Tips, guides and reports for people repairing televisions and electronic equipment

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SEPTEMBER 2001 £3.00

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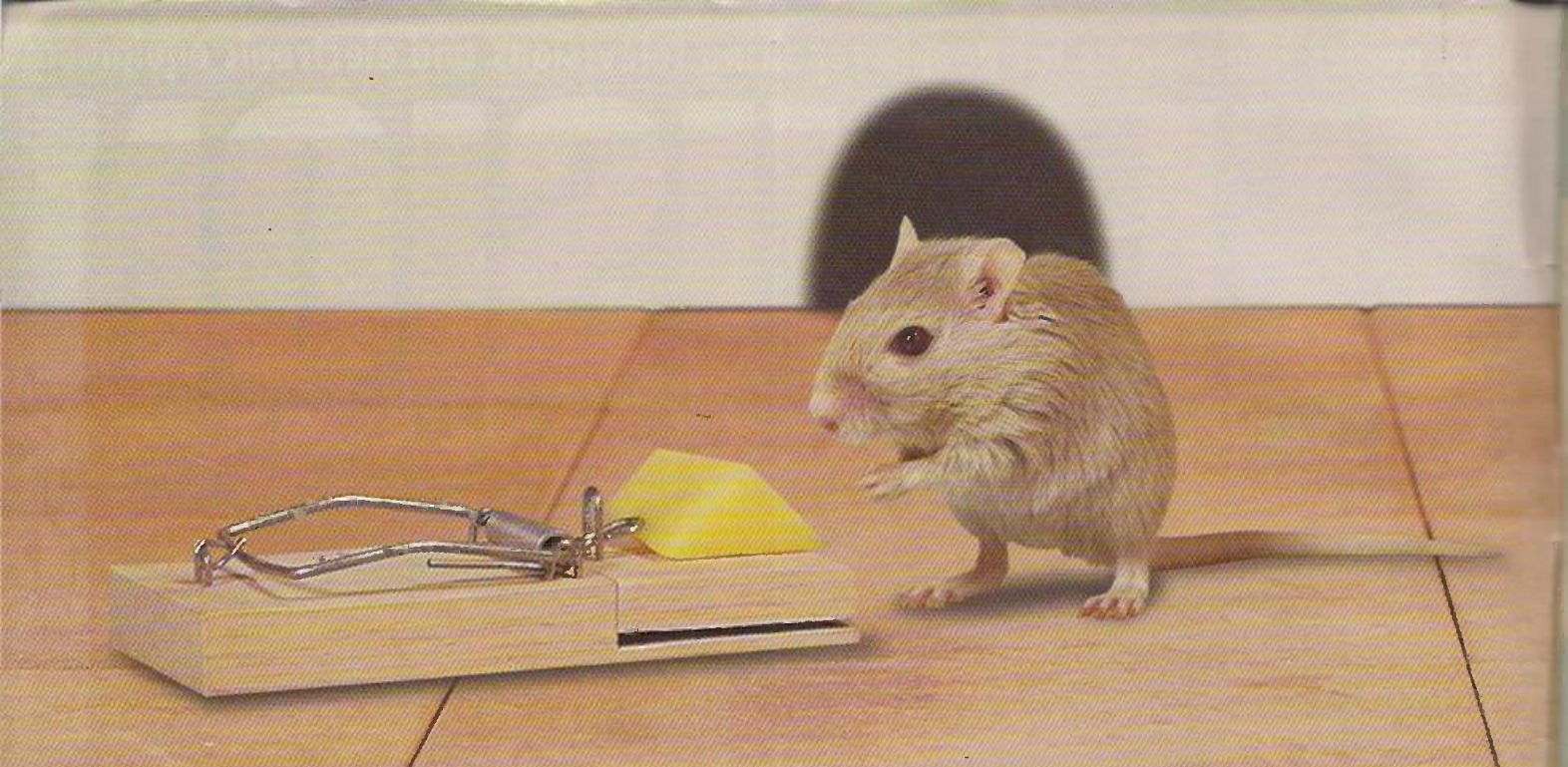

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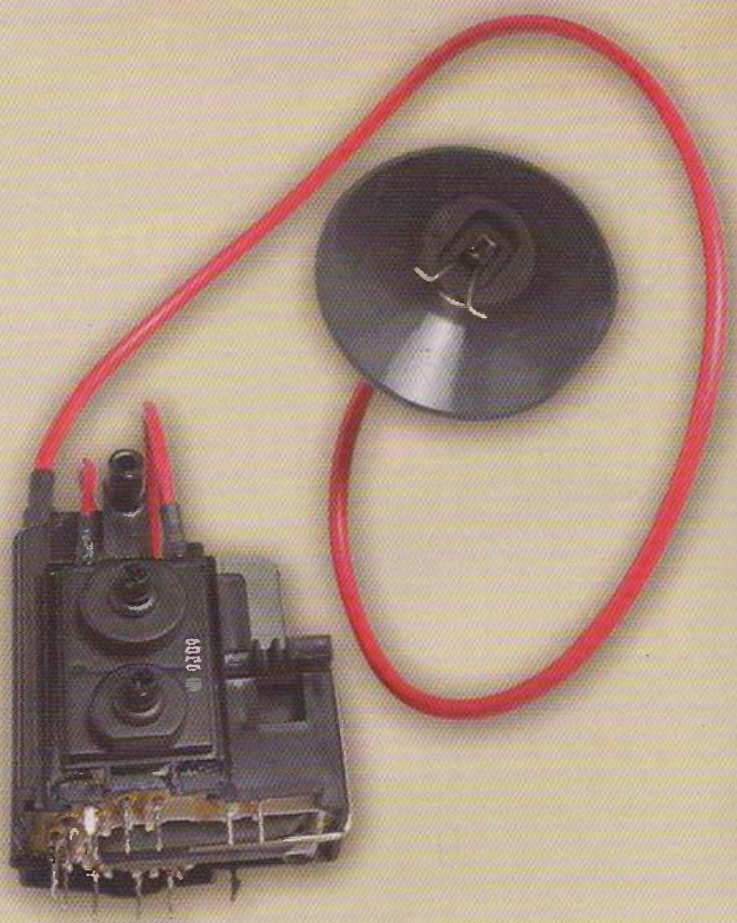

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Note that we are unable to answer technical queries over the telephone and cannot provide information on spares other than that given in our Spares Guide.

Next issue, dated October, on sale September 19th.

The repair/throwaway problem

If you were running a mass-assembly plant the ideal situation would be for the products to leave, in vast quantities, and never be heard about again. It would be best if the plant could be evenly loaded over a long period of time. i.e. production would be sustained at an optimum high level for a lengthy period, with no hiccups as the market varies or shutdowns for any reason. This way the profit from the plant would be maximised. It would be preferable for new products to be introduced without too much disruption, and you would aim to avoid any recalls, and hope that after-sales attention would be minimal. This would be the perfect world for the production manager, and one thought for a time that this was how Japanese manufacturers saw things, with their emphasis on the smooth-running workplace, product reliability, and going for the largest market share.

Alas, the world is not a perfect place. Even the best companies suffer from reliability problems from time to time, and markets don't operate to suit production needs. Then there's the question of what to do about products at the end of their expected life. This has not, in the past, been at the forefront of manufacturers' concerns, but the situation could well change. Products have to be disposed of eventually, and the success of modern industry means that there is a rapidly growing quantity of equipment that's no longer required. It has now become a major concern, hence the European Commission's Waste Electrical and Electronic Equipment Directive and similar moves around the world. It's going to make manufacturers in particular think about the end life of their products, as responsibilities are being imposed on them. The problem is not only the sheer bulk of unwanted scrap equipment, but the fact that a surprising amount of noxious material is present in everyday products.

Our concern in the servicing industry however is with what happens to products during their lifetime. To a mass product manufacturer this is largely a nuisance concern. Providing for the needs of repair companies is not something that's welcomed by most manufacturers. But, whatever the assumed life span of a piece of equipment, it's not going to self-destruct at an appointed hour. A lot also depends on the use it has received which, with electronic equipment in particular, doesn't mean making no use of it – most electronic equipment likes to live at an even temperature without on/off surges.

However well designed a piece of equipment is, with plenty of ventilation and the use of generously-rated components, there is still an element of unpredictability about fault occurrence. At one level you can plan for maximum life time between failure, but Mrs Smith won't be greatly impressed if this is explained to her when her set has failed.

You could argue that greater emphasis on serviceability and longevity are relevant aims now that there is so much concern about waste. But longevity always runs up against the problem of technical innovation. Products do eventually become obsolete, at which point they are either junk or museum pieces. Should we, however, aim for better quality products? If this means higher prices, as it inevitably does, the public would not be too happy.

There has to be a certain amount of compromise about this. It would be pretty pointless to produce everyday equipment with a planned life span of say fifty years. The equipment would become inefficient, with a poor feature specification, long before then. But what is an appropriate life span, and how much service back-up should be provided during this time? These are easier questions to ask than to answer.

It nevertheless seems that the tendency to the throwaway approach has gone too far, and needs to be redressed. In particular those great big widescreen sets with multichannel sound and a host of features will not be viewed by their owners as throwaway items for a long time to come. It's surprising that PCs are so often regarded as being throwaway items, but this is probably because they have to earn their keep and can't do so when they are unable to put the latest software to use.

Servicing may well become an increasingly important part of the overall industry. When you consider the early days of TV, with virtually hand-made sets, servicing was extremely important. Firms could even sell on the promise of good service back-up. The sets were unreliable, because the technological fundamentals were not too well understood (how many years did it take to be able to produce reliable mains filter capacitors?), and service engineers performed much the same tasks as those who manned the primitive production lines. We can't go back to that situation of course, but servicing does have a significant role that's been neglected in recent times.

Most set failures today are for fairly simple reasons, and are not too difficult to deal with. Getting repairs done should be encouraged. As a letter in this issue well puts it, "repair is environmentally-friendly recycling". The problem is that for so many people it's as easy to go out and buy new, at a knock-down price with a statutory guarantee, as to go to the trouble to have a repair carried out. The repair business could do itself a great favour by making it clear to the public what it can do, at what sort of cost, and providing a fast, efficient service. This is again easier said than done, especially since repairers are nowadays few and far between and the nice idea of setting up prominent service centres is unlikely to be economically viable.

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Cumulus BUSINESS MEDIA

TELETOPICS

BSkyB's results and Sky+ launch

BSkyB has reported a pre-tax loss of £514·4m for the year to June 30th, an increase from the £262·7m loss during the previous year. The substantial loss is partially accounted for by losses of £119m on BSkyB's interactive service and £116m on its stake in the German service Kirch PayTV. There is also the fact that BSkyB has continued to invest heavily. Since the end of 1998, BSkyB has invested £2·4bn in converting its operations to digital technology, including new channels, digital STBs and marketing. At the operating level the situation is much better: BSkyB recorded an 88 per cent profit increase to £160·2m. The company expects to be in overall profit by the end of 2001.

The German venture with Kirch was expected to become profitable in 2002 but has been performing poorly. BSkyB has the option to sell its stake to Kirch, but the potential prize is the largest pay-TV market in Europe.

During the last financial year BSkyB added some 940,000 digital subscribers, bringing the total to over 5·4m. Its target is for seven million digital subscribers by 2003.

Despite a subscription price increase in January, BSkyB's churn rate has remained comparatively low at ten per cent. This is in fact the lowest rate for a pay-TV service anywhere in the world. Average revenue per subscriber rose seven per cent to £302. and in addition £11 per subscriber average was made from interactive services. BSkyB plans to increase its average revenue per subscriber, including interactive services, to £400 by 2005.

BSkyB has also released further information on its new set-top box, Sky+, which is being manufactured by Pace. The decoder incorporates a 40GB hard disk that can record an average of 20 hours of TV programming, and has a twin-tuner facility so that viewers can record one programme while watching another. The technology has been developed by Pace, NDS, NEC and OpenTV. BSkyB does not intend to subsidise the new box. It goes on sale this month (September) at £300 plus a subscription of £10 a month for the basic free-to-view channels. Premium services will cost extra. Subscribers will also have to pay an installation charge – £50 for existing subscribers, £100 for new ones. The charge includes replacing the existing LNB with a quad type. BSkyB will market the Sky+ directly to start with, but the STBs will be available via high street retailers shortly afterwards. BSkyB has plans to provide 20-30 new features by remote downloads to the box's hard disk.

ITV Digital

The change from ONdigtital to ITV Digital has now been implemented, and ONnet has become ITV Active – it now has over a hundred portal partner brands. Two Way TV is the new name for ITV Digital's games service. Operating on channel 46, it offers cash prizes to games players and expects to offer pay-per-play and multi-player gaming by the end of the year. There are plans to rebrand the ITV network ITV1 later this year.

ITV Digital has reported an increase of 48,000 subscribers for the quarter ended June 30th, bringing the total to 1,135,000. The annualised churn rate at the end of the quarter was 23 per cent.

