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TELEVISION May 2001
Dealing with the digital confusion

The public could be forgiven for thinking that digital TV is a con to get people to take on pay-TV. After all, the main sales effort has come from the pay-TV broadcasters, who have the finance and motivation to get people to go digital. It has in fact been vial for the contending providers of digital TV, satellite, terrestrial and cable, to collar as large a proportion of digital viewers in order to guarantee the future of their services. But however much pay-TV broadcasters may wish to sign up viewers, there is a substantial number of people who are either simply not interested in the additional services that digital can provide or who simply don't want to pay for what they feel should be free. It's not just that these people don't want digital TV however, they will affect the eventual analogue-digital transition, since no government is likely to switch off the analogue transmitters so long as a substantial proportion of viewers rely on them.

Since it is wasteful to have duplicated services in analogue and digital form, the question is how to appeal to those who are reluctant to switch over. The main effort has to go into putting across the idea of free-to-air (FTA) digital terrestrial TV. This shouldn't be too difficult, given adequate resources, because FTA digital offers a wider range of channels for no extra running cost and good-quality reception. But it does of course involve expense, on a receiver if you don't get an STB subsidised by a pay-TV service and, quite probably, on an expensive aerial upgrade - to ensure adequate signal input from the lower-power digital TV transmitters and to take into account the different UHF channel groupings that digital TV has brought about.

What can be done to encourage FTA digital viewing? Danny Churchill, deputy chairman of the Digital Television Group (DTG) and director of technology development at Dixons, writing in ERT Weekly identifies the problems as follows. He feels that the large number of broadcasters, setmakers and retailers involved are finding it difficult to get together to help promote digital TV. They have different agendas and different levels of commitment. There is a lack of overall leadership, and a push for change is not helped by the fact that the analogue TV market is still a very healthy one. Nevertheless everyone welcomes the existence of a new market, and an advertising campaign, starting at Easter, should help promote the multi-channel benefits of digital terrestrial TV.

But however good the promotion, it won't be successful if there is an inadequate supply of digital receiving equipment, either STB converters or integrated digital TV sets. The problem here has been uncertainty over basic receiver specification. From the public's point of view there has also been a lack of clear information on FTA DTT and the equipment available for its reception. The retailers have been found wanting in this respect - remember those now famed government ministers who tried and failed to get adequate answers to their questions? The blame tends, not unjustifiably, to be passed around. Why should retailers be expected to make much effort when little equipment is available and the public is being given little encouragement to take to FTA DTT? The FTA broadcasters also have their problems. For example if the BBC makes an effort at FTA promotion the pay-TV broadcasters are inclined to shout 'foul'.

According to Danny Churchill, dealer research has established that consumers find it difficult, at the point of sale, to distinguish between analogue and digital widescreen TV sets. The introduction of a DVB logo as a kitemark for IDTV sets, now backed by the government with the support of BREMA and the DTG, should help here. The research also revealed that while awareness of the BSkyB and ONdigital multi-channel pay-TV offerings is very high, awareness of the FTA option, and in particular its extra channels, is very low "if not zero". DTT broadcasters are combating this with an advertising campaign that promotes ten-channel widescreen digital as preferable to five-channel 4.3 analogue TV. This is linked to the kitemark with the campaign line "look for the DVB logo". ONdigital should benefit indirectly, since it will be easier to obtain subscribers once members of the public have taken the digital first step.

The problems of DTT coverage and aerial requirements are being looked at by a DTT working group which plans to make a lot more information available to manufacturers and dealers, including a series of service area maps that will show where adequate signal strength can be guaranteed. These will be issued to manufacturers so that they can provide dealer advice. On the aerial side, ONdigital and the DTG is providing manufacturers with an updated "area installation experience report". This indicates where reception has been troublesome and is improving. The aim is to provide advice to retailers so that they can sell with confidence. The Confederation of Aerial Industries (CAI) is collaborating with these moves, and a guideline of charges has been produced. Prices should range from £40 for aerial adjustment to £275 for a new system guaranteed to provide optimum performance in the prevailing reception conditions.

There's a long way to go to get everyone to move to digital TV. But at least some practical steps are being taken to encourage the move.
The analogue TV switch off

Two recently published reports suggest that the analogue TV switch-off may have to be postponed beyond the government's target of 2006-2010. A report by the media buying and research agency Optimedia says that by 2005 almost a third of homes could still be relying on analogue TV transmissions. The government's target for the start of the switch-off is conditional on at least 75 per cent of homes having access to digital TV, with full conversion to digital happening when at least 95 per cent of homes are equipped for digital TV and sets are available at prices affordable to those on low and fixed incomes.

Optimedia forecasts that almost 7.6 million (30 per cent) of households will still be receiving analogue TV in 2005, and that 3.2 million households will have opted for free-to-air (FTA) digital TV. It believes that OnDigital's pay-TV services will account for just 7.6 per cent of the market, with less than two million households having signed up.

The Consumers' Association, after carrying out a survey of 1,918 adults about their attitudes to and awareness of digital TV, concludes that the government's plans for the analogue switch off are "fatally flawed". Of those without digital TV, 32 per cent said they would never have it. 48 per cent of viewers said they would watch only FTA channels after the switch-off. So far, 66 per cent of those without digital TV said that they would not consider the switch. Fifty per cent of retired analogue TV viewers who knew about digital TV said that they would never switch to digital.

The Consumers' Association says that the government should end the forced march to the analogue switch-off and adopt a digital changeover policy that enables viewers "to switch to digital easily, affordably and because they want to". It's view is that the government should either postpone the shut down of analogue TV or subsidise the switch-over by making it either "inexpensive or free", so that viewers have "no or negligible financial outlay".

There seems to be no good reason to hasten the switch off, apart from the illogicality of continuing to run both services. But subsidies would be an expensive commitment, especially when the likely need for a good new aerial for terrestrial digital TV is considered. It is also going to be very expensive to achieve digital TV coverage that's comparable with that of the analogue services.

The government has decided to launch an information campaign to combat confusion about the technology and the services available. It is also to introduce a kitemark to identify sets able to receive digital services. The intention is to avoid confusion with sets that have digital features but don't provide digital reception. Ministers who made enquiries found that they were given misleading information by some retailers.

Satellite ITV

In what appears to be a rather curious piece of wheeler-dealing, ITV has reached agreement with SES to lease Astra 2D transponders for its services. The ten-year deal involves payment of some £100m. So ITV could, by the end of the year, be available to satellite viewers separately or via BSkyB. It seems that BSkyB had been asking £20m a year for ITV to join the SkyDigital package. Negotiations between ITV and BSkyB are expected to follow.

Kingston's VOD service

Kingston Communications plans to launch a video-on-demand service that will be based on the largest single streaming media server computer in the world. The server, nCube's n4 system, would enable Kingston to provide more than 6,600 audio-video streams simultaneously from a single item of multimedia content at a rate of 2-4Mbits/sec. Servers today typically provide about 500 streams per computer, so that broadcasters have to use several.

Kingston currently provides an ADSL-based service for several thousand subscribers in the Hull area, offering digital TV, high-speed internet access and local information on demand.

NEC has developed a domestic personal-assistant robot called PaPeRo (Partner Personal Robot) that can recognise people's faces and 650 spoken phrases and can speak more than 3,000 phrases. On the basis of voice recognition it can carry out a number of tasks such as access to e-mail via the internet, the operation of TV, video and other equipment and appliances, provide reminders, play games and tell the time. The idea is to provide a user-friendly human-machine interface to make modern systems more readily usable by those who might experience difficulties, such as the elderly. It could also help with emergencies and with home security. Further development work on the system is being carried out.

Satellite TV news

Eutelsat's Eurobird satellite was successfully launched into orbit at 28.5°E on March 8th, with a footprint that includes the UK. Its 24 transponders operate in the 11.2-11.7 and 12.5-12.75GHz bands. Eutelsat has signed a contract with Boeing Satellite Systems Inc. for fast delivery of the e-bird satellite, which will orbit at 25.5°E with twenty transponders covering Europe. Launch is expected to take place in the second quarter of 2002. The transponders will be optimised for IP access networks with return-link capabilities.

SES, the Astra satellite operator, has agreed to buy General Electric's satellite division GE Americom in a $5bn cash plus shares deal that will make it the largest company in the field. Assuming that it's approved by the US regulatory authorities, the merger should be completed by the end of the year. SES will then have a global network of regional satellite systems, 

May 2001 TELEVISION
Sony has unveiled a range of new products, many of which will be released in the UK this year. They include Sony's first plasma-screen display (see photo above), Model PFM-42B1, which still sells for about £6,000. The screen has a diameter of 42in, with 3,150 million pixels and offers four aspect ratios, 16:9, wide zoom, letterbox zoom and 4:3, plus a zoom facility for close-ups.

A new range of projection TV sets, known as PS2 (nothing to do with the games console!), includes Sony's Digital Reality Creation (DRC) technology which uses digital processing to increase screen resolution. Screen sizes are up to 61in.

Sony says that DVD player sales in Europe will increase from four million in 2000 to about eight million this year. The company's new DVD models include the DVP-S9000ES, which incorporates a Super Audio (SACD) player; Model DVP-NS400D which provides DVD-Video, audio (SACD) player; Model DVP-D9000ES which incorporates a Super Audio CD player and CD-R/RW operation; and the combined DVD/SACD/CD player and receiver Model SLV-SE810 with 5.1-speaker system. Sony has confirmed plans to launch a combined DVD-RW/DVD+RW home video recorder next year.

Model SLV-SE810 is a hi-fi VCR which includes satellite decoder control, a Smart Dial Timer, the Smart Search Plus tape management system, and Sony's Reality Regenerator and Super Trilologic technologies which are designed to improve picture quality.

Sony has ceased production of new Video-8 camcorders, its entry level now being Hi-8. Model DCR-TRV30 is a DV camcorder with a 1.55-megapixel CCD image sensor whose horizontal resolution is 530 lines and still image resolution 1,360 x 1,020 pixels. The camcorder uses 14-bit digital signal processing and features Super Steady Shot and NightShot technologies. Digital-8 Model DCR-TRV830E includes an MPEG movie feature and comes with a portable printer for still images. The CCD-TRV78E is a Hi-8 model with a 2.5in. LCD screen and a x560 digital zoom (x20 optical).

Last year Sony launched the MVC-1000, the first digital still camera to use CD-R discs as the recording medium. Models MVC-CD200 (with 2.1 megapixel CCD image sensor) and MVC-CD300 (with 3.1 megapixel image sensor) use 8cm CD-R/RW discs, each of which can store up to 81 fine-quality images or 13,000 VGA images.

In the audio sector Sony has launched the first multi-channel SACD player in Europe, Model SCD-XB770, and a PC-connection kit that makes it possible to download music files stored on a computer hard disc to a blank MiniDisc. The music files (such as MP3) are converted to PCM files before being stored on disc. The latest MiniDisc recorders offer high-speed dubbing and LP recording (x2 and x4). New MiniDisc portable players are compatible with LP recordings.

Sony has launched double-density CD-R/RW media and drives. The new discs can store twice as much data as a conventional CD (1.3 Gbytes compared with 650 Mbytes). The first double-density drive, Model CRX200E-R, can write CD-Rs at x12 speed and CD/RW discs at x8 speed. It can read conventional CD-R/RW discs, but double-density discs cannot be read by standard CD-ROM or CD-R/RW drives.

The new double-density discs are the same size as ordinary CDs (120mm diameter, 1.2mm thick) but the track pitch is reduced from 1.6 microns to 1.1 microns, the maximum pit length is 0.623 microns instead of 0.833 microns, and the scanning velocity is 0.9m/sec compared with 1.2-1.4m/sec. The laser wavelength is the same (780nm), but the numerical aperture with the double-density laser optical system is 0.50 instead of 0.45 for reading data and 0.55 instead of 0.50 for reading/writing data.

Toshiba’s China move

Toshiba has ceased to make CRT TV sets in Japan for the domestic market, transferring production to China. The aim is to reduce costs in a market that Toshiba sees as becoming increasingly competitive. Toshiba had been producing about half a million sets a year at its Fukaya plant in eastern Japan. The plant will now concentrate on liquid-crystal projectors and the development of digital TV.

Production capacity at Toshiba’s Chinese plant at Dalian is being increased from the present million a year to one and a half million. Some 800,000 sets a year, including digital TV models, will be exported to Japan. Key components such as ICs for digital signal processing will be supplied to Dalian from Japan.

Next-generation processor

Sony Computer Entertainment, which makes the PlayStation 2 games console, has joined forces with Toshiba and IBM in a $400 million, five-year programme to develop a next-generation microprocessor chip with supercomputer processing power (teraflops) for consumer applications. The work will be carried out by a team of 300 at IBM’s Austin, Texas base. Toshiba and SCE jointly developed the processor for the PlayStation 2.

The new sub-0.11-micrometer processor, to be called Cell, will employ various technologies including copper interconnect, silicon-on-insulator transistors and the use of low-k dielectric material. It will enable "intelligent" consumer products to communicate with one another and the internet via broadband networks. Possible future applications could include holographic or 3D TV.

This slimline video wall system has been added to Mitsubishi's range of video appliances. The display is based on Texas Instruments' digital light-processor chip, which provides XGA quality. Control is from a PC via an RS232C port. The light-source lamp has a life of 8,000 hours and provides a high-brightness display at 500cd/m².

TELEVISION May 2001
WHAT A LIFE

A tale of ordinary folk? Donald Bullock on some of the characters he has encountered during his time in the TV servicing trade. All life is here!

The Colonel

When there was The Colonel, who was a horse expert. He arrived in a huge, newish Land Rover that was loaded with bales of straw. His Hitachi colour set was on top of them. He was dressed in tweeds and brogues, his speech was slow and quiet, and he oozed quality of a restrained kind. A horse clopped by as he brought his set in. It seemed to send him into a quiet ecstasy.

"I love horses" he said. "They’re my business and my pleasure. I keep a horse farm. How fortunate I am to make a living from something I love."


"We keep about a hundred horses" he said. "Breed ‘em, train ‘em, look after their health. Got our own vet of course. Supply several Arab sheikhs..." He went on to say that he was writing an authoritative book on horses and everything to do with them.

"Don’t like to boast, but the book’s been commissioned by the country’s top publisher. Couldn’t really spare the time, but then I couldn’t refuse the £250,000 advance – just for doing what I’m happiest at..."

Colonel French’s set was a Model C2514T. The symptoms were lack of height, and it kept shutting down. I decided to check the HT voltage first. It should have been 150V but was high at 190V. As a result the line output stage derived 27V supply, which powers the TA8427K field output chip IC601, had been driven up to 35V. So IC601 was being severely overrun.

The cause of the trouble was in the circuit that monitors the HT voltage for regulations purposes. R951 (82kΩ, 0-5W), which is in series with the HT preset, on the chassis side, had risen in value to 115kΩ. A replacement restored normal operation and, to be on the safe side, I replaced he TA8427K chip as well.

Colonel French collected his set a day or two later, took the bill and promised to drop his cheque in the post. "A pleasure, Colonel."

It didn’t arrive, and after three months and a few reminders I telephoned his house.

His wife answered. I tactfully suggested that the bill might have slipped her husband’s mind as he was engrossed in writing his book.

"How much is it?" she asked.

"Twenty pounds" I replied.

She promised to bring the money in the morning, and did. She was a colourless and sad soul, with a pale, worried face and baggy eyes. She arrived on an ancient scooter, and paid with
some well used notes and silver coins.

I felt sorry for her as she counted out the money. She looked all in, as pale, ill and shaky as her husband was bonny, solid and fit. As she turned to go she stumbled.

"Is something wrong, Lady French?" I asked.

She blinked and shook her head. "There's no Lady French" she said. "Please don't take any more work from him. He's an unemployable nobody. Name's Roy Small. Done no end of time for fraud. He's inside right now. We've got nothing but debts. I've had to borrow this bit of money. He spends everything he gets on his silly countryman's clothes, and spends his time wandering around looking at horses. We live with my people. Otherwise I'd starve."

"But the book" I said, "that huge advance."

"All fantasy" she replied flatly. "And the Land Rover?"

"It belongs to my sister's husband. My husband nags and nags until he gets to borrow it. When it runs out of petrol he abandons it and cadges a lift back. We often have to collect it from miles away."

The bomb
Then there was Mrs Webster, the manager of a prestige hotel which she ran to her own strict standards. At the end of the day however she would enjoy a specially-prepared meal in the hotel's dining room then adjourn to the bar, where she would gently punish the gin bottle. Mrs Webster, originally from Wales, had a store of wartime reminiscences. They became more entertaining as the gin flowed.

One evening, while I was fixing their Philips projection set, she invited me to join her at the bar. "I'll tell you about the bomb" she said, in her melodic Welsh dialect."

By the time I got there the gin was flowing well. The bomb – it was thought to be a landmine – had dropped somewhere in the Rhondda valley. But nobody knew quite where, which is how she'd become involved.

Suddenly she heard a faint ticking and, as the line moved on, she stopped, parted a bush and found herself falling down a deep well. She landed on a pile of soft hay and there, beside her, was the landmine, ticking away.

"I knew the area well" she said, "all the pit-workings, the mineshafts, everything. So it wasn't surprising that when Mr Churchill came to our village next morning he sought me out."

"This bomb will be ticking gently, Mrs Webster" he said, "and I want you to organise a group to find it. I have to tell you that it's a dangerous job. The bomb could go off at any time. But there could be a medal or two in it."

"I don't care about the danger or the medals, I'll do it" she replied.

So, Mrs Webster told us, she lined up two hundred people, side by side, and advanced them slowly across the valley, with their ears to the ground. Suddenly she heard a faint ticking and, as the line moved on, she stopped, parted a bush and found herself falling down a deep well. She landed on a pile of soft hay and there, beside her, was the landmine, ticking away.

"I called out, and everyone came back and helped me out" she continued, "and of course they made the bomb safe."

"Was it a deep well?" I asked her. "Forty eight feet, eight inches" she replied.

I looked at her. "How do you know it was forty eight feet, eight inches?" I asked.

"I counted the courses of bricks as I fell" she replied. "Four to the foot."

Then she reached for her gin again.
### Line Output Transformers

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<td>CAP31</td>
<td>175p</td>
<td>10</td>
</tr>
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<tr>
<td>KSS 210 A Replacement</td>
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<tr>
<td>KSS 210 B</td>
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</tr>
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</tr>
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<tr>
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### Aerial Installation Accessories

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<td>Twist On F Connectors</td>
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<tr>
<td>Y Splitter Inductive 3 way</td>
<td>PLG57</td>
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<td>7mm Coax Clips with 25mm nail Pack of 100</td>
<td>CLIP1</td>
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</table>
Having discovered that modern tape recorders don’t have provision for a microphone input, Keith Cummins designed the preamplifier/mixer circuit presented here to meet this need.

Microphone preamplifier

When I set about finding a replacement for my thirty-year old Sony TC136 tape recorder I discovered that more recent models don’t have provision for a microphone input. This is a drawback, as I sometimes need to produce voice recordings to send to distant family or friends. So, having bought a new recorder plus a MiniDisc machine, I decided to design and build a suitable microphone preamplifier. The result is presented in this article. The preamplifier includes a pan-pot for moving the voice position within the stereo field, and a mixer stage that provides voice over other programme material.

Design parameters
The design assumes that a good-quality dynamic microphone with an impedance of 600Ω will be used. Phase is maintained, i.e. with both the microphone and line inputs a positive-going input results in a positive-going output. A design aim is that the signal-to-noise ratio and frequency response won’t compromise the performance of the recorder. Because of the unit’s likely infrequent use and the possibility that a mains power supply could introduce both hum and earth-loop problems, I decided to use battery power – two PP3 batteries provide positive and negative 9V rails. The unit is housed in a neat, sloping panel box that’s available from Maplin. The basic specification is set out in Table 1.

Circuit description
The full circuit of the unit is shown in Fig. 1. It uses two ICs, IC1, an OP27, is the microphone preamplifier stage. IC2, a TL074, contains four operational amplifiers which are used to provide the stereo panning and the mixing facilities.

The microphone preamplifier could hardly be simpler. The OP27 chip, which is a low-noise instrumentation op-amp, is used in the classic inverting mode. Since pin 2 is a virtual earth, R1 sets the input impedance. Its value, 620Ω, matches that of the microphone. C1 has two functions. It sets the low-frequency roll-off point, in this case 60Hz, for the microphone channel. It also blocks DC, ensuring that the op-amp offset is not amplified by the ratio R2:R1. This ratio does set the AC gain however. To be precise, this is \(-\frac{\text{R2}}{\text{R1}}\), the minus sign indicating phase inversion.

