite Reception

Terrestrial DX and satellite TV reception reports. News on broadcast TV and satellite band changes. Meteor shower dates for 2002. An unusual satellite service. Roger Bunney reports



November turned out to be a remarkable month for DX-TV reception. So often as winter approaches reception falls off. But during November 2001 there was really long-hop F2 reception, some Sporadic E reception, some very active moments during the Leonids meteor shower, a little tropospheric reception and even an aurora!

The higher sunspot count as a result of increased solar activity produced plenty of F2 signal propagation. On the 1st through to the 9th, then the 11th, 14th to the 17th, 19th, 20th and 25th channel E2 or R1 (or both) signals were received during the mornings. Australian TV ch. A0 vision buzz was heard, using a scanner, on the 3rd and the 17th.

There was SpE reception on the 2nd (ch. E2 SVT – Sweden) and the 11th, when unidentified ch. R2 signals put in an appearance. Solar storms produced an aurora on the 6th. During this event Cyril Willis (King's Lynn) received very strong signals in chs. E2, R1 and E3. A short-lived tropospheric lift on the 16th produced reception from RTL (Luxembourg) ch. E7. The Leonids meteor shower peaked on the 17th when, from about 0750 hours UK time, there were many signal pings and longer-duration pictures in Band I up to ch. R3. Band III was also full of short-lived signal pings.

In all an exciting and eventful month.

Cyril Willis has recently invested in an Icom R7000 scanner which enables him to identify specific video carriers by checking the offset frequency. It arrived in time for him to receive American (Nova Scotia and Mississippi) 50Hz amateur stations on the 19th and, of course, various low-band US police signals at 42MHz, for example the Nebraska force with read-outs of stolen vehicle registrations.

Our congratulations to the Benelux DX Club on reaching its 40th anniversary.

Satellite sightings

During the period under review the conflict in Afghanistan dominated the news in all media. On November 24th there were newspaper reports suggesting that US special forces had been in covert action. This confirmed what I had seen during an APTN feed on November 18th, mid afternoon UK time. I had been checking a new Europe*Star (45°E) feeder circuit at 11·565GHz V (SR 5.632, FEC 3/4). The videotape playout, with identification 'APTN KABUL', carried pictures showing the wreckage at Kabul's military airfield. It cut to a partially damaged single-storey building on the airfield. Coalition aircraft could be seen landing behind trees: activity included lorries unloading equipment at the building, and a lattice structure being assembled on the ground. The men were armed. A further cut took us to a new section of tape shot from inside a van, whose windows were covered with red filter 'gels'. A group of Afghans approached the building, and two casually dressed men walked towards them. There was a conversation in which they seemed to be explaining what they had been doing in the building. They were undoubtedly US special forces personnel, who were establishing an operational centre and were dissuading the locals from being too inquisitive!

New feeder circuits were also found at 11·667GHz V (Reuters 'TV 625') and 11·594GHz V, the latter with many reports for English-language networks including the BBC. By the 19th Sky News had established an uplink, 'SKY NEWS JALALABAD UKI 685', at 12·520GHz V. All feeds used the common 5.632+3/4.

Tragedy struck again on the 12th when an American Airlines Airbus A300, flight 587, crashed in the Rockaway area of Queens seconds after take-off from JFK airport. Several live news reports appeared via Reuters capacity on NSS K (21·5°W). When I checked PAS-3R (43°W) I found Fox News relaying live pictures then switching to extensive live coverage from the crash site.

A ch. E2 signal recently received via F2-layer propagation.

Dramatic, unedited pictures from a local resident's camera seconds after the impact were complemented with other live images from news organisations when their crews arrived shortly afterwards. Fox News is at 11·579GHz H (19,875+3/4).

North America has been slowly returning to normal. On the 4th the Canadian Ice Hockey League was seen in action via NSS K Globecast channel 1 – at 11·590GHz V (20,145+3/4). Also on a sporting theme, Roy Carmen (Dorking) watched interviews on a future cricket tour by India and the refusal of certain members of the UK team to travel overseas: this was via Eutelsat 2F3 (21·5°E), at 11·039GHz H (SISLink-12 UKI-588) and 12·524GHz H (BBC UKI-365-P1), in both cases using 5,632+3/4.

Another serious fire in the St Gothard road tunnel under the Alps was covered by French TV and Swiss TV. The French feed was seen via Intelsat 801 (31·5°W) at 11·025GHz V (5,632+3/4), with live pictures showing scenes of burnt-out vehicles and firemen at work clearing the charred remains. Swiss TV was uplinking via Atlantic Bird-2 (8°W) at 12·630GHz H (6,111+3/4) with similar pictures.

Edmund Spicer (Littlehampton) suggests that Belgian exiles might find it worthwhile trying Astra 1 (19·2°E) at 12·610GHz H (27,500+3/4) where RTBF-Sat has been carrying out tests. He also comments that the downlink EIRP of the Globecast and APTN feeds has been reduced – his signals suffer from dropouts. The EIRP of the NSS K Reuters feed at 11·462GHz V has certainly dropped in recent weeks – there's pixellation with a 1·2m dish.

A final note from Nick Brigden who reports reception of real analogue signals, very weak, at 11·721GHz V from about 50°E. This could only be from a Gorizont satellite at 53°E or the little used Turkish Anatolia satellite. I checked but found nothing. Nick might have seen an 'occasional feed', perhaps via spot beam to Turkey with the UK outside the footprint.

Seen during an APTN news feed from Kabul on November 18th, via Europe*Star (45°E). This covert video footage was taken from within a van with filtered windows. Two US special force members, one with face blanked and the taller one to his left, discuss local matters at the military airfield.

Broadcast news

Ireland: The UK telecommunications groups NTL and Crown Castle have backed away from buying into RTE's transmission network – various microwave links plus masts and transmitters. The government in Dublin had hoped that the buyer would upgrade the network to make the start of digital transmissions possible. There are other possible buyers however, including France Telecom.

Norway: The commercial channel TV2 has been given a seven-year licence extension, until the end of 2009. But, after some years of paying only a nominal fee for its commercial monopoly, it will face much higher fees, including a turnover tax based on advertising revenue.

Central Europe: New commercial terrestrial TV licences are to be awarded in Austria in February. The Czech commercial TV channel TV3 could close this winter as a result of wrangling over share holdings.
Italy: The 43·3-43·5875MHz section of the VHF spectrum is to be made available as a 'civil general communications band', with 24 channels spaced at 5kHz. It will be used for purposes such as scouts, sports expeditions, safety operations etc., not for private (individual) communications. This information comes from the UK *Six Metre Group Bulletin*, which also says that the **Spanish** TV Bands I and III were to close by the end of 2001.

Tragedy again when American Airlines flight 587 crashed on November 12th, seconds after take-off from JFK airport. The burning wreckage seen via NSS K (21·5°W).

2002 meteor shower dates

My thanks to Neil Bone, director (Meteor Section) of the British Astronomical Association (BAA), for the following information on the main meteor shows during 2002. The first shower, the Quadrantids, will be over by the time this is published (it was due to peak on January 3rd-4th). The Perseids shower will probably peak late in the evening of August 12-13th: if there's no moon it could produce visible action across the night sky. The Leonids shower is expected to produce enhanced activity, with a probable peak at 1000 hours UTC on November 19th. High shower rates are expected from the Gemininds on December 14th at 0400 hours UTC.

For further information refer to the Meteor Diary section of the *BAA 2002 Handbook*. The British Astronomical Association is at Burlington House, Piccadilly, London W1J 0DU (phone 020 7734 4145).

Shower	*Overall period*	*Expected peak*
Lyrids	April 19-25	April 21-22
Aquarids	April 24-May 20	May 4-5
Cetids	May 7-June 9	May 14-25 (rather flat)
Delta Aquarids	July 15-Aug 20	Jul 28-29, Aug 6-7
Perseids	Jul 25-Aug 20	Aug 12-13
Orionids	Oct 16-30	Oct 20-22
Taurids	Oct 20-Nov 30	Nov 1-7 (broad, flat, low)
Leonids	Nov 15-20	Nov 17-19*
Geminids	Dec 7-16	Dec 12-14 (broad)
Ursids	Dec 17-25	Dec 22-23

* Peaks expected Nov 18-19, several hours apart.

Satellite news

Some of you may have noticed the flickering images, captioned 'Videophone live', transmitted over network TV news from inside Afghanistan. This technique makes use of a videoconferencing package called 'TH2 Talking Heads', distributed by 7E Communications, which is normally used for video transmission at corporate meetings, conferences etc. Reporters at the battle front have been using it in conjunction with the Immarsat 'Global Area Network' (GAN), uplinking from remote sites via an appropriate L-band Immarsat satellite. The technique has provided instant low-definition live pictures from anywhere in Afghanistan by using the very compact Immarsat phone unit and two standard GAN slots, each 64kbits/sec, in parallel. With continuing advances in compression technology, we can expect greatly improved picture transmission quality via the Immarsat system over the next few years.

Eutelsat is now offering its new 'visAvision' service, initially for Germany, that can provide sixteen TV channels bundled as four packages. There are four Turkish-language channels, three Italian RAI channels, two Serbian, one Croatian, one Romanian and two Polish channels. Further channels will be added as required. VisAvision is transmitted from the Atlantic Bird-2/Telecom 2D slot (8°W).

An English-language version of the Arabic al-Jazeera TV channel will open in early 2002. Al-Jazeera is currently available in the UK in Arabic, from Astra at 28·2°E. The US government has under consideration setting up an Arabic-language satellite TV channel that would be financed through the Initiative 911 programme. The aim of the 24-hour a day channel would be to provide a positive US image to the Muslim world.

From Easter 2002 SkyDigital programming will include the three main Irish TV networks and RTE's four radio services. NTL's Morn Hill teleport, currently under construction just off the M3 at Winchester (junction B3404/A31), will uplink the sixteen regional ITV channels to Astra 2D. Travel agent Thomas Cook is to open a 24-hour TV channel via SkyDigital publicising the services available from the tour agents it represents. The Strasbourg Forum of European Cinema is conducting a feasibility study for a Eurocinema TV channel.

Worrying times for satellite operators such as PanAmSat, Telesat (Canada), Thuraya Sat Comms (UAE) and XM Sat Radio that use Boeing 702 series satellites. A solar panel problem may result in a reduced satellite life span. The concentrators that maximise solar radiation on to the solar panels are out of specification. In the long term the consequence will be reduced power output and impaired satellite operation.

To save costs the French pay-TV operator Canal+ is merging many of its operations and subscription activities with its Canalsatellite digital platform. Canalsatellite's managing director has said that there are no current plans to make a takeover bid for the state-owned network France-2 when this is privatised.

RSD Communications, which has been supplying auto-search digital receivers, has ceased UK production. This might cause sat-zapping difficulties. The company's receivers could simply be set to a particular frequency and, if a signal is present, the receiver would lock up with all the parameters held in memory. I don't know of any other currently-available receivers that provide this facility. Various receivers are reviewed in the December/January 2002 issue of *Telesatellite International*, including the Aston Simba 201 which is described as "a DXer's best friend". But it has no auto-scan function that samples the 10·7-12·75GHz spectrum at 1MHz intervals, using the eight common symbol rates within the range 1·8-40Mbits/sec. It's distributed in Germany by Mascom GmbH Germany, D-Augsberg, whose e-mail address is ac@mascom.de.