ITV Digital and BT have announced a new strategic partnership under which BT will market an ITV Digital subscription package to its customers. BT subscribers will be able to get all ITV Digital's primary channels, the new ITV Sport channel and all the pay-per-view football for £19.99, a saving of £3. The offer will also be open to ITV Digital subscribers who have or transfer to the BT phone service.

The VMD130 is one of a range of five MiniDV-format camcorders recently introduced by **Thomson Multimedia**. Its features include a digital memory card for the production of VGA-quality photographs, a USB port for fast-data transfer to a PC, and a DV input to allow re-recording of edited footage on the cassette. Other models range from the entry-level VMD120 to the flagship VMD170, which comes with IntroDV software for digital film editing and provides SXGA-quality photos via its multimedia card.

DVD news

Computer company Dell has joined the DVD+RW Alliance, a group of companies that's promoting this recordable DVD format. Philips, joint developer of the DVD+RW format, will be showing its DVD+RW recorder Model DVDR1000 at the Berlin IFA electronics show. Philips will also be showing a new DVD-Video player, Model DVDQ50, which uses the company's Digital Crystal Clear technology. This was first used in TV sets.

Features of Sharp's new portable DVD player, Model DV-L88S, include an 8in. 16:9 LCD monitor display, a Digital Super Picture facility for adjusting the contrast and brightness, and Virtual Dolby Surround sound.

Philips has launched three TV-DVD combo models (28PW6816, 28PW6826 and 32PW6826) which use the Philips Blackline-S Real Flat picture tube. The DVD player section can play DVD-Video, Video CD, audio CD, CD-R and CD/RW discs. There's digital zoom and an optical digital output

New from Philex

Philex has added two masthead amplifiers to its SLx range of aerial accessories. The 15dB-gain version is suitable for most applications, the 26dB-gain version being intended for use with a long cable run or a passive splitter. The 12V power supply required is connected via the download cable.

Philex has also added five new digital multimeters to its range. There's a pocket multimeter with integrated torch, a 4000 count, a large LCD screen, auto-ranging and data storage. A digital capacitance meter has nine ranges from 200pF to 20μF. The entry-level meter has a 1999 count and 3.5-digit LC display: it includes frequency and capacitance measurement. The high-performance model has extra features including temperature measurement. Finally there's a heavy-duty auto-ranging digital multimeter with 3.75-digit LCD and 3999 count. It warns against incorrect testing leads for large-current inputs.

For further information on these products contact Philex Electronic Ltd., Philex House, 110-124 The Broadway, West Hendon, London NW9 7PP. Phone 020 8202 1919, fax 020 8202 0014 or e-mail sales@philex.com

The company has a web site at http://www.philex.com

Digital radio

Commercial digital radio broadcaster Digital One has extended its coverage to 80 per cent of the UK, reaching a potential audience of 44·8m people. It has been opening an average of two transmitters a month, with the total at present 46 on air. The plan, with its partner NTL, is to have a total of 70 transmitters in operation. The service started in November 1999, when coverage extended to 69 per cent of the population. The company says it is on course to exceed its licence requirement of 85 per cent coverage of the UK by the end of 2002. Digital One currently broadcasts ten services nationally, including simulcasts of Classic FM, Virgin and Talksport. The other seven are digital-only channels.

Texas Instruments and RadioScape, a UK firm, have developed a digital radio design that could cost setmakers about £30 (for everything except a case, dials and speakers) and enable DAB receivers to be sold at under £100. Texas Instruments has contributed the hardware, which is based on TI's TMS320DRE200 decoder chip, while RadioScape has provided software. The hardware includes eight other TI chips and a tuner produced by Hitachi. The companies claim that this is the most cost-effective reference design for a Eureka-147 DAB receiver.

Airship broadcasting

The use of unmanned airships stationed at 60-65,000ft above the Earth's surface for communications purposes has been proposed by the Advanced Technologies Group, which is based at Bedford. The advantage is that the cost of the airships would be a fraction of that of a satellite to do the same job. The airships would hold station for up to five years using a combination of solar-powered electric engines and a lightweight diesel engine. They would carry transponders for mobile phone, broadband internet and digital radio and television broadcasting, also both military and civilian surveillance.

The group has developed a prototype StratSat airship which reached 500ft during its first, successful flight. It's a tenth the length of the planned 656ft airships. ATG hopes to produce two full-size StratSat airships by mid-2003.

The company admits that there is huge scepticism towards the use of airships, but considers that it has solved all the technological problems and has identified suitable markets. It says that there is enormous potential, with virtually no competition.

Airships have been used in the past for broadcasting purposes, as readers of Roger Bunney's column will know. Advances in the technology involved could make this an attractive proposition.

Pace reports

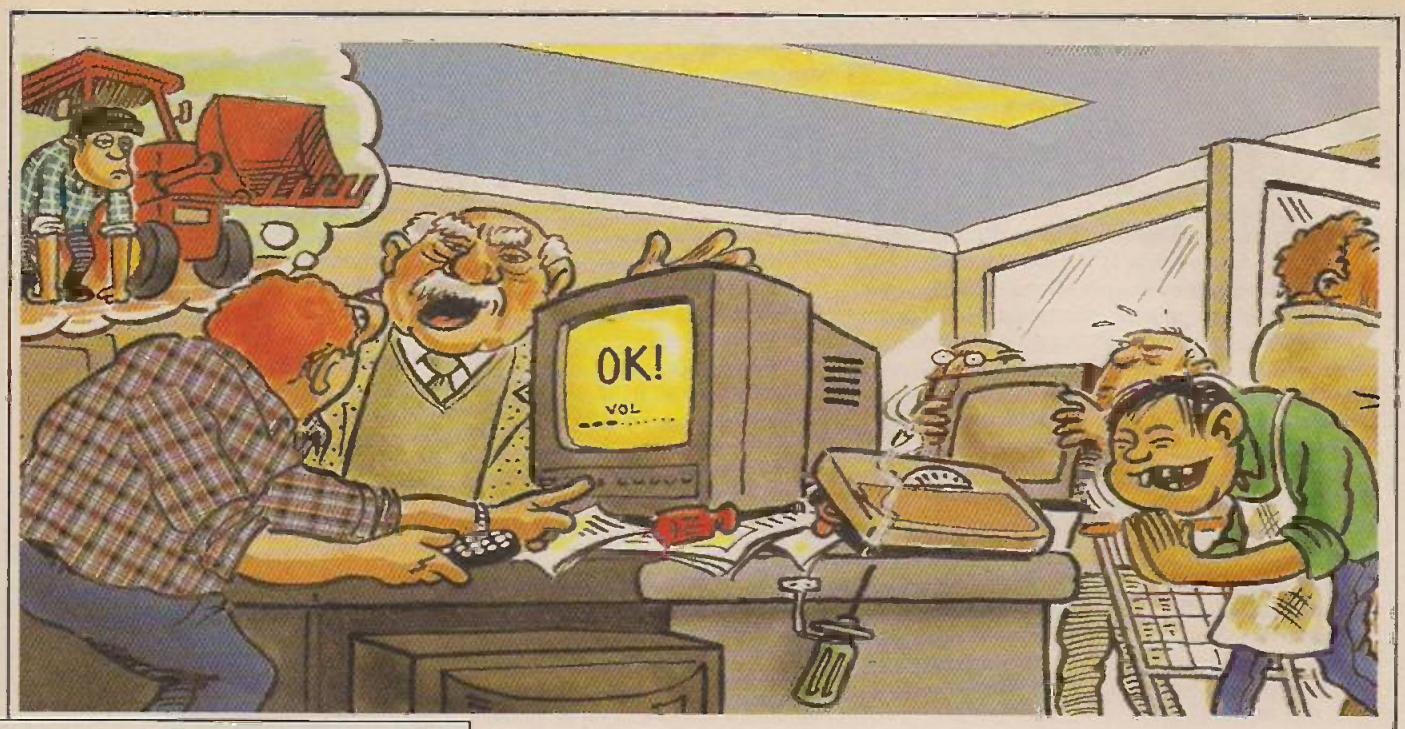
Pace Micro Technology has announced a profit before tax increase of 59 per cent, to £38·1m, for the year to June 2nd. Turnover increased by 39 per cent to £523·6m, with sales of the company's STBs up by 27 per cent at 2·7m (2·1m in the previous year). This growth was mainly in the UK, as BSkyB, NTL, Telewest and ONdigital continued to take decoders at a high rate. According to Pace 28 million digital STBs were installed worldwide in 2000. New installations are expected to rise to 34 million this year. This will bring the total to some 100m in 80m homes. This is a large number but is still small in relation to the world's 1·2bn homes with TV, Pace adds.

Pace has announced an expansion of its video over internet protocol (IPTV) division in the US. The company says that demand for video over the internet will grow as the demand for connections to high-speed, IP-based networks increases. Domestic DSL (digital subscriber line) connections are expected to reach 14·4m in the US by 2004. Home fibre-line connections will add to the opportunities.

Pace will be demonstrating new STB technology at this year's International Broadcasting Convention in Amsterdam, including hard-disc drives, the Pace-Xcom digital television adaptor (DTVA) and home networking. The latter could see the set-top box evolving into a hub for the interactive home, delivering audio, video, voice and data around and to and from homes. The DTVA is a remarkably compact device that enables analogue TV sets to work with digital TV signals.

Speech-recognition IC

Philips Semiconductors has developed a new speech-recognition chip called the Hello IC. It can interpret the equivalent of up to a hundred words, with continuous-connected word recognition so that the user can give it instruction sentences. There is no need for users to train the system to understand the words (this was necessary with some earlier designs, to cater for differing voice characteristics). Philips says that use in home entertainment systems is envisaged, eliminating the need for multiple or complicated remote-control handsets to operate items such as a TV set, audio system and DVD player.



The secret of an unrepairable set that landed on Paul's bench is eventually revealed. Meanwhile I had all the easy ones. Servicing commentary by Donald Bullock

WHAT A LIFE

I could tell that the chap who was approaching our shop wasn't quite the ticket. He was wearing a white apron and was pushing a supermarket trolley that was covered with a shawl. When he came in he bowed and gave me a grin.

"Please do you lepair television sets?" he asked, "I'm the take-away. It's in my tlolley."

I gave him a big smile. "Noted for it" I replied, "we lepair any make – or tly to."

He went outside and brought the trolley in. The set it contained was a little Matsui model. "We've been lobbed of our ploglammes" he said. "I'm Mistelee."

I couldn't figure out exactly what he meant, so I nodded understandingly, wrote Charlie Chan on a job card, and put the set on Paul's bench. It was still warm. Then I turned to the set I'd been about to look at.

An 11AK19E3 chassis

It was a Seg, model Zurich, and the chassis said 11AK19E3. Oh for the days when they were all Ekco, or Bush, or Philips, or even Pye, Cossor, or English Electric I thought. Then I recalled those tiny high-value Philips resistors that used to lie half hidden and wide open, the Perspex Ekco line output transformer shrouds that used to conduct themselves to oblivion, the Cossor sets that required a contortionist to change the tuner valves, and the English Electric sets with the EY51 EHT rectifier at the bottom of a pit of wax well down under the tube. I turned my thoughts to happier things.

I had opened the shop that morning because Paul had been to a get together the previous evening and Steven had to go to the dentist.

When Paul arrived, a bit jaded, he eyed the Matsui set. It was a 1408R.

"What's up with this one?" he asked.

"It's been lobbed of its ploglammes" I replied, "Mister Chan is vely distressed."

He gave me a funny look and plugged the set in.

I settled to the Seg. It was tlipping, sorry tripping, and the standby LED was flashing. Grinning cleverly, I homed in on the line output transistor and tested it. It read perfectly. Grinning a little less cleverly, I checked the HT voltage. It was also correct. So I suspected a load on the line output transformer, and started by disconnecting the tube's anode cap. No luck. I looked at the chassis, then out of the window. It was a lovely morning, with such a pleasant light. I wished myself at Baker's Pool, after a few tench. Then back to reality.

"Have we got a circuit for this Seg thing?" I asked Paul.

He started to laugh. So I thought awhile then tried another angle.

"Any idea why it's dead?" I said. "I mean, do they have any stock faults? It's tripping."

"Is the LED flashing as well?" Paul asked.

I nodded eagerly.

"Dunno" he said, "unless the feed to the regulator is missing. If it is, replace the safety resistor. It's R867, 0·33Ω."

I looked at him, but he had returned to the clouds with the Matsui. So I checked the resistor, which was open-circuit. I replaced it and carried out a resistance check between the supply and chassis. Everything was OK. Before switching on I spoke to Paul again.

"Er, any idea why the resistor failed?"

He shrugged. "Dunno" he replied, "they seem to go for no reason."

So I switched the set on. Up came a good picture.

"Can't make head nor tail of this set" Paul continued. "None of it makes any sense. Refuses to work, but I can't find any fault."

"Try the, er rectifier" I volunteered.

He eyed me coldly and returned to his misery.

A Samsung

Just then Victor Smallpiece called in with a big Samsung colour set. He's a thin-faced fellow, a bit timid, from the Land of the Leek.