The gain from the mic. input terminals, in dB, is
\[20 \log_{10} \left(\frac{220,000}{620}\right)\] i.e. 51dB.

Since the microphone is terminated by its own impedance, its terminal voltage is reduced by 6dB. So the preamplifier’s gain relative to the open-circuit output voltage of the microphone is 51 - 6 = 45dB.

The upper frequency limit is determined by the OP27 IC’s gain-bandwidth product. Because of the high gain, the device starts to run out of steam just above audible frequencies. It’s 3dB down at 25kHz. This is acceptable and helps reduce the possibility of RF breakthrough.

Because of the low DC offset and the use of positive and negative supply lines, there is no need to block DC to the mic. level control RV1, whose slider is taken to the non-inverting inputs of IC2a/b. This is where the circuit starts to get interesting.

The pan amplifier section
When the gains of IC2a and IC2b are equal, the same microphone signal level will appear at the left- and right-channel outputs and the sound will appear to come from mid-way between the stereo speakers. The purpose of the pan-pot RV2 is to move the apparent sound source left or right across the stereo sound stage.
To do this correctly, the gain in one direction has to be increased by the same amount as the gain in the other direction is reduced.

As I discovered when designing the circuit, this is not as easy as it sounds. First, I should mention that it is not a good idea to allow full power on one side and nothing on the other — this gives rise to a somewhat unnatural 'top-sided' stereo effect. My listening experiments indicated that a maximum 12dB difference in levels is about right.

Having established this, the next task was to design a circuit that is symmetrically balanced, so that for every 1dB increase at one side there's a complementary 1dB decrease at the other. If, for moment, you imagine that R7 and R8 are not fitted, then do the calculations to find out what happens to the gains of IC2a and IC2b as RV2 is adjusted. You will see that there is an increase of nearly 5dB at one side but the corresponding decrease at the other side is only about 2.5dB. This is unacceptable since, overall, the sum of the two output levels has increased. We want the apparent sound source to move but not become louder.

The solution is to provide cross-coupled feedback via R7 and R8. The scheme works as follows: With RV2 centred, the outputs from pins 1 and 14 of IC2 will be equal. Thus in this unique position the gains can be calculated by imagining R8 to be in parallel with R5 and R7 to be in parallel with R6. A simple calculation shows that this is equivalent to removing R7 and R8 and changing the values of R5 and R6 to 27kΩ. The gain in each channel is then 11.36dB.

Having established this, we have to consider what happens when RV2 is moved off centre. Let's say it's moved upwards, i.e. the gain of the left channel is increased. The gain of IC2a increases, and feedback via R7 to the inverting input of IC2b reduces this op-amp's output. This reduced output is applied via R8 to the inverting input of IC2a, further increasing its gain. Thus the compensating effect, in dB, is complementary in the two halves of the circuit.

The compensation has to be precise: too much will overcompensate for the error we want to correct. The simple op-amp calculations I started off with were superseded by two sheets of A4 and involved some horrible numbers. What you have to do is to assign voltages and currents to the various parts of the feedback network, then apply Kirchhoff's Laws, derive six simultaneous equations, solve them, calculate the gains and pour yourself a whisky!

The results of this toil are shown in Table 2, measured at 1kHz using a Levell RC oscillator type TG200DMP and a Levell broadband voltmeter type TM6B. The errors are so small that they are insignificant with listening tests.
Capacitors C2 and C3 are included as DC blocks to prevent the op-amps' offset voltages being affected by RV2. As the TL074 is a FET input device, 100 per cent DC feedback can be applied via R5 and R6. This minimises the offset. Note that although C2 and C3 are electrolytics they work with such low voltages (millivolts) that their polarisation is insignificant. This also applies to C1 in the microphone preamplifier section.

**The mixer section**

The outputs from IC2a and IC2b are fed via R9 and R10 to the mixer stages IC2c and IC2d. As far as the inverted microphone signal is concerned these act as...
unity-gain inverting buffers, since the feedback resistors R11 and R12 have the same values as R9 and R10.

The L and R line signal inputs are fed via R15 and R16 to the ganged line level-control potentiometers RV3a/b, whose sliders are directly connected to the non-inverting inputs of IC2c and IC2d. Seen from these inputs the mixer stages have a gain of two (6dB), since the gain is determined by \((R9 + R11)/R9 = 200/100 = 2\). So R15 and R16 are included to attenuate the input, but only by 4.5dB. This provides a "spare" 1.5dB of gain so that the line level control doesn't have to be rotated to fully clockwise to achieve unity gain through the unit. SW1 is included to connect these inputs to provide a mono signal if required. This can, for example, help reduce noise if an old mono vinyl disc is being played by a stereo pickup cartridge.

The outputs are buffered by R13 and R14 before passing out at SK4 and SK5. The very small offsets involved (less than 5mV) permit direct coupling to be used, eliminating the need for coupling capacitors at various points in the circuit.

The batteries

Lastly the two batteries that provide + and -9V supplies. The use of two rails enables the op-amps to be operated symmetrically about chassis potential. The 18V total also provides plenty of signal headroom, which is beneficial because it prevents overloading and enables the compression circuits in the recorder to receive a clean signal even when it's large. This is particularly helpful should the microphone be knocked accidentally, minimising the "thump" effect that might otherwise be squared off, generating nasty, audible 'crunchy' harmonics.

The batteries are decoupled by C4 and C5, which ensure that the AC impedance remains low as the batteries age. SW2 is a simple on/off switch.

I was tempted to include an indicator LED, but it would have consumed about the same as the rest of the circuit. So to preserve battery life, using zinc-chloride batteries, is at least 38 hours. Note that alkaline batteries, though good for heavy loads, will provide only 50 hours at about twice the price. Another case of

Construction

The unit is built into an ABS desk control box type M1005, whose external dimensions are 161 x 96 x 61/39mm. The ABS part is black, with a grey finish aluminium panel that looks very smart, especially if a labelling unit is used to print grey identification labels. I use a Brother P-Touch 85, which produces a very professional result.

One of the problems with building the components into the box is the mounting arrangements. It's best to avoid having odd screw heads projecting from the box.

Table 2: Differential gain of the pan amplifier.

<table>
<thead>
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<td>-6.4</td>
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<tr>
<td>end of range</td>
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Fig. 4: Positions of the main components and connections on the stripboard. This is a suggested guide for the upper (component) side. Use the front panel as a template to position the potentiometers. Cut the potentiometer shafts to 9mm and enlarge the holes for the potentiometer legs to 1mm.
Internal view of the preamplifier/mixer unit.

The connections can now be made between the board and the batteries, switches and sockets. Fit an earthing connection between the on/off switch and the panel: this then connects to the switch and the stripboard 0V line. Fit the mono/stereo switch. Wire the battery connectors, one lead from each to the appropriate + and – board connection, the others to the on/off switch. Wire the mono/stereo switch to its pins on the board. These leads do not need to be screened. Screened leads are necessary for the remaining connections, to the four phono sockets and the mic. socket.

To fit the phono and mic. sockets to the case. As with the on/off switch, install an earth connection under the mic. socket securing nut, to ensure that the plug and socket shells are earthed. This earth can be connected to the socket’s earth pin, which is in turn connected to the stripboard. The battery + and – rails can be at the other edge, decoupled by C4 and C5 whose common 0V connection is linked across the board to the 0V track. These leads do not need to be screened.

Check all interconnections thoroughly, cut/disconnect any long bits of track that go nowhere, then offer up the board to the potentiometers and solder all the connections. You will find that the board is quite rigid. Tighten the potentiometers’ securing nuts fully, taking care not to twist them and put strain on the board. The connections can now be made between the board and the batteries, switches and sockets. Fit an earthing connection between the on/off switch and the panel: this then connects to the switch and the stripboard 0V line. Fit the mono/stereo switch. Wire the battery connectors, one lead from each to the appropriate + and – board connection, the others to the on/off switch. Wire the mono/stereo switch to its pins on the board. These leads do not need to be screened. Screened leads are necessary for the remaining connections, to the four phono sockets and the mic. socket.

Before you connect the batteries check that there are no supply rail short-circuits. If you have an eye glass, inspect the tracks for solder splashes or whiskers (no, I’m not perfect, and neither are you!). This can save time and effort later. If all looks OK, fit the batteries, switch on and check voltages.

Big voltages, except on the supply rails, will indicate that something is wrong. Pin 6 of IC1 and pins 1, 7, 8 and 14 of IC2 should all be very close to 0V. If all is well, try applying a signal to the mic. input while monitoring the test point with a scope. If this is OK, set RV1 to maximum, RV2 to centre position and check that you have outputs from the unit, equal in each channel. Check that the line input is mixed correctly with the mic. signal. If all is well, fit the control knobs and label the controls, switches and sockets.

Fit the four panel screws and the job is done.

Component list

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<tr>
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*0.4W, 1%. All others 0.25W, 5%.

Sockets: SK1 Maplin FK22 (requires Maplin mating plug FM50); SK2-5 Maplin YW06G.

Knobs: Two NK2 (Maplin RX01B), 1 PK2 (Maplin RX02C).

Miscellaneous: Two PP3 battery connectors (Maplin HF28); ABS console M1005 (Maplin LH63); stripboard, connecting wire, screened lead, rubber band etc.
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Safe wiring practice for car electrics

Vehicle wiring may need to be altered for many reasons - basically because the owner wants something to be added. It can be done safely or botched. In the following article Tom Baker outlines the best way to go about this sort of job. It's an ideal field for TV engineers looking for a lucrative way of supplementing their income.

"If I'd a pound for every time I did such and such I'd be rich by now." You must have heard that said many times, and have probably said it yourself. I'm no exception. If I had a pound for every time I've had to tidy up someone else's poor attempt at car wiring, or repair badly-wired and indeed dangerous joints in wiring harnesses, I would have retired long ago. I don't pretend to be a leading authority in such matters, but if you follow the guidelines in this article you will have fewer sleepless nights worrying about whether your beloved vehicle, or your customer's beloved vehicle, will work reliably and not burst into flames.

I have been fitting car radios/CD players, immobilisers and alarms, and items such as electric windows, reversing aids and so on for many years. To say that nothing surprises me now would be only too true. I'm not a registered auto electrical engineer, but I am a fully-qualified TV engineer - one who is always on the lookout for ways to expand my business. I have learnt the hard way, with help from good friends in the auto electrical trade, and consider that I am now fully competent in this field. Some of the jobs that have come to me after work done by mainstream garages confirm this view.

First, a word of encouragement. Don't be afraid to tackle this type of work. It can be very lucrative. You will probably have to get your hands dirty for a while, but such jobs will more than pay for the extra hand cleanser and towels you'll use.

Joining wires
There are several different ways of joining wires together. Let's start with the 'chocolate block', or screw-terminal connection block to give it the proper name. For various reasons, I don't like to see these blocks used for car wiring. First, they are bulky, and you can never be sure that you haven't tightened the screws to the extent that most of the wires have been severed and the joint is made by a single strand. Or you can trap the insulation beneath the screw, and thus don't make an electrical connection at all. The screw head can break while you are tightening it or, worst of all, the screw was cross-threaded from new and, when you tighten it fully, it doesn't touch the wire at all, leaving you to wonder why the new unit you've just installed won't work. You may spend several hours checking your work before you discover the cause.

Then there are the auto-electrician's friends, the crimp connectors. There are butt, spade, bullet, piggy-back, pin, fork, snap-lock, flag and closed-end versions, and some come with male and female variants. I do use these, but not as much as I used to. If used correctly, they are very safe, but you must have the proper tool for the job. Simply using cutters and pliers isn't good enough as, in my experience, there is no guarantee that the crimps will be the same, i.e. some are easy to crimp and some need a vice to
together and cover with either sticky tape, plasters or, a bit better, if the crimp hole is too large for the wire, double up the wire to make sure you have only enough wire to make the connection safe. If the crimp hole is too large for the wire, double up the wire to fill the hole. And finally use only the correct-colour crimp for the job: red for 0.5–1.5mm², blue for 1.5–2.5mm² and yellow for 4–6mm².

There's the cowboy's way of connecting wires: twist them together and cover with either sticky tape, plasters or, a bit better, insulation tape - but not wrapped neatly either.

Preferred method
I prefer to join wires together with solder then cover with heat-shrink sleeving. There's a knack to doing this, and I will try to explain it clearly. First, you must unwrap the wiring harness back far enough to get to your wire properly. This isn't always easy, as you may be on your back underneath the dashboard, but it has to be done. Then cut off the required length of shrink-wrap sleeving to cover the joint - remember that it has to go over two wires and of course the solder, once the joint has been soldered. The clever bit is to fit the shrink-wrap on to the wire and keep it away from the heat of your iron, otherwise it will start to shrink before you can get it over the joint. Remember also that there must be no solder spikes on the joint: a spike could break through the heat-wrap after it has shrunk, then short out to the next wire when you recover with new insulation tape the 'loom you undid.

If you have to join more than one wire into an existing loom the only safe way to do so is to cut the wire in the loom and join the new one with one of the two ends, get your shrink-wrap over the biggest soldered end, then resolder the other end to the joined wires, recover with the shrink-wrap and introduce back into the loom.

I have seen cases where the insulation has been stripped back a little bit on the wire, the new wire just wrapped around the open joint, then taped. This must not be done. It's very dangerous, because it is impossible to achieve a sufficiently tight joint for electrical safety. The joint can go high-resistance and start a fire, especially where you are trying to introduce another live wire, say for a radio memory or an amplifier.

Why things go wrong
The most common cause of fuse blowing is wires that are badly fitted through holes in the metalwork of the car, chafing the insulation and thereby causing a short-circuit. If you must go through metalwork, fit a grommet so that the wire cannot chafe. Bad earths are another reason why things don't work.

It's very useful to have a tool for fault tracing. I use a device called a Power Probe, which you connect to battery live and earth and has a switch for either +12V or -12V. It has a continuity check and tells you whether a wire is live, dead or earth.

Hints and tips
When dealing with modern cars fitted with airbags it's important to ascertain whether a wire you are about to cut or join is part of an airbag circuit. There is nothing worse than having an airbag go off in your face, because it's expensive to get it put back. If possible, always connect extra live wires to the appropriate points in the fuse box - there are very often spares to join to. If there aren't any spares, you can always connect to the battery terminals. A number of slave fuse boxes are nowadays available. All you have to do is to find somewhere safe to fit one. Connect a large live cable from the battery plus terminal, then use the outputs you require with appropriately-rated fuses. You must always fit the correct fuse when installing a new circuit.

In addition, when fitting a car audio amplifier you must use the correct wire size for the electrical side and also the speaker side. If you have to go under carpets or through sills the same basic rules apply: make sure the leads don't go over sharp bits of metal or through holes without grommets.

Insulation tape
Insulation tape is worth its weight in gold in certain areas but is a right pain when used in the wrong areas. The use of insulation tape to reinsulate a wiring loom after work on it, and to cover new wires inside the car loom, is good. But beware of using tape in the engine compartment. This is a hot spot for plastic wrapping, which can harden, shrink and subsequently come off. There's also the problem of dampness in the engine area: this can lead to tape becoming unstuck and thus falling off.

Where heat and water are a problem you can use either self-amalgamating tape or split corrugated tubing which enables you to open it down the split so that the wires can be inserted for protection, after which you should put a bit of self-amalgamating tape over each end and use tie wraps to attach the tubing somewhere safe, away from excessive heat and vibration from pulleys, belts, fans etc.

Caravan sockets
As I've seen so many poor attempts at wiring a socket for either a trailer or a caravan this subject merits special attention. It isn't hard to install a socket and, if you follow the instructions on the pack (you can even get them pre-wired) and use the correct cable, connected to the correct wires in the rear light loom, with reinsulation afterwards, you can't go wrong.

The previously mentioned Power Probe is a help here. You can insert the pointed probe into the cable insulation and gently touch the wire inside to ascertain which state it's in, i.e. live, dead or earth, without causing any damage other than a tiny pin-prick. This isn't quite as easy as it sounds however, as countless pin-pricks to my hand testify. I've by now learnt to carry a box of plasters with me - blood stains car upholstery and is difficult to remove.

To say that I've seen more cock-ups with this type of wiring than any other would be to understatement the situation. Here are a few things to avoid. First, don't connect your new wiring directly to the rear of the bulb unit. This looks messy and in some cases makes it difficult to change bulbs when they blow. Don't trap the wires under the spare wheel or jack. I've very often come across this. And don't leave the new wiring where it can get caught by items placed in the boot, or in a tray of water. The latter can be present when the lid doesn't close properly, which is often the case. As you've probably guessed by now, this is another situation where I find tie wraps ideal. There always seem to be suitable holes for the purpose in the rear of boot.

Good luck!
I hope this introductory article will encourage you to venture at least into the cleaner side of auto electrics. It's a way of boosting your income with some welcome, easily-earned money.

In future articles I'll deal with radio/CD installation, alarms/immobilisers, aerials, reversing aids and rear-view cameras, and car radio decoding after removing the radio or having a flat battery.

Incidentally, terminals and connectors can be ordered from Cable Ties Direct, 72-76 Clun Street, Sheffield S4 7JS, phone no. 0114 249 9259, fax order line 0800 073 2023.

Heading photo: An example of how not to do it. Don't use screw-terminal blocks like this!
Servicing the Sony BE3D chassis

In this concluding instalment Giles Pilbrow deals with system control, the service mode, the I²C bus, teletext and signal processing, then rounds off with a list of some common fault conditions.

The microcontroller chip and the video, sound and teletext signal processing chips are all on board A. This board looks a bit daunting at first sight, with its high proportion of surface-mounted components and integrated circuits. The following notes outline circuit operation and provide practical advice on fault finding.

System control
The heart of any modern TV chassis is its microcontroller chip. This one uses a Siemens SDA5250M 8-bit device, which operates with an 11.5MHz clock. For flexibility the operating software is stored in a separate 128K-byte ROM chip, IC3 – the software version is usually printed on the chip’s label, or can be read from the ‘IC status’ screen in the service mode. User and production data are held in a non-volatile memory, IC2. This 32K-bit serial EPROM is linked to the I²C bus. To reduce the possibility of the NVM data becoming corrupted, IC2 has an additional control line (pin 7) to inhibit writing unless the microcontroller chip has specifically requested it. For data to be written, pin 7 must be low.

To ensure reliable start-up a reset pulse is generated by IC4. This is applied to the microcontroller and some of the other ICs once the standby 5V supply has been established.

Software updating
There were several software revisions during the life of the BE3D chassis. Problems ranged from intermittent switching to standby (early F1 and F2 models) and loss of picture/sound (all sets made before March 1997) to intermittent problems with the set not coming out of standby (all models fitted with IC1001). Sony issued various bulletins that detailed the software changes. The most recent was TV04899, which included some circuit changes on board A. If IC3 is replaced without modifying the circuit the result will be field collapse – the set will not shut down.

The service mode
Access to the service mode is by putting the set into standby then pressing the sequence of keys shown in Fig. 2 on the remote-control handset.

Once the set is in the service mode TT... is displayed on the screen – this is known by Sony as test mode 2. When a two-digit code from the handset is entered at this point some functions are activated. There are many so-called TT codes. The more useful ones are listed in Table 1.

Other adjustments can be accessed via the service menu.

The I²C bus
With the exception of the teletext chip all the ICs on board A are controlled by the I²C bus. Each chip contains a number of memory locations known as registers, which need to be loaded with data before the IC can perform its tasks. Fig. 3 shows the I²C bus and microcontroller arrangement.

It’s not possible to see what data is transferred via the I²C bus. The only checks that can be made are for activity on the clock (SCL) and data (SDA) lines, and that the amplitude of these signals is similar. For fault-finding there’s a diagnostic system that indicates errors either
with the bus generally or when a specific IC fails to respond. The error codes are listed in Table 2. There are three categories as follows:

1. General, where a number of devices fail to respond. This is usually because a supply is missing.

2. Bus problems. Either the SCL or the SDA line is held low, usually because of failure of an IC. Short-circuits can be identified by resistance checks. If no short-circuit can be detected, each chip can be isolated in turn from the bus lines. This is easier than it sounds, as 10002 resistors are fitted in series with the clock and data inputs to each chip. Lifting each of these in turn along the affected bus line will reveal the culprit.

Obviously the set won’t work when one of the chips is disconnected, so the thing to do is to look for a change in the error code when a chip has just been disconnected.