I'll try to obtain further information on it and report back.

In the same issue of *Tele-satellite International* there's a comprehensive listing of the satellites currently in orbit. I find this excellent bi-monthly magazine invaluable. It's available from major UK newsagents or you can phone 01344 620 799 or visit the web site at www.TELE-satellite.net/secure/int

An unusual satellite service

While reading the November 2001 issue of the industry publication *Via Satellite* I came across a news item that intrigued me. The launch of a Taurus rocket belonging to the Orbital Sciences Corporation had failed on September 21st. Despite corrective manoeuvres to achieve the correct orbit the rocket had crashed into the Indian Ocean, taking with it two satellites (Orbview-4 and QuickTOMS) and "a commercial payload of human remains" that was being launched on behalf of Celestis Inc. What could this mean?

It turns out that Celestis Inc. is a US company, established in 1997, that offers unusual after-death services: it will send your cremated remains into space using one of several commercial packages. For $5,300 (payment plans are available) you and your relatives are offered a capsule printed with a personal message, an invite to and video of the launch, and a "dedicated virtual memorial of the deceased on our web site". In time the Celestis memorial satellite re-enters the atmosphere and "harmlessly vaporises, blazing like a shooting star in final tribute".

For $12,500 you are offered the Lunar Service, with which "a symbolic portion of the cremated remains" go into lunar orbit or land on the Moon's surface; or the Voyager Service, which "launches the cremated remains into deep space". The latest offer is the Ad Astra Service, at only $299. A star is named in honour of the deceased and a high-energy memorial is transmitted to the stars. The message includes tributes, details of the deceased and photos. A confirmation certificate is provided, together with a map that shows the location of the newly-named star.

An unusual enterprise. If you should want to know more you can visit the company's web site at www.celestis.com/services. ■

Ground Zero on the Family Memorial Concert day, October 28th. The debris still burns. Seen via NSS K (21.5°W).

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: A line output transformer for the Matsui Model 21V1N (Grundig CUC7350 chassis) and a TC4052 IC. A.G. Chamberlain, 62 St Luke's Road, Bournemouth BH3 7LU. Phone 01202 521 990.

Wanted/for disposal: Require an MN15522VMS IC for the Panasonic Model NVJ35 VCR. Have for disposal a working Tektronix type 545B oscilloscope, complete with manual, circuit diagrams etc. Buyer collects (Upper Colwyn Bay, North Wales). Phone David Else on 01492 531 584.

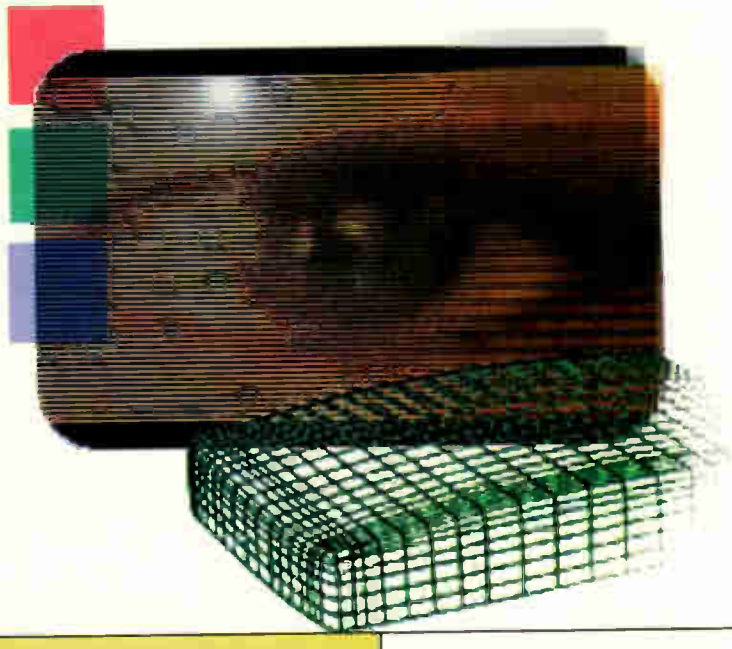
Wanted: Remote control handset for the Amstrad TS80/TS88/TS86/TS87 audio unit. Will pay good price for a tidy, working unit. Phone Ron Bloy on 01324 552 241 (24 hours).

Wanted: Working control module board, 1021 prefix, for a Philips System 4 TV set. David Forfar, 26 Noel Gate, Aughton, Nr Ormskirk, Lancs L39 5EG. Phone 01695 420 950 or e-mail daforfar@uclan.ac.uk

Wanted: Circuit diagram or service manual for the Grundig Model TVR3715GB TV/video combi unit (believed to be GCK1600GB chassis). Set is of recent manufacture and was sold by Comet. P. Chilton, 63 Hospital Lane, Coseley, Bilston, W. Midlands WV14 9LF. Phone 01902 664 736.

Wanted: Service manual for the Topward Model 7045 40MHz oscilloscope. Does anyone know a source of spares? Fault is no EHT. Phone Don Jannece on 01277 822 380 (Brentwood, Essex) or e-mail don.jay@btinternet.com

Because of office closure during the Christmas/New Year period we have had to close this column early. Readers are welcome to send in requests for help.



TV FAULT FINDING

Reports from
Michael Dranfield
John Hepworth
Michael Maurice
Geoff Butcher
Dave Gough
Philip Salkeld
Chris Avis
Ian Bowden
Bob Flynn
Stephen Dixon and
Robin Beaumont

We welcome fault reports from readers – payment for each fault is made after publiation. See page 234 for details of where and how to send reports.

Tatung E series chassis

This set had a most unusual fault: there was only half a picture, in the top part of the screen. I replaced the TDA8350Q field and EW output chip IC401 but this made no difference. Both 1·2Ω safety resistors in the supplies to IC401, R422 and R437, tested OK. To cut a very long story short, I discovered that disconnecting R421 (22Ω, 2W) in the EW modulator circuit restored a full picture, but with excessive width and bent verticals. The cause of the problem was shorted turns in the EW loading coil L409. As a result line pulses were being fed back to the TDA8350Q chip – the new one had also been destroyed. **M.D.**

Hitachi C2556TN

If one of these sets goes off intermittently, the cause will probably be dry-joints at the three-terminal regulator IC951. If the set trips three-five seconds after switch on, replace R950 (68kΩ) in the power supply. Use a 350V metal-film type. A set will trip out even when this resistor rises in value by 1kΩ, so beware! **M.D.**

Daewoo GB14F7T1

This TV-video unit came in with a tape stuck inside and wouldn't switch on. The standby switch-mode power supply was running and about 8V was present at diode D831. But there was no voltage at the 6V regulator IC1806. I found a plug/socket (P803) marked 8V in, 8V out. There was 8V at the input but no output. The unit came on when these two pins were linked together. I then discovered that the pins go to the on/off button at the front of the unit.

A major strip-down was necessary to get at the switch, which was dry-jointed at the PCB. There's no access to it from underneath. **M.D.**

Tatung F series chassis

This set came on with no green in the display. Then, after about ten seconds, it went into the protection mode – dead with the standby LED flashing. Checks on the tube base PCB showed that R913 was open-circuit, R922 had risen in value to 220kΩ and R903 was out-of-tolerance. Replace these 180kΩ, 0·75W resistors with the 350V metal-film type (available from Farnell). I wouldn't have expected to find resistors that had gone high-value in such a new set. So this could become a stock fault. **M.D.**

Ferguson B68N (ICC8 chassis)

This set was dead, though the power supplies would come up for about five seconds before dying back. Not much time to look for the cause of the trouble! I eventually discovered that the BSR51 line driver transistor TL17 was faulty. I used a BC879 as the replacement because it is easier to obtain. It's a Darlington transistor with integral collector-to-emitter diode. **M.D.**

Bush 2768NTXSIL

If the set won't come out of standby, or the line output transistor is blown, always replace the 2SC1573 line driver transistor. I fit a different type, as the 2SC1573 seems to be prone to failure. **M.D.**

Sharp C3720

The cause of changes in brightness level accompanied by variations in height was traced to a dry-joint at the regulator transistor Q604, which is near the mains on/off switch. **M.D.**

Mitsubishi Euro 10 chassis

This fault would apply to other chassis that use the same audio circuitry, such as the **Euro 4 and 6**. There was a picture but no sound. A check at the audio output chip showed that its supply was missing, because the SOC2000 protector Z952 in the power supply was open-circuit. There didn't seem to be any shorts, so I fitted a new protector and switched on. As the protector didn't blow I connected the scart lead from the Sky digibox I have on my bench. Perfect sound blasted out, and did so for two hours until I took the set back.

I plugged it in, connected the aerial and switched on. No sound! Red-faced. I took the set back to the shop and connected it to the scart lead and the aerial. AV sound

was OK, but there was not a peep at RF. Time for scope checks. There was no audio output from the IF chip IC101 (pin 9), so I took one from a scrap board and fitted it. This made no difference. I then swapped over the detector coil L301, which restored the sound. The moral is to check both AV and RF operation before returning a set. **J.H.**

ITT Compact B2 chassis

This set was dead. It tripped just as the HT voltage appeared. When the feed to the line output stage was disconnected the HT supply was OK. So I checked for shorts and anything obviously amiss in the line output stage, but couldn't find any faults. As I had a LOPT on the shelf I fitted it. No difference!

Perhaps there was something wrong in the power supply. I decided to check the electrolytics. C700, C701 (both 10µF), C704 and C711 (both 47µF) were all low in value. Four capacitors later all was well. **J.H.**

JVC AV21SX1EK

This set intermittently displayed partial field collapse, with the top quarter of the screen going blank. Tapping the top of the set would restore the picture for a few moments. The cause of the problem was a dry-joint at C961. This 2,200µF, 25V electrolytic capacitor smooths the output from the 8V regulator chip IC951. The 8V supply is used, amongst other things, to power the TDA8366 IF/colour decoder/timebase generator chip IC101. **M.M.**

Bush 2850NTX (TV4 chassis)

A vertical white line (line collapse) is not uncommon with these sets, the cause being a dry-joint at the scan coil connector on the PCB. This time however the 330nF, 400V scan-correction capacitor C419 was burnt and open-circuit. A replacement restored the scanning.

I've also seen these sets badged **Schneider**. **M.M.**

Toshiba 2873DB

There was lack of width and EW correction. The cause of the fault was the TA8859CP chip Q302. Note that there are various versions of this chip, denoted by the suffix. The correct part should be ordered from Toshiba. **M.M.**

Mitsubishi CT25A3STX (Euro 12 chassis)

There was no text, no Nicam and the picture was very wide. The cause was a corrupted EEPROM chip, IC702. So I replaced it, set up the parameters and for good measure replaced C906 (47µF, 50V) and C909 (2·2µF, 50V) in the power supply, on the primary side.