"Good morning, Mr Bullock, don't they?" he smiled

I'm not too fond of him, so I just gave

him a friendly grin.

"We don't watch the telly much" he continued, "but when they go we can't seem to get on without them, haven't they?"

I looked at his set, which was a 21in. Samsung Model CI5322. It's fitted with the P68SC chassis. "What's up with it?" I asked.

He grimaced and shook his head violently. "When I tried to get a picture it screamed it's head off. Terrible. Even the wife's dog got out. And Effie Philips started to hammer on the wall."

"Who's Effie Philips?" I asked, trying to show interest.

"Our next door neighbour, Mr Boater. Awful woman, doesn't she? D'you know, Mr Bullrush, she's had seven husbands. and . . . "

"OK Vic" I cut in, I'll give you a ring."

As he left, I got the set on to the bench and switched it on. It squealed all right, but I couldn't see why Effie should have kicked up so much fuss. Still I didn't know Effie.

"I can't mend this set" announced Paul. "My mate Joady earns three hundred and fifty quid a week driving a little bulldozer thing. And he can only count up to seven."

I conjured up a mental picture of Joady, standing bolt upright and strumming the floor with his knuckles. Then I got back to the Samsung set and dived at the 2SD1651 line output transistor. It was short-circuit.

"Found the trouble with my set" I said, as I fitted a replacement. Then I switched on. Nothing happened. I measured the resistance between the transistor's collector and chassis. It seemed to be all right, so I checked the HT feed. It was missing. Why hadn't I done this first? I soon found that the 10Ω, 7W feed resistor was open-circuit. I replaced it, checked carefully for any other damage, then switched on. The set gave a clunk. issued a wisp of smoke and started to bawl at me.

"This set's driving me mad" Paul said. "You ought to see Joady's car. One of those Silver Sphinxes. Cost him twenty thousand quid, but what's that to him? His house is like a mansion. Earns nearly four hundred quid a week, and no worries . . .

Blow Joady I thought. What about this Samsung? I checked the new 2SD1651 transistor, which was short-circuit. And the new HT feed resistor had gone to heaven. Why? I checked for other shorts in the line output stage, but couldn't find any. Then I looked for dry-joints around the line output transformer. Everything seemed to be OK. At last I slipped my brain into gear, fitted a 100W bulb as a dummy load in place of the line output transistor, and measured the HT voltage. It was 165V instead of 125V.

"Ha, the Samsung's HT is high" I said, "thought so."

"But not before you blew up a line output transistor and power resistor" said Paul.

I looked at him. "Look, I can't help it if you can't mend that Matsui" I said. "I've always been able to manage 'em. Get the old grey matter working instead of thinking of bloody Joady and his bulldozer. Why, when I was your age . . ."

I turned back to the Samsung set and probed around in the power supply to see why the HT was so high. I eventually discovered that C852, a 470µF, 16V electrolytic, was low in value at 200µF. It's in the error-voltage sensing circuit. It seemed reasonable to assume that this was the cause of the trouble. So I fitted a replacement, a new 2SD1651 line output transistor and power resistor. Then I held my breath and switched on. Instead of the screaming noise an excellent picture came up, and when I measured the HT voltage it was spot on at 125V.

Scales

Just then John Berryman, the most unlikely undertaker I've ever come across, plodded in. He's tall, bulky, red-faced and bluff. In fact he'd pass for a fruit farmer around here. And he doesn't mince his words.

"How be yuh, Don?" he bawled.

"Never mind the trade enquiries, John" I replied. "How is trade, anyway?"

"Pretty good, Don, an' just as well too. If they don't keep on dyin' we can't go on livin'. Here, mend these will you?"

At that he put a set of bathroom scales on the counter. Bathroom scales! When he'd breezed off I looked at them. The platform was solid. I removed a baby's teething ring that was jammed beneath it, then jumped on to test them out. I saw my weight and whistled. Good God!

The major

A pair of scruffy men came in with a 28in. JVC set, Model AV28VM1EK. They were followed by Major Hagger.

"Morning Mr Bullock" he rasped, "on the bench is it?"

I nodded.

"Put it there you chaps, and wait by the car" he barked." The men made their exit.

"Sound but no picture, don't you know" he said. "Do whatever's necessary and give us a ring, there's a good fellow." And off he strode.

I switched the set on. Paul heard the rustle of EHT and looked over.

"If you turn up the first anode control you'll find you've got field collapse" he said. "That's another easy one you've got."

I took the back off, marked the first anode potentiometer's setting, and wound it up. A very reduced red raster appeared. When I homed in on the field output chip IC401 I found that it looked a bit baked and was very warm. So I fitted a replacement, returned the first anode potentiometer to its original position, and switched on. An excellent picture appeared, just as Steven came in.

The Matsui's problem

Paul looked over at Steven. "Dad's had nothing but easy ones today" he said, "while I've been lumbered with this Matsui set. Hey, do you know Joady, my mate? He earns over four hundred and fifty quid a week just for sitting about on a bulldozer thing. Bought his bird a gold ring last week, with a diamond as big as an egg. No worries at all."

Steven fingered his face. "Trouble with a Matsui?" he asked.

"Sure have" said Paul. "It won't work and I've spent all morning looking for a fault. Everything I check turns out to be perfect. But it still won't work!"

Steven looked at the set, tried it, then sniffed at it.

"The customer's Chinese" he declared.

"How did you know that?" I asked.

"The set smells like a takeaway. I know him. Name's Lee, not Chan."

I nodded.

PIN code installation

"I reckon he forgot his PIN code again" said Steven, "fed it in wrongly a few times and disabled the set. Like he did last summer when you and Paul were in Spain. Gave me the runaround, I can tell you. Had to reset it with another number in the end."

"How does it work?" Paul asked.

"You have to switch the set off for at least an hour and a half, then switch it on. You are then allowed three attempts to enter the correct code. If you make a mistake each time, you have to switch off again, wait and try again. I think we'd better install a new number – an easy one that even he won't forget. Say 1 2 3 4."

"How?" I enquired.

"Enter the wrong code three times. The set will be disabled. Switch it on and press the volume down button on the set while pressing 7 on the remote control unit. Hold both buttons down for a few seconds until OK appears on the screen. The set will then function and you can install a new code."

"What a life!" I said. "It's like everything else electronic. Full of time-wasting and confusing gimmicks. not because anyone wants them but because the technology is there and manufacturers are scared stiff not to use it. When I came into this trade fifty years ago I knew it would be difficult. Now, because of man-made complications, it's becoming impossible."

"My mate Joady doesn't have these problems" said Paul. "He gets nearly five hundred quid a week just for lolling about in a little bulldozer thing. Makes you think!" ■

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Approxinately 25% additional information

Over 8000 different faults listed

Seperate section for VCR/TV combinations

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BUH515D	250p	IRF710	150p	MJE18004	125p	TIP36C	65p	LM2416T	650p	STK73605	375p	STRS6707	1000p	TDA4565	150p	UC3844	70p
BUH517	275p	IRF720	85p	MJF18004	175p	TIP41A	20p	LM324	30p	STK73907	700p	STRS6708	575p	TDA4600	200p	UC3844AN	80p
BUH517D	175p	IRF730	125p	MJF18006	200p	TIP41C	22p	LM339	35p	STK7406	650p	STRS6709	600p	TDA4600 II	160p	UC3845AN	80p
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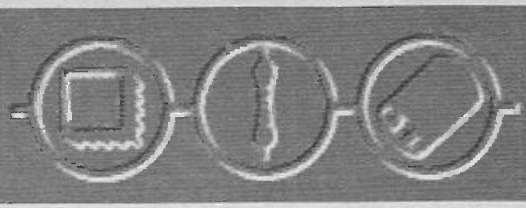

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1000uF	CAP33	£2.10	10
2200uF	CAP34	£5.25	10
3300uF	CAP35	£5.00	5
4700uF	CAP36	£6.10	10
25 Volts			
10uF	CAP37	£0.45	10
22uF	CAP38	£0.45	10
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47uF	CAP39	£0.48	5
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220uF	CAP42	£1.20	10
330uF	CAP43	£1.40	5
470uF	CAP44	£1.90	10
680uF	CAP45	£3.15	5
1000uF	CAP46	£3.65	10

VALUE	CODE	PRICE	PER PACK
10 Volts continued			
1500uF	CAP47	£3.90	5
2200uF	CAP48	£2.00	2
3300uF	CAP49	£2.20	2
4700uF	CAP50	£3.65	2
6800uF	CAP51	£3.90	2
35 Volts			
1uF	CAP130	£0.40	10
3.3uF	CAP131	£0.40	10
4.7uF	CAP132	£0.45	10
10uF	CAP52	£0.50	10
22uF	CAP53	£0.45	10
33uF	CAP54	£0.50	5
47uF	CAP55	£0.85	10
68uF	CAP133	£0.55	10
100uF	CAP56	£0.85	10
150uF	CAP57	£0.95	5
220uF	CAP58	£1.45	5
330uF	CAP134	£1.60	10
470uF	CAP135	£1.75	10
680uF	CAP59	£6.50	10
1000uF	CAP60	£4.35	10
2200uF	CAP61	£2.45	2
3300uF	CAP62	£10.00	5
4700uF	CAP136	£3.50	2
50 Volts			
1uF	CAP137	£0.35	10
2.2uF	CAP138	£0.35	10
3.3uF	CAP139	£0.35	10
4.7uF	CAP140	£0.35	10
10uF	CAP63	£0.50	10
22uF	CAP64	£0.70	10

VALUE	CODE	PRICE	PER PACK
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68uF	CAP142	£0.90	10
100uF	CAP66	£0.85	10
220uF	CAP67	£1.75	10
330uF	CAP68	£2.45	10
470uF	CAP69	£4.35	10
680uF	CAP70	£4.90	5
1000uF	CAP71	£5.25	10
1500uF	CAP143	£4.50	5
2200uF	CAP72	£3.25	2
3300uF	CAP144	£3.25	2
63 Volts			
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1uF	CAP74	£0.35	10
2.2uF	CAP75	£0.35	10
3.3uF	CAP76	£0.50	10
4.7uF	CAP77	£0.35	10
10uF	CAP78	£0.50	10
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33uF	CAP81	£0.85	10
47uF	CAP82	£0.95	10
68uF	CAP83	£1.30	5
100uF	CAP84	£1.20	10
150uF	CAP85	£2.80	5
220uF	CAP86	£2.80	10
330uF	CAP87	£4.00	10
470uF	CAP88	£5.25	10
680uF	CAP89	£5.00	10
1000uF	CAP90	£5.40	5

VALUE	CODE	PRICE	PER PACK
100 Volts			
0.47uF	CAP91	£0.50	5
1uF	CAP92	£0.85	10
1.5uF	CAP93	£0.70	5
2.2uF	CAP94	£0.50	5
3.3uF	CAP95	£0.50	5
4.7uF	CAP96	£0.50	5
10uF	CAP97	£0.95	10
22uF	CAP98	£1.05	10
33uF	CAP99	£1.55	5
47uF	CAP100	£1.75	10
100uF	CAP101	£2.10	10
220uF	CAP102	£6.00	5
470uF	CAP103	£6.00	5
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2.2uF	CAP146	£0.45	10
10uF	CAP147	£1.40	10
22uF	CAP148	£1.80	10
33uF	CAP149	£2.30	10
100uF	CAP150	£3.25	5
200 Volts			
100uF	CAP151	£3.25	5
250 Volts			
1uF	CAP152	£0.60	10
3.3uF	CAP104	£1.75	10
10uF	CAP105	£2.60	10
22uF	CAP153	£2.30	10
47uF	CAP106	£4.35	10
100uF	CAP154	£4.50	5
220uF	CAP155	£2.00	2