3. Device failure. Each chip has error codes of its own. Most have several to indicate different internal problems. Exactly what these mean is of little relevance for servicing.

There are cases where no error code is displayed. This can happen if the micro-

---

Table 1: Useful TT codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT00</td>
<td>Exit service mode.</td>
</tr>
<tr>
<td>TT07</td>
<td>Enable/disable ageing mode.</td>
</tr>
<tr>
<td>TT08</td>
<td>Reset customer setting to factory default.</td>
</tr>
<tr>
<td>TT13</td>
<td>Scart auto 16:9 switching (pin 8) enable/disable.</td>
</tr>
<tr>
<td>TT14</td>
<td>Display software version and TV status.</td>
</tr>
<tr>
<td>TT16</td>
<td>Sets for 32in. wide CRT.</td>
</tr>
<tr>
<td>TT21</td>
<td>Sub-contrast adjustment (use red/yellow keys to adjust).</td>
</tr>
<tr>
<td>TT22</td>
<td>Sub-colour adjustment (use red/yellow keys to adjust).</td>
</tr>
<tr>
<td>TT23</td>
<td>Sub-brightness adjustment (use red/yellow keys to adjust).</td>
</tr>
<tr>
<td>TT24</td>
<td>Set up for UK operation (PAL I, UHF chs. 21-68).</td>
</tr>
<tr>
<td>TT37</td>
<td>Sets for 25in. (24in. wide) CRT.</td>
</tr>
<tr>
<td>TT38</td>
<td>Sets for 29in. (28in. wide) CRT.</td>
</tr>
<tr>
<td>TT49</td>
<td>Erase and reprogram the NVM (programme position 59 only).</td>
</tr>
<tr>
<td>TT74</td>
<td>Teletext/OSD horizontal shift (use red/yellow keys to adjust).</td>
</tr>
</tbody>
</table>

---

Fig. 2: Entering the service mode.

Fig. 3: Block diagram of the system control arrangement. R617 is on the main board.
controller chip isn’t running, or has an internal fault.

Teletext
All BE3D chassis sets have teletext, but there are two different types of decoder. The simplest version uses the teletext capabilities of the microcontroller chip IC1. This involves the minimum of external circuitry for the purpose. The main difference is that the frequency of crystal \( X_1 \) is 18MHz.

Although IC1’s teletext capabilities are perfectly adequate, it does not have the ability to produce the detailed graphics needed for the menus in some models. With these, IC1001 is added. It’s an SDA5273 chip from the Siemens Megatext family of devices, referred to as Compact Text in Sony chassis. Instead of making use of the I²C bus, a proprietary three-wire bus is used to link IC1001 directly to the microcontroller chip IC1. IC1001 requires line- and field-frequency pulses to operate. Loss of the field pulses will result in text/OSD rolling. With loss of the line pulses there will be no output at all.

Sound
Sound signal demodulation and decoding is handled by IC202, which in UK sets is an MSP3410 that can deal with both 6MHz mono and Nicam stereo signals. The sound IF signal is fed in at pin 25, after which it is digitised and decoded internally. Unlike older designs there are no frequency-determining components, such as ceramic filters, in the sound channel. The sound systems that IC202 will decode are determined by the destination setting stored in the NVM, and can be changed by the TT codes: TT24 sets UK operation.

Should a foreign receiver be brought into the workshop, conversion is simple. Just enter the service mode and, at the TT prompt, type in 24. This should at least give mono audio. Sets made for the Russian and German markets are fitted with an MSP3400 chip which does not have Nicam capability.

IC202 has two pairs of stereo outputs. Pins 56 and 57 provide signals for the audio output chip on the main board. Pins 59 and 60 provide outputs for the headphones and the line-out phono connectors. It’s possible to establish from the sound menu the type of signal here (mono/Nicam) and the volume level. This additional output from IC202 is useful when you are trying to establish the cause of a no-sound fault, as checking for sound at the headphone socket will reveal whether IC202 is working.

Surround sound
Sets equipped with Dolby Pro-Logic are fitted with a small daughter board known as the A1 board. This has a Motorola digital signal processor chip, IC1201, and a 256K-bit RAM, IC1202. Digital audio is fed directly to the DSP chip from IC202 on board A, using what’s known as the I²S bus.

The A1 board is piggy-backed on board A, being held in place by its two 8-pin connectors. Take care when inserting board A1, as the connectors are not keyed. If the board is fitted the wrong way round the set will shut down and display error code 4, because the SDA line is earthed.

The main audio output from IC202 is not used in these models. All the audio is routed through board A1, with the front left/right channels fed to the output amplifier IC1200 and the centre and surround channels fed to an output chip on board K1.

Faults on board A1 are rare. To help with fault-finding an extension lead, part no. 9-948-000-27, is available.

The jungle chip
The colour decoder and timebase generator stages are in IC301. This was originally type CXA2000Q. In later sets it’s type CXA2076Q. The two chips can be interchanged, but some circuit and software changes are required to enable older boards to work with a CXA2076Q. These are detailed in Sony service bulletin TV08397. IC301 will decode both PAL and NTSC signals, and all models have both crystals fitted. Secam compatibility is possible using an additional TDA8395T decoder chip (IC303). PAL delay is handled by IC302, which is either a Sony CXL5520M or a Philips TDA4665T. There are some circuit differences with these two ICs, so when deciding what to use, the symptoms being no colour or incorrect hue with some phase shift between the chrominance and luminance signals.

Video switching
IC201 selects either S- or composite-video signals from the tuner or any of the AV inputs. The switching voltage from pin 8 of the scart sockets is fed to pins 4 and 6 of IC201. The video level at these pins indicates the signal-source state, as follows: 0-2V no signal; 4.75-7.25V a 16:9 signal; 9-12.5V a 3:4:3 signal. Some external equipment provides insufficient voltage to switch the set to the correct mode. To overcome this, the auto 16:9 switching can be disabled by entering TT13 in the service mode. Pin 23 is fed with a sync signal derived from the tuner’s video output. This is used as a flag to the microcontroller that a valid signal has been detected.

The tuner
The BE3D chassis uses a combined tuner/IF unit manufactured by Sony. While the tuner section is considered to be non-serviceable, the IF section can be repaired and circuit information is included in the service manual.

The most common problem is an intermittent picture or picture disturbance. It can normally be instigated by tapping the set. If the fault persists, the IF board should provide a clue. The places to concentrate on are the 8-pin interconnection between the tuner and IF boards and the 6-pin output terminal.

For no video output check Q01 (2SA1037K), which sometimes goes short-circuit or leaky.

Known fault conditions
Set comes on then goes to standby with two flashes of the standby LED: The SYTV9379 field output chip IC500 is faulty or dry-jointed.

Table 2: Error codes for bus problems.

<table>
<thead>
<tr>
<th>Number of LED flashes</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Main board protection in operation. Field output failure or excessive current.</td>
</tr>
<tr>
<td>3</td>
<td>SCL line low. Short across line.</td>
</tr>
<tr>
<td>4</td>
<td>SCL line low. Short across line.</td>
</tr>
<tr>
<td>5</td>
<td>SCL and SDA lines low. Any device could be faulty.</td>
</tr>
<tr>
<td>6, 12</td>
<td>Failure of the NVM IC2.</td>
</tr>
<tr>
<td>7, 16, 21</td>
<td>Failure of the tuner.</td>
</tr>
<tr>
<td>8, 9, 24</td>
<td>Problem with the Nicam decoder chip IC202.</td>
</tr>
<tr>
<td>10, 18</td>
<td>More than one device hasn’t responded.</td>
</tr>
<tr>
<td>19</td>
<td>Failure of the video switch IC201.</td>
</tr>
<tr>
<td>20</td>
<td>Failure of the teletext chip IC1001.</td>
</tr>
<tr>
<td>21</td>
<td>Problem with the Dolby Pro-Logic decoder chip IC1201.</td>
</tr>
<tr>
<td>22</td>
<td>Problem with the tuner.</td>
</tr>
<tr>
<td>23</td>
<td>Failure of the Bültel-text chip IC1001.</td>
</tr>
<tr>
<td>24</td>
<td>Failure of the video switch IC201.</td>
</tr>
<tr>
<td>25</td>
<td>Failure of the tuner.</td>
</tr>
<tr>
<td>26</td>
<td>Failure of the NICAM decoder chip IC303.</td>
</tr>
<tr>
<td>27</td>
<td>Failure of the NICAM decoder chip IC303.</td>
</tr>
<tr>
<td>28</td>
<td>Failure of the NICAM decoder chip IC202.</td>
</tr>
<tr>
<td>29</td>
<td>Failure of the tuner.</td>
</tr>
<tr>
<td>30</td>
<td>More than one device hasn’t responded.</td>
</tr>
<tr>
<td>31</td>
<td>Failure of the video switch IC201.</td>
</tr>
<tr>
<td>32</td>
<td>Failure of the tuner.</td>
</tr>
<tr>
<td>33</td>
<td>Failure of the NICAM decoder chip IC303.</td>
</tr>
<tr>
<td>34</td>
<td>Failure of the tuner.</td>
</tr>
</tbody>
</table>
Set comes on then goes to standby with two flashes of the standby LED. Set works all right once D505 is disconnected: Zener diode D505 (MTZJ-T-77-3.6A) in the protection circuit is leaky.

Set comes on then goes to standby with two flashes of the standby LED, which still flashes when D505 has been removed: Replace the NVIM memory chip IC2.

Set does not go into standby fully – picture disappears but the line is still running: Check/replace Q602, Q603 and Q604 in the standby switching circuit, also reservoir capacitor C615. Then ensure that the HT is 135V. If not, replace the error detector chip IC602 (SE135N).

Set operates normally until standby is selected. It then pulses in and out of standby, with RY600 clicking each time: Check/replace Q601 (2SC3852A), D603 (6.8V zener diode) and R634 (2252) on the primary side of the power supply. R634 was not identified as such in Fig. 1 last month (page 350): it's the 22Q resistor between D604 and Q601.

Brief burst of EHT followed by no operation, with no error code: The excess-current protection system is in operation because the line output transformer T803 is faulty.

Set intermittently shuts down at switch on. Some arcing interference is visible on screen when the set does work: Replace the line output transformer T803.

Line tearing when hot (32in. models only): Replace the line driver transformer T804 with new type, part no. 1-437-195-14.

Incomplete degaussing: Replace relay RY600 with improved type, part no. 1-755-018-11.

Picture is partially blanked horizontally: Zener diode D817 (RD5.6ESB2) in the blanking circuit is leaky.

Over bright almost negative picture but without flyback lines: Set is in the ageing mode. Enter T107 in the service mode to clear.

Random channel change or volume bar appearing: Replace tactile switches S900/1/2 on board D.

No sound (headphones OK) with PS600/1 open-circuit: Replace the TDA7264 audio output chip IC1200.

Very distorted audio or loud crackling sound: The audio demodulator/processor chip IC202 (MSP3410) is faulty.

Set locks up or shuts down when hot: IC202 (MSP3410) is faulty. This fault can always be confirmed by heating IC202.

Complete loss of sync in the teletext mode: IC1001 faulty (models that incorporate IC1001).

Incomplete or scrambled OSD and menus, teletext OK: IC1001 faulty (models that incorporate IC1001).

Its readers will benefit from its wealth of easily assimilated information, and repairs hitherto thought impossible will speedily become routine. And the first may well cover its purchase price. Congratulations on a comprehensive, well-written and lucid work' Electronics Informer.

'Interesting, entertaining and useful for both practitioners and teachers. All round a satisfying book which deserves to be considered as a tool rather than an ornament collecting dust on the shelf.' Skillset Newsletter

Service engineers and technicians have come to regard this book as essential to their work. As a bench-side companion and guide it has no equal. Its purpose is to ease and speed up the processes of fault diagnosis, repair and testing of all classes of home audio equipment: receivers, amplifiers, recorders and playback machines. The mechanics and electronics of domestic audio are examined by Nick Beer in a down-to-earth and practical way, concentrating on what goes wrong, how to track down problems, and how to solve them.

A symptom index and comprehensive manufacturer and supplier guide allow quick access to specific advice and suggestions. The third edition is bang up to date with the latest technology - DVD, CD Recordable, PC audio systems. There is also new material on PA equipment.

UK Price: £32.00 Europe £34.00 ROW £64.50
Keith Cummins describes an alternative way of linking a digibox, a VCR and TV set(s) as required. It provides advantages where two or more TV sets are in use.

This article describes a rearrangement of the usual digibox, VCR and TV set interconnections. The advantage is that it enables the UHF outputs from both the digibox and VCR to be distributed simultaneously to another TV set (or sets if a distribution amplifier is used) in parallel with the analogue terrestrial TV signals.

**Conventional approach**

The usual arrangement is shown in Fig. 1, with the incoming terrestrial analogue TV signals daisy-chained through the digibox and VCR to the TV set in that order. The VCR is fed with the terrestrial channels plus the digibox's RF output, and in turn feeds the main TV set with the terrestrial channels plus both tape playback and digibox RF output signals. Scart connections may or may not be included, depending on the use of baseband PAL, digibox RGB, stereo sound etc.

**The alternative**

The rearrangement I have adopted is shown in Fig. 2. A Nicam VCR precedes the digibox in the UHF daisy-chain, and separate scart leads connect the digibox to the VCR and main Nicam TV set.

The scart connection between the VCR and the digibox makes recording of baseband PAL from the digibox possible despite the fact that the VCR and digibox are "the wrong way round" as far as UHF linking is concerned. The UHF output from the VCR is included with the other signals fed to the digibox, and as a result is present in parallel with them and the digibox's own UHF output for distribution to other receivers via the digibox's UHF2 socket. Note that additional receivers, even if Nicam capable, will be unable to produce stereo sound from the VCR or digibox as their UHF outputs carry only FM sound.

In my case the digibox's factory UHF output setting was ch. 68. The VCR's UHF playback output is on ch. 37. There's no Channel 5 terrestrial signal in my area – I receive it, courtesy of Sky, via the digibox. The main terrestrial channels are in group A (21, 24, 27 and 31). There's a local RSL station on ch. 54. So I was in luck and didn't have to retune either the VCR or digibox output.

To summarise, the scart link between the digibox and the VCR enables baseband PAL and stereo sound from the digibox via the aux facility to be recorded: for playback, baseband PAL and stereo sound from the VCR are fed to the digibox. The digibox's UHF2 output provides analogue UHF TV, including terrestrial UHF and UHF from the digibox and VCR (sound is mono FM only), for distribution to other TV set(s). The scart link between the digibox and main TV set feeds RGB video and stereo sound from the digibox, and baseband PAL plus stereo sound from the VCR, to the TV set. The analogue terrestrial TV signals are fed to the main receiver via the UHF link.
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<tr>
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</tr>
</thead>
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<tr>
<td>Address</td>
<td></td>
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<tr>
<td>Postcode</td>
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</tbody>
</table>

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- Input capacitance: 40pf + oscilloscope capacitance
- Working voltage: 600V DC or pk-pk AC

**Switch position 2**

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

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

To order your pair of probes, send the coupon together with £21.74 UK/Europe to Probe Offer, Electronics World Editorial, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Readers outside Europe, please add £2.50 to your order.
Philips introduced the Anubis series of colour TV sets in 1991. The chassis had been designed to drive tubes of size up to 21in., and was the successor to the G90AE and G90B chassis. A considerable number of these sets were sold, and they have proved to be extremely reliable. However they are now coming back in part exchange as customers upgrade to more modern widescreen sets. We have found that they are well worth reconditioning to sell as a second set or to those who just want a basic, cheap TV receiver. The tubes are almost always good and bright, the PCBs are hardly ever burnt or discoloured, and once a set has been renovated it can be installed and forgotten about. As with all Philips products, spares are readily available and the prices of major items such as the line output transformer are very reasonable. Philips Service is to be commended!

The circuitry is contained on a single PCB which is modular, i.e. the board is divided into specific areas each of which is dedicated to a particular circuit function. The microcontroller chip provides a menu system for automatic tuning and the brightness, contrast and colour settings. Menus can be called up from the front panel or via the remote control unit. The microcontroller chip also switches the set in and out of standby.

Power supply
The power supply forms the heart of the chassis and, along with the line output stage, is where most faults occur. So it’s a good idea to take a look at the operation of the power supply before considering the faults that can occur.

Fig. 1 shows the basic power supply circuit (much simplified), which is of the now familiar Philips SOPS (self-oscillating power supply) variety. It provides a 95V HT supply for the line output stage, a 9V supply for the audio output stage, and a 5V supply for the microcontroller chip when the set is in standby (when the set is fully on the microcontroller chip is powered by the line output stage derived +5B line). All other circuits are fed with a low-level voltage in standby so that they cannot operate.

The mains input is fed to bridge rectifier D6502-5 which charges its reservoir capacitor C2505 to about 290V. Chopper transformer T5525 and transistor Tr7525 are connected as a blocking oscillator, with feedback to the base of Tr7525 via winding 15-10 of the transformer. Block B controls the on/off switching of Tr7525. There’s regulation feedback from the secondary side of the circuit via optocoupler IC7514. Resistors R3514/18/20 provide pulses to start the circuit operation. Incidentally there’s nothing new about blocking oscillators: I remember valve versions in the timebases of TV sets in the Fifties and early Sixties!

When Tr7252 conducts, energy is stored in the transformer. This is released when Tr7252 is switched off. The rectifiers on the secondary side of the circuit then conduct.

The 95V HT supply is monitored by Tr7537, with zener diode D6537 providing a reference voltage at its emitter. Tr7537 drives the optocoupler via Tr7552/4.

Protection
Overvoltage protection is provided by the crowbar trip consisting of transistors Tr7556 and Tr7555. Zener diode D6555 monitors the line output stage derived +5B supply, while D6557/8/9 monitor the 95V supply. When Tr7555/6 latch on, the SOPS is switched off via IC7514.

Standby operation
Pin 19 of the microcontroller chip IC7600 controls the on/standby action by switching transistor Tr7571 on or off (for standby). When Tr7571 is switched off, thyristor Thy6570 is able to conduct. It charges C2560 to some 13V, which is fed to the regulation circuit via zener diode D6568. This reduces the on time of the chopper transistor, with the result that the output voltages are greatly reduced.

The 5V regulator transistor Tr7561 provides the supply to the...
microcontroller chip IC7600. When the set is switched on, IC7600's reset pin 33 has to be kept low for at least 1 msec. Zener diodes D6562/65 and transistor Tr7563 provide the reset action.

**Faults**  
Perhaps the most common fault is a dead set with the mains fuse blown. The first thing to check is the degaussing posistor PTC3501 which often arcs over inside. If the posistor is OK, check whether the chopper transistor Tr7525 is short-circuit. If it is, the optocoupler IC7514, transistors Tr7512/7515/ 7516/7555 and diodes D6522, D6523 and D6517 (some of these are not shown in the simplified circuit) should also be checked.

After a failure of this type it's advisable to fit the replacement components in the SOPS repair kit ES7021. Philips recommend this for continued reliability. The kit contains an optocoupler, four bridge rectifier diodes, a 2A mains fuse, transistors Tr7525, Tr7516, Tr7512 (BC848) and Tr7515 (BC858), and diodes D6522, D6523 and D6517 (BZV85-5V1).

All very well, but what do you do if the set still fails to power up? The answer is to check the thyristor Thy6570 (SFOR5D43) and the associated LL4148 diode D6569. These could be defective, holding the set in permanent standby. In this event the red standby LED should be illuminated, telling you that the primary side of the circuit is working with the +5A supply present.

Sometimes however the +5A supply goes haywire when the set is switched to standby. The symptoms are that the set doesn't switch off properly, with the picture flickering on and off. The cause is the 6.2V zener diode D6568. A kind of motor-boating sound from the loudspeaker, with the LED flickering, occurs when transistor Tr7553 (BC858A) is leaky. This transistor can also be responsible for a power supply 'hiccup' every so often, with the picture flickering each time the hiccup occurs.

A dead set does not necessarily mean a power supply fault of course. A fault in the line output stage will trip the power supply, with the set shutting down.

**The line timebase**  
Fig. 2 shows a simplified circuit of the line timebase, which is straightforward. IC7015 (TDA4504) is a multi-function chip that contains the IF section, the timebase generators and the sandcastle pulse.
generator. The squarewave output at pin 29 is passed to the line driver transistor Tr7440 (BF422) which is transformer-coupled to the output transistor Tr7445 (BUT11 AF). The output stage provides the line deflection current, various supplies from the secondary windings on the transformer, and the EHT, focus and first anode voltages.