A few weeks later the customer called to say that the fault was back again. This time I checked the electrolytics on the secondary side of the power supply. As most were leaking I replaced the lot. After resetting the parameters all was well. **M.M.**

JVC AV25F1EK

There was a text fault with this set. The pages kept jumping to ones that hadn't been selected, or different pages would be displayed, usually several times a minute. Close inspection showed that there was a solder bridge between pins 1 and 2 of the SAA5243 text processing chip IC02. Correct operation was restored once this bridge had been removed. **M.M.**

Sanyo CBP2876A (ED0 chassis)

This set was dead with the 2SD1556 line output transistor Q650 short-circuit. The cause of its demise turned out to be C605 (2·2µF), which was leaky. It couples the line drive signal to the base of the TIP111 Darlington line driver transistor Q600. **M.M.**

Philips 25ST1750/05B (GR2.1AA chassis)

There was excessive width and adjustment of the width control had no effect. In addition the set would go off after a couple of hours, with the standby light flashing. If the set was switched off and allowed to cool down, it would come back on again. The latter fault was caused by some burnt joints, but the width problem was caused by a component failure. R3585 (15Ω) near the line output transformer was open-circuit. **G.B.**

Toshiba 222T5B

This elderly TV set still produced an excellent picture, but the sound channel's bass response was very poor, with a nasty grating noise. The treble response was OK. When I examined the loudspeaker I was amazed to discover that the foam surround had completely disintegrated, leaving a gap all the way round the front of the cone! I couldn't get an exact replacement speaker, so modified the baffle to suit an alternative size. **G.B.**

Goodmans 285NS (Daewoo CP775 chassis)

This set was dead with the power supply ticking away very faintly. Cold checks showed that the 2SD1880 line output transistor Q401 was short-circuit. So was D406 (BYW95C), which is in series with the HT feed to the line output stage. The cause of the trouble turned out to be the LOPT, T402. I used an HR7927 as the replacement. Once these items had been replaced there was full operation. **D.G.**

Philips 21GR2350 (G90AE chassis)

This set would work all right for ten minutes or so then shut down with the power supply pulsing loudly (motorboating). Some hefty tapping around the LOPT area showed that Q7502 was dry-jointed. It's one of the transistors in the field output stage. A good resolder cured the fault. **D.G.**

Bush 2867NTX

The customer complained that there was severe picture bowing after a minute or so. A close visual check revealed a very nasty dry-joint at L652. There was no further trouble once this had been attended to. **D.G.**

Sanyo CE28WN4B

These relatively new sets are starting to come in with extended height and EW geometry problems. It's a known fault condition. For this model fit modification kit B10H04N1C. If it's a Dolby Pro Logic model however, use kit B10H04D0L. **P.S.**

JVC AV25VM1EK

The set was dead with the standby light on. It didn't take long to discover that the line drive was missing. I then checked the supply at pin 35 of the TDA8366 jungle chip IC101. There was 0V here instead of 8V. This supply comes from the 8V regulator IC951, which had 11V at its input but nothing at its output. There was a good picture once a replacement, part no. KIA7808PI, had been fitted. **P.S.**

Bush 2867NTX

The cause of field collapse and no sound turned out to be R818 (22kΩ, 2W), which was open-circuit. It's in the LT supply to the jungle chip. **P.S.**

Sanyo CE28WN4B

This set would cut off with the LED flashing – it was in the protection mode. To disable this, disconnect R648 to prevent the set going to standby. I did this, switched the set on and waited for the fault to show up. After a couple of hours the CRT's heaters went out. When I traced back to the line output transformer I found a dry-jointed resistor. Once this had been attended to all that was required to complete the repair was to refit R648. **P.S.**

Sharp 51AT-15H (5BSA chassis)

A well-known fault with this chassis is the BC636 transistor in the field output

stage overheating and going short-circuit. Once you replace it and get the scanning back, more often than not there are green and red lines at the top of the picture. To cure this replace D504 (1N4148) which is just behind the transistor **P.S.**

Daewoo GB2898ST (CP775 chassis)

The customer complained about buzz on sound at low volume levels. Daewoo Technical provided the answer: resolder the field output IC's heatsink, using plenty of solder. The **Goodmans Model 285NS** is fitted with the same chassis and develops the same fault. **P.S.**

Sony KV25K5U (FE1 chassis)

There was no remote-control operation with this set, though the remote-control handset was transmitting normally. The output from the remote-control receiver was at about 100mV, which seemed to be rather low. A substitute from another chassis made no difference. The cause of the trouble was eventually traced to the 5·6V zener diode D011, which is connected across the receiver's output: it was leaky. Once a replacement had been fitted the output rose dramatically, to about 4V, and remote communication was restored. **C.A.**

Goodmans GD2580 (Ferguson TX92 chassis)

This set was reported to be dead, but ran for several hours on the bench before it failed. The cause was simply a dry-joint at CP13 (1·5nF, 1·6kV), the capacitor in the snubber network connected to the drain of the chopper FET TP16.

There was another problem. The CRT's heaters would go out because of a dry-joint at pin 9 of the CRT base socket. In fact all the connections were suspect. **I.B.**

Hitachi C2564 (G10Q chassis)

This set sometimes failed to start from cold. Once it did start it never failed to restart. The cause of the trouble was found to be C927 (470µF, 25V), which is the reservoir capacitor in the supply to the 12V regulator IC921. It had fallen in value. **I.B.**

Panasonic TX21MD1 (Euro 2 chassis)

The complaint was "no tuning". This was correct: no signals were found when the tuning swept across the band. I also noticed that the snow on the screen looked very dark, and that the snow livened up when the tuner's IF output pin was touched. This suggested that the IF/detector section was OK.

I removed the tuner, opened it up and attached it to the rear of the PCB to provide access while running the set. It then worked normally, but with a little squirt of freezer it failed again. The cause of the fault was found to be loss of the supply to one of the surface-mounted ICs. The two large (relative to all the other ones in the tuner) 82Ω surface-mounted resistors, which are in parallel, were both lifting off the solder at one end. The fault was cleared by resoldering them. **I.B.**

Toshiba 259D9B

The report said "just lines on screen". But the set ran for hours before it failed. There was then loss of both line and field sync, which proved to be very, very sensitive to movement of the chassis and, in particular, a cable bundle that passes around the teletext PCB. The cause of the problem turned out to be an invisible dry-joint at pin 1 of ICF01 on the teletext PCB. The soldering at several other pins of this IC was suspect, so to be sure every pin was resoldered. **I.B.**

Philips Anubis BAA chassis

The only life that came from this set was a pulsating squeak. A check on the more obvious suspects produced no joy, but perseverence paid off. I found that C2540 (2,200µF, 16V) was leaky. A high-temperature replacement was fitted, restoring the power. **B.F.**

JVC AV28SD4EK

The power came up briefly then died. As so often with this type of fault, a new line output transformer was required. **B.F.**

NEI 2131TX

Intermittent loss of power was caused by a poor connection at L802, which is near the chopper transformer. Unless you use a magnifying glass the joint will look all right. **B.F.**

Aiwa VXT1000 Mk 2

This TV/video combi unit was totally dead. On investigation I found that there was an internal short-circuit within the STK7348 power chip, between pins 3 and 7. In addition R103 (1·5Ω, 3W), R104 (27Ω, 3W) and R105 (1kΩ, 0·5W) had failed, and C90 (1µF, 50V) read faulty. After fitting replace-ments I gave the unit a long soak test. This proved that all was now well. **B.F.**

Bush 2871NTX (11AK19 chassis)

The power supply was tripping because the BU2508AF line output transistor was short-circuit. Several poor joints, especially at the scan coil socket, were suspected of being the cause of the failure. These were resoldered and a new transistor was fitted. It failed at switch on. When I carried out a closer inspection I found that the scan-coil plug had been overheating internally. This had caused the poor connections on the main board and the demise of the transistor.

I removed the plug and socket and made the connections directly to the board, then fitted a new transistor. This restored normal operation. **B.F.**

Toshiba 258T7B

The faults with this set were a loud screeching noise, which was worse when it was first switched on, and corrugated verticals. The first fault was caused by the fact that the 12V supply to the audio IC was going very high. The cure was to replace C866 and C869 (both 10µF, 50V). Fortunately the IC had survived without damage. The cause of the corrugated verticals was also capacitor trouble, this time C820 (470µF, 15V). **B.F.**

Hitachi G7P chassis

The power supply was pulsing. I had a resistor modification kit from Charles Hyde in stock, so this was fitted. It's best to replace the electrolytics and the TDA4601 chopper control chip as well. **S.D.**

Sony KVM2131U (BE1 chassis)

For field faults, replace the uPC1488H field output IC and also C504 and C507, which are both 470µF. **S.D.**

Panasonic TX28PK2 (Euro 4 chassis)

After a few minutes this set would start to trip, with the main power relay cycling on and off. The overvoltage trip senses the 150V HT voltage via a 75V zener diode that's connected to a potential divider network across this supply. The lower resistor (R872) in this network had not been pushed through the PCB and had not been soldered. As a result, the zener diode was sensing the full HT voltage. Remaking the faulty connection cured the problem. **R.B.**

Sony KV28FX65U (AE5 chassis)

This new stock set would work for about thirty seconds, then the picture would break up into a fine mosaic and disappear. The on-screen displays, sound and teletext continued to work normally. I found that disturbing board B1 (100Hz processing) made the fault come and go. Closer inspection of the large surface-mounted ICs revealed poor soldering at IC2311 – one of the earth pins was just touching the print. Reflowing fresh solder to the affected parts cured the fault. **R.B.**

Panasonic TXW28R4 (Euro 4 chassis)

This widescreen set would trip to standby at random after a few minutes. On investigation I decided that the vertical protection circuit was the cause. Capacitor C464 is shown as 22nF in the circuit diagram but 220nF in the parts list. A 22nF capacitor had been fitted, but in fact 220nF is the correct value – confirmed by Panasonic Technical. The fault cleared once the correct value had been fitted. **R.B.**

DVD

Reports from Geoff Darby

We welcome fault reports from readers – payment for each fault is made after publication. See page 234 for details of where and how to send reports.

Sony DVP-S335

The customer's complaint was that this DVD player wouldn't read discs. It was OK when I first tried it, but when it had been on for about an hour it wouldn't spin the discs I inserted. A new laser unit cured the problem – proved by a long soak test.

You have to fit a complete deck assembly which, in common with most Sony DVD players, is type KHM220AAA RP. It's easy to fit. Start by removing the whole deck/drawer assembly – there are four screws and the connectors. Next remove the disc clamp (two screws) and the drawer, by simply pulling it all the way out. There are no timing issues here. Remove the three deck retainer screws, release the ribbon connectors and lift the deck out.

The three rubber grommets can be used with the new deck. Fit the deck and connect its ribbons. Remove the laser shorting solder blob at the top rear of the optical block. Refit the drawer and disc clamp, and reinstall the whole assembly back in the main unit.

Finish off by running the test/auto-alignment programme as described in the service manual. **G.D.**

Panasonic DVD-L50EC

There were two problems with this beautiful little personal DVD player, which has a colour LCD screen. First, the internal speakers didn't switch off when the headphones were plugged in. The cause was the headphone socket itself, as expected, but not in the way I'd assumed. The socket doesn't switch the audio directly in the normal way. Instead, a single switch element, which works when the headphone plug is inserted, connects a microcontroller line to chassis. An electronic mute system then operates, using transistors in the audio path. The pin on the headphone socket was broken. A new socket, glued to the PCB before soldering to add some mechanical strength, cured the problem.