VALUE	CODE	PRICE	PER PACK
350 Volts			
1uF	CAP156	£0.70	10
3.3uF	CAP157	£1.50	10
10uF	CAP158	£2.25	10
22uF	CAP159	£3.40	10
400 Volts			
1uF	CAP107	£2.15	5
2.2uF	CAP108	£2.25	5
4.7uF	CAP109	£3.15	5
10uF	CAP110	£4.00	5
22uF	CAP111	£2.50	2
47uF	CAP112	£3.50	2
100uF	CAP160	£4.00	2
220uF	CAP161	£7.00	2
450 Volts			
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2.2uF	CAP114	£3.20	5
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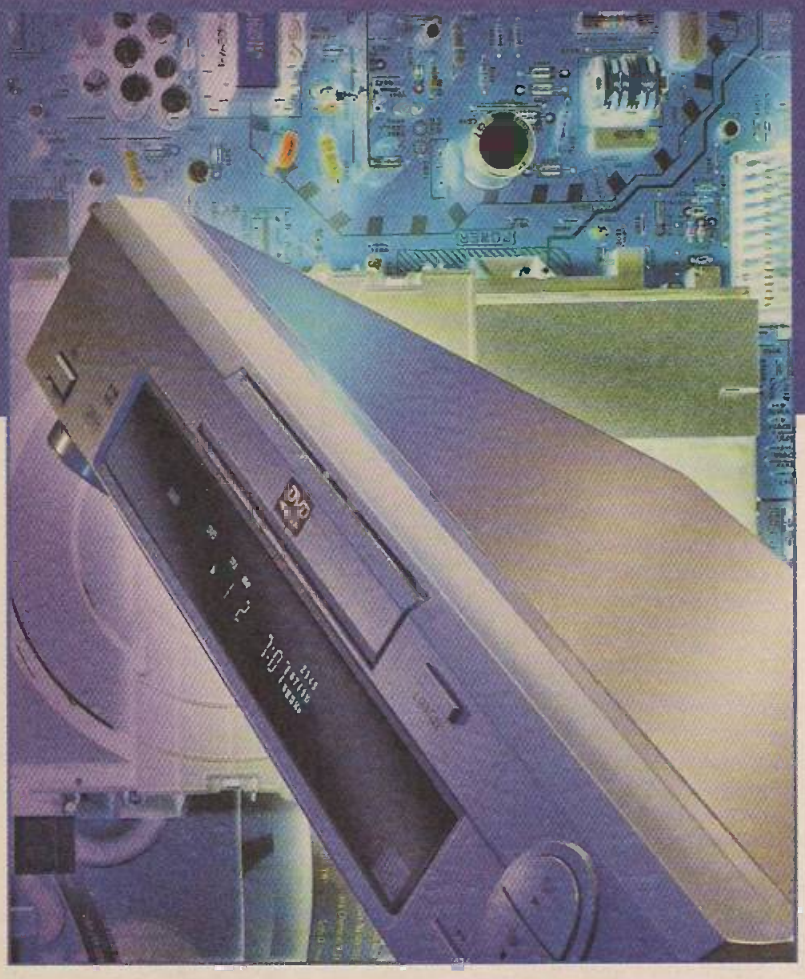


DVD player servicing

The DVD has been a great success, and large numbers of players have been sold. They are now appearing in service departments in increasing numbers, and present their own problems. K.F. Ibrahim starts a new series on their operation and fault-finding/servicing procedures

We'll start this new series on the DVD system and player servicing by looking at the basic characteristics of the disc, the DVD encoding processes and data flow from the disc.

The disc

The DVD evolved from the CD, its construction being basically the same as that of the CD-ROM. Digital data is stored on a DVD in the form of a spiral track of pits in the basic 'land'. As the laser pickup head scans the disc, it translates the pits and intervening land into ones and zeros. By using a laser beam with a shorter wavelength than that used with a CD, the storage capacity of a DVD is increased to a few gigabytes (GBs). The shorter wavelength (650 or 635nm compared with 780nm for a CD) reduces the diameter of the spot beam, thus enabling the laser to focus on and read a smaller pit size with a closer track pitch. Table 1 compares these characteristics. Improved signal processing and error correction also contribute to the disc's increased data storage capacity.

The basic DVD has the same diameter as a CD (there is also an 8cm version), but whereas the CD has one substrate the DVD has two 0·6mm thick substrates which are bonded together back-to-back, providing the necessary stiffness to avoid disc wobble or tilt.

The data may be recorded on one side only of a DVD (single-sided) or on both sides (double-sided), and each side may have a single recording layer or two layers as shown in Fig. 1. There are thus four different recording formats:

Single-sided (SS), single-layer (SL)
Single-sided (SS), dual-layer (DL)
Double-sided (DS), single-layer (SL)
Double-sided (DS), dual-layer (DL)

With dual-layer recording, layer 1 is read through layer 0. So layer 0 must be semi-transparent. It has a reflection of 20 per cent compared with 70 per cent for the second layer. With a double-sided disc data is read from both sides. The disc is either turned over or a dual-head arrangement may be used.

Thus the storage capacity of a DVD depends on its recording format. Table 2 lists the capacities of each type of DVD. It will be noticed that the capacity does not quite double with the dual-layer configuration. This is because a longer pit length is used with the dual-layer arrangement, to avoid reading errors

Table 1: Comparison of CD and DVD track characteristics.

Characteristic	*CD*	*DVD*
Track pitch	1·6µm	0·74µm
Minimum pit length	0·83µm	0·4µm
Beam diameter	1·4µm	0·9µm

caused by interference between the layers.

With a single-sided, single-layer DVD the data is read from one side, as with a CD, starting at the inner circumference then reading outwards. With a dual-layer DVD, the data may be recorded in either of two ways: both layers recorded with the data starting at the inner circumference and continuing to the outer circumference of the disc; or the first layer starting at the inner circumference and continuing to the outer circumference while the second layer starts at the outer circumference and continues to the inner circumference.

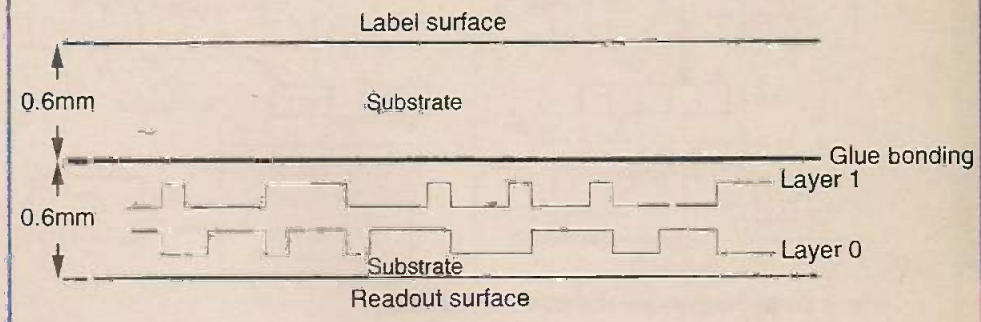


Fig. 1: Arrangement of a single-sided, dual-layer DVD.

DVD classification

There are two main DVD classifications, DVD-ROM and DVD-Video (DVD-V). The DVD-ROM is a high-capacity, high-quality read-only storage medium for PCs. The DVD-V is a version of DVD-ROM for storing moving video plus audio software. There are three other official DVD specifications: DVD-Audio (DVD-A) for Dolby Dolby audio; the write-once DVD-R; and the rewritable DVD-RAM. In addition two other rewritable formats have been developed, DVD+RW and DVD-RW.

DVD encoding

A DVD recording consists of three elements: video, audio and other data, including PCI (Program Control Information), DSI (Data Search Information) and additional data streams such as sub-picture and extra audio channels. See Fig. 2. The video and audio information originates in analogue form of course, and thus has to be digitised before being encoded: other data such as PCI and DSI is digital to start with and doesn't require encoding.

The analogue signals are first converted to a digital format by their respective encoders, which then remove non-essential or redundant parts of the picture and sound information and perform bit-reduction. The output from each encoder is a series of discrete video or audio data packets, which are known as packetised elementary streams (PES). Together with the other (PCI and DSI) packetised elementary streams, they are fed to a multiplexer which produces the programme stream. This

Table 2: DVD disc capacities and playing times.

Disc type	*Capacity*	*Hours (video)*
12cm SS/SL	4·7GB	2·5
12cm SS/DL	8·5GB	4
12cm DS/SL	9·4GB	4·5
12cm DS/DL	17GB	8
8cm SS/SL	1·36GB	0·75
8cm SS/DL	2·48GB	1·25
8cm DS/SL	2·72GB	1·5
8cm DS/DL	4·95GB	2·5

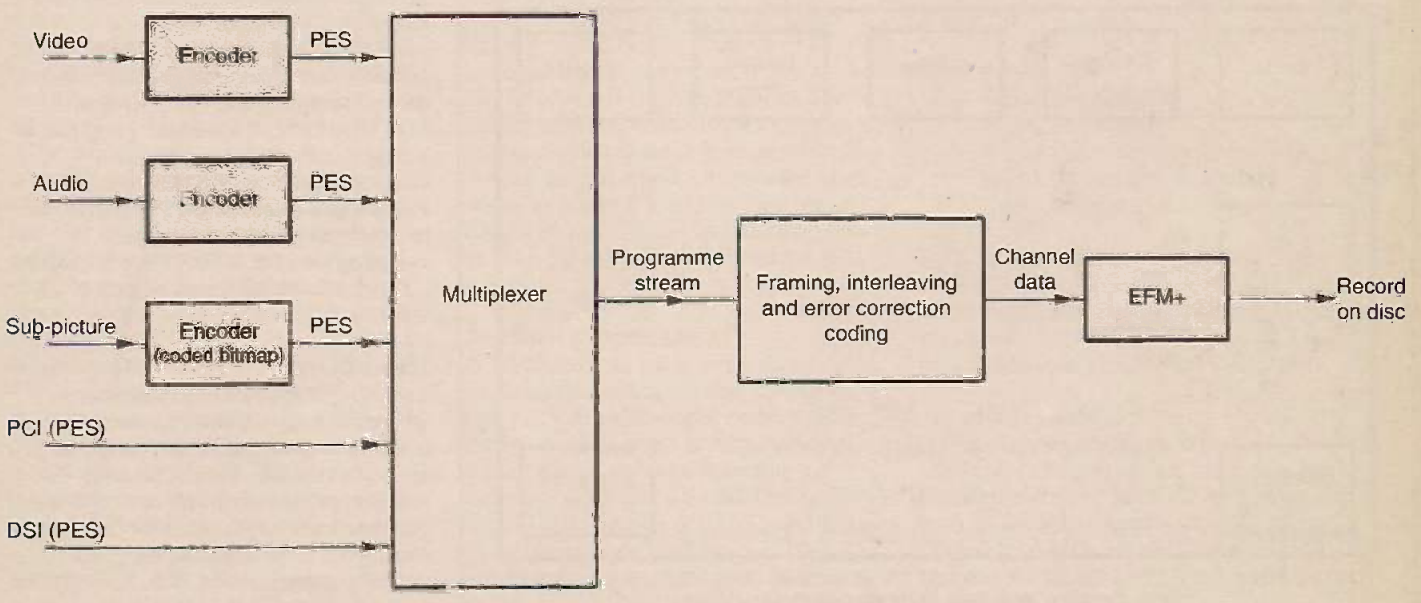


Fig. 2: DVD encoding, basic processes.

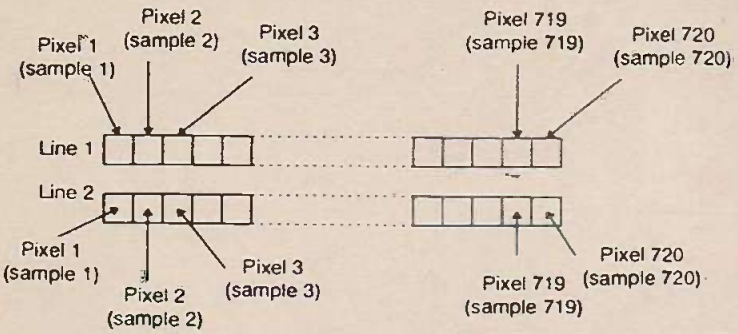


Fig. 3: Pixels/samples per line (625-line standard).

consists of a sequence of video, audio and other PESs.

Error correction and interleaving are next applied, after which the data stream is structured as regular data frames known as channel data. Eight-to-sixteen modulation (known as eight-to-fourteen plus, i.e. EFM+) is carried out before the data is recorded on the DVD.

MPEG-2 video encoding

The first task of the video encoder is to digitise the analogue video signal picture by picture. TV picture digitising consists of sampling a picture frame's contents scan-line by scan-line. To maintain picture quality, there must as a minimum be as many samples per line as there are pixels, with each sample representing one pixel. Two factors determine the number of pixels in a television picture: the number of lines per picture and the aspect ratio. The British PAL system uses 625 lines, of which 576 are active, i.e. they carry video information (with the US 525-line system there are 480 active lines). For digital TV the aspect ratio is taken as 5:4, which suits the video encoding process. This involves organising the picture content into blocks and macroblocks. If the vertical and horizontal resolution are to be the same, the number of pixels per line is 576 x 5/4 = 720.

Each line will therefore be represented by 720 samples, with each sample representing one pixel – sample one represents pixel 1, sample 2 pixel 2 and so on (see Fig. 3). The process is repeated line by line until the end of the frame, when it's repeated for the next frame and so on. To ensure that the samples are taken at exactly the same point in each frame, the sampling frequency must be locked to the line frequency. For this to apply, the sampling rate has to be an exact multiple of the line frequency.

The above figures apply to what is known as standard-definition TV (SDTV): for high-definition TV (HDTV) the number of pixels per line is increased to 1,920 and the number of active lines is doubled to 1,152, though 1,080 lines are normally used when the aspect ratio is 16:9.