The line output transformer T5445 can be a source of trouble in more ways than one. The internal insulation can break down with a short-circuit between the primary winding and chassis. This closes down the power supply. The same thing happens with a short-circuit between the primary and chassis connection within the transformer.

Another peculiar fault can occur when tuning a VCR’s UHF output: the set won’t lock to it – most frustrating! There’s a small modification that can be implemented to cure this. It ensures proper pull-in of the VCR channel. Connect a BZY79C-6V2 zener diode and a 1N4148 diode in series, anode to anode, between pins 14 and 21 of the TDA4504 chip IC7015, with the cathode of the zener diode to pin 21 and the cathode of the 1N4148 diode to pin 14.

**Copy-protected tapes**

While on the subject of connecting a VCR to these sets it’s worth mentioning the
problem of playing Disney tapes, which are copy protected. The results jump all over the place, because these sets don't like reproduction from copy-protected tapes. I discovered this when I sold a set to a friend for his daughter's bedroom. She was hooked on Disney videos! Extra pulses are added to the field sync with these tapes, the result being instability.

A number of modifications are required to cure this, because both the chroma and the sync circuits are affected. In the sync section, change C2350 to 47nF, C2351 to 4.7μF, R3350 to 75kΩ and R3351 to 1.5kΩ. There are several changes to the chroma circuit to prevent flicker. Add a 47nF capacitor between pin 12 of IC7250 (TDA4650) and chassis; change C2267 to 1nF; replace jumper wire 9268 with a 5.1kΩ resistor (Philips part no. 4822 116 52286); replace C2310 with a 10kΩ resistor; remove R3306 and fit a jumper wire in its place. This should, hopefully, resolve the problems. I say hopefully because in practice I could still detect a slight flickering of the picture.

**Hotel mode**

An acquaintance of mine works for the local council at the rubbish disposal skips. He brings me these sets for repair and resale, after which we split the profits between us. Recently he came through the door with a 21in. Anubis A set in his arms, plonked it on my bench and announced that it came on OK but with just a snowy screen, suggesting that perhaps the tuning system was at fault as it was impossible to call up the tuning menu. He was amazed when I pushed a few buttons, got the set to retune and told him that there was nothing wrong with the set: it had been locked in the hotel mode, a setting that prevents the user from fiddling with the tuning or adjusting the volume level – handy for hotel bedroom sets!

To deactivate this mode, select ch. 38 then press both 'select' on the front panel and 'sleeptimer' on the remote-control handset for four seconds, after which an H will be displayed at the front of the set. Switch the set off then back on again. This removes the H and cancels the hotel-mode setting, so that normal tuning and volume control once again operate. Note that the set can be returned to the hotel mode by repeating this procedure. Also note that non remote-control sets employ an earlier version of the microcontroller chip; with this the hotel mode can be set/reset at the front control panel – press 'select' while holding the search button in. Should you replace the microcontroller chip with a later version and find that the set is stuck in the hotel mode you will need to replace the ST24C02P EEPROM then retune all the programmes.

**Nursery set**

So, going back to where I started, a perfectly good TV set had been thrown out because someone couldn't unlock the hotel mode! There's a further tale to be told about this particular set which, after being cleaned up, was put on display in the shop for sale. A few days later her ladyship from a nearby stately home rushed in declaring that she urgently needed a television for the children's nursery – something second-hand would do. Her eyes fell on a nice little set that stood in the corner. It was the previously-mentioned Anubis. "Perfect" she declared then, once a deal had been struck, she said she would send the butler round to collect it. Later that day Jeeves drew up in a very stylish limousine and took the set. There we have it then, a perfect "rags to riches" tale, with a set from the local council skips now residing in a rather posh nursery! Anubis is the ancient Egyptian god of death, but here he is residing in a rather posh nursery!

A newsgagent can order any magazine for you, whether or not the shop normally stocks it.

If you buy your copies of Television from a newsgagent and want to make sure you get every issue, just ask at the counter.
Regular readers will probably be aware of 'smart-home technology', or 'home networking', an idea that the high-tech community has been advocating for many years. Technical developments to date have been quite basic, with most progress in the area of 'assistive technology'. The prospect of e-mail access to a refrigerator, sending a movie direct from a PC to a TV set some distance away, or engagement in multi-player video games using computers three floors apart has yet to be realised.

A major consideration is the transmission system. Hard-wired data cabling (RF technology) or the use of existing mains wiring both have their backers. Another approach is a composite system, which would enable installations to be customised. One such system is being promoted by the HomePlug Powerline Alliance.

The HomePlug Powerline Alliance
The Alliance's founder members – AMD, 3Com, Cisco Systems, Compaq, Conexant, Enikia, Intel, Panasonic, Texas Instruments, Motorola, S3's Diamond Multimedia and Tandy/Radio Shack – have recently been joined by Cogency Semiconductor Inc. The initiative has received public approval from Microsoft which, not surprisingly, supports industry efforts to bring about the digital home.

HomePlug Powerline Alliance Inc. is a non-profit corporation. It was established to provide a forum to help create global standards and technical specifications for home powerline working, also to propagate the demand for relevant products and services through sponsorship of market and user education programmes. Founded in March 2000, it has since grown rapidly. There are now over fifty member firms whose interests span hardware, software, semiconductors, consumer electronics, utility and retail operations.

Field trials on the technology were carried out last June in more than 500 homes worldwide. This led to the HomePlug 1.0 specification, which will enable products to be brought to the market during 2001.

Cogency's chip sets
Cogency Technology Inc., founded in 1997, specialises in chip sets for residential powerline networking. It subsequently merged with Power Trunk to form Cogency Semiconductor Inc. Cogency's design team came from the computer division of LSI Logic Corporation, which has a worldwide mandate for several core technologies including PCI, 1394 (FireWire), USB (the universal serial bus) and Pentium multi-processing chip sets. Power Trunk's main activities were in power networking: the company had developed a range of high-speed transmission products for its 'channel-adaptive technology'.

The new company has adopted a wide design brief, and is to use its skills in OFDM (orthogonal frequency-division multiplexing) to enter other developing markets including broadband wireless. Its overall experience has given it the ability to provide building blocks for use in semiconductor devices for in-home networking, home gateway and audio/video streaming via powerlines, also future wireless products.

Cogency engineers were the first in the home of the future is likely to be controlled and linked to the outside world by digital technology. There are various ways of going about this. Mark Paul describes the system being promoted by the HomePlug Powerline Alliance.
the world to demonstrate high-density, multicarrier transmission via power lines and make clear the benefits. The company claims that the use of channel-adaptive technology as an effective, high-quality transmission system enables fast powerline networking to be achieved in even the worst transmission conditions.

Cogency Semiconductor, based in Ottawa, aims to make the electronic home a reality.

Its products should enable people to create a network throughout their homes with no need for any extra infrastructure. Ron Glibery, Cogency’s Chief Executive, comments that “domestic users aren’t likely to want to pull professional cable through their walls at home, as in an office: the challenge is to find solutions that use the existing infrastructure, in particular by distributing digital signals via power lines”.

HMT technology
Cogency manufactures a channel-adaptive technology chip that enables digital data to be transmitted and received, at the high speeds required, via ordinary electrical sockets. Applications of the technology include shared broadband internet access between PCs and internet appliances and multidevice gaming – in addition to audio/video distribution within the home.

Video transmission is of course impossible at a 2,400 baud rate. Cogency’s claim is to have taken the transmission rate to megabyte speeds. Its harmonic multi-tone (HMT) technology uses a wider frequency band of multicarrier signals, which are processed dynamically at lower cost than any other similar technology. The system self-monitors the multicarrier transmission for real-time impairments, then adapts the signal dynamically without performance degradation.

The networked home
Much of the infrastructure to enable people to take full advantage of what the internet has to offer is already in place. Although fun gadgets – networkable TV sets, refrigerators, wheely bins etc. – are still on their way, the PCs are there. An increasing number of homes will soon have more than two PCs that can be networked together. It seems reasonable that the first step in the networked home will be to link PCs, printers, modems, DVD players, a home network server etc.

The primary use of the home network will perhaps be to link several PCs to a single high-speed internet connection.

What will the home network market involve? Some believe that consumers will take advantage of a world-wide network of interactive media and TV programming. The driving force is likely to be entertainment content. It’s a fact of life that consumers will pay a premium for this.

Consumer electronics companies such as Sony, Panasonic, Samsung and Thomson Multimedia are working overtime on the connection of their equipment to the internet. Many internet appliances are still only on the drawing board, but LG Electronics at any rate has come up with the internet refrigerator, which gives the user access to the internet through a flat-screen monitor built into its door. There is more to come!

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**How to order**

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**Closed circuit television**

Closed Circuit Television (CCTV) surveillance is one of the fastest growing areas in the security industry. This book is an essential guide for all security professionals and CCTV installers. However, unlike most existing books on CCTV, this is not just a discussion of security issues, but a thorough guide to the technical side – installation, maintenance, video recording, cameras and monitors, etc.

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Contents: The CCTV industry; Video signal transmission; Light and lenses; Television fundamentals; The camera; Monitors; Video recording; Switchers; Telemetry; Motion detection; Commissioning and maintenance.

Post your order to:- Jackie Lowe, Room 514, Quadrant House, The Quadrant, Sutton, Surrey, SM2 5AS

Or Fax 020 8652 8111
What seems to happen is this:

The receiver scans each UHF channel in turn, from ch. E21 to ch. E68, looking for digital multiplexes (muxes). When it finds a mux it looks for the digital channels within, notes the programme number assigned to each one, and stores it in the receiver's memory. If there is no specific programme number for a channel it's stored as a channel number (numbered 1, 2, A, B, C and D) is found, the new channels are stored correctly. The first time a given mux is encountered its channels are stored as described above. Channels from a different mux, previously stored in the receiver's memory, are moved to the next available position. The new channels are stored correctly.

The receiver when signals are available from two or more transmitters as “haphazard”. Digital terrestrial TV contains an identical mux on a higher channel number and e-mail address (if any). Your address and telephone number will not be published unless requested, 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.

Digital terrestrial TV

In his article on digital terrestrial TV reception in the April issue Bill Wright describes channel storage by a DTTV receiver when signals are available from two or more transmitters as “haphazard”. What seems to happen is this:

The receiver scans each UHF channel in turn, from ch. E21 to ch. E68, looking for digital multiplexes (muxes). When it finds a mux it looks for the digital channels within, notes the programme number assigned to each one, and stores it in the receiver's memory. If there is no specific programme number for a channel it's stored as a channel number (numbered 1, 2, A, B, C and D) is found, the new channels are stored correctly. The first time a given mux is encountered its channels are stored as described above. Channels from a different mux, previously stored in the receiver's memory, are moved to the next available position. The new channels are stored correctly.

The second time a given mux (numbered 1, 2, A, B, C and D) is found, the receiver checks to see if the service is present in which mux, it's possible to work out how the channels will be stored. The problems occur when a weak signal contains an identical mux on a higher channel than a strong one, because the strong transmitter's channels will be overwritten.

Bill also mentions cutting the wire to pin 8 of the scart to disable auto-switching with an STB. This is rarely necessary, as the TV/DTV button on the digital remote-control unit sets pin 8 (input switching), pin 16 (RGB switching) and the RGB video pins 15, 11 and 7 to 0V, which should make most TV sets revert to the previously selected analogue channel and then operate normally. An STB with up-to-date software comes on in the DTV mode when started manually and in the TV mode when the timer is reset.

In his DX-TV column Roger Bunney mentions a thirty-pound 'Mac'-style VHF/UHF portable monochrome receiver. I bought one at the end of last year with a view to dabbling once more in VHF DX-TVing. The set certainly looks promising, as it comes complete with a circuit diagram. In the UK version the three-position I/M/UHF switch has the left and centre positions wired together and the dial has only two scales, showing channels 21-69 UHF and 4-13 VHF.

Having rewired the switch in accordance with the circuit diagram I have yet to find any Band I signals, though utility stations are evident in Band III. The receiver is not as usable as I had hoped for UHF reception, as the drive cord system suffers from very bad 'stiction' that makes tuning rather hit-and-miss. I'm sure that the keen experimenter will find a solution to this problem.

Alan Pemberton, Sheffield.

Ni-Cad battery charging

I read Ian Field's article on Ni-Cad battery charging (March issue) with interest - it's a subject that we here at Micomicon know more than a little about and may be able to shed some light on the question of NiMH versus Ni-Cad batteries and the 'memory effect' referred to.

Two effects associated with Ni-Cad batteries have become confused in people's minds. Only one of them is anything to do with memory. It was first noticed by NASA. An orbital satellite's batteries were being charged when it was in sunlight, and drained when they were used to power the satellite while in darkness. This happened at precisely the same time each day, the charge lasting for exactly the same number of minutes and the discharge occurring at precisely the same current and lasting, again, for exactly the same number of minutes. After many days of this partial charge/discharge cycle, NASA noticed that the batteries wouldn't deliver power beyond the point at which they had been previously discharged - in other words the batteries had 'memorised' the point of partial discharge, and refused to operate after this point had been reached.

This is the true 'memory effect', and is the source of the myth that Ni-Cad batteries should always be completely discharged before being recharged. It almost never occurs. You wouldn't need to use your laptop for say one hour, 16 minutes and 30 seconds every day and charge overnight repeatedly for a couple of weeks before the effect would appear. This is obviously not going to happen in normal use.

The effect usually referred to as 'memory' is in fact a voltage drop. It has nothing to do with reduced capacity and does not occur as a result of partial charge/recharge cycles. The cause of the problem is a secondary alloy of nickel that's created when a fully-charged battery stays on a trickle charger for some length of time. A normal Ni-Cad cell has a nominal voltage of 1.2V, while the secondary alloy has a lower nominal voltage of about 1.08V. Thus a ten-cell battery (nominal 12V) that suffers from this problem could be thought of as a dual battery, with one part providing 12V and the other 10.8V.

In use, power will always be drawn from the higher-voltage section first. Your laptop will operate normally until the 12V section of the battery is exhausted and power starts to be drawn from the lower, 10.8V section. Most laptops won't function at this lower voltage. The battery will be considered to be suffering from loss of capacity and returned to the charger.
Monitor scan rates

Geoff Butcher's fault report on an IBM 07-593 monitor (February, page 246) had me thinking when he commented that his substitute line output transistor worked "well within its limits, even at the highest scan rates". The notion that a line output transistor is under the greatest stress in the highest-resolution modes is worth consideration.

First, one has to remember how the scan-current waveform is produced. When the output transistor switches on it produces a linearly rising ramp current in the inductive load. This occurs during the second half of the scan, when the beam is deflected from the centre to the right-hand side of the screen. But in addition the energy stored in the transformer must be sufficient for the efficiency of the diode to be able to provide scan current during the first half of the following line.

Lower scanning rates keep the transistor on for longer, with the possibility that the peak collector current might rise to a higher level than with the faster scan rates. In most circumstances the B+ regulator will be set to provide, automatically, a safe supply rail voltage for the mode in use. But modes are often grouped to economise on settings/EEPROM size. This involves the compromise in how closely the B+ control matches the line output transistor's forward conduction time.

Ian Field,
Letchworth, Herts.

Qualifications and registration

Having read all the letters published so far on the registration of engineers I would like to mention the registration certificate issued to me in 1952 for TV (see photo above right). I had previously received sections A and B. This certificate ensured that my wages would be at least the current rate for a qualified engineer with television experience, and was issued by the RTRA (now RETRA).

I continue to work (see Monitor fault reports March) and would be interested to know if anyone else still has one of these Radio Service Trade certificates?

E.T. Evans,
Fleet, Hants.

Further to Jason Boylin's letter on qualifications and registration (March), I have worked in the TV trade for over 45 years with no formal qualifications other than the amateur radio exam, and as far as I know have not electrocuted anyone or burnt their house down. If this makes me a cowboy, so be it. Because of the rapid progress of technology, qualifications mean very little after a year or two. I could probably draw you the circuit diagram of an early Fifties TV set from memory, but this doesn't help much when you are battling with one of today's microcomputer-controlled monstrosities.

I wonder whether having qualifications actually makes you a better engineer? The days when hubby would put the family set on the kitchen table to look for the valve that didn't light up are long gone. Anyone who repairs modern TV sets has to have a fairly good knowledge of basic electronics and certain skills, especially when you consider the fragile nature of today's equipment. I have read criticism in these pages of those who cream off the easy jobs. Which easy jobs? Even the replacement of a line output or chopper transistor calls for a degree of skill, and unless the underlying cause of the fault has been found the job will soon be back again. How long would someone who refused to carry out a further repair last in the business?

Repairs required because of signal processing or microcontroller faults are often uneconomic because of the time needed or the cost of ICs. In this neck of the woods most people are not prepared to spend more than £30-40 on a repair, unless it involves a large-screen set – and I'm getting to the age when I have difficulty reaching these.

Strangely, work has improved dramatically this year. At present I have about fifteen sets in the workshop. This time last year I was looking for a job. I think the upturn is largely because of the number of local firms that have ceased to trade over the past year. This is born out by the fact that since I changed my longstanding advertisement in the local paper from "second-hand sets for sale" to "TV repairs" quite a few people have told me that they can't find anyone to do repairs. I think the way forward for me anyway, is the course that Bruce Adams has taken, i.e. vintage radio repairs. I already get a few, but have not been able to command the price he does. At least I understand them however!

Peter Nutkins,
Charmouth, Dorset.

Cost of digital TV

I have no real objection to digital TV, though I think analogue transmissions
provide better definition. But the haste to
dump analogue by 2006 is irresponsible. I
have customers who are frightened that
their screens will suddenly go blank. Some
cannot afford to buy a new TV set, let alone
pay for programmes. For a fair and smooth
transfer, like 405-625, analogue TV should
not be shut down before 2015, if at all.
Half the people do not want or cannot
afford pay-TV, myself included. They need
to be able to buy a digital TV set, take it
home and use it. None of this conditional
access and control by broadcasters
nonsense. I was amused when I read that
the government minister involved went
shopping for a free-to-air digital TV and
couldn’t find one. No surprises there. The
latest crazy idea is to give everyone a free
STB. What, only one?! As most
households will need at least four, this is
not a very good idea.

As for widescreen TV, you can keep it.
Everyone’s picture has to be stretched,
squashed and have gaps, including
widescreen, to accommodate it. The 4:3
aspect ratio has better geometry and viewing
comfort. Widescreen TV is like watching a
tennis match through a letterbox.

John Langley,
Burton Latimer, Northants.

Audio faults
The fault report on a Peavey UMA150T
amplifier with a failed negative supply
reservoir capacitor (March, page 309)
reminded me of a similar problem I had
with an A&R Cambridge SA200 hi-fi
power amplifier that dated from the early
Eighties. The reservoir capacitors in this
particular unit have two extra ‘dummy’
tags to provide additional mechanical
support on the PCB. But because of a
misunderstanding these tags were
connected to chassis instead of being
commoned to chassis instead of being
contacted to ‘floating’ pads as they should
have been. The remedy was to cut off the
dummy tags. I’m not familiar with the
Peavey amplifier, but it may be worth
checking whether this is the case. These
extra tags are presumably in contact with
the electrolyte inside.

On the subject of the Quad 303 power
amplifier (February, page 245), in later
production the reservoir and output
capacitors were mounted with their
connection tags uppermost to help alleviate
the leakage problem. Quad used to supply a
small extension loom to enable older 303s
to be modified when these capacitors had
to be replaced, but it would be easy to make
your own.
The Quad 303 used some very obscure
transistors in the driver and output stages.
Quad have supplied alternatives for the
pre-driver and output transistors as they became
obsolete, but the 38495/38496 driver
transistors remain a mystery. If anyone
knows of alternatives for these transistors,
which have proved to be reliable, I’m sure
this information would be of interest — not
just to myself.

On a different subject, TV sets that catch
fire (February), note that the mains rectifier’s
reservoir capacitor is usually connected
across the rectified mains input when the set
is in standby. This increases the likelihood
that the capacitor will leak electrolyte,
forming stray conductive paths on the PCB.
It’s clearly another possible fire hazard.

Another point to note is that the PCB
(always SRBP rather than fibreglass, for
cheapness) in the power supply area often
looks badly charred after a few years’ use.
One wonders how badly charred the PCB
could be before it starts to become
conductive.
The degaussing thermistor also usually
remains connected to the mains supply. It
can blow up without warning. Incidentally,
plug-in air fresheners are normally heated
with a PTC thermistor that’s connected
cross the mains supply. I once pulled one
apart and was surprised to find that it
wasn’t fused! Are there any known cases of
the positor in these units shorting?