Secondly, when the player had been running for a long time the picture blocked and broke up. I didn't see this in the workshop. But when I initiated the jitter test mode (use 'play' and 'pause' on the unit and '5' on the remote-control handset) a figure of 098 was obtained. This is 9·8 per cent, and is out-of-specification – the figure should be no higher than 095.

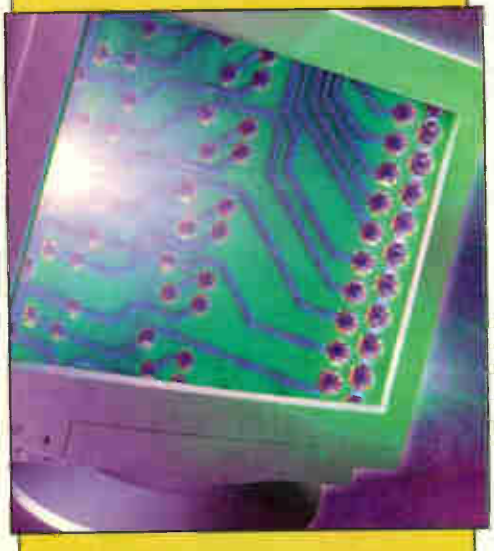
Although the laser's mechanical alignment can be adjusted to minimise the jitter figure, my experience with Panasonic players is that if the figure is wrong with the manufacturer's original settings the laser is probably faulty. This can usually be checked, with any model, by leaving the unit to run while displaying the jitter value. Note that the sequence of buttons to be pressed to get into the jitter mode varies from model to model. If the jitter value remains basically stable, increasing by only a few decimals with time and progress through the disc, adjustment should be tried and will almost certainly enable the figure to be reduced so that it's within specification. Adjustment involves careful rotation of hex socket screws to correct the disc turntable tilt with respect to the laser. Consult the service manual for details of how to carry out these adjustments.

If the jitter value steadily climbs however it's fair to conclude that the laser is faulty. In this case the figure rose above 12 per cent ("jit 120" indicated) with time. A replacement showed 083, indicating that it was within specification and didn't require adjustment. This value is typical of a correctly-operating Panasonic laser. During a long soak test the figure did not climb above 091, showing that all was now well. **G.D.**

Sanyo DVD1500

There was no analogue sound output from this player, either from the phono sockets or the scart connector. Checks at pins 9 and 10 of the DAC chip IC673 showed that good-level, normal-looking audio was present. It arrived correctly at pins 3 and 5 of the following dual op-amp output buffer IC674, but didn't emerge at pins 1 and 7. DC checks then showed there was no supply at pin 8 of this IC.

The cause was circuit protector PR483, at the input to the 12V regulator in the power supply. It's one of those little yellow ones that look like a resistor and often go open-circuit for no apparent reason. A replacement restored the sound. As the 12V supply is the main rail, it's curious that everything apart from the sound seemed to work all right. **G.D** ■



MONITORS

Fault reports from
Geoff Butcher
Stephen Dixon
Duncan Robinson, LCGI
Ian Field and
Alun Rawson-Williams

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

Dell D1526THS

I was told that this monitor had gone off whilst in use, leaving the front-panel green and yellow LEDs illuminated. On investigation I found that the 2SC5129 line output transistor's collector insulation had broken down and that the transistor was shorting to the heatsink. I've had trouble before with poor insulation with this type of transistor, so to be on the safe side I fitted a BU2527AF. There were also some dodgy-looking joints in the transistor's base drive circuit. They might have contributed to the failure by adding spikes to the drive waveform. **G.B.**

Philips CM11342

A new line output transformer had been fitted but two weeks later this monitor came back with the complaint "not working". The power supply worked all right with a 60W bulb as the load, but when the feed to the line output stage was reconnected the power supply outputs all fell to about half the correct voltage. A great deal of time was spent carrying out checks in the power supply and line output stage, moving backwards and forwards from one to the other. Eventually I found that the cause of the trouble was a high-resistance soldered joint at R3432 in the power supply. **S.D.**

DAN CPS1560LR

This 15in. monitor is of CTX manufacture, with a DAN badge. The problem was no display. I removed the 2SC3886A line output transistor Q40 and tested it with one of those transistor analysers: it was short-circuit. While fitting a replacement I noticed a dry-joint and obviously broken track at the cathode of D417, where it's connected to the main PCB in the line output stage. Once these repairs had been carried out the monitor worked normally. **D.R.**

Elonex SV14LR

When this monitor was switched on it rustled up then shut down instantly. The power supply continued to work however, with the correct output voltages. But there was no line drive. I eventually discovered that to provide protection Q409 shunts the supply to the MC1391 line oscillator chip, via R444 (30Ω). To disable the shutdown so that I could make some measurements I decided to lift one end of R444.

But there wasn't time to measure anything! The monitor made a loud fizzing noise and smoke began to billow from the line output enclosure. The cause of this dramatic effect was C424 (33µF, 160V), the reservoir capacitor for the B+ supply. It had leaked and corroded most of the way through one leg. Once this capacitor had been replaced and R444 had been reconnected the monitor ran happily enough. **I.F.**

Elonex XV17

I know of two types of XV17: the AST-based version, which is similar to the Digital VRC16, and the other type which I've come to the conclusion is made by Liteon. Four of the latter type arrived in the workshop together.

One had an intermittent 'sync-on-green' switch. The second had been to another repair firm. Whoever had handled it had been unable to find the cause of the fault. So the connectors on the front panel's micro subpanel had all been swapped around to make sure that no one else could! This worked very well: it destroyed the microprocessor!

The remaining two were fresh from a disposals warehouse. Both rustled up with the screen remaining blank. When the brightness and contrast controls were turned to maximum, a dull, milky bar of light appeared at the top of the screen. The only thing I could find that was out of specification was the CRT's grid voltage. This was at –66V instead of about –45V. But reducing the voltage to obtain beam current produced only a blank screen. Then I noticed that someone else likes swapping over plugs.

P593 on the video module had green and orange wires going to it. They should be red and black, from chassis and 17V to the nearby three-terminal regulator. The green/orange wires (sometimes blue/orange) belong to P597 at the other end. They come from points marked 'clamp' and 'mute' on the main PCB.

On the front micro subpanel, P705 is the electronic screwdriver port and P702 the occupied five-pin connector. There are two nine-pin connectors, P701 and P704. On some versions the two plugs are different and cannot be swapped. Others have identical connectors and can! P704 is identifiable by having two screened cables among the ordinary wires: P701 has only ordinary wires. If P702 has been inserted in P705, the microprocessor will be confused. If P701 and P704 have been swapped the subpanel will be damaged. **I.F.**

Fujitsu TE772B

When this 17in. monitor was powered, the amber LED would produce a short glimpse of light then the monitor would sit lifeless. I found that the IRF630 B+ supply chopper MOSFET Q951 was short-circuit with the

PCB around it discoloured. As the B+ regulator is of the boost type, removing the faulty MOSFET leaves the inductor in series with the LOPT, providing an unboosted supply. I found that the line output stage seemed to work in this condition, and therefore fitted a replacement IRF630 MOSFET.

The display that then appeared was too wide, and was shifted at either side. There was obvious lack of side pincushion correction. While poking around with a plastic trimming tool I found that the lack of correction was most pronounced when C963 (22µF, 250V) was moved. One of its leads consisted more of corrosion residue than metal!

After replacing this capacitor the monitor produced a very narrow display, with still no geometry control. It soon became apparent that Q951 wasn't doing anything. Tracing back from its base, through mounds of white glue, I found that the gate feed resistor was burnt beyond recognition. I decided to fit a 22Ω replacement and carry on. The drive comes from Q952 (2SC945P) and Q953 (2SA733P). Q953 had collector-base leakage. So both transistors were replaced.

The monitor now produced a full-width picture, and geometry control was restored. But some of the resolution modes didn't work properly. The cause was eventually traced to oxide scale within the solder joint at one of the two low-value resistors in the B+ chopper's current-sensing circuit – any modes that drew above a certain current activated the over-current trip. **I.F.**

Delta Electronics DPS75SB SMPS

This is a PC chopper power supply box. The customer is a local trader, so he brought along just the power supply, not the whole PC. But he told me that it was a H-P computer. Delta is a well-known pattern PSU supplier whose products also appear in original equipment.

I found that Q951 (2SK537) and Q952 (MPS2222A) in the auxiliary chopper/standby supply were both short-circuit. The PCB and most of the components around Q951 had been severely discoloured by heat, indicating that the unit had been running very hot for a long time – particularly as this group of components is directly in the blast of air from the built-in fan! A combination of well-cooked white glue and heat discoloration made it impossible to read the component designations from the PCB lettering, but it was still possible to identify all the affected components – one way or another!

A 2·2µF electrolytic capacitor next to a pair of optocouplers is almost certainly part of the error amplifier's sampling circuit. In view of the effect of heat, it must be replaced with a non-electrolytic type, which can be secured in place with adhesive. D952 looked the worse for wear and had also been running too hot, so I upgraded it to a UF4007. D957's leads been almost eaten through by decomposition products from the white glue and had to be replaced – it's a 15V, 400mW zener diode. The resistors in this area are very tiny, but only a few had been overheating. As they were discoloured I decided to replace them anyway, fitting larger ones because these would conduct heat from the PCB and dissipate it in the airflow from the fan. The main ones were: R953 20Ω, R954 390Ω and R952 27kΩ.

The heat fin for Q951 is of pressed steel rather than a more efficient material such as copper or aluminium. In addition the original MOSFET in this position is rated at only 1A. As a TO3P encapsulated device has almost equivalent radiating surface to the original TO220 device plus heat fin, and a device with a higher drain current rating would have a lower resistance when on and thus lower loss, I decided to fit a 2SK956 (800V/9A/150W) instead of the original 2SK537 (900V/1A/60W). The heat-fin solder lugs bridge part of the circuit, so a wire link must be fitted if the fin is discarded – in view of the state of the soldering at the lugs, a wire link should be fitted anyway.

My bench test of the rebuilt power supply lasted for several hours – without the cooling fan, to see how hot the TO3P MOSFET would run without a heat fin. It was no hotter than most of the other semiconductor devices in the unit.

As a final note, if the rebuilt power supply doesn't work first time check the fusible resistor R957 (51Ω, 1W). **I.F.**

AST 5LA

This 15in. monitor is made by Samsung. If the monitor is dead (no power LED light at the front) and the power supply is in the trip mode, with the HT rectifier D517 running hot and you get a low-resistance reading both ways across D507 (at the centre back of the chassis), the 2SC5148 line output transistor Q503 is likely to be short-circuit (all ways). **A.R-W.**

Nech CM1566

This was a really difficult fault to deal with. When the monitor had been on for about three minutes, two horizontal white lines would appear superimposed across the display, the first 1cm from the bottom, the other at the centre of the screen. They increased in intensity the longer the monitor was left on. The cause turned out to be C323 (0·22µF), though heating and freezing it had no effect on the symptom. This capacitor is a chocolate-brown item, mounted inside the field output chip's metal heatsink envelope. **A.R-W.**

Compaq PC power supplies

The power supplies in Compaq PCs are generally non-standard, and the cost of replacements is prohibitive. I was able to repair the following three at reasonable cost.