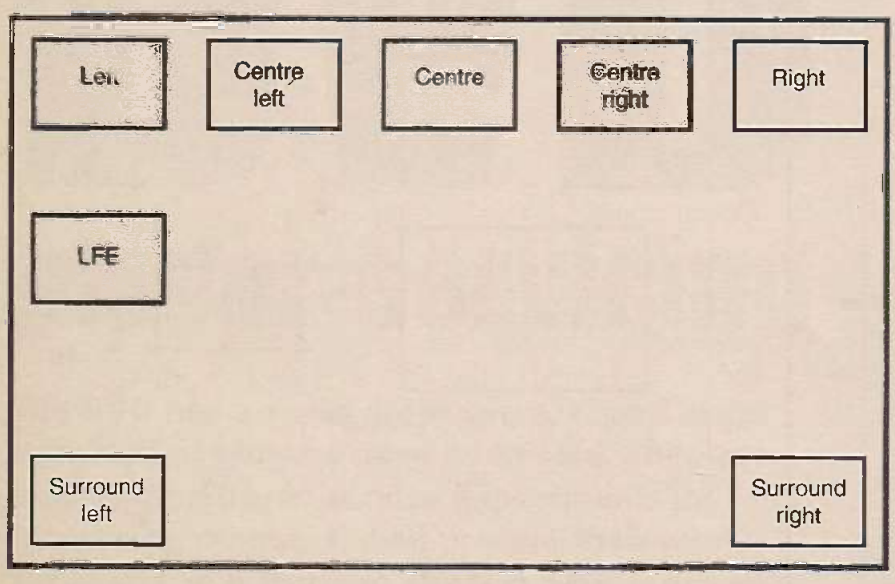


Fig. 4: Possible speakers in multi-channel systems.

The sampling rate

The total duration of one line of composite video is 64µsec. Of this, 12µsec is used for the line sync pulse and the front and back porches, leaving 52µsec to carry the video information. The sampling rate, in MHz, for SDTV is the number of pixels per line divided by 52. With 720 pixels per line, this comes out at 13·8MHz As the sampling rate must be a whole multiple of the line frequency, a rate of 13·5MHz (858 and 864 times the line frequency with the 625- and 525-line broadcasting systems respectively) is recommended by the CCIR.

The sampling frequency must also be greater than twice the highest frequency of the analogue input, by ten per cent or more. Thus with a video signal that, at the studio, may have a frequency range up to 6MHz, a sampling rate in excess of 2 x 6 = 12MHz is necessary. The selected rate of 13·5MHz also satisfies this requirement.

Video sampling

Colour video consists of three components, luminance (Y) and two colour-difference signals, R – Y which is known as Cr and B – Y which is known as Cb. In an analogue video system the luminance is given prominence, since the human eye is mainly sensitive to the luminance components of the light wave. In digital video the luminance is also given prominence compared to the two chrominance components.

For the luminance signal, which contains the highest video frequencies, the full sampling rate (13·5MHz with SDTV) is used. A lower sampling rate is acceptable for the chrominance components Cr and Cb, which contain lower video frequencies. The CCIR recommends half the luminance sampling rate, i.e. 0·5 x 13·5 = 6·75MHz.

This gives a total sampling rate of 13·5 + 6·75 + 6·75 = 27MHz.

The bit rate

Sampling is followed by quantisation, where the sample values are rounded up or down to quantum values before they are converted into a multi-bit code. For studio applications, 10-bit coding is used. For broadcasting purposes 8-bit coding is considered to be adequate for good-quality picture reproduction. An eight-bit code provides 2^8 = 256 discrete signal levels.

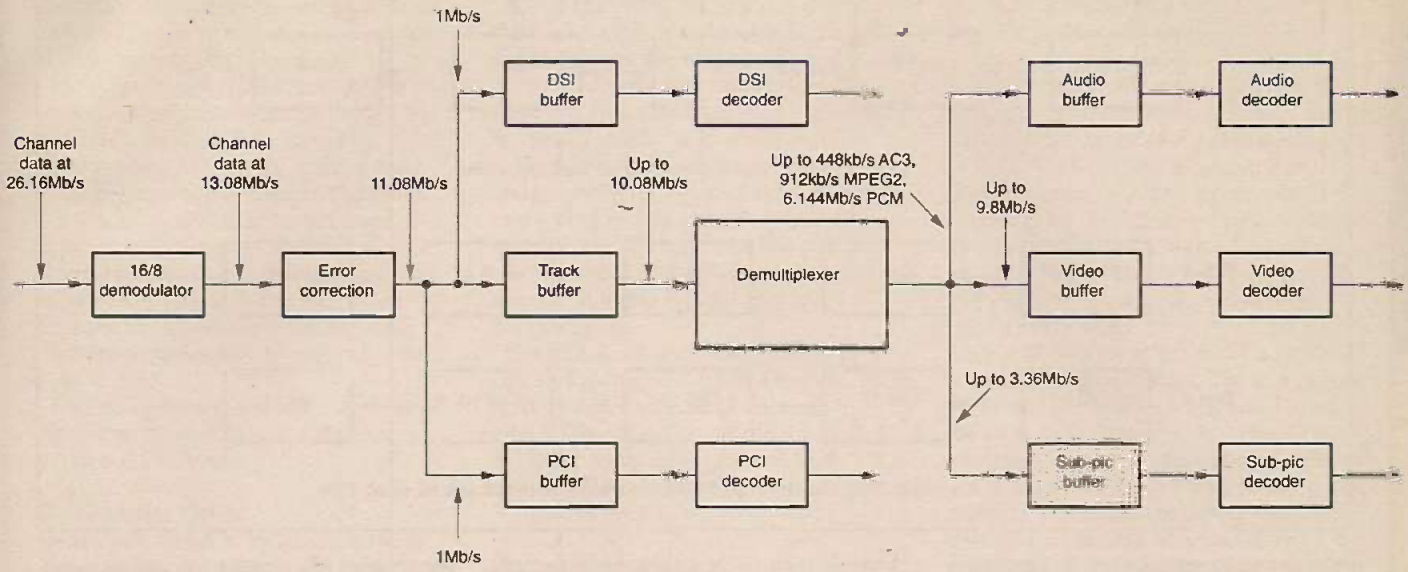


Fig. 5: DVD data flow from the disc to the decoders.

The bit rate can be worked out as follows: Bit rate = the number of samples per second x the number of bits per sample. The number of samples per second = the number of samples per picture x the number of pictures per second. For the luminance signal the former is 720 x 576 = 414,720. With a picture rate of 25 per second, the number of samples per second works out at 720 x 576 x 25 = 10,368,000. The bit rate for the luminance component of the signal is therefore 10,368,000 x 8 = 82,944,000, i.e. 82·944Mbits/sec.

For chrominance sub-sampling, the bit rate can be worked out as follows: The number of samples per picture is 360 x 576 = 207,360. Multiply this by the picture rate (25), the bit rate (8) and the number of chrominance components (2) and you get 207,360 x 25 x 8 x 2 = 82,944,000 bits, i.e. 82·944Mbits/sec.

The total bit rate, luminance + chromiance, comes to just under 166Mbits/sec, a prohibitively high data rate that would require a very large disc capacity to store even a very short film clip. Hence the need for data compression.

Video encoding

There are two major aspects of video encoding: data preparation and data compression with DCT (discrete cosine transform) quantisation. Video data preparation ensures that the raw samples from the picture frames are organised in a way that's suitable for data compression, which is carried out in accordance with the internationally accepted MPEG-2 system.

The MPEG-2 compression system carries out two major data reduction processes, in the following order: temporal redundancy (time related, i.e. frame-by-frame) and spatial redundancy (space related, i.e. within a frame).

Temporal redundancy is an inter-frame reduction technique that compares 16 x 16 pixel blocks from two successive picture frames, predicts the difference between them, and produces a vector which describes their movement, frame-by-frame. Spatial redundancy, which is also known as intra-frame compression, removes unnecessary repetition of the contents of individual picture frames. It's carried out using a type of Fourier transform known as a discrete cosine transform (DCT). The purpose of DCT is to transform sample values of 8 x 8 blocks of pixels into coefficients. The number of coefficients is then reduced by not passing on those at near zero, while the rest are quantised, i.e. rounded up or down, to produce a smaller number of integer values. These are translated into an 8-bit digital code that forms the data bitstream.

Audio compression

A DVD disc can incorporate up to eight audio tracks, which are also known as streams. Each stream can convey either mono sound or a part of multi-channel sound. There are three recording techniques: MPEG-2 audio; Dolby Digital (also known as AC-3); and linear PCM (pulse code modulation). Two other formats are available as additional options: DTS (digital theatre system) and SDDS (Sony digital distribution sound).

Table 3: Parameters for linear PCM.

Sampling rate	*Quantisation (bits/sample)*	*Maximum number of channels*
48kHz	16 bits	8
48kHz	20 bits	6
48kHz	24 bits	5
96kHz	16 bits	4
96kHz	20 bits	3
96kHz	24 bits	2

Fig. 4 shows possible speakers for multi-channel audio. The audio channels may be arranged in several ways, as follows:

1/0 Mono
2/0 Stereo (right, left)
3/0 Right, left, centre
2/1 Right, left, surround
3/1 Right, left, centre, surround
2/2 Right, left, surround right, surround left
3/2 Right, left, centre, surround right, surround left
5/2 Right, left, centre right, centre, centre left, surround right, surround left (this is possible with MPEG-2 only)

In addition a low-frequency effect (LFE) channel, also known as a subwoofer channel, which handles only frequencies below 120Hz is available with all the above combinations. Dolby Digital 5.1 adds a subwoofer to the five-channel 3/2 mode. The LFE channel provides the 'theatre effect'.

To convert a multi-channel recording to

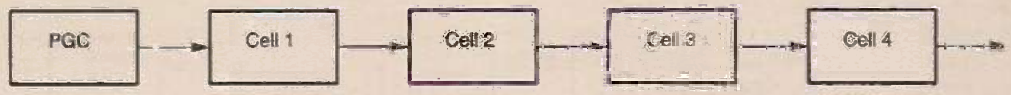


Fig. 6: Monolithic playback of a single title.

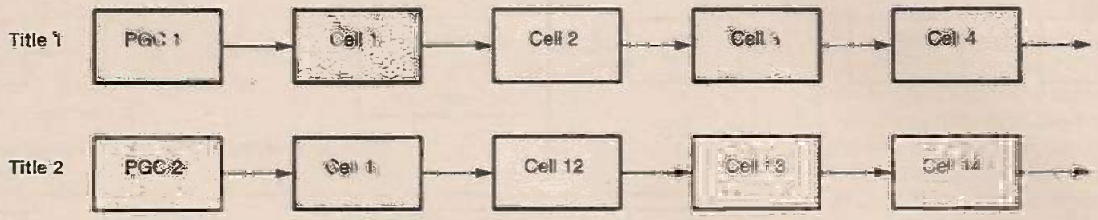


Fig. 7: A multiple title arrangement with monolithic playback of each title.

a simple stereo output a process known as downmixing is used. This involves matrixing the centre and surround channels on to the main stereo channels in accordance with a defined mathematical formula.

MPEG audio

MPEG audio encoding involves splitting the audio baseband into 32 sub-bands of equal bandwidth. Audio signal frequencies that fall within each sub-band are sampled at 48kHz and converted into a multi-bit code. Audio compression is applied by using special algorithms that remove parts of the audio data without affecting the sound quality, a process known as masking. This exploits the following characteristics of human hearing. A quiet sound is made inaudible by a low sound of near frequency, while quieter high frequencies are masked by loud lower ones. In addition human hearing has a finite frequency resolution, so that certain frequency bands sound alike.

The quantised sub-bands, together with the control and error-detection information required, are fed into a multiplexer to obtain an MPEG-2 audio packetised elementary stream. Additional channels such as the LFE subwoofer are placed on a separate extension PES stream.

Dolby Digital (AC-3) encoding

Dolby Digital, also known as AC-3 (AC for audio compression, or audio coding), can be used for all channel arrangements up to 5.1. The sampling rate is 48kHz, with an average of 16 bits allocated to each sample. Its compression technique differentiates between short transient signals and long continuous sounds. Prominence is given to the latter, in the form of longer sample blocks compared to transient sounds. The encoding is smoother than with MPEG-2, whose sub-band technique creates arbitrary boundaries. Bits are allocated dynamically to compensate for different listening environments, e.g. theatre, home or auditorium.

Linear PCM

Linear PCM (pulse code modulation) is uncompressed (and thus lossless) audio as used for CDs and most studio masters. Analogue audio is sampled at 48kHz or 96kHz, with 16, 20 or 24 bits used per sample (CD audio is limited to a sampling rate of 44·1kHz). Because of the absence of compression and the high sampling and quantisation rates, the bit rate could be excessively high. For this reason it's limited to 6·144Mbits/sec. The equivalent bit rates for MPEG-2 and Dolby Digital are 912 and 448kbits/sec. Linear PCB can carry up to eight channels, but for five or more channels the lower sampling rate of 48kHz must be used. Table 3 shows the basic parameters for linear PCM.

Framing, interleaving and error-correction coding

Before the data is recorded on a disc it is structured into blocks that contain the original PES (video, audio etc.) together with sync and error-correction data to ensure that the original PESs can be identified and decoded without errors. The result is 2,418Byte blocks, which are fed into the 8-to-16 (EFM+) modulator.