No mention has been made of VCRs
and satellite receivers. Nowadays these
nearly all have a switch-mode power
supply and remain in standby to keep the
clock running etc. They are often housed in
badly-ventilated TV/video cabinets, which
adds to the problem. Modern ‘mid-engine
VCRs’ are usually assembled on a single
PCB, with the deck mechanism screwed
down on top and no access to the tracks
underneath. Dry-joints in the power supply
would go unnoticed, unless they were
actually producing on-screen symptoms.
I hope that these points provide food for
thought, and don’t prove too alarming!
Simon Pearson,
Chipping Norton, Oxon.

In the December issue audio faults page
Russell Fletcher mentioned Peavey Black
Widow drivers and their replacement
baskets. I’ve come across several of these
and other pro. speakers where the driver
has stopped working and a quick meter
check at the speaker terminals suggests
that the coil is open-circuit. But a double
check with the meter at the coil end of the
flexible connecting wires proves
otherwise. In this event replace the
connecting wires with some desoldering or
other very flexible braid and the speaker
will have a new lease of life. Don’t
demand the speaker until you have
checked this out.

John Beer, J.B. Electronics,
Tiverton, Devon.

How to survive
I’ve been in and around the TV trade since
leaving school way back in 1958 – you
know, valves and all that! I don’t want to
be a security guard or work in a hotel
(current local job options), so I’ve got to

squeez e a few more years out of the TV
trade until I can retire (yippee!). With
this in mind I’ve had a lot of problems that
have caused the downfall of
local shops with repair facilities (apart
from unrealistic borrowing based on
excessive optimism, and trying to compete
with the nationals on selling new goods)
and have come up with the following.

The firms I’m thinking of have all taken
on too much work. I know that sounds
daft, but the most common complaint I hear
from customers are: so and so had my set
for weeks, kept fobbing me off with excuses,
waiting for parts, promised to phone me
back and didn’t, never called when he said
he would, rude, etc. Sounds familiar? A
customer will then go on to complain about
all and sundry.

So, if you are a one man and his dog
outfit like me, I suggest the following
policy. I work on a free estimate and a no
charge, no fee basis. I find that if I haven’t
sussed out cause of a fault within half an
hour I probably never will, so I return the
set to the customer promptly with sincere
apologies that on this occasion I’ve been
unable to help. I’m still the good guy, for
telling them the way it is. Most customers
are happy that you’ve tried, and will
normally buy a second-hand set from you
rather than spend hours that you can’t
afford or on back order, forget it – it
will only lead to grief. You don’t want
your workshop piled high with sets you’ll
never repair or waiting for parts you’ll
never get. Far better to lose half an hour
now than spend hours that you can’t
afford, and your reputation won’t be
wrecked. As for videos, I don’t have the
leads and jigs needed to work on the newer
stuff, so forget ‘em. The cost of repairs is
likely to exceed the cost of a new machine.

All right, you won’t make a fortune in
this way, but you’ll definitely avoid an
awful lot of aggravation, and it isn’t the
end of the world to turn away work you
don’t want.

The photo above was provided by a
customer to show me what the intermittent
fault on his Matsui portable looked like
when it was present. Now that’s what I
call helpful!

Mike Hayward,
Falmouth, Cornwall.
Audio Faults

Reports from
Mike Leach
Pete Roberts
Paul Sargent, LCGI and Andre Nel

We welcome fault reports from readers – payment for each fault is made shortly after publication. See page 426 for details of where and how to send reports.

Sony HCD-H650M midi system
This model uses a standard KSS-240A laser assembly which, as we all know, is prone to failure. Recently I’ve had several cases where a new laser assembly failed to cure the skipping and jumping symptoms – usually the machine wouldn’t read discs. The problem can be caused by an intermittent laser ribbon cable. If a new cable fails to cure the fault, try replacing the three 47µF, 4V surface-mounted electrolytic capacitors C105/6/7 on the CD board. The smell when you desolder them will usually indicate whether they are the cause of the trouble. M.L.

Arcam Alpha 6 CD player
A loud humming noise came from within the metal cabinet – the audio relay was vibrating very fast. If you get this symptom, try replacing C416 (470µF, 25V). It’s mounted close to the mains input plug. The chances are that this capacitor will be the sole cause of the problem. M.L.

Sony HCD-MDS
The MiniDisc unit wouldn’t eject a disc. Once the machine had been stripped down it was easy to eject the disc by manually winding the belt on the MiniDisc assembly. The mechanism would then load another disc, but wouldn’t eject it.

The cause of the trouble was the BA6287F loading drive chip IC431. It’s an eight-leg surface-mounted device which is on the digital board. The Sony part no. is 8-759-040-83.

I’ve had one case where there was an irreparable burn-up on the board when this IC had failed. So it’s worth checking the condition of this area of the PCB whenever one of these machines comes in, whatever the fault. M.L.

Roberts R700 transistor radio
This old-timer was an original from 1968, not the current replica. It’s an unusual design, with completely separate tuners and IF strips for AM and FM reception, with only the audio stages common. Germanium transistors are used throughout. The faults were first no FM reception then loss of AM reception. The cause of the AM fault was traced to a shorted decoupling capacitor that removed the power to the Mullard mixer/oscillator/IF module.

The cause of the FM problem took rather longer to sort out. These sets use Mullard AF11x series diffused-alloy transistors, which are known to suffer from two failure modes: a collector-to-case short and a shorted base-emitter junction. Someone had been melting solder on top of the IF amplifier transistors – remember, these are germanium devices! As a result two of them had failed, also the mixer/oscillator transistor in the tuner head. Fortunately the tuner’s special RF amplifier had survived, as an AF115 won’t work in that position.

After fitting three new transistors from my small stock of these vintage devices all that was necessary was to repair a print break that prevented the bass control working. P.R.

Sony TA-VE150 integrated AV amplifier
Several of these amplifiers have come into the workshop. They all seem to suffer from similar problems. The usual reported symptom is one channel intermittent. It could be the rear or front speakers or even both. The customer may complain that one channel is permanently off, the other intermittent. I’ve found that the cause is nearly always dry-joints at the output ICs and regulators.

The main PCB comes out very easily. Check for dry-joints at IC751, IC701, IC651, IC501 and IC501. Also check plugs CNS800 and CNS801, and regulators IC801 and IC802.

I’ve had to replace an output IC and a switching relay only once. M.L.

Sony HCD-RX80
There was a background hum on one channel, and ‘notchy’ operation of the volume control, with this 3-CD, twin-cassette midi system. IC201, which is labelled “EQ/VOLUME”, seemed a likely candidate. As it’s a large flat-pack surface-mounted IC all other possibilities were checked before I ordered and fitted a replacement. I breathed a sigh of relief when it cured the problem. It’s also expensive! P.S.

Sanyo DC-F380KR
The complaint with this midi hi-fi unit was no record or playback via the right-hand tape deck. All other functions worked normally. I noticed that each deck had two solenoids, and that the left-hand solenoid on the faulty deck didn’t seem to move at all. When I followed the wiring back I came to Q3132 (2SA952) on the front PCB – next to the fluorescent display unit. Although it measured good both in and out of circuit, a replacement restored normal record and playback operation. Strangely, the new and the old transistors both produced a gain reading of 372 when checked with my Peak component analyser!
Round the world yachtsgirl Ellen MacArthur beats up channel, approaching the end of the Vendee Globe Race. Reception via Intelsat 801 at 31.5°E.


Roger Bunney reports

There was no F2-layer reception at all during February, with the maximum usable frequency rising to only 41.5MHz (on the 22nd). Conditions had been excellent during the previous two months. Tropospheric conditions were more interesting however, with a couple of periods that produced enhanced reception. The settled weather conditions around the 14/15th produced signals from the east and south east. Dave Philpot in Looe, Cornwall noted UHF TV and FM radio from the Benelux countries, including RTL (Luxembourg), and NE France. There was excellent UHF TV from France here in south Hampshire. Cyril Willis (King's Lynn) received signals from Germany, the Benelux countries and Norway (NRK chs E5, 9 and 10), also the old favourite RTL ch. E7. In the Netherlands Ryn Muntjewerff received twenty five SVT-2 (Sweden) UHF stations including regional programming from Pajala ch. E34. There was a further spell of tropospheric enhancement on the 18th, with signals from the south and SE, but conditions were not as intense as a few days earlier.

Some Sporadic E reception was logged during the period, but very little. Peter Schubert (Rainham, Essex) noted unidentified programming in ch. E4 (the Netherlands) carries Arabic programming which includes Arabic script. So beware: that exotic ch. E4 signal might come from a lot closer than the Middle East!

Back-tracking to January, Cyril Willis noted good meteor shower activity on the 3rd and 15th, from the Quadrantids shower. Cyril has just come out of hospital after an operation: he has our best wishes for a speedy recovery.

Very occasionally Equatorial Guinea ch. E2 is received in Europe. For a closer look at typical pictures from this TV service check the web site of radio amateur 3CS1, at www.qsl.net/kb2wf

Satellite sightings

I had a change of dish during the month. My 1.2m prime-focus dish was removed from its concreted-in post on the 14th (incidentally we were Sky digitised that day!) and on the 15th a new Channel Master offset dish was installed. Greg Wood (Winchester) aligned the tracking from 43°W through 1°W to 42°E. A spectrum analyser makes the job easy: with the lack of analogue signals nowadays any other approach would be almost impossible. Locating the orbital slots with the new actuator arm that has reed-pulse operation (the previous dish had an H-to-H mount with optical-pulse operation) has taken ages. At the time of writing I've found most of the satellites. The new Gardiner LNB had low gain, so I refitted the old 10GHz unit.

Regular readers may recall the problems I had when I first moved to the present house and erected my two dishes. A neighbour complained, and the local planning enforcement officer appeared. I subsequently gained retrospective permission for the 1.2m dish. It seems that the same neighbour, looking at the new dish from a bedroom window, has once again complained. As a result the planning enforcement officer has reappeared, quoting chapter, text and verse regarding the nearby 1.5m dish, the number of dishes about the premises, DTT/DOE regulations and so on. The moral is, either pick your neighbours or don't live within the Test Valley council area!

During the period that I was off-air, UK/US planes bombed targets in Iraq. Nick (Sutton) checked the APTN feed via Hot Bird (12.581GHz H, SR 5632, FEC 3/4)
and found that Iraqi TV was being relayed in both PAL and NTSC. President Sadam was of course featured, with military footage of tanks, marching troops, jets, missiles and so on.

An event that touched many around the world was the return of the lone yachtswoman Ellen MacArthur, who had sailed around the world in the Vendee Globe Race. There was extensive coverage via several Intelsat 801 (31.5°W) downlinks on February 18-19, and at least three downlinks on the 11th as Ellen arrived in France. SNG-26 TES-26 UKI 358 was at 10.974GHz V, the same ident with a completely different camera shot was present at 10.988GHz V; while a French feed with the ident CANAL240F2 was present at 11.024GHz V. These links all used SR 5632 and FEC 3/4.

There was action in space on the 10th as another Shuttle flight ferried more sections to bolt on to the International Space Station. The video downlink was carried by the Reuters NSS K (21.5°W) lease at 11.462GHz V. There were truly excellent pictures plus output from the “Korolen Space Centre, Houston”. At one point the Reuters transmission cut to a Russian control room that was apparently also involved with the mission.

The same lease carried crisp pictures from Camp David, Maryland on February 24th when Tony Blair met President Bush – the signals arrived from “WH Pool Camp David”, i.e. White House pooled video feeds.

Programming from Djibouti is now available via Arabsat 2A/3A (26°E) at 11-075GHz H (SR 27500, FEC 3/4). It’s in a Lebanese digital multiplex that also carries Zen TV, Al Manar, NOS-NTV and about seven test channels with colour bars.

Dave found a “big fat BT carrier at 11.47GHz H (SR 26463, FEC 3/4) with five-six channels including DD World, Test card, BT’s promo etc.” This was from PAS-9 at 58°W. For up-to-date information on satellites worldwide Dave recommends the website www.lyngsat.com.

Scanner enthusiasts should check 269.74MHz narrow FM via the US Fleetsatcom bird at 15°W (where Hugh Cocks (Portugal) has found Colombian Spanish radio programming). It can be received in the Algarve using an indoor aerial, but in the damp and freezing UK I have to use a high disccone aerial with CT100 coax feeder. The signal is stronger in the evening.

Roy Carman (Dorking) watched an unusual sports event recently relayed to TV channel CT2 in the Czech Republic via Eutelsat II F4 (28.5°E) at 11.554GHz H (27500, 3/4). Scramble bikes fitted with spiked tyres raced on snow while towing a skier.

The crew that will fly to and spend a year at the International Space Station were presented at a press conference held at the Johnson Space Centre at 1830 GMT on February 27th. This was broadcast live via NSS K at 11.590GHz V (5632, 3/4).

Finally, a quick round-up of some snippets. The Racing Channel has been testing via Hot Bird 13°E at 11.623GHz V (27500, 3/4) as an FTA signal. News feed signals have been seen via West Express 3A (11°W) at 12.669GHz H (6111, 3/4). Spanish-language enthusiasts might like to tune to the PTA Canal 47 Sevilla via Hispasat 3°W (28120, 5/6). Although Arabsat at 26°E is the recognised hot spot for Arabic programming, there are also many downlinks via Nilesat 101 and 102 at 7°W – Syrian programming has now arrived here at 11.823GHz V (27500, 3/4).

**Digital DX prospects**

Radio and TV transmissions are both steadily becoming digital – the ITU has just given the OK for the Medium Wave radio band to be used for digital sound broadcasting! What are the prospects for DX reception of digital signals?

Experience with digital satellite reception has been successful but frustrating. The lack of any digital signal presence via an analogue TV receiver doesn’t help, as it means either an analogue scan to check for likely frequency stops during a digital auto-search or the use of a digital receiver to scan and memorise all the signals found. This is time consuming and hardly what I’d call DXing! But the experience gained is helpful when it comes to terrestrial digital reception.

Analogue TV transmission allows weak signal capture: the

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Analogue TV transmission allows weak signal capture: the
Start of a news feed from Honolulu via NSS K after a US sub sank a Japanese fishing boat.

Screen displays noise plus the weak signal, which can be enhanced by bandwidth reduction (or threshold extension with a satellite transmission). With a digital transmission there's an excellent, noise-free picture - or nothing! We therefore require a strong digital signal input level. This is the limiting factor with weak or fading tropospheric signals. If we ever get DTT (digital terrestrial TV) in Band I in Europe, how will Sporadic E (a digital signal?) have been the first reports on digital terrestrial TV? During the past few weeks there have been the first reports on digital terrestrial DX reception. An article by Henry Ruh, entitled "Digital DX, it can be done", appeared in CQ-TV (the British Amateur Television Club bulletin) no. 192. Henry works at a ch. A45 station in Chicago, and has been compiling a report on UHF-TV reception in that area, both analogue and digital. He has achieved some remarkable results using a Wineguard combined UHF/VHF aerial with rotor at 25ft above ground level. Henry lives 45 miles from the Sears Tower, Chicago, and is able to receive DTT signals from Milwaukee, Indianapolis, Lafayette, Fort Wayne and Madison amongst other sources. He mentions the "lake inversion effect" that helps with reception from Milwaukee. WMVT-10 Milwaukee (analogue) transmits DTT on ch. A8 (DTV-8), a low-powered station. The signal suffers from co-channel interference and fading, the latter because of water-path inversion and rain. Fading causes picture blocking and audio click dropouts. WRTV-6 Indianapolis transmits parallel DTT on ch. A25, which is well received at about 150 miles. It's interesting that during flat conditions analogue reception from Indianapolis is only PI-2 while the digital reception is excellent (NTSC unwatchable, DTT OK). The DTT pictures are either perfect or missing: there's about a 1dB signal range that leads to picture break-up, blocking and broken sound.

Digital TV transmitters in the UK run at relatively low ERPs, say 10kW, compared to their co-located analogue brothers which can run at up to 500kW ERP. Henry's company has a 500kW ERP UHF DTT transmitter atop the Sears building. It's the most powerful DTT station in Chicago. Other DTT transmitters atop the Sears building include WFLD ch. A31 at 200kW, WCPIX ch. A43 at 100kW and WSNS ch. A45 at 467kW. They are due to be joined by NBC ch. A29, ABC ch. A52 and WGN ch. A19, which at the time when Henry's article was being prepared were on test. He gives thumbs up to DTT DX potential at distances of say 200 miles, with UHF probably providing better results than Band III.

The top end of Band III, which includes DAB, is covered by Sky News. In the February/March issue there's a report from Danish DXer Stig Hartvig Neilson. Using a three-element aerial, he regularly listens to the output from the DR ch. 12C (227.36MHz) DAB transmitter at Holstebro, Western Jutland at a distance of about 80km, and the Oslo Region Osterlandet DAB transmitter, which also uses ch. 12C and runs at 12kW, at a distance of some 400km. Swedish DAB from Gothenburg on ch. 12A, a distance of 200km, is audible. Signal fading sounds like "a gargling effect, as if the audio is being chopped into very small pieces yet fully readable". Stig concludes that digital DX is possible.

While I was compiling this summary I received a suggestion to check out the following internet site:
http://pages.cithome.net/fmfx/dvtt2.html

It includes several pages of clear pictures of US DTT DX taken by Jeff Kadett (MaComb, Illinois). Reception is from several UHF stations, the farthest being WCYB-DT ch. A28 Bristol TN at 538 miles and WDIV-DT ch. A45 Detroit at 416 miles. Jeff uses a 7ft diameter Channel Master UHF dish at 85ft above ground level with head amplifier and very low-loss coaxial cable: the receiver is a PC fitted with a Beta version Hauppauge Win2k NTSC-DTV card. He's a member of the DX group WFTDA - the Worldwide TV and FM DX Association - which was founded in the late Fifties.

All this suggests that DTT-DX is possible, certainly during a tropospheric lift. The signal level needs to be much higher than with an analogue transmission, the threshold margin between lock (good quality) and nothing being very small. Perhaps, in time, fringe DTT equipment will be developed.

My thanks to Ian Pawson of the BATC, Skywaves and the Jeff Kadett web site for permission to quote the details above.

Broadcast news

UK: The ITC has confirmed that more of the UHF spectrum is to be released for digital transmissions. The extra bandwidth is equivalent to some fifty per cent of ONdigital's current allocation. The DTT has yet to decide whether it will be sold off to the highest bidder or allocated to an existing DTT operator.

The Isle of Wight RSL TV station on ch. A28 Bristol TN (ch. 54 H, Rowbridge), which is to open a new channel in Chichester this summer, has acquired majority ownership of the RSL licences for the Swansea and Cardiff areas. It hopes to take on other RSL franchises. There is an extensive website that's worth a look.

Russia: DTT transmission tests are expected to start this summer, using the DVB-T standard. They will be conducted in Moscow, Nizhny Novgorod and St Petersburg initially.

Digital radio: The ITU (International Telecommunications Union) has adopted the digital broadcasting standard DRM, used for several years by Digital Radio Mondiale, for the Medium Wave AM band. Digi-AM will provide improved reception quality but will not include the data provided with Band III DAB. A finalised standard will be issued at the end of the year, with test transmissions starting in 2002 and an official launch during 2003.

The D100 DX-TV converter

The HS Publications D100 tuner unit has for some years been a popular means of achieving DX-TV reception in conjunction with a standard TV set. Previous models have featured switched IF selectivi-
ty (wide, medium and narrow), full VHF/UHF coverage, a remote voltage for variable notch filtering in Band I, variable independent sound carrier tuning with a TV audio output in Band II (FM), and separate RF and IF gain controls.

The company is to produce a new batch of DIOOs that will tune between 45MHz and 230MHz at VHF, including bandspread, but with the UHF coverage extending only to the middle of group B. As the D100 is mainly used for VHF DXing, HS Publications has opted to restrict the UHF coverage - though this tunes down to the 435MHz amateur TV band. The new version of the D100 costs about £150. For further details apply to HS Publications, 7 Epping Close, Derby DE22 4HR (please include an SAE) or phone 01332 381 699.

Satellite news

By the time that this is read Europe*star should be downlinking Sri Lankan TV to Europe via the Electroteks telecoms uplink station at Colombo. Check the Europe*star-1 slot at 45°E.