Series PS2022 power supply: One of the two 62kΩ, 2W resistors near the two mains bridge rectifier reservoir capacitors was open-circuit. As a result there was no start-up supply for the UC3844 chopper control chip.

Series PS2021 power supply: The start-up resistors can be responsible for a dead power supply with this type as well. In this version they are 62kΩ, 1W.

The other dead power supply had a short-circuit FEP16CT rectifier (CR2) on the secondary side of the transformer. To gain access to the fixing screws you have to unsolder the heatsink assembly and lift it out. While it's out, check all the other rectifiers and the n-channel MOSFET. The TO3P-style rectifier is a Schottky-barrier type. The cause of its breakdown is likely to have been C18 (100µF, 25V), which is the reservoir capacitor for the UC3844 chip's supply. When replacing C18, add an 0·1µF multilayer ceramic capacitor in parallel. **A.R-W.**

IBM 59G9978

If the monitor is dead because the power supply won't start up, check whether the two 270kΩ, 0·5W start-up resistors R603 and R618 are high-resistance or open-circuit. **A.R-W.**

Nech S566

This monitor was dead with the front LED pulsing (power supply tripping). A check on the BU2520AF line output transistor Q801 revealed that it was short-circuit all ways.

If the HT at the input to the line output transformer is 45V with no signal present, check for a short-circuit LOPT primary winding and for dry-joints at Q803. This transistor is mounted next to the line output transistor, on the same heatsink. Apart from this the soldering in the S566 is generally very good. **A.R-W.** ■

VCR CLINIC

Reports from
Eugene Trundle
J.S. Ogilvie
Dave Gough
John Hepworth
David I Scott
Ian Bowden
and Michael Dranfield

We welcome fault reports from readers – payment for each fault is made after publication. See page 234 for details of where and how to send reports.

Matsui VP9601N

Under the skin this inexpensive machine is the same as some contemporary **Tatung** VCRs. There were various intermittent faults: failure to lace up; ejecting a cassette soon after its insertion; no picture, but the sound OK; shutdown at some stage while loading or threading. All these symptoms were cleared by replacing the half dozen or so electrolytic capacitors on the secondary side of the power supply. **E.T.**

Daewoo V215

The erase oscillator had failed: recordings made on any but a blank tape had the sound from the previous recording. I found that the oscillator transistor Q201 was short-circuit and R200 burnt. These two components were replaced, along with C204 in case it was responsible for the problem. After that everything was OK. **E.T.**

JVC HRD540, 560 etc

A fault you sometimes get with these and other models that use the same deck gives the impression of drum failure or misalignment of the guide poles. It's usually cured by replacing the 3·3µF, 50V capacitor associated with the drum motor. Also check the brass bushes on the guide poles. **J.S.O.**

GoldStar RC7031

This Nicam stereo VCR produced a dark picture. The cause was traced to C707 (4·7µF, 50V) on the main PCB. It's near connector P7003 in the tuner section. **J.S.O.**

Panasonic NVFS series

I've had a few of these S-VHS VCRs that have come in from other shops with reported drum failure. Before ordering and replacing a drum, check for dry-joints on the drum motor PCB. **J.S.O.**

Sony SLV625UB

The complaint was dead with no display. Checks in the power supply showed that the cause of the trouble was C202 (3,300µF). In fact it had leaked electrolyte on to the board.

When carrying out a repair of this sort I always, as a matter of good practice, check the ESR of all the electrolytic capacitors in the power supply and replace any that are even remotely suspect. **D.G.**

Daewoo DVK985PI

The machine was dead. Internal inspection suggested that the cause of the problem was within the chopper power supply can. This was removed and the usual culprit, C23 (1,000µF), was found to be faulty. But the machine was still dead when C23 had been replaced and the can had been refitted. Back to the PCB. Checks on all the small capacitors near the chopper can revealed that C823, C816, C825 and C826 were all faulty. Replacement of these capacitors restored full operation. **D.G.**

Matsui VX1100

The customer said that this VCR would chew tapes, with a length of tape not rewound into the cassette. Mechanical checks with our transparent test cassette soon showed the cause. Some of the felt on the brake band had been lost, and as a result the supply reel didn't work correctly. A new brake band restored normal operation. **D.G.**

Hitachi VTM212E

The customer said that this VCR made a terrible clicking noise in any mode. She was right – it sounded awful! I removed the base, inserted a test cassette and selected play. The cause of the trouble was soon evident: the nylon drive cog at the base of the capstan motor was split. Even though this item is replaceable (it pulls off) I was unable to obtain one. But Wiltsgrove supplied a complete capstan motor assembly for only £9.95. Who needs a cog at that price?! **D.G.**

Sharp VC787H

There was no sound or picture in the E-E mode, but the sound appeared when the test pattern was switched on. When a tape was played the picture from it appeared on the screen but the sound wasn't from the tape – it was the E-E sound. A scope check at pin 3 of IC2201 showed that video was present, but there was no supply at pin 9 because zener diode D2201 was short-circuit. A replacement restored normal operation. **J.H.**

Panasonic NVHD605

Failure to accept a cassette was accompanied by an 'F03' indication in the display. The motor-drive coupling had split, causing loss of drive to the cassette-loading mechanism. I've had this problem before with these machines. No wonder the spares stockists supply the couplings in packs of ten! **D.I.S.**

Sony SLVE70UY

Tapes were being tangled during ejection. I noticed that the half-loading arm wasn't being retracted during unlacing, and felt

certain that it and the pivot shaft merely needed degreasing and re-oiling. On this occasion however something else was wrong: the return spring had broken. A replacement spring plus cleaning, oiling and adjustment of the half-loading mechanism restored correct operation. **D.I.S.**

Sony SLV715

This machine was dead with no activity on the secondary side of the chopper power supply. A pity, since the power-supply module is no friend of mine: its soldered-on metal cover and cramped component layout don't lend themselves to good-tempered repairs! Sony's Kit 777 was confidently fitted however, replacing all thirteen capacitors on the secondary side of the power supply. then the module and machine were reassembled. The mechanism and display now worked, but the signal sections didn't and there was no remote-control operation.

Checks on the rebuilt power module revealed that there was no 12V output. So the whole lot had to come apart again! The cause of the trouble was eventually traced to resistive leakage on the component side of the power module PCB. It was at its worst beneath capacitors C208 and C209, whose leads were badly corroded. The cause of this corrosion was undoubtedly leaked electrolyte from the larger electrolytic capacitors. Fortunately thorough cleaning of the PCB with isopropanol. replacement of C208 and C209 and a repeat replacement of Kit 777 finally restored correct operation. **D.I.S.**

Mitsubishi HS750V

The report said that this machine was dead. In fact when it was connected to the mains supply the front panel display would flash then go blank, after which the machine failed to respond in any way. The cause of the trouble was found to be C9A3 (1,000µF, 10V), which is in the power supply area. It had fallen in value. **I.B.**

Thorn VR414LVA

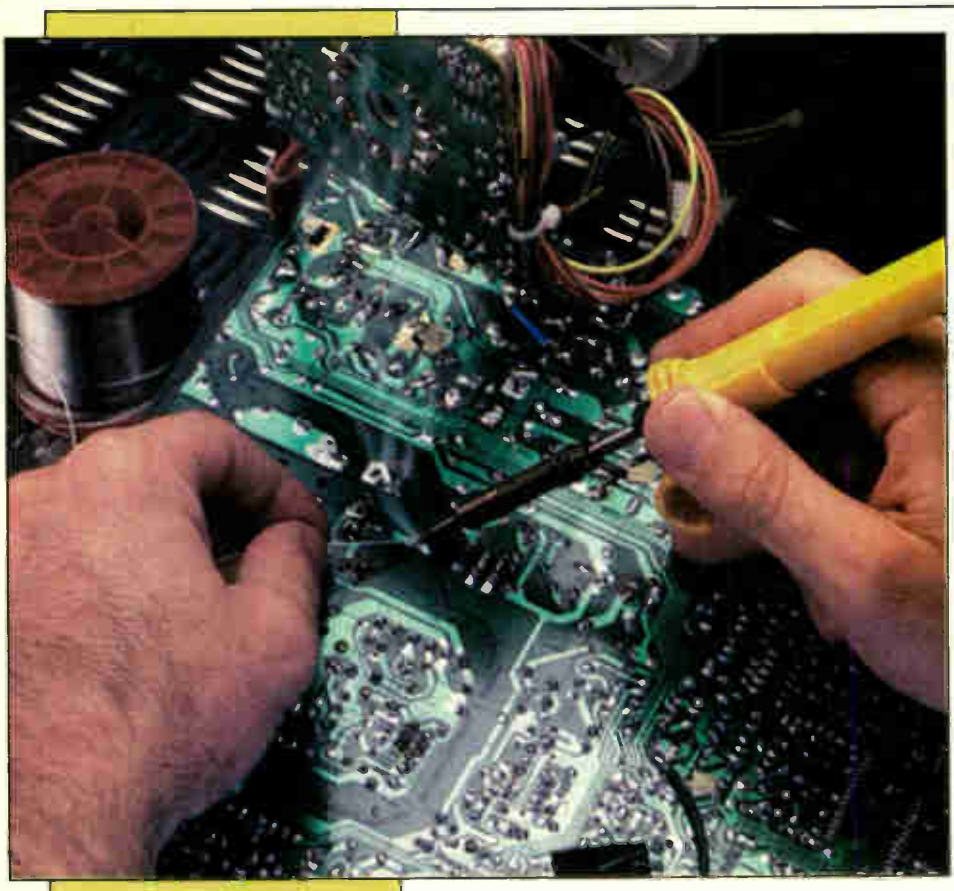
This VCR worked fine mechanically, and playback was OK. But when a tape was inserted all tuning was lost. Checks showed that the 32·5V supply, at the collector of Q406 (2SA1266), was low at only 18V. The voltage fell even farther when the mechanism was being driven. The cause of the trouble was Q406 itself – it was almost short-circuit base-to-emitter. A correctly-regulated supply was present once a new 2SA1266 transistor had been fitted. **I.B.**

Sony SLVE700UX

The report said poor/noisy E-E sound. In fact there was an intermittent crackle on the left Nicam channel output – if right channel only or mono sound was selected there was no problem. The cause of the trouble turned out to be the surface-mounted audio switching chip IC102 (BA7632F). It's on the small PCB which has the line-in two scart socket on it. This PCB is at the top left of the machine. There was no noise on the input signal at pin 7 of the IC, but grass-type spikes of noise were present on the output at pin 1. **I.B.**

Goodmans VN6000

This machine was dead. Checks showed that the Ever 5V supply was low, because C822 (330µF, 10V) had dried out. Use a low-ESR capacitor as the replacement. **M.D.** ■



JACK'S WORKSHOP

Jack Armstrong

The SkyLink system

Many people like to watch TV in the bedroom. With this market in view, several devices have been produced to facilitate the connection of video and audio signals from the living room to a bedroom TV set, and also to enable remote-control signals for the bedroom TV to be used to control equipment in the living room.