As the data is written on the disc using a non-return-to-zero inverted (NRZI) format, in which a transition between pit and land represents a one and a non-transition represents a zero, long stretches of land or conversely very short and frequent pits would be likely to occur. Both situations must be avoided if the player is to be able to synchronise its

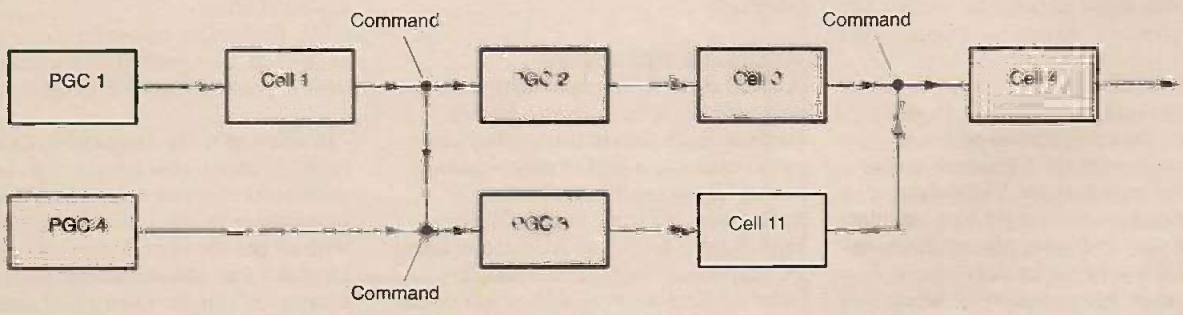


Fig. 8: How branching operates.

decoding and control processes with the encoded data. For this reason, eight-to-sixteen modulation is used.

Eight-to-sixteen (8/16) modulation converts 8-bit (one byte) data into a 16-bit code which has been carefully arranged to minimise DC energy and reduce frequency. It ensures that there are at least two or at most ten zeros between any groups of ones. Eight-to-sixteen modulation is normally referred to as EFM+ (eight-to-fourteen plus), because EFM was the form originally used for modulating CD audio channel data.

Following 8/16 modulation the size of the recording blocks is doubled to 2 x 2,418 = 4,836 bytes.

DVD data flow

Each block of 4,836 bytes contains video, audio, sub-picture and information data (presentation control information – PCI – and data search information – DSI). It consists of the relevant packetised elementary streams and includes error-correction and identification data.

Channel or programme data obtained from a DVD disc contains five packetised elementary streams (PESs): video PES (one stream); audio PES (up to eight streams) sub-picture PES (up to 32 streams); PCI and DSI. Sub-picture information includes subtitles, karaoke and menus. Fig. 5 shows the data flow paths from the disc to the data decoders.

Each block of programme data is read off the disc at a constant rate of 26·16Mbits/sec. After 8/16 demodulation the data flow rate is reduced to 26·16/2 = 13·08Mbits/sec. Following error correction the error bits are removed, reducing the data flow rate further, to 11·08Mbits/sec.

At this stage PCI and DSI data is transferred to separate buffers at 1Mbits/sec for decoding. The remaining components of the data blocks are fed into a track buffer, at 11·08Mbits/sec, demultiplexed and then passed via individual video, audio and sub-picture buffers to the relevant decoders.

While the video, audio etc. data enters the track buffer at a constant bit rate, it's fed to the separate buffers at variable bit rates. A variable bit rate provides the most efficient data transfer, by allocating the total available bits where they are needed at a particular time. For the same image quality, a constant video transfer rate would be twice that required with a variable transfer rate. The low picture quality with Video-CD is because it uses a constant video transfer rate of 1·15Mbits/sec.

Each PES is limited to a maximum bit rate as follows: video 9·8Mbits/sec; PCM audio 6·144Mbits/sec (8 channels); Dolby Digital audio 448kbits/sec; MPEG-1 audio 384kbits/sec; MPEG-2 audio 912kbits/sec; sub-picture 3·36Mbits/sec.

Recording time

A DVD disc's recording time is determined by its capacity and the data transfer rate – the speed at which data is read from the disc. Although the data transfer rate for reading each recorded block is constant at 26·16Mbits/sec, the average is far less at about 3Mbits/sec. The relationship between capacity, transfer rate and recording time is: disc storage capacity = average transfer rate x recording time.

Constant linear velocity

The optical head reads the data as the disc rotates. For the data to be read at a constant rate, the disc must rotate at what is called constant linear velocity (CLV). This means that the disc has to rotate at a faster speed (angular velocity) when the optical head is reading the track near the inner circumference than when it's reading the track near the outer circumference.

Data structure

A DVD contains two types of information: control, for navigation; and data to provide the video and sound (presentation). There's a complex set of navigational tools to provide control flexibility for normal programme playback and facilities such as search, parental control and multiple angles.

The basic 'presentation unit' is the cell. It's the smallest addressable chunk of programme information. A film or part of a film (a chapter or section) is a sequence of cells. Each one has a unique ID (identification) number, which can be called up for decoding and presentation by a program (PG) within a programme chain (PGC). With DVD there are up to 999 PGCs for every title and 99 PGs within every PGC.

Fig. 6 shows the structure of a single 'monolithic' title or film. There's a single PGC, and the playback is linear (hence the term monolithic), with no facility for branching to change the order of cells.

With most video DVDs there are multiple PGCs. The sequence of cells will thus depend on which PGC is selected. Fig. 7 shows the structure of a DVD with two titles and one PGC per title.

Branching (see Fig. 8) is normally required, to provide facilities such as parental control (where some scenes, in the form of cells, are blocked or bypassed) and multiple angles (which enable the viewer to select different camera angles for the same scene). In such cases the player is directed to move from one PGC to another without any interruption to the displayed video – this is known as seamless playback. Individual cells may be used by more than one programme chain.

A programme chain normally consists of a number of such chains within a complicated navigational system.

To follow

In Part 2 next month we will start a detailed look at DVD players – how they make use of the information available on the discs.

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

The RETRA Service Conference 2001

Now in its fifth year, the RETRA Service Conference has become a focal point and sounding board for our section of the industry. Eugene Trundle was there to report on the proceedings

The annual RETRA service seminar, held at Solihull this year, attracted a large and attentive audience. President Harry Vidler's keynote speech reviewed the current situation in the industry and the marketplace. Widescreen TV sets and DVD players are selling well, but other sections of the high-tech industry are in the doldrums – especially PCs and mobile, WAP and 3G phones. Sky goes from strength to strength. It's now the most successful operation of its kind in the world, with over five million digital DTH subscribers. And Sky has been available for a mere twelve years. Its current aims are to reduce the subsidies to new subscribes and raise the average viewer subscription above the £500 a year (£42 a month) mark.

Acknowledging that much consumer electronics gear is now in the throwaway category, Harry Vidler pointed to the great strength and advantage of independent companies: service. He urged them not to throw after-sales opportunities away, leaving them for the manufacturers to pick up. This has happened with white goods, where millions are currently being made (but not by us!) on repairs and conversions to new sales. He quoted a good example of "customer-conditioning" by British Gas: a post-repair statement to an in-guarantee customer stated "labour £84, parts £25.49, VAT £19.16, total £128.65 – this is not an invoice". It was certainly a powerful incentive to renew the contract!

Oscilloscopes then and now

Tektronix is one of the most respected oscilloscope manufacturers, but one which has for many years neglected the consumer servicing sector. Seeking to redress this situation, Trevor Smith presented some suitable products for the repair technician – Models TDS224, TDS3054B and THS730A. They embrace digital-storage, digital-phosphor and four-trace technology and are raster-based models that are suitable for use with digital equipment. Excellent instruments all, with prices not as high as I had feared but still in the four-figure bracket. It's inescapable that the test gear required to deal with today's consumer electronics gear *is* expensive, and needs to be well used to earn its keep.

Harking back to simpler days, Trevor Smith outlined the history of the oscilloscope and the part played by Oregon, US-based Tektronix in their development. After the hand-held DMM, the oscilloscope has become the second-most important tool for design, servicing and maintenance.

The first oscilloscopes were valve-based, like the equipment with which they were used. They analysed repetitive analogue waveforms, primarily for military applications. Subsequently the TV broadcasters became good customers, and solid-state technology started to be adopted. The days of analogue, real-time instruments were beginning to run out. By the mid-1980s things had moved on a lot. The computer industry was rapidly expanding and required better test equipment. Clock rates increased, and the signals that mattered were increasingly pulse waveforms, not necessarily repetitive: one-shot trigger/capture and multiple traces were required, with the ability to display steep pulse edges. The DSO (digital storage oscilloscope) provided a solution to these needs. It could seize and hold transient phenomena, and even in effect look back in time, using its in-built memory system.

We have now reached a convergence point, where video recorders, TV sets and PCs are doing many of the same things. The complex signal and data streams call for the use of a digital-phosphor oscilloscope (DPO) which, incidentally, doesn't actually have any phosphor! Displays are simulated on an LCD panel. A DPO can acquire, store and display complex waveforms with a fast refresh rate. There are other benefits, such as multi-colour readouts, 'three-dimensional' displays, high capture rates and learning ability.

Technical education

Having advanced test equipment is one thing. Understanding it, knowing how to drive it and carry out all other aspects of consumer-goods servicing efficiently, is quite another. It has to be said that service technician training has not been a strong point in the UK over the last few years. The Electronics Examination Board (EEB) and the Electrical and Electronics Servicing Training Council (EESTC), represented at the conference by the knowledgeable Carol Crouch, have been working hard on this.

Carol Crouch reviewed the TV service trade down the years from 1924 (Baird demonstrating TV – of a sort – at Selfridges) to the present situation, where breakdown rates are very low, home repairs are virtually extinct – and the typical service technician is in his sixth decade of life! She predicted a severe skills shortage in our sphere in the next ten years, and described ways in which it could be tackled through education and training. The EESTC was set up in 1991 to develop standards for training technicians, and currently promotes the profession to prospective recruits and school-leavers.

Service Course 2240, though good and popular, is now somewhat dated. It has been succeeded by Course 6958, which was launched in 1999. This course includes some white goods content and meets most Technical Certificate requirements, underpinning the practical knowledge called for by NVQs in a way approved by the Training Council. Undertaken off the job, this package is primarily intended for use in technical colleges. Foundation and Advanced Modern Apprenticeships, for which a government-funded incentive may be available to employers, are also receiving attention and being promoted.

Technician training, on a chargeable basis, is also available in various forms from the CAI (Confederation of Aerial Industries), focused on the needs of aerial/dish and MATV installers and cable technicians. Amongst the courses on offer are C&G 3456, NVQ Level 2, and distance-learning packages.

The Tektronix THS730A hand-held, two-channel digital oscilloscope has a bandwidth of 200MHz and a sampling rate of 1GS/sec per channel.

Taking control

George Morton, an ex-TV field engineer and service manager, is now a business-efficiency consultant. His presentation to the conference concentrated on customer relations and care. It started with a demonstration of how to control other people's thinking and reactions!

Customers pay our wages, declared Mr Morton, while employers only handle the money. Few people set out to be awkward, we were told, and skilled customer handling is vitally important. The key to this is communication. When it brakes down, impenetrable barriers can go up. The customer needs to be listened to, treated with care and courtesy, given attention and reassurance: to sum this up, an *effective response* is required. Establish a warm relationship, as you would with a friend or family member, and look at things from the customer's point of view. In this way you will be able to take control of the situation. I'm all too aware that 'situations' are common in our business!

George Morton quoted research which suggests that, in terms of impact, words account for only seven per cent, tone of voice accounts for 37 per cent and body language no less than 55 per cent. A handshake counts for a lot, as does a friendly touch on the arm and addressing your customer by name. Eye contact is important, also your stance: for a man, it's best to take up a position at 45° to a male customer, in order to not appear threatening or dominant; a lady customer prefers you to face her directly – the better to suss you out it seems!

Good customer relations are the lifeblood of an independent dealer. If you have a problem in this area, you need to acknowledge first that you might be part of the problem rather than part of the solution. Having spent three decades in the service department myself, I heartily agree with all this.

Aerialisation

Tim Jenks of CAI (the Confederation of Aerial Industries) made his third appearance at the conference, as entertaining and informative as ever. He stressed the need to maintain high (no pun intended!) and professional standards in the aerial and wiring business. You can then expect an equitable reward.

Mr Jenks summarised the current digital TV situation as follows: ITV Digital has some 1·25 million subscribers, BSkyB some 5·8 million (still not fulfilling initial predictions) and cable some 1·2 million (an additional 2·3 million still have analogue subscriptions). About 48,000 viewers use Sky purely for free-to-air TV. Since its launch ITV Digital (ONdigital) has dealt with well over 400,000 service calls. Some 140,000 IDTVs have so far been sold: at present they are selling at a rate of about 8,000 a month.

Turning to terrestrial DTV reception, Tim Jenks stressed the need for high-quality aerials, cables and even outlet plates, with good impedance matching all the way to the set's tuner. It's becoming increasingly necessary to measure *and record* true signal levels. The acceptability of analogue reception was decided by riggers and customers, but the DTV receiver makes its own irrevocable decision!