The Dutch digital multiplex Canal Digitaal is to include a pay per view service starting this summer. It will offer first-run movies prior to their release for the subscription TV channels Canal+1 and Canal+2. Receivers fitted with Mediasat decoding and Canal+ software will be required.

APTV Satellite Holdings (Hong Kong) and Great Wall Industry (China) have signed an agreement to launch Apstar-5 in early 2003. It will replace Apstar-1 at 138°E. The satellite will carry 38 C-band and 16 Ku-band transponders – fifteen C-band transponders have already been leased by Singapore Telecomms. Great Wall is also to launch the new Intelsat APR-3 in early 2002. This all Ku-band satellite will slot in at 85°E. Chinese operator Sinosat has taken a lifetime lease on six transponders. Sinosat has also leased several C-band transponders aboard an Intelsat craft to be launched in 2003 to orbit at 178°E.

According to the February issue of the NZ trade magazine SatFACTS there's a major problem with the supply of intermediate-size dishes in Europe. Factories are making dishes in sizes up to 1m, larger ones not being required with the signal levels provided by most satellites. Professional users tend to use dishes with diameters of 2m or more. As a result 1.2, 1.5 and 1.8m dishes are becoming rare. Channel Master (UK) still sells a 1.2m offset dish however.

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FINDING

Reports from
Michael Dranfield
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Glyn Dickinson
Chris Watton
Michael Maurice and
Jason Boylin

We welcome fault reports from readers – payment for each fault is made shortly after publication. See page 426 for details of where and how to send reports.

Tatung T20TD50 (D chassis)
When teletext was selected the picture remained in the background. The set was not in the mix mode however, as the background colours changed when mix was selected. Pin 19 of the SAA5244P text chip should be low in the picture mode, high for text. This was OK, but the change wasn't being passed on to pin 5 of IC302 because Schottky diode D304 (BAT85) was open-circuit. M.D.

Grundig CUC7350 chassis
The dealer who brought this set along described the fault as a “twitching picture”. On test I noticed that the width varied with picture content. When I checked HT supply the voltage varied between 119V at high-brightness white and 129V at black level. The cause was eventually traced to R60027 (0.5652), which is part of the current-sensing network in series with the chopper FET's source connection. R60028, in parallel with R60027, could also cause the problem. In 14in versions of the chassis these resistors are 0.68Ω. Note also that the correct HT setting depends on the type of tube, varying between 124-130V. M.D.

Alba CTV4855
This set produced very little sound output even though the on-screen display indicated that the sound should have been at maximum. The cause of the trouble was the 220µF, 16V sound coupling capacitor C202. M.D.

JVC CS2181EKT
All stations had reverted to ch. 21, which is BBC1 in our area. Other stations could be tuned in but not stored. The basic cause of the fault was two surface-mounted capacitors on the station-select module. They had both leaked electrolyte and damaged the print. The MN1226S memory IC also had to be removed, as there are through the board links that had gone open-circuit beneath it. I used a single strand from a length of 24-strand bell wire to repair these links. M.D.

Hitachi C2164TN
This set would trip out at switch on. As I didn’t have a service manual I spent a lot of time getting nowhere. Then I recalled the customer mentioning that he had connected extension speakers to the set’s rear speaker terminals a couple of weeks before the set had gone off. When I removed the TDA7263M audio output chip the set came back to life. Note that the correct M version must be fitted, as the TDA7263 has a different heat sink fitting. M.D.

Tatung T25NE61 (E1 chassis)
The picture had shifted right up to the top of the screen – only an inch of the bottom was visible at the top. Pins 1 and 2 of the TDA8350Q field output/EW driver chip IC401 should have differential field drive inputs from the TDA8366 IF/colour decoder/timebase generator chip IC501. One of these inputs, which are directly coupled, was missing. A new TDA8366 IC cured the fault.

You get a similar effect when the field scan coupling capacitor in the Ferguson 14in. portable Model 3787 (NordMende chassis) goes short-circuit. M.D.

Panasonic TX14B3T (Z375 chassis)
There seemed to be no picture, but when the setting of the first anode control was advanced the field collapse symptom appeared. IC301 (TDA8356) was faulty. The part number is the same as the IC type. To prevent failure of this IC at a later date, three modifications should be carried out: change the value of C309 to 22µF, 100V (part no. ECQA2A103L); add an 0.01µF capacitor (part no. ECQM2A104J) across R310; and fit a 2.2Ω, 1W resistor in place of jumper wire R420. P.S.

Sharp DV5131H (S3B chassis)
There was continuous tripping because the line output transistor Q603 was short-cir-
cuit. The set’s past record showed that two previous replacements had been fitted in a short period of time, so I contacted Sharp Technical Service. The advice provided was as follows: fit a 2SD1556 transistor, part no. TX013BBMZ; fit a coil, part no. VP-CFI90K0000, in place of FB601; and add a 18k2, 1W resistor in series with R600. P.S.

Sony KV28WS2U (BE3D chassis)
A couple of months ago (March issue page 290) I mentioned that failure of the EPROM in these widescreen sets is becoming a common problem. Two repairs bounced. I have now discovered that the EPROM corruption was caused by the red gun flashing over. Fortunately the EPROM could be reprogrammed, and the two tubes were under warranty. Never a dull moment! P.S.

Bush 2867NTX (1A1K9 chassis)
If the picture sometimes takes a long time to appear but comes up quicker when the first anode control on the line output transformer has been adjusted, the item to check is capacitor C608 (10µF, 250V). It’s the reservoir capacitor for the supply to the RGB output stages. You’ll find it at the edge of the chassis, next to the LOPT. P.S.

Hitachi C2848TN
If C6**488TN-311 appears on the screen the set is in the factory set-up mode. The cure is as follows. Remove the flag at the bottom of the remote-control unit and press the tuning button. Then press the menu button. Finally, go to standby. When you exit the standby mode the set prompt will be cleared the fault by manually resetting this chip IC602. As it was always possible to do this, the cure was easy. G.M.

Sony KV32WF1U (BE3D chassis)
I dreaded having to tackle this fault: the symptoms were two serrated lines, one near the top of the screen and the other near the bottom. I phoned Sony Technical and was overjoyed to learn that it was a known problem. The cure is to fit an improved line driver transformer, part no. 1-437-090-31. It works. P.S.

Samsung C15079T
I was told that this set “had sparked and the picture was all lines”. When I checked I found that the set was dead. The two 100µF, 200V HT reservoir/smoothing capacitors were puffed up, and the R2K over-voltage protection diode had blown apart. It seemed that excessive HT had been the cause of the trouble, so in addition to the above items I replaced the 22µF, 50V electrolytic on the primary side of the power supply, the SMR40200C chopper IC and the HIS0169B hybrid chip HC301. It’s also worth checking the audio output IC as this can go short-circuit. G.S.

JVC AV28WT4
This set was stuck in standby with the ECO light flashing. I found that the B1 secondary rail read virtually short-circuit. The cause was a short in the EW circuit. Normal operation was restored once D521, C470 and Q466 had been replaced. G.S.

Sharp CS05 chassis
The sound from one channel was distorted. It was worse at high volume. Normal sound was restored by replacing the relevant audio output transistors Q311 and Q312, their parallel diodes D307 and D308 and the 27V zener diodes D303 and D304 in the drive circuitry. G.S.

JVC C14EIEK (Onwa chassis)
The complaint with this set was that sometimes, at switch on, there was just a snowy screen and no sound. When this happened there were also no on-screen displays and no response to the remote-control unit. This led me to the TM573C47 microcontroller chip IC602. As it was always possible to clear the fault by manually resetting this chip (connect pin 32 to chassis momentarily) much time was wasted probing around in the reset circuit.

The cause of the trouble was eventually found and was far more strange. There was a slight nick in the front edge of the PCB. This had severed the print that links pin 2 of IC602 to chassis. Pin 2 is used for factory testing of the IC, and is normally left earthed. Presumably with the pin floating there was a 50:50 chance as to whether the set was in the run or test mode. Much time would have been saved if the offending print had not been made invisible by a thick covering of black ink on the underside of the PCB. A small wire link cured the fault. G.M.

Hitachi CPT2158 (NP85CQ Mk II chassis)
This old set had been brought in with the complaint “poor picture”. The screen was dark and streaky, and the overall picture brightness seemed to fluctuate. The cause of the trouble turned out to be zener diode ZD801 (3V, 500mW) on the tube base panel – it was leaky. ZD801 is part of the black-level restoration network, and affects all three drives (RGB). G.M.

Sharp DV376OH/377OH (4BSA chassis)
The set was allegedly dead. Checks in the power supply revealed that this was working. All the secondary voltages were OK except for the 13V output that should have been present at the cathode of D602. There is no fusible resistor in the rectifier circuit, and D602 read OK on a diode test. Nevertheless a replacement restored the missing supply. I fitted a GP15 type. G.R.

Grundig GT2103 (G1000 chassis)
I’ve had this fault several times now. The set seems to be dead, and after various checks you find that the ST5365 microcontroller chip IC500 isn’t being reset (pin 33). If there’s no reset voltage pulse something is wrong. There are two surface-mounted transistors, TR450 (BC847) and TR451 (BCX19), in the reset circuit. What usually seems to happen is that TR451 goes short-circuit. I replace them both. One set would work only with TR451 removed. I’d already replaced both transistors and the 3.9V zener diode DS40. G.R.

NEI E28G1FXN
This set had a dark picture and dark graph. In addition remote control didn’t work. The feed to the 5V regulator near the rectifier diodes on the secondary side of the power supply was only 4V; but rose to 7V in standby. The value of its feed resistor R586 had risen from 2.2Ω to 9Ω. I fitted an 0.25W safety type. G.R.

Philips L6.2 and L6.3 chassis
For channel lock-up etc. replace the BC337-40 transistor Tr7505. G.R.

Nokia 3724 (Mono Plus chassis)
This set was tripping because of a short-circuit across the U2 (12V) supply. The cause was on the CRT base panel, where pin 2 of the TEA5101/NB RGB output IC was dead short to chassis. The chip is available from CHS. G.R.

Sony KVM2101U (BE2 chassis)
There was excessive HT – it measured 180V instead of 135V across the reservoir capacitor C609. All the color output transistors and the 3.9V zener diode chip put that right, but the power supply was now squealing. The culprit turned out to be the 21V supply reservoir capacitor C610 (22µF, 63V). G.R.

Tatung F series chassis
These sets come in many guises, including Hitachi and Goodman. They have a halffive chassis, with mains isolation provided by the LOPT and the scan coils. So care is needed when servicing. Care is also needed with the larger-screen models as there is a tendency for an unsupported CRT to crack the cabinet front when the back is removed.
This particular set would occasionally remain in standby, with a slight squealing noise. Close inspection with a magnifier revealed that two surface-mounted components at the edge of the chassis, R812 and C807, had never been soldered. G.D.

**Philips 25PT4103 (L6.2 chassis)**

Smoke then dead was the complaint with this set. As usual, C2912 (2.2nF, 2kV) had split. But once a replacement had been fitted I was rewarded with buzzing and no pictures. The HT was correct, but the secondary LT voltages were low. An external 9V feed got the set going, but with severe line cogging. Things were fine with a 200V mains input!

Despite the correct HT voltage, I decided that the cause of the trouble lay on the primary side (the chassis uses a non-isolated series chopper circuit to supply the HT for the line output stage), and eventually discovered that the two parallel current-sensing resistors R3514/5 (1Ω, 0.5W fusible) had risen slightly in value. G.D.

**Sharp 51AT15 (5BSA chassis)**

Now that these sets are a few years old it has been proved that most problems, such as slow starting, line cogging, line output transistor failure or intermittent tripping, result from the standby Q601, using Sharp-supplied spares. Don’t worry: for once they aren’t expensive! G.D.

**Fidelity 3121**

This supermarket set uses a version of the Turkish-manufactured PT-11 chassis, which can also be found in Alba/Bush and Amstrad sets. I’ve had a couple that were stuck in standby, with the voltage at pin 2 of the LM317 regulator chip I3 at only 2V, although the supplies were present. This is the switched 12V line, which is turned on by the microcontroller chip I301 at pin 41. Unfortunately this device is designed to fail just after the guarantee period! The numbers on it make no sense, but it’s available at quite a reasonable price under.

**Amstrad WSTV3032**

The BU2525 line output transistor had blown. When a replacement had been fitted the set ran for a minute with a narrow, folded picture, the output transistor getting hot and diode D01 smoking. The capacitors and all the silicon in the line output stage were checked and a new L0PT was tried, but the diodes kept overheating. The culprit turned out to be the STV2145 EW driver chip, which had no output. It’s worth getting quotes for this device. One supplier quoted £16.40 plus VAT, another £13 plus VAT. C.W.

**Salora M chassis**

If one of the colours is missing or varying in level, check the 82kΩ resistors on the CRT base panel – R12 (red), R22 (green) and R32 (blue). It’s quite common for them to fail. I replace all three C.W.

**Hitachi C1415T**

There was sound but no CRT display. Some quick checks revealed loss of line drive because the BF459 driver transistor Q701 was open-circuit. This type of transistor is used in the RGB output stages in some earlier Hitachi models, in which it also has a tendency to go open-circuit. M.M.

**Sony KVDX271TJ (AE1 chassis)**

This set had difficulty in coming on from cold. The cause turned out to be C615 (1,000µF, 25V) which was leaky. It’s the reservoir capacitor for the 14V supply via Q603 on the secondary side of the chopper power supply. Once a replacement had been fitted the set would come on from cold without any trouble. M.M.

**Mitsubishi CT29B2STX**

Failure of C906 (47µF, 63V) is a well-known cause of tripping with these sets. Similar symptoms are now beginning to appear because of failure of C909 (22µF, 63V). I now replace them both whenever a set comes in for repair. M.M.

**GoldStar CI20C22F (PC42B chassis)**

At switch-on this set would come on for a fraction of a second then revert to standby. Checks showed that the GL7812 12V regulator I931 was open-circuit. M.M.

**Goodmans GD2880**

This set’s picture was very poor, with ghosting. It looked like an aerial problem, but a check with my pattern generator proved that the cause of the trouble was within the set. Resoldering a number of dry-joints in the IF section restored a normal picture. M.M.

**Philips 21GR2550 (G90AE chassis)**

If the picture displayed by one of these sets gives the impression that the CRT is flat, with one or more colours missing, go straight for the three 68kΩ feedback resistors R26, R28 and R29 on the CRT base panel. You will almost certainly find that one or more has gone high in value or open-circuit. In the interests of reliability, replace all three. M.M.

**Bush WST66 (4400 chassis)**

"No results" it said in the report that came with this 28in widescreen set. The LEDs on the front panel worked correctly, and at switch-on an HT rustle could be heard. Scope checks showed that the 5V supply was missing at pins 39 and 44 of IRC1. Checks at test points then showed that the 5V supply was missing at TP6. The BD441 transistor was faulty. The heatsink clip retained hadn’t been fitted correctly and it had probably overheated as a result. This was confirmed when I tried to replace the transistor and noticed that the print on the underside of the PCB had come away.

Some repairs/links were needed to get this set back into service in a safe condition. Note that with this fault the handset’s standby button no longer operates. J.B.
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: Full Motion Video cartridge for the Philips CD1210. Can anyone supply or provide information on a source for this item, which is required for a renovation project? Please phone Bob Mitchell on 01670 861 197 (evenings) or e-mail r.mitchell@lincon.net.


Wanted: Remote control unit and operating instructions (how to tune) for the Bush Model 1493NTX, and advice on an equivalent EEPRROM (XL24C02P). Also a remote receiver panel (front of set) for the Thomson/Ferguson IKC2 chassis. Are there any particular causes of line striations with later Ferguson TX9 series sets with text? E. Burch on 0239 278 3811.

Wanted: Winding data for the output transistor after a short in the Seventies equipment must continue. D. Lee, 16 Devonshire Place, Cloughton, Birkenhead. Wirral, Cheshire CH4 1TU.

Wanted: Handbook and/or service manual for the Silver (Shin-Shirasuna Electric Corporation) cassette recorder Model ST33V 00L. Phone Norman Grant on 01786 451 230 or e-mail david.jordan3@virgin.net.

Wanted: Circuit diagram (photocopy OK) for the GoldStar Studioworks Model 78i monitor. Phone Ian Livingstone on 01482 887 946.

For disposal: Approximately twenty years’ issues of Television magazine (240 copies) up to 1990. Phone B. Hopkins on 01327 350 706 (Towcester, Northants).

Wanted: Remote control unit and operating instructions (how to tune) for the Thomson/Ferguson ICK2 chassis. Also a remote receiver panel (front of set) for the Thomson/Ferguson ICK2 chassis. Wanted: Circuit diagram for the Rediffusion/Doric Mark 1 colour TV chassis. Also a mains lead with flat-pin socket for the STC/ITC VC11 monochrome portable. Any pre-1970 colour TV sets and spare welcome. Phone Keith Parker on 020 8361 8896 (Barnet, Herts).

Wanted: Circuit diagram for the Bush Model PM3232 oscilloscope. Alan Pearce, PO Box 1048, Ndua, North Somerset BS48 4GH. Phone 01275 856 005 or e-mail alan.pearce@btinternet.com.

Wanted: Service manual or circuit diagram for the Philips Model PM3232. Also a copy of the Philips KX8230 chassis. Wanted: Service manual or circuit diagram for the Philips Model KX827PS1. This monster, chassis type SSS-40B-A dates from about 1980. Can anyone suggest a source of spares at reasonable cost? The line output stage has fried! Ian Johnson, 6 Heathfield Crescent, Kidderminster, Worcestershire DY11 6GF. Phone 01562 750 971.

Wanted: A 37in. Mitsubishi TV set, any model considered. Please phone Leslie Hine on 01229 582 557 or 01229 582 962.

Wanted: Service manual or circuit diagram for the Atari 1040/ST PC. Also a tuning potential divider for the Philips KX8230 chassis. Please phone P. J. Axley on 01792 533 577 (Swansea).

Wanted: Six 6V, i.e. 6AC56, 84, 6Z4, 75, 76 etc., for the Traveller car radio, made in the USA. Also a circuit diagram and any information on the date of manufacture and name of the manufacturer. The only number I can find is 1-9870. The valves were made by National Union (USA). Any help with information on this set would be appreciated. R. Bocarro, 149 Little Chequers, Wye, Kent TN25 5DU. Phone 01233 811 683.

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Gerry Mumford
Michael Dranfield
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Fault reports from MONITORS

Ian Field and
The Quadrant, Sutton,
Television, Fault Reports,
made shortly after publication.

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teachers - payment for each fault is

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tessa2@btinternet.com

MONITORS

Fault reports from
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JVC TM14EK
This standard composite-video monitor had
lost frame sync - the picture was jumping
badly. Checks revealed that the frame
generator was operating at only about
35Hz. There is no hold adjustment, and the
frame generator and sync circuits are all
within the M52018SP chip IC201. This is
not a cheap or common item. Fortunately
the replacement I ordered cured the fault.
G.B.

IBM 6321-R13
There was a breakdown in the insulation,
with arcing, at the top of the focus unit. I
found a bad joint at the earthy end, on the
line output transformer - it had presumably
caused excessive voltage at the other end.
When I powered the monitor after
reinsulating the affected area there was just
a blank grey screen that could be varied by
adjusting the brightness control. The
TDA4851 video processor chip Z701 had
also failed. G.B.

Sony CPD1000GST
This monitor powered up all right but there
was no display, just a blank screen. The clue
to the cause of the fault was the lack of any
visible glow from the tube's heaters. I found
that the heater supply smoothing capacitor
C632 (470pF, 16V) was virtually open -

Tatung C5D1RDK-E01
This monitor wouldn't store user settings.

The obvious thing to do was to replace the
8-pin EEPROM IC502, but to my
amazement this made no difference. I won't
tell you how much time was wasted looking
for the cause of the problem, or for how
many weeks I had the monitor. Then an
identical one came in for repair. This proved
that I had fitted the wrong EEPROM, a
24C02 instead of a 24C04. You need a
blank one - it's quite possible that my
supplier had sent the wrong type. M.D.

IBM 6312-002
The customer said that this monitor had
been running for a while then the display
collapsed to a vertical line which, he added,
was green! It's one of those awkward
designs in which the plastic tray has to be
separated from the front/CRT assembly
before the PCB can be lifted out for access
to the print side. So I decided to start by
removing the PCB, without powering up
and waiting for the fault to show.