The Sky digibox has a clever design feature that consists of a second RF output socket which can also supply 9V DC and recognise special serial-data commands from an external unit. BSkyB calls this the SkyLink. The SkyLink system uses an infra-red sensor, which looks rather like a miniature computer mouse, to detect signals from a remote-control handset used in the bedroom (or elsewhere). A cable links this sensor to a unit that's connected in-line between the bedroom TV set and the digibox in the living room. The system converts any remote-control signals into a serial-data stream that's fed back to the digibox via the coaxial signal-feed cable. See Fig. 1. The digibox recognises this serial-data stream, when present, and reacts accordingly – by changing the programme or whatever.

Versions

At least three versions of the SkyLink are available. The first to be marketed was the TV Link from Global Communications. It was followed some time later by the Digilink MRX930 from Labgear. The latter is slightly more expensive but has proved to be more reliable in service. More recently Philex has introduced the SLX Link. This is a low-cost system but, because it's so new, I can't comment on its reliability. Photos 1-3 show these systems.

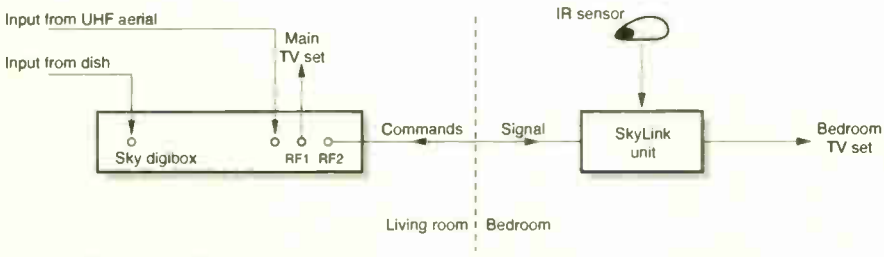


Fig. 1: The basic SkyLink arrangement.

Problems

The reasons for the problems I've had with the TV Link are not known to me. One thing I do know is that it is not a good idea to plug the in-line unit into the TV set's aerial socket directly, as doing so can cause mechanical strain on both the unit and the aerial socket. Make the connection via a flexible lead.

A local Sky installer tells me he's found that coiling the coaxial signal cable several times close to the TV Link unit can cure one that apparently doesn't work. Here's another solution that has been passed on to me. A Sky installer called on a customer to fit a replacement TV set. The TV Link system worked fine with the old set, but refused to work when the replacement Philips 16CT2216/25S set was connected, despite the fact that the red LED still lit, indicating that the 9V supply from the digibox was present. Thinking that the TV set might be applying a DC load, the installer cut the coaxial cable and added a coupling capacitor. This cured the problem. I can't explain either of these 'cures', since the Link unit has a built-in coupling capacitor.

Most or all digiboxes can sense an overload and will switch off the 9V supply when there's a fault. This is usually obvious, as the SkyLink unit's LED will go out. Simply viewing the digibox's service menu will turn the voltage back on once the fault has been cleared. The remote-control sequence to reach this hidden menu is Services, 4, 0, 1 Select, 4. See Photo 4.

Precautions

The connection between the digibox's RF2 output and the SkyLink unit should consist of continuous (no joints) double-screened satellite cable, such as RG6 or better. If single-screened TV coaxial cable is used, operation could be intermittent – because external interference could get into the cable. For the same reason the cable should be kept away from other wiring, especially mains wiring.

If a booster or splitter is required, it must be one that's compatible with the system. Remember that it has to pass on the 9V supply from the digibox and pass the serial data back to the digibox. The amplifiers in the DA range from Global Communications are ideal, as each amplified splitter is designed for the job. There are 2-, 4- and 7-way versions, with a gain of approximately 7dB at UHF. These and Link systems can be ordered

Photo 1: The Global Communications TV Link.

Photo 2: The Labgear MRX930 Digilink.

Photo 3: The Philex SLX Link.

from SatCure (http://www.satcure.com) and most other satellite distributors.

Operation

The SkyLink system is also useful for operating a Sky digibox that's shut away in a cupboard. Plug the Link unit into the RF2 output socket and place the infra-red sensor 'eye' outside the cupboard.

SkyLink works only with a Sky digibox, nothing else. It must have a continuous cable connection to the digibox. Should an incompatible UHF amplifier be present, Global Communications can supply a handy little 'bypass' device that passes the 9V supply around the amplifier and passes the data stream back.

Alternative systems

If even this doesn't work, or you need to be able to control other equipment in addition to the Sky digibox, the Powermid system is more suitable. It consists of a transmitter and receiver, both of which are in the shape of a pyramid. The transmitter senses remote-control commands, sending them to the receiver without need for cables. The receiver reproduces the infra-red command signals to operate any equipment that's within sight. Some cable TV boxes will not work with his system however.

If you can't install a cable to the bedroom your best bet is to use a Videosender such as the Technisat Telestar. This plugs into the digibox's scart socket and transmits the picture and stereo sound to an accompanying unit next to the second TV set. You can order this from Satalogue (01332 812 588 or http://www.satalogue.com).

Auto-On

Another clever device for use with the SkyLink system is the Auto-On from Kesh Electrics. It can be set to select a specific programme whenever the mains supply to the digibox comes back on after

Photo 4: The Sky RF outlets menu.

say a temporary power fault. This system is ideal for use in a hotel that might, for example, use six or more digiboxes in a rack. Imagine trying to shield five digibox front panels while you select the programme number for the sixth one, then repeating this procedure with the other five! The Auto-On solves this problem and ensures that each digibox shows the required programme without need for manual resetting after each power failure. Global Communications can supply a rack-mounted system that performs a similar function.

You can obtain the Auto-On direct from Kesh Electrics. Phone 01365 631 449 or go to www.pacelink.co.uk. Note that this device has nothing to do with STB manufacturer Pace Micro Technology. Auto-On will work with any Sky digibox. The Global system can be ordered through satellite stockists. ■

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

Information and spare parts for analogue satellite receivers can be found at http://www.netcentral.co.uk/satcure

Information and parts for ICE (in-car entertainment) equipment can be found at http://www.satcure-focus.com

SATELLITE NOTEBOOK

Reports from Christopher Holland and Pete Haylor

Music Choice menus

Music Choice broadcasts ten uninterrupted audio music programmes on ch. 480 as an 'Active' service that's available with any Sky subscription. If an extra charge is paid, 34 more programmes are available on ch. 481. Prior to spring 2001 each programme had its own channel number, from 851 upwards. The EPG radio station numbers were then changed, and some customers found this much easier to use. The following is a simple way to navigate through the Music Choice Active menu.

Select ch. 480 (audio on 480 is hit list in mono) and press the remote control unit's red button to bring up the main interactive menu – see Photo 1. The programme required can then be selected by highlighting it in red, in a similar way to using the EPG, then pressing the round 'select' button on the remote control unit to go to this programme. Once a programme has been selected (see Photo 2), you can get back to the main menu by pressing the remote control unit's green button. When listening to a programme you can scroll through what's playing on the other programmes by pressing the remote control unit's green then the up and down buttons. Press the select button to go to a programme directly. Photo 3 shows what is being played in the classical programme while listening to the blues programme.

What isn't widely known is that the programmes all have individual numbers within the active menu and that you can go to a programme directly by entering its number. These are as follows:

001	*Hit list*
005	*Christmas (late November to early January only)*
010	*Classical favourites*
020	*Dance*
030	*Gold*
031	*Love songs*
050	*Alternative rock*
060	*Easy listening*
070	*Jazz*
071	*Blues*
090	*Country*

Photo 4 shows the number for jazz being selected while the blues programme is being displayed. Note that the number of a new programme cannot be keyed in unless the current programme has been selected for more than a few seconds, so rapid programme changing isn't possible.

If you have a favourite music programme it can be placed in the extra channels menu by going to the 'add channels' menu, entering transponder 25's frequency (12·188GHz H) and then selecting the programme or programmes required in the normal way. Note that information on the track being played will not be available when listening in this way, and that if any updates are made to the technical characteristics of the signal the extra channel will have to be deleted and re-memorised. **C.H.**

Digital channel update

The latest channel additions at 28·2°E are listed in Table 1 – where allocated, the EPG number is shown in brackets after the channel name. ITV 2 requires a minimum Sky subscription and is not available with the free-to-air viewing card.

The ITV 1 regional transponder allocations have remained as shown last month. The ITV region that corresponds with the viewing card's post code comes up on ch. 103. If the local area is within

Photo 1: Music Choice main menu.

Photo 2: Music Choice blues.

an analogue ITV regional overlap area, the relevant regions come up on chs. 963 and 964. At present all ITV regions can be viewed by adding them as extra channels. They can also be watched using Irish viewing cards, though this might not last for long because of copyright restrictions. An ITV 'William Road' test card (see photographs in the January issue) labelled 3-6 is still present via transponder 54 (10·906GHz V), which intermittently switches to London ITV 1 programmes without the sound.

The BBC is running tests via transponder 1 (11·719GHz H) labelled TES 2 through to TES 6, with BBC Choice and BBC Knowledge at present being shown. Two radio station tests have appeared at the BBC's transponder 5 (11·798GHz H), labelled R5 LSE (relaying Radio 5) and NYR, which identifies itself as a test for a new BBC Radio service.

MBI (ch. 698) has ceased transmissions. **C.H.**

Table 1: Latest digital channel changes.

Channel and EPG	*Sat*	*TP*	*Frequency (GHz)/pol*
Abu Dhabi TV	EB	D11S	11·662/H
BBC Radio Cymru (904)	2A	1	11·719/H
ITV 2 (226)	2D	54	10·906/V
Relax with a book radio (905)	2B	33	12·344/H
Sirasa TV	EB	D4S	11·527/V
The Dental Channel (952)	EB	D4S	11·527/V
The Villain (903)*	2B	32	12·324/V
Text Me TV	2B	33	12·344/H
Thomas Cook TV	EB	D4S	11·527/V
TV Warehouse (652)	2B	33	12·344//H

*The Villain radio station appears on EPG 903 only with viewing cards in the Birmingham post code area. It can be added as an extra channel for those outside the Birmingham area.
TP = transponder, 2A = Astra 2A, 2B = Astra 2B, 2D = Astra 2D, EB = Eurobird.

New dishes

I first came across The Raven Company's new range of dishes at the last CAI Trade Fair. It includes the Gemini which has the dish face in the horizontal plane, similar to current Sky dishes. There are three versions, 70cm mesh, 70cm solid and 90cm solid. It should, with the wide-arc multi-LNB arm, solve the problem where a customer requires reception from 13°E and 28·2°E but cannot have more than one dish. I've tried several other dishes without luck: when the dish is also used for 28·2°E, the signal with some 13°E channels is not adequate.

One of my customers had just moved into a new housing complex in Coventry and was told that only one dish was allowed. It seemed an ideal opportunity to try out the Gemini. I used the 70cm mesh version as it looked like the Sky ones on other houses, and fitted the extra arm. A spectrum analyser was used for adjustment. The results from 13°E were good, and the signal fed to the Sky receiver was the same as with the small Sky dish.

I've since installed a 70cm solid version at the workshop, with LNBs for 13°E, 19·2°E and 28·2°E and space for another arm if required. **P.H.**

Prime TV

Prime TV has been causing me some problems: it's way up the band, and a poor installation will not provide a good picture. Mr Ali was one customer who complained. When I tried his system all the channels except the one he wanted could be received.