A common misconception is that a wideband aerial is required for DTTV. This is true with caravans and boats and in a few areas. Elsewhere the higher gain and out-of-band rejection qualities of a grouped aerial provide better results. It's becoming clear that we need more signal than the broadcasters would have us believe, with 50dBµV the benchmark. One factor in achieving good signal quality and minimising interference is the use of decent coaxial cable. Because there is so much bad cable about, the CAI now offers a test, accreditation and certification service based on BS EN500117, backed up by test house RN Electronics. The tests involve both electrical and mechanical characteristics. A certificate of compliance is issued when the cable comes up to the required standard.

At the start of digital terrestrial TV broadcasting in the UK the 8MHz, six-channel multiplexes were assigned different powers at most transmitter sites, depending on anticipated interference levels. The multiplexes that were given the most favourable treatment were those with the highest viewer figures, i.e. BBC and ITV. The present policy is to equalise the powers of the different multiplexes, on a suck-it-and-see basis, resulting for example in a 3dB boost (double the power) at Bilsdale. Similar 'tweaks' are to take place at Black Hill, Mendip, Oxford, Sutton Coldfield and elsewhere limited only, according to Tim Jenks, by the number of interference complaints received. It remains to be seen who will foot the bill for return calls to those who complain about signal-overloading close to a boosted transmitter site. My own experience in East Sussex during a high-pressure period in early July was of higher than normal interference to analogue reception – and a surprise appearance of Channel 5 in a normally-taboo region for it.

The PTR

Peter Kennaugh of Pace Micro Technology presented the latest high-tech product from his innovative company, the Sky 3000 personal TV recorder (PTR). It's a digital set-top box that incorporates a PC-type 40GB hard-disk drive on which TV programmes can be recorded in the form of MPEG-compressed, encrypted data. Up to about twenty hours of programming can be recorded. The hard-disk drive is highly integrated with the receiver, so that recording can be initiated from the EPG, part of which is a 'personal planner' to show record status. The many features and benefits include: the ability to pause a live programme for subsequent continuation; excellent fast-motion, pause and trick-play pictures, based on frame-hopping rather than segmented-frame display; simultaneous record and playback; link-recording for serials and soaps; book-marking of recordings; and VHS library creation in conjunction with a separate tape deck.

The PTR has two tuners, an optical audio data output port (TOS link), two fast serial-data ports and a high-speed modem. It has more chip memory than many PCs! There's an 8MB cache for the hard-disk drive, two banks of 4MB flash, 3MB of SDRAM and 2MB for MPEG processing. We've now come so far with LSI technology that the control microprocessor and MPEG decoder functions are combined in a single chip. This amazing box of tricks should be in production by the time you read about it here.

Peter Kennaugh went on to describe the future possibilities for home networking and automation, whose 'gateway' may be a fibre line from the local exchange or an ADSL link (see *Television* January 2000, page 168), and whose LAN (Local Area Network) will consist of an ethernet or wireless system that embraces the set-top box, TV set, telephone and PC. Appliances in the kitchen and elsewhere can also be hooked in. The system's remote control will work rather like a PC mouse, able to initiate print-out of TV-broadcast recipes, send picture mail over the internet, turn on the cooker and so on. Impressive technology but, in my experience, the British public is very conservative!

The Tektronix TDS3054B four-channel digital phosphor oscilloscope has a bandwidth of 500MHz and a sampling rate of 5GS/sec per channel.

Making service pay

The British public featured a lot in the next presentation, given by the well-known Bedford TV dealer and past president of RETRA Mike Peters. To put today's market conditions in perspective, he described the days when he first entered the trade. A TV set was then a luxury item that cost about 69 guineas, a good technician was paid about £8 a week, while the service manager was paid £10.50. Selling prices were controlled by the manufacturer, and the profit margin was about one third. So one TV sale paid the week's wages of both the repairman and his manager. A service call cost typically 45 pence in those days, and a good tip would be five pence. The repair bill was sent out afterwards. Sensible customers didn't pay it immediately: there was a good chance that the set would go down again meanwhile, opening up the opportunity to get two jobs done for the price of one . . .

It was a 'gold strike' for dealers in those days. The situation now is summed up in a recent *Which?* report from the Consumer's Association, which put a fault on a Hotpoint washing machine and invited seven service providers to repair it. Only two of them got it right, including Hotpoint which charged £75 for their trouble. A VCR was likewise nobbled: the heads were dirtied, a drive belt was flipped off and a tape guide was misaligned. Of the nine repairman to whom it was submitted, eight failed miserably. Two still had the machine in their possession nine weeks later. Five of them were DASA or RETRA members. Only one dealer (a RETRA member!) got it right, but was upbraided for charging £43 + VAT. Such then is the public perception of us as service providers – the poorest paid there are. At about this time Mike Peters received an updated tariff from his solicitors, with a list of partners and their charges, ranging from £165 an hour to a 'mere' £120. We must adopt a more professional approach, urged Mike, and charge professional rates for our service.

Going on to describe his own operation at Bedford, Mike Peters told us that customers get a Service Charter and are charged an inspection fee (not a deposit, which would be perceived as refundable). The fee is deducted from the bill if the repair is agreed. The Charter shows the

likely labour price range, varying from £23 to £85 per repair across the product range from a VCR to a large, widescreen TV set. VAT is extra, and if the higher quoted figure is likely to be exceeded the customer's permission to go ahead is sought: 90 per cent of repairs come within the specified bands. A maximum of three working days is the target for repair turnaround. Communication is very important here: no customer goes for more than seven days without a progress report from the service workshop.

This formula – highly skilled technicians selling professional services to 'blue-chip' customers at respectable rates – is plainly successful. It works, declared Mike Peters, to the tune of a six-figure labour turnover (net of VAT) per annum.

The Promax Satellite Hunter from Alban Electronics.

Pictures from plasma

What's plasma? It makes up 99·9 per cent of the universe, in the form of free-moving electrons and ions. This definition opened a talk on plasma picture displays by Andrew Mullen of LG Electronics. Plasma display panels have improved enormously over the last six years, with production yields now better than 80 per cent and sizes up to 60in. diagonal. Prices have come down, and performance has improved in many ways – though it's still difficult to achieve true black in the image.

A description of plasma-screen operation appeared in the February 1999 issue of *Television*, on page 248. These panels have some advantages over alternative large-screen displays: clean, even pictures; immunity to magnetic fields; minimal physical depth; and a wide viewing angle. At present the main application for PDPs is in public areas and offices, but Andrew Mullen believes that they and LCD screens will eventually take over completely from CRTs.

On the practical side, PDP display systems are relatively simple devices and are not really hard to service. There are four main ICs, for colour decoding, de-interlacing, scan-conversion and RGB drive, plus a 4MB memory buffer for the display and the usual control and power supply sections. PDP monitors tend to be versatile with regard to inputs, having both analogue and PC ports.

Defects in plasma displays are mainly confined to pixel faults – dark cells, wrong-brightness cells and, worse, flashing or fully-on (bright) cells. Faulty pixels in a PDP cannot be 'zapped' out, like LCD ones. Virtually all commercially-produced plasma panels have pixel defects, and what's acceptable is defined at the factory-inspection stage: a certain minimum in the centre quarter of the screen, and no clusters anywhere. It's hoped that fans will be eliminated at some future date.

Questioned from the floor, Andrew Mullen suggested that in domestic use the life span of a PDP might be about ten years. But he would not be drawn when asked to quantify this in terms of running hours.

Exhibition

Once again there was plenty of interest to delegates at the various trade stands provided by those who supported and sponsored the conference.

Alban Electronics had on demonstration a wide range of Promax test equipment, including the new Prodig-2 terrestrial signal-level meter, designed for the digital age, and a new concept in digital reception meters, the Satellite Hunter, which offers the simplest possible operation in three automatic phases – detect, identify and optimise.

CHS. now the ASWO partner for the UK and Ireland, had a new range of competitively-priced COM remote-control units on show. The company is also now the main distributor for Hitachi, Teac and technical publisher U-View.

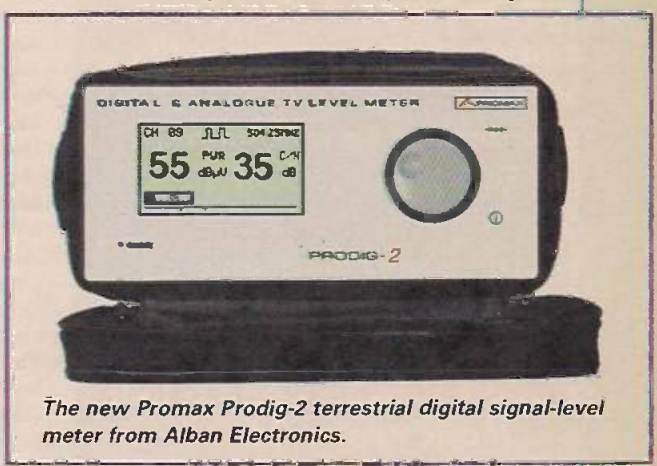
Classic, represented by TW Electronics (Newbury), is supplier for the new range of Ruwido remote-control units and Termol transformers, along with Amadeus and Futek products. The company offers a wide range of electrical and mechanical spares at practical prices.

The current version of its fault-finding tip database was demonstrated by Euras, using beautiful large-LCD laptop PCs! It's now in 32-bit form, for sharper graphics and diagrams. The new software has made navigation easier. It is now possible to print several repair tips per page, and to make direct contact with the Euras database via the internet. Ever more circuit diagrams, IC data and repair solutions are being added to the database.

SEME, diversifying in partnership with its trade partners and customers, concentrated on its Trade Supplies division, which specialises in new and selected-grade finished products along with a wide range of home-security devices and products. The Voltek wireless external camera system has recently been added to the SEME product range.

Servisol's stand featured its wide range of chemical service aids, mainly in aerosol form.

Sony mounted a working demonstration of the Assist database, now in DVD-ROM form to accommodate the vast amount of information it holds: everything that used to be in the service manuals (paper ones are no longer produced) and a great deal more. Assist is available to Sony account holders and service centres on a subscription basis. Details of Sony's new distance-learning concept, TrainNet, were provided. It's being set up to replace conventional classroom education for service engineers.



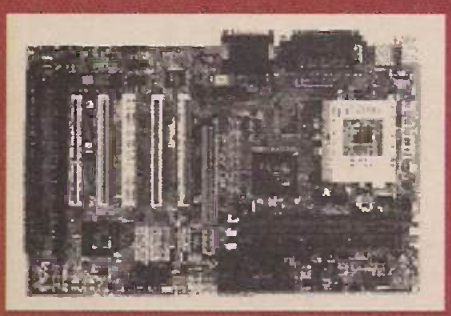
The new Promax Prodig-2 terrestrial digital signal-level meter from Alban Electronics.

Round up

In summary, the wide range of topics covered by this conference made for an interesting and thought-provoking day for all those present. Servicing is no cinch these days, but an exchange of information and ideas is helpful, stimulating and encouraging – and it makes you feel that you are not alone in your struggles. ■

The WEEE Directive

The problem of what to do with redundant electronic and electrical equipment is of increasing concern to the authorities. As a solution, the European Commission has adopted the Waste Electrical and Electronic Equipment Directive, which will place responsibilities on product suppliers and retailers. Mark Paul explains the implications



The European Commission has adopted a proposed Waste Electrical and Electronics Equipment (WEEE) Directive, which is to be implemented in conjunction with a Directive on the Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment. As mentioned in Teletopics last month, the Directives have now been given initial approval by European Union environment ministers. The purpose of the WEEE Directive is to make the collection and disposal of electronic equipment at its end of life mandatory, with the producer of the equipment being responsible for both the management of these processes and financing them.

The term 'producer' as used in the Directive needs to be defined: it covers a manufacturer who sells products under his own brand name, a supplier who buys product and supplies it under his brand name, or an importer. The term 'distributor' is used in the Directive to mean anyone who provides products for users, e.g. retailers or rental organisations.

The parallel Directive aims at the prevention of hazardous waste by limiting the use, from January 1st 2008 onwards, of certain substances in new electrical and electronic equipment. The separation of the ban on certain hazardous substances from the WEEE Directive, brought about by pressure from industry and governments, is intended to ensure harmonisation and avoid market disruptions.

Background

The background to these proposals is growing concern that, as technical innovation continues at an ever-increasing rate, there will be a similar growth in electrical and electronic equipment at landfill sites. In 1998 for example some six million tonnes of electrical/electronics waste was present in landfills, with waste from consumer electronics alone constituting 40 per cent of the lead in landfills.

The European Commission expects these volumes to increase by 3-5 per cent annually, three times higher than the growth of average municipal waste. This would mean that in five years 16-28 per cent more WEEE would be generated, and twice the amount in twelve years. The rate of growth of this "ecological burden" brought home to member states the need to do something, which means drafting legislation to address the problems. The result has been the birth of WEEE, whose fifth draft was adopted last June. We should now be in a period of negotiation involving the European parliament and the Council of Ministers prior to formal adoption. Implementation of the Directive is due to take place in 2006.