The only bad solder joint I could find
was at C519 (1.5g, 200V) in the line scan
section. It didn't appear to have separated,
but had obviously been getting hot in
operation. The body of the capacitor was
securely glued to a couple of nearby
inductors with an excessively large blob of
silicon rubber. This undoubtedly contributed
to the failure, as the capacitor was not free
to move with thermal expansion and pushed
down on its leads as it warmed up. Several
components had to be removed to cut away
the excess sealant safely (come back 'brown
glue', all is forgiven!). The rest of the
soldering was OK, but to minimise the
possibility of a bounce I went over the PCB
looking for any soldering that could be
improved.

As usual with this monitor the horizon-
tal scanning was inadequate. There was a gap
of at least 0.75in. at either side of the screen
at the maximum width setting, even though
the height could be adjusted 'way over'. The
addition of a little extra to the flyback
tuning capacitance usually does the trick. It
doesn't seem to matter whether the extra
capacitance is added across the line output
transistor's collector/emitter or directly
across the transformer's primary winding. In
this case it was easier to add the extra
capacitor across the transistor. 270pF is
generally enough, but with this monitor
680pF was needed to get the display to
within 0.5cm at each side.

If the capacitance increase is large the
line output transistor may overheat. In
extreme cases the line scan will become
creamed at some point after mid screen. The
cure for this is to upgrade the line output
transistor. This model has a 2SC3886A
transistor with a collector current rating of
8A. A suitable upgrade would be to fit a
2SC3688, which is rated at 10A. A BU2508
could, as another example, be upgraded to a
BU2520 with the same effect.

In this case the transistor didn't overheat,
and there was no evidence of any
horizontal-linearity distortion. So I left
the original transistor to get on with it! I.F.

Elonex MN024
This version of the MN024, labelled
'Advanced Colour Monitor', uses the
Philips chassis that has an auxiliary chopper
power supply which sticks up on a small
steel bracket that's screwed to the cabinet
floor. It's similar to one of the Digital
monitors, which may in turn be the Philips
CM1800 chassis or one that's very similar.
Anyway, this particular monitor was
reported to be dead with the LED glowing
yellow.

The use of a fairly complex safety
shutdown system and an unusual
arrangement of dual B+ PWM regulators
that serve the EHT generation and line
scanning separately (despite a single
transistor to drive both) makes it difficult to know where to begin. When the monitor was switched on it produced a brief indistinct noise, similar to 'rustling up', then shut down. The CRT's heaters remained alight, but checks soon showed that the main power supply had shut down. So the heater feed must come from the auxiliary power supply subpanel.

The line output transistor and efficiency/EW diodes were all OK, and cold checks showed that there was nothing amiss on the primary side of the power supply. Testing with power applied revealed that the failure lay at pin 7 of the LOPT. The power supply then got going, but MOSFET 7623 was destroyed and resistor 3638 (1kΩ, 2W) overheated. It would obviously have been better to unsolder both MOSFETs, 7623 and 7618 (both type IRF730). With this done the power supply produced normal outputs and continued to run without shutting down.

When I unsoldered the rest of the LOPT's pins to enable resistance checks to be made I discovered that there was a short between the collector winding (pins 1-2) and the winding with the earthed centre-tap (pins 4, 5 and 6). Take care when looking up the number on the HR CD-ROM. On all previous occasions when ordering LOPTs for Philips chassis the 5-digit part number of the transformer (30391 in this case) has been sufficient. Fortunately I noticed before reassembly. Nor must the nylon insulating washer on the PCB with solvent and inspected the soldering. Several areas had been reworked.

The monitor had then been returned, but shortly afterwards the customer complained that it sometimes wouldn't come on - it just sat there whining. On its return to the workshop I carried out a more thorough resoldering operation, concentrating mainly on the timebase area. The soldering to the UC3842 chopper control chip also looked a bit duff. But the prime suspects were the three-terminal regulator IC902, whose solder joints looked even dulleer, and the earth track that runs between the pins of T401 and the solder lug slot for the print side LOPT screening plate. The track beside the slot had cracked and partially lifted, and may have been intermittently shorting to one end of R425. It depends on the version: with some the track has a gap at the other side of the slot, so the break just mentioned leaves this track unearthed.

When the screening plate is refitted and soldered to the relevant lands it's difficult to see if both ends of the broken track are securely soldered to the plate's lug. To overcome this I fit a length of 20SWG wire that must extend at least 15mm either side of the screen's lug slot, to avoid the risk that it might move while the solder is being melted to secure the lug. L.F.

Decoupling capacitors C508 (1000, 16V) and C534 (1μF, 50V) had fallen in value by about fifty per cent. G.M.

Etronex TE1438A
The problem was a similar-looking symptom of positive feedback in the associated EHT transistor Q335, which was feeding back the CRT's picture signal to the associated EHT transistor Q335. The EHT transistor Q335 had also seemed to be intermittent, though its base drive was fairly constant. The symptom is caused by R632 (43Ω, 2W, 1%), which drops the input to IC602 (78CU12). It takes its supply from the 21V rectifier and should deliver about 15V to the 12V regulator. R632 can go high under load, though it measures OK when checked out of circuit. If the input to IC602, which feeds the CRT
circuit, there was nothing amiss. The CRT's heaters remained alight, but checks soon showed that the main power supply had shut down. So the heater feed must come from the auxiliary power supply subpanel.

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When I unsoldered the rest of the LOPT's pins to enable resistance checks to be made I discovered that there was a short between the collector winding (pins 1-2) and the winding with the earthed centre-tap (pins 4, 5 and 6). Take care when looking up the number on the HR CD-ROM. On all previous occasions when ordering LOPTs for Philips chassis the 5-digit part number of the transformer (30391 in this case) has been sufficient. Fortunately I noticed before reassembly. Nor must the nylon insulating washer on the PCB with solvent and inspected the soldering. Several areas had been reworked.

The monitor had then been returned, but shortly afterwards the customer complained that it sometimes wouldn't come on - it just sat there whining. On its return to the workshop I carried out a more thorough resoldering operation, concentrating mainly on the timebase area. The soldering to the UC3842 chopper control chip also looked a bit duff. But the prime suspects were the three-terminal regulator IC902, whose solder joints looked even dulleer, and the earth track that runs between the pins of T401 and the solder lug slot for the print side LOPT screening plate. The track beside the slot had cracked and partially lifted, and may have been intermittently shorting to one end of R425. It depends on the version: with some the track has a gap at the other side of the slot, so the break just mentioned leaves this track unearthed.

When the screening plate is refitted and soldered to the relevant lands it's difficult to see if both ends of the broken track are securely soldered to the plate's lug. To overcome this I fit a length of 20SWG wire that must extend at least 15mm either side of the screen's lug slot, to avoid the risk that it might move while the solder is being melted to secure the lug. L.F.

Mitac L1450
This monitor was stuck in standby with just an amber LED lit and no display. The BU250DX line output transistor Q501 was short-circuit because its base drive capacitors C508 (100μF, 16V) and C534 (1μF, 50V) had fallen in value by about fifty per cent. G.M.

CTX 1765D
The monitor powered up with a green LED but no display. This suggested trouble in the line output stage. I found that the 2SC4769 EHT transistor Q335 was short-circuit along with the 2SK1377 pre-regulator FET Q338 and the neighbouring BY236 diode D327. Fusible resistors R460 (1Ω, 0.5W) and R470 (0.6Ω, 0.5W) were both open-circuit. Replacement of these items restored the display. G.M.
Sony SLVE295UX etc

This machine sometimes refused to eject a cassette and would go to sleep a few seconds later. The clue to the cause of the trouble was a whirring sound. It came from the loading motor, whose worm was cracked. As a result, when loaded the motor shaft rotated inside the worm. Shades of the Panasonic K deck, but in this case the little plastic bit is available separately.

I guess this fault could occur with any Sony model that uses the S tape deck.

E.T.

Hitachi VTF660E

Playback via the RF modulator was fine but the picture that came via the scart socket was marred by lines of interference - similar to the effect of co-channel interference with analogue terrestrial TV reception. The culprit turned out to be the BH7633AS signal-routing chip IC4501 on the rear jack PCB. It contains amplifiers and clamps as well as switches.

E.T.

Sony SLVE730

This machine was to all intents and purposes dead, but when listening closely in the power supply area I heard a single squawk shortly after switch on. There was normal operation once C153 (47µF, 50V) and C154 (1µF, 50V) on the primary side of the power supply had been replaced.

A similar power supply module is used in Models SLVE35/50/60/70/80 and SLVSX60/70/80. E.T.

Philips 14VP200/07

This TV/video combi unit was still under guarantee. The fault symptom was a tinny buzz during tape playback only. It came and went when the ribbon cable from the audio/control/erase head was flexed at the PCB end. Because of access problems and difficulty getting the unit to work when it was dismantled, I decided to replace the ribbon cable and resolder the socket to the main (VCR) PCB. This cured the fault. E.T.

Aiwa HVGX350K

The fluorescent display panel was very dimly lit – in fact the display was only just discernible. Checks showed that its heater voltage was low. The cause was failure of CP25 (100µF, 10V) in the power supply section. E.T.

JVC HRJ225

Because of a broken gear on the upper side of the deck there was no eject. This is becoming quite a common fault, which is easy to cure by removing the carriage and unclipping the sliding-brake assembly. There's just enough room to replace the gear without the need for a major strip-down.

Once this had been done however there was a strange problem. When the machine was connected to the mains supply the mechanism would shuffle and the capstan motor would spin quickly, trying to eject a tape that wasn't there. The machine would then shut down. I initially suspected the mode switch, which is difficult and very fiddly to change, but the switch turned out to be OK. A faulty start sensor eventually proved to be the cause – a replacement cured the problem. It's worth noting that when a tape was wound into the machine manually in the fault condition everything worked fine, including fast forward, rewind etc. The fault symptom showed only when the machine was first powered up from the mains. M.L.

Sony SLV825UB

E-E operation was very poor and there were bent verticals. The cause of the trouble was traced to C13 (1µF, 63V) in the IF assembly. M.L.

Goodmans PD1700

There was playback but no record. The cause was the BC848B transistor 7605. D.M.T.

Panasonic NVHD620

This machine was dead. Checks showed that the problem was caused by QR1101 (UN6114) and Q1102 (2SD1991A) in the voltage-control section. D.M.T.

Samsung/Goodmans TVP5050IST

This unit was stuck in the pause mode. I found that the slider supply gear (item G520) was cracked - a replacement restored normal operation. The part no. is SAMSAC6680142A. D.M.T.

Goodmans/Daewoo VP2500

In the E-E mode there was just a blue screen. With playback there was no picture but the sound was OK. The menu was OK. The cause was traced to R350 in the video processor circuit. It's a 27052 surface-mounted resistor. D.M.T.

Sanyo VHR276

This machine caused me a lot of grief. The customer complained that it would switch off when going into record. Easy I thought, replace PR512. So I fitted an N25 circuit protector, printed out an invoice and left. A couple of days later the customer com-
plained that the fault was still present, and added that it usually occurred after a rewind. So I replaced the mode switch. After that the machine acted strangely. I took it back to the workshop and found that the machine would accept a tape but when any function was selected it would lace up, unlace then switch to standby. I started off by carrying out checks in the power supply, but there was nothing wrong there. Then I checked and double checked the alignment, which was correct. In desperation I fitted another mode switch. After that the machine worked correctly. M.M.

**Hitachi VTF360**

This machine would intermittently fail to record or play the control track and creased the edge of a couple of tapes. The cause was found to be the back-tension band: the felt had parted company with the plastic band. A replacement restored normal operation. M.M.

**Sony SLVE280**

The customer complained about very poor recorded sound and intermittent failure to record. The circuit protector looked in a bit of a sorry state, so I replaced it with a CP N25. After that the record and playback sound were both good, and I was able to assure the customer that his machine wouldn’t cut out again. M.M.

**JVC HRJ425**

This machine wouldn’t go into play because the pinch roller failed to contact the capstan shaft. The cause was lever assembly item 50, which was cracked. M.M.

**Sharp VCMH60**

To start with there was motor pulsing and no display, but after a few minutes the VCR worked normally. When the outputs from the power supply were checked the 5V rail was found to be low. The fault was cured by replacing C925 (470µF, 10V) and C929 (330µF, 10V). R.B.

**Daewoo V200**

There was no display, so some voltage checks were carried out. I found that the -24V supply was missing. All that was required was to replace R62 (18Ω, 0.25W). R.B.

**Samsung SV222B**

This machine was dead. To restore normal operation several items in the power supply had to be replaced: transistors Q1SR01 and Q1SR12, diode D1SR11, zener diode ZD1SR1, capacitor C1SR12 and resistor R1SR11. R.B.

**Akai VSG295**

This machine’s recorded pictures were intermittently snowy. The cause was dry-joints at capacitor C609 (10µF, 50V), which is part of the TU +B supply. R.B.

**LG T1631**

There was very low E-E and playback sound. The cause was a dry-joint at L402, which is in the supply to pin 11 of the BA7797 chip IC401. R.B.

**Hitachi VT530E**

"Poor tracking" it said on the job card. I nearly missed this one! When the machine had been playing for about an hour the picture paused every second or so. The culprit was a faulty and very hot capstan motor. Within a week I had another identical failure. P.S.
Last month’s column ended with a promise of more on servicing Apple Macs. So here goes.

Worn drives
The hard drive will eventually wear out, which will provide you with an opportunity to talk the machine’s owner into fitting a larger capacity drive. In fact there probably won’t be any choice, since 20-500Mbyte drives are now rather scarce. All older Macs used SCSI drives, both internal and external. Later Power Macs use standard IDE drives.

If you don’t buy an Apple drive (you probably won’t) you will need a piece of software to be able to carry out low-level formatting. The usual choice is either HDT by FWB Software or SilverLining by LaCie. In addition you will need a set of operating system installer discs or CDs - unless the owner can provide them.

Power supplies
Power supplies occasionally fail. Apple spares such as these are “authorised dealer only”, which means that you can’t buy them. If you are familiar with switch-mode power supplies however repair shouldn’t be difficult. Circuit diagrams are generally “unavailable”.

Getting a new power supply fitted by an authorised dealer can be expensive. So the Mac owner is likely to be happy to pay if you can fix the supply at a PC price!

Software problems
Software problems are very common. Macs use dozens of little helper applications called extensions. Incompatibilities can occur should an owner carelessly install software without checking. Usually however an extension causes problems because it becomes corrupted. You can check for this by starting the Mac with the shift key held down. Hold the key until you see “extensions off”. If the computer now runs all right, there’s probably an extension problem.

The quickest solution is to drag the extensions folder from inside the system folder to the desktop, then immediately reinstall the operating system. This will create a new extensions folder. If the Mac now boots up and runs all right, you can drag any non-standard extensions from the folder on the desktop to the systems folder, a few at a time, and restart the computer. If the problem returns, you’ve narrowed the cause down to just a few extensions.

Fonts can cause similar problems, so treat them in the same way if necessary. This method of fault-finding is time consuming, but the Mac owner will pay. Problems with files or the hard drive can often be fixed by running Norton Utilities (the Mac version) or TechTool Pro.

Sometimes an application refuses to work properly. The cause is often a corrupted preference file. You’ll find it in the preferences folder inside the systems folder. Simply drag the offending file to the wastebasket then re-launch the application. This will create a new preference file. If this fails to cure the problem, put the old preference file back and reinstall the application.

No registry
You will be pleased to know that the Mac has no registry. It keeps track of all the files in a ‘desktop file’ which is invisible. It doesn’t rely on this totally however, and in any case you can easily rebuild the file by holding down the option/alt and command/Apple buttons while restarting the computer. Hold the two keys down until the ‘rebuild desktop’ dialog window appears.

Corruption of the desktop file can make icons revert to their generic form or produce the “application not found” error message. This is not usually a serious problem, unless it’s a symptom of disk corruption in general.

The desktop file should be rebuilt once a month as a routine precaution, though most Mac users don’t bother.

No software
The complaint that “there’s no software for the Mac” is simply not true. I’ll admit that software is well hidden, but look at any standard package such as Microsoft Office and you’ll find that a Mac installer is included.

The only software that’s missing is Microsoft Access. This is probably because Access is so bad compared with the Mac standard Filemaker Pro that Microsoft don’t want anyone to make a direct comparison!

Making a start
You’ll need a basic toolkit before you can tackle Mac repairs. First get a mouse, in case the customer doesn’t bring his along. The most recent Macs use a USB connection for the mouse – earlier ones use an
A DB connection, which is peculiar to Macs but is nowadays used for camcorder connections. The same connector is used for the keyboard — USB for later ones, camcorder type for the earlier types. One exception is the very early Mac Plus, but you can worry about this if you ever see one!

You start a Mac by pressing the on/off key on the keyboard: it usually has a left-pointing triangle. Early Macs make a ping sound as they start. Later ones make a boing sound, while the very latest produce an orchestral chord.

Screws are usually indicated by seeing pangs at start-up. A hardware fault such as a loose PCl card produces a sound like breaking glass with a Power Mac. Shut a Mac down by pressing the off key then the return key.

Monitors
Apple monitors normally use a 15-pin D plug, with some of the pins linked together in such a way that the computer can deduce the monitor screen size, scan rate, etc. To use a standard SVGA monitor you will need a 15-pin to 9-pin adapter with ten DIP switches included. These switches must be set in order to simulate the links that the Apple Mac looks for. It's a tedious job unless you know the actual switch settings for every possible combination (I haven't found a list, but I'm working on it).

Since a 14in. Apple monitor can often be bought for a few pounds, you would be well advised to obtain one. It will work with most Macs.

A few Macs were made with a special 'hd45' connector instead. The 'hd45' adaptors are rather expensive new, so see if you can find someone who is throwing them away. It happens all the time — people don't realise their value!

Getting inside
A wide variety of case styles have been used, and the method of opening them is not always obvious. The MacSE/30 shown in the accompanying picture has four fixing screws in the rear cover. The top ones are recessed into the carrying handle aperture and a very long screwdriver is needed to remove them. The tool I use is a hardened-steel box rod (2.5mm AF) 23cm in length with a handle in addition. This is needed for all the early 'portable' Apple Macs, from the Mac Plus onwards. They all have a built-in 9in. monitor tube by the way, and use 30-pin SIMMs. I'll cover this and other details in a later instalment.

Meanwhile don't throw those Mac bits away! The portable Apple Macs are now regarded as collectors' items and, since the USB was adopted by Apple as the new standard serial connection method, supplies of 8-pin mini-DIN serial connection peripherals are in demand. Printers in particular are hard to find, and I predict that keyboards and mice will follow.

An Amstrad SRDS45
Back to satellite receivers! I was surprised when this one arrived since analogue repairs are minimal nowadays. The dealer who sent it had "fitted two Satellite's without success". Apparently the power supply "keeps going bang".

When I dismantled the unit I noticed that the power supply DC connection plug had been cut off and each wire soldered individually to the tracks beneath the board. I intended to replace the power supply in any case, so this was no problem. When I removed the recessed screw inside the decoder screening box the cause of the original 'power-supply fault' became obvious: a brown wire was firmly trapped beneath the screw head, shorting the 12V supply to chassis!

With this fault corrected and another power supply fitted the receiver worked perfectly. As I didn't have the correct power supply I modified one from an SRDS10, by replacing the LLF004 transformer with the LLF007 from the SRDS45 and then replacing the 350µF reservoir capacitor C620 in the 23V tuning supply with a 470µF, 35V capacitor to cope with the now higher 30V supply.

A Grundig GDS200 BSkyB digibox
Wossname up Church Street phoned me this morning. The conversation went like this:

"You fix these dodgy boxes. I've got a Grundig one here. Customer says her baby dropped his feeding cup and orange juice splashed inside. I've had a look and there's only a couple of drops. It's really sticky but I've wiped off most of it with a cotton bud."

"No thanks."

"... and now the little green LED comes on, but it's dead."

"No thanks."

"It should be easy to fix. You'll have a look at it for me, won't you?"

"No thanks."

"Probably just needs a squirt of alcohol."

"I could do it myself. Look, I don't want it. If you want to try cleaning it that's fine. Slosh plenty of warm soapy water on to it, drain it, then finish with isopropyl alcohol and dry it with a hairdryer."

If you have any questions about Apple Macs you can e-mail Jack from the internet web site at http://www.ukstay.com/jack

You can also contact Mac Users and ask questions at the Yorkshire Mac User Group web site (YMUG) http://www.ymug.york.co.uk

Information about Sky Digital satellite receivers can be found at http://www.satcure.co.uk

You can order Apple Mac cables, connectors, batteries and other accessories from the SatCure web site at http://www.satcure.com

Leave it in a warm place for a couple of days then test it. That's the routine."