My first step was to go up on to the low roof and adjust the dish for maximum signal. But the results were still poor. A spectrum analyser check indoors, at the receiver, showed that there were small signals at the lower end of the band, with the signals at the top end almost disappearing. I then checked the 'satellite cable'. It was ordinary TV coax! Replacing this cured the 'problem'.

In another case a light press on one side of the dish cured the fault – the dish was out of alignment. **P.H.**

LNB problems

The installation had a dish with a twin-output LNB for two digiboxes. At times one or the other would loose several channels. I had to carry out a number of checks with the spectrum analyser at the LNB before I saw the fault. Then, one LNB output produced a very peculiar trace which suddenly cured itself. A new LNB cleared the trouble.

A callout to an installation with two LNBs had me going round in circles. A normal trace was seen when the spectrum analyser was connected to one of them, and a picture was displayed, but only intermittent pictures were produced by the receiver. As this was an old Pace receiver it seemed to be the likely cause of the trouble. I unpacked and connected a new digital receiver, but when I tried to download from 13°E only three stations appeared. A further spectrum analyser test produced perfect signals with good pictures over the whole band. So another receiver was tried, with the same results. After several more tests the spectrum analyser's display was missing and the real cause of the fault was revealed: the LNB was intermittent. A replacement LNB restored normal operation.

Another customer had bought a new TV set and had connected it up himself. But there was no satellite reception. Checks showed that the cables were all connected correctly but no signal was being received from the dish. A check with the banana meter at the dish at the front of the house produced perfect results, with over 75 per cent signal and quality. The cable was thrown over the roof and was the obvious suspect. To prove the point I cut the cable at the point of entry to the house. No signal here, same signal as before at the dish. A new cable was fitted, run through the house and connected to the receiver. But there was still no reception. A further test at the dish showed that there was now no signal here – the LNB was intermittent. A replacement provided reliable reception. **P.H.** ■

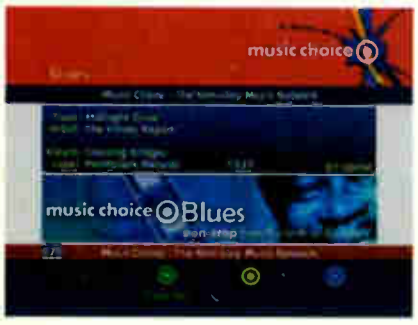


Photo 3: Music Choice scroll.

Photo 4: Music Choice number.

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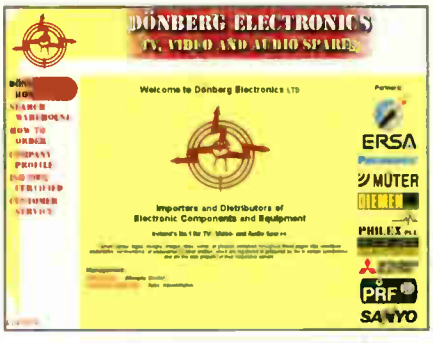

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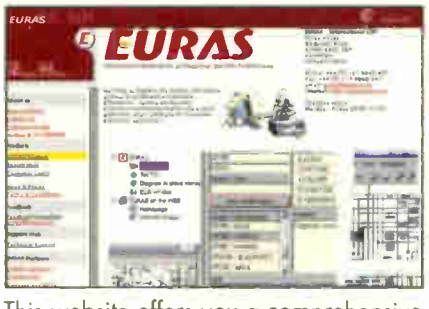

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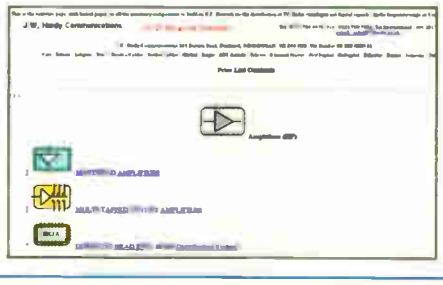

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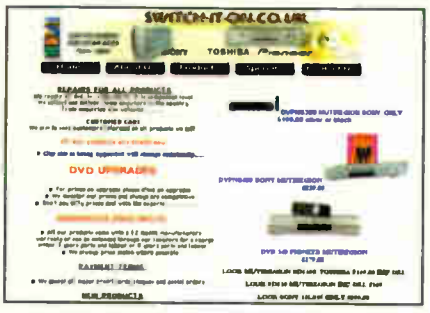

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Input capacitance	40pF+oscilloscope capacitance
Working voltage	600V DC or pk-pk AC
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Bandwidth	DC to 150MHz
Rise time	2.4ns
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Input capacitance	12pF 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

AUDIO FAULTS

Reports from Geoff Darby D. Buckingham Robin Beaumont and Trevor Parker

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

Sony MZ-R70 Personal MD

"Screw missing and not recording properly" it said on the job ticket. The screw was missing from the door, which left it loose on the hinge/disc-holder assembly. This sort of thing can cause poor recording or playback, as the whole disc-holder assembly relies on being fixed firmly to the outer door – if not, the disc can lie at an angle. In this case however the poor recording was caused by the fact that the overwrite head was bent out of line. As Nick Beer commented a couple of months back, it's hard to understand how so many get to be damaged, as the head is lifted out of the way completely in all conditions other than record.

From the spares point of view, the overwrite head is part of the laser assembly. This makes replacement a very expensive out-of-guarantee repair. If the bend is not too bad you can sometimes straighten it, then realign the head over the lens by eye and trial. This machine responded to such treatment, with normal recording restored. If you are careful, it's also possible to fit an overwrite head from a scrap laser.

Typical symptoms with a bent overwrite head are normal playback of a disc with an earlier recording on it but stuttery or no playback of a more recent recording. Also, if you remove the disc and put it back in you may well get a "disc error" message – because, at the end of the recording session, the misaligned head corrupted the TOC. A disc that has been 'destroyed' in this way can often be recovered by putting it in another machine that's happy to give you menu options even though it cannot read the disc. You can then zero the disc by selecting 'erase all', which will write a new 'blank disc' TOC. **G.D.**

Pioneer XR-P60C

The customer complained that this amplifier had blown a pair of speakers. She had gone next door for a while and came back to find that the volume was on full. When I checked the amplifier on the bench I found that, sure enough, the volume couldn't be turned up or down. In fact the longer the amplifier was left on, the higher the volume became.

The electronic volume control system is within the LC7535 chip IC406, but a replacement made no difference. I then decided to carry out some supply line checks. The lines involved are –14V and +14V, which are provided by regulator transistors Q502 and Q501. There was 30V at the collector of Q501 but only 0·5V at its base and emitter. After scraping away black hot-melt in the area I discovered that R501 was discoloured – it looked like 33kΩ but is actually 2·2kΩ. When checked it proved to be open-circuit. A replacement restored the supply at the emitter of Q501 and normal volume control operation.

I must say that Pioneer was very helpful in supplying information. **D.B.**

Sony TCEX660

This cassette deck is part of a four-piece audio system. A dim or completely black fluorescent display is a common problem. The display's heater is fed with 50Hz AC via two 100µF electrolytic capacitors, C161 and C162, which can overheat and fail. If you are lucky, replacement capacitors will restore the display – use the best, low-impedance components you can find. In severe cases however the display's heater will have been overrun, making replacement of the display necessary.

Sony recommends use of a new capacitor type, part no. 1-131-938-21, when carrying out this repair. **R.B.**

Pioneer CDJ-500S

The lid of this professional-DJ style CD player didn't always open when eject was pressed – i.e. the problem was intermittent. I eventually discovered that because one of the two metal arm/roller assemblies which hold the lid shut was slightly bent, the eject/lock slider assembly sometimes didn't slide to the correct position. While it held the lid shut, it didn't operate one of the tiny switches on the slider. Realignment fixed the problem. **T.P.**

Grundig M10P

There was no CD or tape operation with this all-in-one hi-fi unit, though everything lit up normally. After checking all five fuses I eventually found an open-circuit N20-type circuit protector. A replacement restored life to the cassette and CD sections, but it was obvious that the CD mechanism was jammed, with the loading motor straining away.

I had to remove the CD mechanism, but this presented a problem because I couldn't open the tray to get the fascia off. I found that by removing the screw which secures the turntable I could remove this item then push the complete mechanism forwards, giving access to the two screws and plastic tabs that secure the fascia. When the tray was completely out, I could see a leaf switch that wasn't being operated properly. After a slight bend with the pliers and reassembly everything was fine. **T.P.** ■

LETTERS

Send letters to "Television", Cumulus Business Media, Anne Boleyn House, 9-13 Ewell Road, Cheam, Surrey SM3 8BZ or e-mail tessa2@btinternet.com using subject heading 'Television Letters'.

Please send plain text messages. Do NOT send attachments. Be sure to type your full name, address, postcode, telephone and e-mail address (if any).
Your address and telephone number will not be published but your e-mail address will unless you state otherwise.
Please send ONLY text intended for the letters page. Correspondence relating to subscriptions and other matters must be sent to the office address given above.

Cheap digital TV

If you want cheap digital TV and don't want to subscribe (see letters November, page 32), do what I did. I was lucky to find a Minidish and LNB in excellent condition at a car boot sale for £5. After installation, I started to look around for a receiver. The local shops tried to put me off by saying that you cannot get them, Sky won't allow it etc. Eventually I tried www.gxl.com and managed to obtain a Grundig digibox and remote-control unit (no dish) at auction for £51. When I connected it to the previously installed dish the free channels came through with no trouble.

I phoned the BBC website number that's concerned with digital TV and said I had installed a second-hand digibox. I was simply asked for the box's serial number etc. A couple of days later I received the card and phoned again to authorise it. After another day I was getting all the free and all the BBC channels, Ch. 4, Ch. 5 etc. I upgraded the software by holding down the backup button.

I now have a fully functioning digibox for £56. The TV set works in the RGB mode via the scart socket, so the pictures are excellent. I'm now looking forward to ITV and the new BBC channels.

Bob Grounds,
Witham, Essex.

TV displays in vehicles

I found Tom Baker's reference to rear-view video systems (December) interesting, but it started alarm bells ringing in the back of my mind. When battery-operated TV sets became a reasonable proposition in the Sixties, parliament passed a law that made it illegal to have a TV display mounted in a vehicle in such a position that the driver could see it. As it's never safe (from a politician's viewpoint anyway) to repeal a prohibition once it has been introduced, it's quite likely that this one still applies.

In those days no one outside broadcasting used the term monitor, but I fear the claim that a monitor is not a TV set might not be accepted as a defence. I don't think there's much risk from the overburdened police, who don't seem to want to know about most motoring infringements. A more likely danger is that an insurance company might jump at the chance not to pay up after an accident, on the grounds that the vehicle was being driven illegally!

Regardless of this possibility, with the increasing use of liquid-crystal displays in vehicles for various purposes a clarification of the situation would be helpful.

Tony Jaques,
Manchester.