"But why won't you..."

"Because I guarantee my repairs, and I can't guarantee something that's been treated to a dose of citric acid with added sugar, colouring and preservatives! Even if it works after cleaning it will probably fail a week or two later, because of corrosion or conductive salts trapped beneath the ICs."

"What shall I tell my customer?"

"Tell her to claim on her house insurance. You can buy her a nice new Panasonic digibox for about £300 inclusive. Or you can send the Grundig to Genserve in Swindon who will replace the mother board for you. The telephone number is 01793 886 333 (strictly trade only)."

MacSE/30 fixing screw positions.
In the December 2000 issue I mentioned a device that makes a Sky digibox come back on a predetermined channel after a mains supply failure. Normally a digibox reverts to standby following a mains interruption. A multi-receiver set-up, for example at a hotel, could cause problems unless there is some sort of UPS (uninterruptable mains power supply) to provide the receivers with constant mains power. Kesh Electrics, which manufactures the previously mentioned unit, has now come up with the Digimemo. It can be connected to up to six digiboxes, thus simplifying the arrangements with a multi-receiver installation.

The unit is housed in a small case, see Photo 1. Six coaxial leads, each terminated with a standard Belling Lee aerial socket, emerge from it. At first sight you could be forgiven for thinking that it’s some sort of exotic RF signal amplifier or splitter!

The Digimemo works by simulating a remote-control signal from the ‘mouse’ infra-red pickup device that can be connected to a digibox’s second RF output connector to provide channel changing at a different location via a coaxial cable and a second remote-control unit. The digibox assumes that someone is sending it a remote-control signal from another location to switch it back on after a power interruption.

**Use**

Each lead from the Digimemo is connected to the second RF output at the rear of a digibox. Power to the second RF socket must be switched on via the digibox’s installation menu, as if a ‘mouse’ is to be connected (see Photo 2). This provides power for the Digimemo. It doesn’t matter if you have fewer than six receivers. Just leave the unused connectors unterminated. They can be connected at any time in the future should the installation be upgraded with more receivers.

It is most important that all the digiboxes in the installation are connected to a common mains supply source, so that they all suffer a failure together and thus all start the reboot process at the same time when power is restored.

**How do you determine the channel a digibox boots up with?** Go to the favourite menu and place a tick (see Photo 3) beside the channel you want the digibox to go to at power-up. Scroll through the menu to ensure that no other channels have been ticked. The need to do this is because the Digimemo repeats the on command several times during the first minute or so, to allow for the fact that different makes of Digibox have different boot-up speeds. If you have more than one favourite channel in the list, the digibox may change channels to the next favourite within a few seconds of starting up with the first one. This could cause some confusion!

Kesh has tested the Digimemo by connecting it to every possible permutation and combination of types of digibox. So you can mix say some two-year old Pace digiboxes with a Grundig from a year or so ago and the latest Panasonic or Sony models: they will all work together happily with the same Digimemo unit.

**Availability**

At the time of writing the Digimemo-6 is available at about £99. Kesh Electrics plans to make available units with fewer outlets – these will cost less. For the latest information on price and availability, phone Kesh on 0286 863 1449. Or go to the website at www.pacelink.co.uk.
The address is Kesh Electrics, Main Street, Kesh, Co. Fermanagh, N. Ireland BT93 1TF. C.H.

**Pace 2500B digibox**

This newish digibox came to me from another dealer. He had sent it to Pace for repair and a while later had received a call from Pace to say that half a dozen ICs had been replaced but the box still wouldn’t come out of standby: it had probably been subjected to a high-voltage spike down the modern line, and was therefore not economical to repair. This was a serious challenge. I’ve repaired plenty of digiboxes, but not one returned by the manufacturer!

Once the lid had been removed it was evident that the flash memory U7200, U7202, U7204 and U7206 had been replaced, along with the DSP1675 modem chip and a handful of components in the modem section. I eventually found that pin 41 of the U7201 housekeeping microcontroller chip U600 was running at 30MHz instead of 10MHz. I traced back via the buffer chip U203 to the source of this clock signal, pin 30 of the of the QPSK demodulator chip U403. It’s derived from a quartz crystal which is connected to pin 49. This was the source of the problem: a new 10MHz crystal (X401) brought the box out of standby and it then worked all right.

The biggest problem with digiboxes is that they usually stick in standby when faulty. At least when a box switches on you can see the fault symptoms on the screen. M.D.

**Pace VC200 VideoCrypt decoder**

The 1A mains input fuse had blown and the MIE18004 chopper transistor was short-circuit. The cause was a short-circuit UF5402 diode, D30, on the secondary side of the power supply. M.D.

**Pace 2200 digibox**

This digibox worked fine via the start socket but there was no output from the UHF modulator. In addition there was no RF loop-through. The problem was caused by water seeping down the aerial cable. I traced the cause of the loss of RF loop-through to an open-circuit surface-mounted resistor, R663 (2.2kΩ), which provides Q610 with base bias. No output from the modulator was caused by loss of the 33V supply at the surface-mounted resistor R644 (22kΩ). This supply was present at the RF bead L694 on the outside of the screening can however. Now these units use multi-layer PCBs, and it was evident that a through-hole was open-circuit. But the link was to the middle-sandwiched PCB. The box thus appeared to be beyond repair.

I decided to connect L694 to the junction of R644/C652 via a short length of insulated wire. There are small holes at each corner of the modulator’s screening can. They enable the wire to be passed through and allow the lid to be refitted. The result: 100 per cent success! M.D.

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**Test Case 461**

Can any manufacturer of home entertainment equipment have produced, over the years, a more diverse range than Sony? As time has gone by we’ve praised the company’s products, cursed them, taken them on holiday (the Walkman) and to bed (clock radios), enthusiastically sold and rented them, wondered in this area with the separate control lines for volume, brightness etc.

No manufacturer’s products are immune to failure however. And when the fault with a piece of Sony equipment is intermittent, the cause can be as difficult to locate as with the products from any other manufacturer. Television Ted was struggling with an older Sony TV set, Model KVM2140U (old chassis), that had worked perfectly on soak test for four days before the fault had put in an appearance. The sound, vision and raster had then disappeared, though the set was not dead: the indicator LED remained on, and EHT was still present — signified by a ‘bristling’ at the back of a hand held near the screen.

The set was left running with the back on and meters connected to the tube’s blue cathode and the 120V HT line. It took a further two days of testing for the fault to reappear. The meters then showed that the HT remained constant at 120V but the tube’s blue cathode voltage had risen. What, in a set without serial-bus control, could lead to this along with failure of the sound? Over a coffee Ted and Sage hatched a theory between them, that a line output transformer earthing pin was poorly connected, removing a supply voltage to both the sound and vision processing stages.

So much for guesswork! The relevant LOPT pin, no. 11, was perfectly well soldered to the PCB land. And anyway if the cause of the trouble had been here the LED indicator would have gone out — it’s fed from the LOPT-derived 12V line. Sage then went back to his bench and Ted got out his mighty magnifying glass, an object of much derision and hilarity in the workshop but very useful for finding poorly soldered joints. The connections to the line output and chopper transformers were examined but proved to be OK. Likewise the print in the signal-processing sections and around the microcontroller chip IC001, though it was hard to see how the problem could arise in this area with the separate control lines for volume, brightness etc.

Ted followed up with a series of physical attacks on the PCB. He tapped it, flexed it, heated it to nearly boiling point with blasts of hot air and got it looking like a glacial ice-cap with freezer spray. But the set was impervious to these assaults, with its screen alight and its speaker speaking!

The set was put back on soak test and, after some hours, the picture and sound once more disappeared. But this time the sound and vision ‘faded out’ over a couple of seconds, which suggested an electrical rather than a physical fault. Further study of the circuit diagram, and a voltage check in the signal section, finally revealed the culprit. What was it? For the solution, turn to page 440.
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Baird 30 Line Recordings
http://www.dfm.dircon.co.uk
For history buffs and the curious here's a fascinating site containing early TV recordings and their background.

BBC
http://www.bbc.co.uk/info/reception
http://www.bbc.co.uk/enginfo
If you need any help with your reception go to this site - both of the addresses point here. There's special advice for people with loft installations, and caravanners and boating enthusiasts

Doknet Service manuals
http://www.doknet.com
This Dutch site says it has 350,000 service manuals and 1 million service parts. You interrogate the database by filling out an order form, with the "request" box ticked, and then wait for an email to arrive back on your computer. However, an on-line index would be useful and maybe on-line downloading of the manuals

Dönberg Electronics
http://www.donberg.ie

EURAS International Ltd
http://www.euras.com/english
"The definitive fault index... based on feedback from manufacturers, technicians and workshops throughout Europe" IER Magazine. Available on CD-ROM including ECA vrt-disk 2000. Subscription includes free Internet access for update downloading, access to pin board, discussion forums and classified ad section. Monitor database also available.

Goot Products
http://www.kieagoot.co.uk
Kiea Trading Company is the sole agent of Goot products. We specialise in supplying the soldering and desoldering product range manufactured by Goot Japan for the UK market. Goot uses advanced production technology to manufacture high quality soldering iron products for industrial, professional and general purpose use.

MB21
http://www.mb21.co.uk/index.html
Another enjoyable site with a "telenostalgia" section about the technical aspects of television. There's also a section on transmitter sites, teletext "then and now", and a "rough guide" to widescreen television.

Matrix Multimedia Ltd
http://www.matrixmultimedia.co.uk
Matrix Multimedia publishes a number of highly interactive CD ROMs for learning electronics including: Complete electronics course, Analogue
filter design, and PIC(R) microcontroller programming (C and assembly).

M.C.E.S.
http://www.mces.co.uk
The MCES site gives details of our range of service including Tuners, Video Heads, RF & IF Modules plus latest prices and special offers.

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http://www.newnespress.com

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

Mauritron Technical Services
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The UK’s leading independent supplier of Service Manuals and Operating Guides from valve to video. Also available on CD Rom or download direct from the internet.

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Sky digital repairs
http://www.horizonsatellites.co.uk
The Horizon site gives details of our range of products and services including Sky Digital Receiver Repairs.

Servicing Advice
http://www.repairfaq.org/REPAIR/F_Repair.html
Here are some frequently asked questions about servicing consumer electronic equipment, with a US bias. But there’s some good material on monitors and CD players and CD-ROM drives. (thanks to David Edwards for this information)

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http://www.switchit-on.co.uk
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The Service Engineers Forum
http://www.E-repair.co.uk
A brand new site dedicated to the needs of service engineers containing detailed servicing articles, circuits & repair tips. The site also includes for sale, wanted & special offer sections, industry news & much more. An impressive site well worth visiting.

For customers without net access, servicing product details are also available by ringing Mike on 0151 522 0053

UK Electrical Direct
http://www.uked.com
For a comprehensive on-line directory, buyers guide and resource locator for the UK Electrical Industry look at this site. Many of the companies listed have links to their own web sites, making this a one-stop shop for a huge amount of information.

UK Mailing List Group
http://www.egroups.com/list/uktvrrepair
Following on from the newsgroup discussion last month there is a UK Email group for TV technicians where you can send an Email to everyone in the group. There's just over 30 people in the group at present. For more details and how to register look at the egroup home page. Just a general comment though - you do have to be careful who you give your Email address to so that you can avoid "spamming" - that is getting lots of unwanted Email about dubious Russian site (amongst others).

PSA
http://www.psaparts.com
This web site gives details of various specialist parts for repairers, from rare semiconductors to computer batteries and printer parts. The vast majority of items are in stock, and can be purchased online via this site's shopping facility.

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

To reserve your web site space contact Pat Bunce
Tel: 020 8652 8339
Fax: 020 8652 3981

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Later this year the College of North West London will open its new Digital Village, which will be a centre for training in digital applications and servicing, covering both consumer and commercial electronics. The Village involves a £150,000 refit of the college’s entire second floor at its main centre in Dudden Hill Lane, Willesden. Complete redesign and refurbishment will be followed by the installation of £60,000 worth of the most up-to-date equipment and latest state-of-the-art facilities. The Digital Village, which is scheduled to open this September, will include a lecture room, remodelled and newly fitted classrooms, demonstration facilities, a foyer display, air-conditioning and sound-proofing.

The college went digital over two years ago when it began running City & Guilds accredited courses on the operation and servicing of DTV set-top boxes, to cater for the introduction of digital TV in the UK. It is now moving into other digital applications. This involves devising and writing a large number of new courses that will make the college the only Further Education institution in the UK offering such a wide range of subjects under one roof. The new courses include college-devised City & Guilds modules in digital television, DVD, PC monitors, network cabling including fibre-optics, digital signal reception (aerial installation), digital audio broadcasting (DAB), video conferencing, integrated digital TV (IDTV), e-commerce, microcontrollers and medical electronics.

The School of Electrical and Electronic Engineering is part of the college’s Faculty of Technology, along with Built Environment and Construction and Automobile studies. The faculty is one of the largest providers of technology studies nationally, and was awarded top-ranking Grade 1 in last November’s inspection by the Further Education Funding Council. In due course the college expects it to become one of the government-designated Centres of Excellence.

Recently the college has been pioneering courses on DVD players, to complement its unique courses on servicing digital TV equipment. The DVD courses are initially being offered as two-day short courses for practising engineers. They will become full mainstream courses in September 2001.

Senior lecturer Fawzi Ibrahim considers the reduced demand for electronics servicing to have been greatly exaggerated. He believes that while there will be fewer electronics servicing engineers in future than in the past, the vital cadre remaining will be of higher calibre in terms of the width and depth of their knowledge and skills.

Servicing digital TV and DVD players are just two of the subjects in a range of courses that the college’s Digital Village will provide in all aspects of digital technology. Fawzi points out that developments in processing and control have changed the nature of electronics servicing. In order to cope with today’s equipment, service engineers frequently have to update their knowledge and skills. The college has set itself the task of meeting these new needs. But it is not dropping any of its existing courses.

In addition to drawing students from around the UK, the CNWL receives many inquiries about DTV courses from abroad and is now offering them to other colleges to run. The college also provides very popular general electronic servicing and PC repair and networking courses.

For further details of the college’s courses and services, contact Sylvia Garvin on 020 8208 5440 or e-mail sylvia.garvin@cnwl.ac.uk.
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### Voltage and current and resistance

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For a PDF file of the meter's manual, e-mail eworld.orders@rbi.co.uk with the subject heading ‘Meter manual’.

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May 2001 TELEVISION
Interference problems

Interference is a perennial bane for those interested in radio, TV and now data signal reception. Modern equipment, with clock pulses and switch-mode power supplies, has made matters worse. David Benyon describes some steps that can be taken to deal with the problem.

In the March issue Roger Bunney mentioned some problems he'd had with interference caused by his digital satellite receiver. The most likely source of the interference is the microprocessor clock edge. I've had similar problems with an expensive Echostar SR-3500 receiver-positioner. Considering the price at which these units were sold, the interference problems are not acceptable. Previous satellite receivers I've had have included a Ferguson SMO2 (which can still outclass some of the newfangled stuff in the picture-quality department) and Maspro Models SRE80 and SRE90: none of these receivers gave any trouble.

The Echostar receiver caused considerable annoyance because it obliterated Radio 1 FM, transmitted at approximately 88MHz. But when the TLO in Holland was contacted his advice was to put the FM receiver in the opposite corner of the room!

Investigation

A good spectrum analyser was employed to carry out an investigation, with a scope probe used as a 'sniffer'. The radiation was found to be coming from the CPU board. It originated from the clock output pin of a 100-pin custom IC. This is the master IC, one of its duties being to drive a crystal to generate a 4MHz clock signal for the Z80 CPU. The clock-signal spectrum was seen to be a comb-like series of spikes, 4MHz apart, extending to over 180MHz (and 4 x 22 is of course 88!). The turnover frequency was about 150MHz. But these measurements were rather approximate, as the probe was not properly matched.

With the probe connected to a scope, a superb squarewave was displayed. It had negligible rise and fall times and razor-sharp corners. While such a waveform might delight the chip designer, it's not really what the user requires - and anyway the Z80 will perform perfectly well with slower clock edges. It might at this point be worth mentioning that RF radiation from most ICs is minimal, as the chip dimensions are too small to make an effective aerial. It's a different matter once a chip is connected to a copper track: the chip can then radiate easily.

Modification

There was insufficient room on the CPU board to add filtering, so an attempt was made to slow the edges of the clock pulses resistively. With some trepidation I cut the 'clock-out' track as closely as possible to the custom IC's clock output pin, while leaving enough land to solder to. A 1.5kΩ resistor. The waveform to aim for is relatively slow - the chip designer, it's not really what the user requires - and anyway the Z80 will perform perfectly well with slower clock edges. It might at this point be worth mentioning that RF radiation from most ICs is minimal, as the chip dimensions are too small to make an effective aerial. It's a different matter once a chip is connected to a copper track: the chip can then radiate easily.

Some internal shielding was also fitted, as CPU boards tend to be electrically noisy. In addition the 'sardine can' that encloses the chopper power supply was soldered to the case with copper braid.

These modifications enabled my clock-radio alarm to operate successfully while sitting on top of the Echostar receiver. With so many Astra analogue dishes being scrapped at present, there is a handy supply of perforated metal that's suitable for screening and allows some ventilation. The perforations are ideal for gluing to plastic with hot-melt glue. But for proper screening a complete box, all electrically bonded and without large apertures, is required.

Chopper interference

The switch-mode power supply is another possible source of interference. It will use 'fast-recovery' diodes, whose 'snap-action' switching can be a fruitful source of interference. Even standard-recovery diodes produce harmonics. For example I once heard of a yachtie who sold his new and expensive wind generator for a song because it caused interference on his radio! When the supply frequency is a few tens of Hz, power diodes can be shunted with small capacitors: 0.1μF usually works. But at switch-mode frequencies different techniques, using RF chokes, are more appropriate. The Farnell Electronic Components catalogue includes a good selection of small, three-terminal capacitors, and three-terminal capacitors with ferrite beads - the Murata devices in the EMC, filters and suppression section are worth a look.

Research

Outrageously noisy equipment can be readily tackled, but for serious research into EMC problems a screened room or 'cage' (an abbreviation for Faraday Cage) is needed in addition to a noise-free filtered mains supply. It might at first sight be thought that this requirement calls for a budget of military proportions. This is not so. For the real enthusiast, a metal-bodied van will suffice. But do be careful and use an ELCB. And beware of static-zap.
Answer to Test Case 461
- page 433 -

The fault with this Sony set was an intermittent and obscure one. Though the sound and picture occasionally disappeared, the on-indicator light and the power supply remained on as normal. It was almost as if the brightness, and sound levels were being turned down simultaneously - and so it proved to be! A study of the circuit diagram showed that various DC control lines converge, via separate blocking diodes, at the collector of Q005 which, as far as we could see, performs some sort of muting or 'soft-on' function. What's for sure is that if its collector goes to chassis potential all the control lines fall to zero, taking the sound and picture with them.

A soak test with a meter connected to the collector of Q005 showed that this was indeed what was happening - because the transistor went open-circuit at random intervals. Once a replacement transistor had been fitted the set ran trouble-free for many days.

But it wasn't released from the workshop until the diagnosis had been proved. The transistor, still unaffected by heating, cooling and violent shock, was hooked up to a small light bulb, a base bias resistor and a 12V supply. On day four the bulb faded out over a period of about one second. Thorough, huh!

Incidentally there seems to be some variation in the circuitry in this area with different models that use the BE2A chassis.

NEXT MONTH IN TELEVISION

Installing car radios

Though modern cars have car radios fitted as standard, many owners prefer to fit something of their own choice. They either call on you to start with or try to do it themselves and get into trouble, making it worse for us. Tom Baker on how to go about it.

VHS runaround

Though the price of many VHS machines has dropped to the point where repair may not be economically viable, many of the problems that occur are relatively simple mechanical ones that are easy to deal with when you know how. Eugene Trundle provides a diagnosis and repair guide, based on many years' practical experience.

CeBIT report

George Cole reports on the CeBIT show, which covers everything from telephones to TV. Highlights of the 2001 show included recordable DVDs, the SD memory card and Dataplay recordable disc.

Measuring the CRT heater voltage

The CRT heater voltage is one of the most important in a TV set or monitor, since it affects CRT life. It is also one of the most difficult to check. Denis Mott presents a meter design that caters for this requirement.

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