Spares problems

Matthew Biddlecombe's letter (December) on obtaining spares highlighted the frustrations we all have, especially with the 'budget' brands. The products that bear these brand names, e.g. Alba, Amstrad, Bush, Fidelity and Schneider to name only a few, are now being sold as cash-and-carry items in supermarkets, retail outlets such as Argos, and by mail-order catalogue companies. Unlike traditional electrical retail shops, these outlets are interested only in selling 'boxes' and most have no interest whatsoever in after-sales service. Repairs under guarantee consist of exchange only. The profit produced by the sale of these products is small, maybe £10-£20 per item, but if you sell a million items there's a substantial profit.

When you are asked to repair one of these items you should, before you start the repair, tell the customer that some spares may not be readily obtainable. Explain that in most cases standard components can be fitted, but that some are unique to the equipment and may cause problems.

Difficulties in obtaining spares are not confined to the budget brands however. I was kept waiting for over six weeks for tuners for some Panasonic TX21MD1 TV sets. Eventually I gave up and sent the old ones to MCES, who repaired and returned

Price madness

Tesco was recently prevented from selling Levi jeans at cut prices. It lost the argument that sourcing product in the US and transferring stock to the UK was fair and competitive – "in the consumers' interest". After a recent visit to Safeway I'm left wondering whether there are other items that deserve court attention, in particular the 14in. Bush internet TV Model 1497ITV/1 (see front cover December).

Imagine my excitement when I received through the mail the latest hot offers from CPC. The Stock Clearance Bargain Basement flyer, valid through the Christmas period, included this same Bush internet telly. Here was my chance to stock up on merchandise at discount prices available only to account-holding, bona-fide members of the trade. The 'bargain' price was £162.24 + VAT, i.e. £190.63. But the Safeway price at the time of writing this letter was £89.99, and Argos wasn't far behind. Questions must be asked when massive retail chains sell at less than half the wholesale price. In this case what were the Safeway sources, and what was the CPC mark-up? Those of us still trading independently require assurance that there isn't some conspiracy to eliminate us.

I also wonder whether consumers, on whose behalf the likes of Safeway and Tesco continue this relentless pursuit of giveaway prices, give any thought to a future in which all the independent shops have gone? Who will they blame when, having squeezed the last penny out of a deal and pushed quality aside for volume, the final meagre bowl of rice fails to feed the people making the products they demand, the landfill gates have been closed and the waterways have been tainted with mercury and bromides?

Donald M. Henry,
Kircudbright, Scotland.

them within a few days.

A number of manufacturers have put spares supply, especially to non-account holders, in the hands of distributors such as CPC, Charles Hyde, SEME and Willow Vale, with most budget brands being dealt with by CPC. It appears that this is where the problem lies. CPC has an enormous catalogue, but most items for Aiwa, Alba, Bush and Grundig seem to be on special order. It can take up to fifteen days to get routine service spares, assuming that the order is processed correctly. It once took me eight weeks to get a door for an Aiwa stereo system. Another door that I have recently ordered looks as if it's going to take as long. Grundig spares can be as bad.

If you experience problems with obtaining spares through these distributors, may I suggest that you take the time to write to the manufacturer concerned? If a manufacturer is aware that there's a problem, he might be persuaded to take action.

Michael Maurice,
Wembley, Middx.

Cleaning valve pins

Mike Horne's letter (December) contained a number of helpful and interesting tips on vintage radio repair. Here's another one. When you need to clean the pins of valves such as B9A and B7G types, obtain some carborundum powder and plasticine, mix them together and put the compound in a small container. This will require a trip to the local old-fashioned ironmonger and toy shop.

Push the valve pins in and out of the compound. This will clean them effectively in a non-abrasive manner. A wipe with switch cleaner completes the job. I've been using this method since the Fifties.

Ian C. Beckett,
Chackmore, Buckingham.

The Finlux 5000 chassis

I find that an increasing number of customers are shunning modern black or silver TV sets in favour of having their ageing sets with wooden cabinets repaired. One that came in recently was a Finlux Model 25E17 (5000 series chassis). The complaint was sound but no picture. When the setting of the first anode preset was advanced, a blank but synchronised raster appeared.

Checks showed that there were RGB inputs at the TDA4680 video processor chip ICe4 but no RGB outputs. So I replaced the chip. Wrong! I then did what I should have done first and checked the sandcastle pulses at pin 14. They were there, but looked as if they had been partially washed away by the tide. The TDA2579A timebase generator chip ICh1 produces these pulses, and checks here showed that the line flyback pulses were missing at pin 12. The cause was Rz25 (27kΩ), which was open-circuit. But finding it was another matter. It resides on the back edge of the main PCB, near the LOPT. To get to it you have to remove the scart board and its plastic surround.

Once Rz25 had been replaced the set produced a surprisingly good picture.

Peter Nutkins,
Charmouth, Dorset.

Camcorder problems

The following experience might start some discussion.

For some time I had been thinking about replacing my old Sony F500E camcorder. When I saw the digital DCR-TRV320E for sale at Dixons for £500 I considered this a real bargain – it had been £750 previously. I was fortunate enough to find that there was one in stock at the Peterborough branch. Before I made my mind up I had a good look over it and read the full specification.

As usual nowadays, a purchase of this nature always brings with it the question of an extended guarantee. I was not interested in this, but was then offered a bag of 'goodies', namely a carrying case (Sony always included this item with its cameras), a pack of three tapes (TDK), a 16Mb memory stick, a cleaning tape and a spare lithium-ion battery (not a Sony one), all for £100.

I've now had the camera for four months and some interesting points have arisen. First, nearly all the 'picture effect' controls are underneath the LCD screen: opening this cuts out the viewfinder. In moderate light the screen is virtually unreadable, while in any sort of sunlight it's completely useless!

The spare battery I bought as part of the package deal wouldn't operate the camera. When I went back to Dixons to complain about this I was more or less told that I didn't know what I was doing and hadn't fully charged it. I pointed out that there was no problem with the Sony battery, but they insisted that they had had no reports of problems with these batteries. I put the battery on charge for a further twenty hours, as they suggested, and after two-three hours the camera display readout showed "full". When the battery was put in the camera it immediately tripped, showed a flat battery in the display and "non lithium". I decided to contact the battery manufacturer, and was asked the batch number on the battery. Given this information, the manufacturer told me that there was a problem with this batch and Dixons had been asked to take the batteries out of stock. They would send a replacement. When it arrived it was from the same batch, and behaved in exactly the same way. After more phone calls I was asked to return both batteries and I would receive replacements. So I now have two batteries.

I wish I could say that the story ends here. The batteries did operate the camera, but after a week in storage the charge fell away and after two weeks the batteries wouldn't operate the camera without recharging. After two or three charges they were no better. The Sony battery lost almost nothing.

When I phoned again there was incredulity that there should be this sort of problem. Send them back and they would do tests. The subsequent report, which arrived less than a week later (doesn't that say it all?), said that there was no indication of losing the charge and that in fact they had performed better than the Sony battery of the same type. I still have the batteries and no one wants to know, including Dixons.

I am now looking for an independent tester to evaluate the batteries and establish the facts. As I pointed out, a camcorder needs to be ready for use at a minute's notice: if a battery has to be charged each time it's needed it is of little use. There is also the question of the likely life of these batteries. I am aware of the price difference between Sony and compatible batteries and was willing to exchange them for Sony ones, but because I had purchased them as part of a package this was not an option.

I'd be interested in any comments on cameras with LCD screens or, for that matter, LCD screens in any application – I find it very difficult to read the instruments in my Peugeot 406 in bright conditions. Also any comments on lithium-ion batteries, though I have to say that I am quite happy with the Sony one.

Leslie E. Swain,
Buckden, Huntingdon.

Vintage rectifiers

Further to J. Ellis's letter on this subject (November, page 32), as I recall it domestic valve radio receivers generally used rectifiers with an indirectly heated cathode. There would have been no advantage with a directly-heated cathode rectifier, as the other valves all had indirectly-heated cathodes. With the old selenium rectifiers the reservoir and other smoothing capacitors had a rating that was able to stand up to the peak as well as the RMS voltage for thirty seconds or so.

G. Cox,
Bexhill on Sea.

Editorial comment: It seems to depend on how far you go back in time. In the very early days directly-heated valves were generally used throughout the set. Directly-heated double-diode rectifiers were quite common up to the early post-war period. ■

Answer to Test Case 470

– page 211 –

In our trade there's seldom a problem that cannot be solved given skill, ingenuity, and an adequate budget to finance these and the time and materials required. Mrs Marriot-Turnbull parted with some £200 but now enjoys Sky TV in the way she wants, even though she doesn't watch *The Simpsons* or *Confessions from Ibiza*. Ray used brackets to secure a stout two-inch scaffold pole to the wall at the rear of her desirable residence. Three strong mountings at brick centres were used to spread the wind- and weight-load and guard against flexing in heavy weather. The dish, carefully aligned, was mounted at the top of the pole, at a height that was just sufficient to look over the ridge of the roof. It's invisible from the road, and is not intrusive when viewed from the patio at morning tea. Well done Ray. There's further business to be done amongst the neighbours in Spa Close.

How about Mr Wainright and his picture break-up? It's a fact that terrestrial digital TV reception is easily upset by the presence of impulse interference. In cases like this it is far better to tackle the cause at source. The resourceful Ray, after a visit to the boiler-spares shop in Horsebridge Wells, fitted a new thermostat, relay and suppressor to the boiler. There was no more interference and picture break up after that. The bill was presented and paid. Well done Ray.

NEXT MONTH IN TELEVISION

Stereo FM signal source

Keith Cummins presents a unit which, when fed with a stereo audio input, produces a stereo FM output. The unit can be used to feed FM receivers around the home, enabling stereo TV sound or music channels from a digibox to be distributed and stereo sound heard with a remote mono TV set and co-sited FM equipment; it can distribute audio from a tape or disc; and it can be used as a test-signal source. A baseband output enables stereo decoders to be checked, while a scope output enables the baseband signal to be monitored.

DOCSIS

In other words the data over cable interoperability specification. It's a standard to which cable communications network operators have to adhere if they want their data to be acceptable on other networks. The specifications ensure compete interoperability between networks, differing makes of equipment and differing kinds of data.

Test report: TV pattern generator

Eugene Trundle reviews the Burosch TV pattern generator which provides a comprehensive range of patterns including a broadcast-standard, full-specification FubK test card. This convenient pocket-sized unit is mains-operated at 12V and incorporates a UHF modulator.

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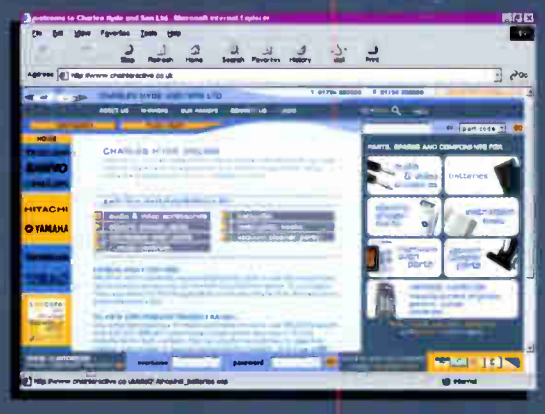

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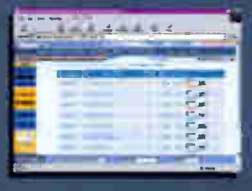

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