Main objectives

The main objectives of the WEEE Directive are:

(1) Improved product design, to avoid generation of waste.

(2) Producers to take responsibility for certain phases of waste management.

(3) Separate collection of electrical/electronic waste.

(4) Manufacturers to establish systems to improve the treatment and reuse/recycling of electrical/electronic waste and other forms of recovery, thus contributing to a higher level of environmental protection with encouragement of resource efficiency.

(5) To improve the environmental contribution of all those involved in the life cycle of electrical/electronic equipment, particularly those involved in the treatment of WEEE.

As it currently stands, the WEEE Directive imposes on member states obligations on the collection and recovery of waste to agreed minimum levels. There is an obligation on distributors to take back product for recycling and for producers to set up systems for the treatment and recovery of waste electrical and electronic equipment at no additional cost to the consumer.

Current situation

The WEEE Directive will have serious implications for the whole of the European electrical/electronics indus-

try, including the consumer section. Most member states of the European Union have set up environment and recycling groups to assess the practical implications and costs involved.

Design

The role of producers will be extended by making them responsible for the management of products at the end of their life. Establishing a link between production and waste management should mean that product design takes eventual recycling and disposal into account. Specialists involved in material recycling confirm the relevance of design in this respect.

Sectors affected

The industrial sectors most likely to be affected by the Directive are electronic component suppliers, equipment suppliers, retailers and electrical repairers, along with the waste collection and treatment industry.

The effects on the latter should be positive. An expansion of treatment and recycling would boost employment. But, depending to some extent on how the financing is set up, it could be that producers will decide to establish their own collection and/or recycling systems. It's likely that public sector support will be required to develop pilot and central facilities. A great deal of research on recycling will be needed.

Compliance

The Directive is addressed to the member states. Businesses will have to comply with national legislation, which will be implemented by the Environmental Protection Agencies concerned. As yet, such agencies have not brought electronic waste management into their planning.

From the production point of view, waste management considerations will include the use of easily recyclable/recoverable materials, the control of hazardous substances, the use where feasible of recycled materials, and common component and material coding standards. In certain cases it will be necessary to use substitutes for heavy metals such as mercury, lead, cadmium and hexavalent chromium, as well as certain brominated flame retardents.

Those involved in the treatment of WEEE will have to fulfil a number of technical requirements that are laid down in Article 5 of the Directive (this relates to the establishment of waste treatment operations and measures) and the Annexes (see later). To do this, considerable investment may be required. It is acknowledged that it will be very difficult to predict where such investment will need to be concentrated, as there are great differences in the structure and geographical location of the businesses involved. The extent of investment required will also depend on whether national or regional legislation is already in place. Those carrying out treatment will have to obtain authorisation from local or national authorities.

Employment opportunities

The recycling is likely to be labour-intensive and could thus increase employment. Governments will present WEEE legislation as part of both environmental and social policy. Various projects have shown that dismantling equipment offers opportunities for the long-term unemployed and disabled.

On the basis of US studies, an average of one job is created for every 465 tonnes of processed material. So the job-creation potential for recycling six million tonnes of WEEE is roughly 13,000 new jobs. Collection and transportation will create many more jobs. This represents a significant employment opportunity in those parts of the UK where electronics companies are clustered.

Scope of the Directive

Annex I A of the WEEE Directive lists the types of equipment involved. Articles 4, 7 and 9 of the Directive refer to the "separate collection" of electronic/electrical equipment from households where member states "take the necessary measures to ensure that systems are set up so that final holders and distributors can return waste electrical and electronic equipment from private households free of charge", "shall ensure that distributors, when supplying new product, offer to take back similar waste equipment from private households free of charge", and that "member states shall take necessary measures to ensure that producers provide for the collection of waste electrical and electronic equipment from holders other than private households . . . and all transferred to authorised treatment facilities".

As the return of waste is to be "free of charge", responsibility for financing will be borne by producers.

This "separate collection" does not however include categories 8, 9 and 10 of Annex I A (see below).

The directive is to apply without prejudice to other Community legislation, in particular with respect to safety and health, and requirements set out in specific Community waste management legislation, such as Directive 91/157/EEC which covers batteries and accumulators that contain dangerous substances.

Products involved

The categories of electrical and electronic equipment listed in Annex I A of the WEEE Directive are: (1) large household appliances; (2) small household appliances; (3) IT and telecommunications equipment; (4) consumer equipment; (5) lighting equipment; (6) electrical and electronic tools; (7) toys; (8) medical equipment systems (with the exception of implanted and infected products); (9) monitoring and control instruments; (10) automatic dispensers.

Category (3) is subdivided into two, centralised data processing (mainframes, minicomputers, printer units) and personal computing, including calculators, fax and telex, telephones of various types and answering systems.

The following are listed under large household appliances: large cooling appliances; refrigerators; freezers; washing machines; clothes dryers; dish-washing machines; cooking; electric stoves; electric hot plates; microwave cookers; heating appliances; electrical heaters; electric fans; air conditioners.

Small household appliances listed are: vacuum cleaners; carpet sweepers; irons; toasters; fryers; coffee grinders; electric knives; coffee machines; hairdryers; tooth brushes; shavers; clocks; scales.

Category (3) is subdivided into two, centralised data processing (mainframes, minicomputers, printer units) and personal computing, including calculators, fax and telex, telephones of various types and answering systems.

Consumer equipment, category (4), is the one that is of most concern to *Television* readers. The list is: radio sets (including clock radios and radio recorders); TV sets; video cameras; video recorders; hi-fi recorders; audio amplifiers; musical instruments.

Category (6) includes drills, saws and sewing machines, while the list for category (7) is electric trains or car racing sets; hand-held video games consoles; and video games.

Category (8) is rather outside the likely concerns of *Television* readers, most of it

being hospital equipment. Category (9) lists smoke detectors; heating regulators; thermostats. Category (10) is for dispensers of hot and cold drinks and snacks.

Treatment of waste

Article 5 of the Directive deals with "treatment of waste". Annex II lists materials and components involved. As a minimum, the following substances, preparations and components have to be removed form any separately-collected waste: PCBs that contain capacitors; mercury-containing components such as switches; batteries; PCBs: toner cartridges (liquid and pasty, as well as colour toner); plastic that contains brominated flame retardant; asbestos waste; CRTs: CFC, HCFC or HFC; gas-discharge tubes; LCDs with a surface greater than 100 sq. cm and all those backlighted with gas-discharge lamps.

These substances, preparations and components have to be disposed of in compliance with other existing Directives.

The following items have to be treated as described. The fluorescent coating has to be removed from CRTs. The mercury has to be removed from gas-discharge lamps. With equipment that contains CFC, HCFC or HFC, the CFC present in the foam and the refrigerating circuit has to be properly extracted and destroyed; HDFC or HFC present must be extracted and destroyed or recycled.

In conclusion

Exactly how all this is to be implemented within the time scale envisaged is hard to see. "Free of charge" will be nothing of the sort. Someone will have to pay for the added cost. If producers cannot absorb the cost, which will be difficult in the present economic climate, it will be passed down the line – ending up. in all likelihood, as higher prices for the consumer.

The policy of making waste inoffensive is of course right. But a heavy-handed approach to its implementation could involve a nightmare of bureaucracy and huge costs. Best to adopt a light approach with general regulatory control.

Six countries in Europe already have legislation on electronics waste disposal in place. In some Scandinavian countries electronics waste is recycled through civic amenity centres and paid for out of the rates. Germany has a similar system, and Holland has a recycling tax on the sale of new equipment – the proceeds are paid to approved recycling companies.

It's uncertain how the Department of Trade and Industry will tackle the matter. But waste disposal and recycling could give rise to a quite significant new section of the electronics and electrical industries. Many producers saddled with the responsibility for waste disposal will probably want to subcontract the work out. There are already specialist firms in this field, such as PMI in Neath, West Glamorgan, which was founded in the mid Eighties and at present deals with about 100 tons of PC PCBs a month. It also refurbishes PCs for resale to the developing countries.

It would probably be best for consumers to be able to take their waste to a civic amenity centre, where it might be passed on to specialist companies such as PMI. Whether everyone would do so is another matter. ■

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A mains surge can cause expensive damage in a TV set's power supply. This unit, designed by Charles Ritchie, avoids damage by triggering a relay in the mains input. It can be particularly helpful where the mains supply is suspect.

Mains overvoltage trip

I had a dead Sanyo Model 21MT2 (EC5-A21 chassis) in for repair not so long since. On investigation I discovered that the 2SD1710 chopper transistor Q613 was short-circuit all round while the 3·9Ω, 5W surge-limiter resistor R602 was open-circuit. Oddly, the fuse was OK. Anyway, once the faulty items had been replaced and a few others in the power supply had been checked the set was back in working order. I gave it an eight-hour soak test, which confirmed that it was fit and well.

Next day the customer collected his set and happily paid the bill. A week later he was back with his set. This time he wasn't happy, and neither was I (I hate bouncers).

With the set back on the bench, I soon found that the components I had replaced a week previously had again failed. I also noticed that C607 (150µF, 385V) was bulging and its blue plastic sleeving was cracked. In fact it had oozed its contents all over the PCB.

I then recalled that I had come across this problem before: the set had been subjected to a sustained excessive supply voltage. When I quizzed the customer he told me that he had been using the set with a generator whose output wasn't well regulated. But the same thing can occur with the ordinary 230V AC domestic mains supply, particularly in rural areas where a lot of my customers live.

I advised the customer to buy a UPS, but he was put off by the price and asked me if I could do something to prevent a recurrence of the problem. I decided to build a unit that would switch off the supply to a TV set, VCR or whatever once the supply voltage exceeded a certain adjustable value.

Circuit description

Fig. 1 shows the circuit diagram of the mains trip unit, which is quite simple. Transformer T1 has two primary windings rated at 120V AC each. They are connected in series to give an input rating of 240V AC. Likewise the two 9V secondary windings are connected in series to provide an output of 18V AC with an input of 240V AC (no load). BR1 and C1 rectify and smooth this supply.

The 18V regulator IC1 is not included just to stabilise the output to the relay circuit. As T1 is only a 3VA transformer, its regulation is

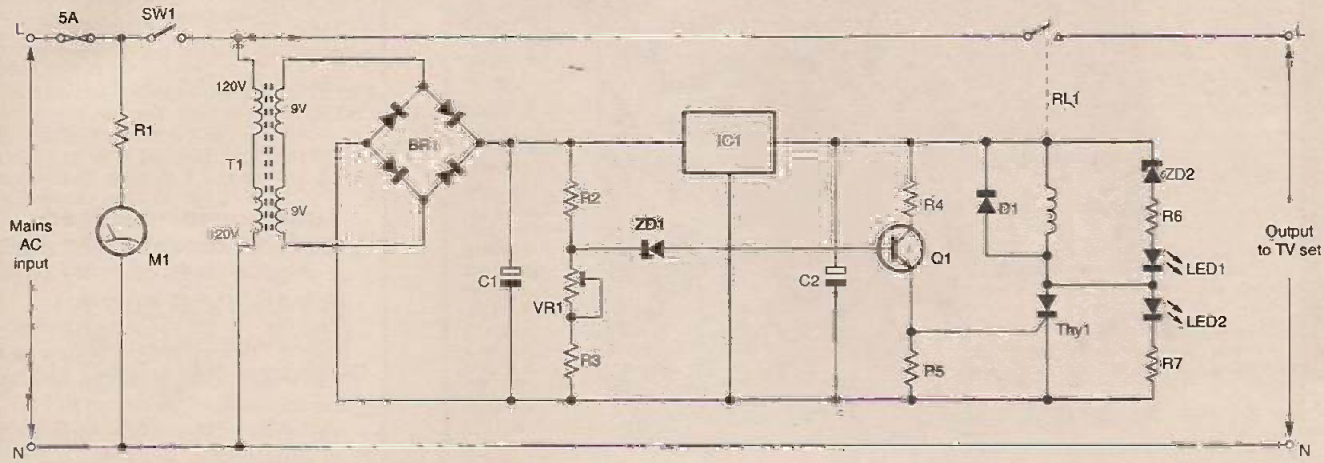


Fig. 1: Circuit diagram of the mains overvoltage trip.

poor (20 per cent). IC1 improves this by stabilising the loading on T1.

VR1 sets the trip voltage, by adjusting the potential at the junction of R2 and zener diode ZD1. Once the voltage here exceeds the value set by VR1, ZD1 will conduct. Q1 will then switch on and fire thyristor Thy1. As a result relay RL1 will latch, switching off the supply to the TV set.

Setting up

One of the snags with setting up is that there isn't an overvoltage when you want one! So we have to simulate an overvoltage. This is quite easy to do using a variac. For setting up purposes T1's two 120V AC primary windings are connected in parallel. Set VR1 to its minimum value, then connect the unit and your multimeter to the variac's output (don't depend on meter M1, which is included purely to provide an indication for the customer).

If the trip is to operate at an input voltage of say 255V AC, the variac's output should be set at 127·5V AC (255/2). VR1 can then be adjusted so that the relay operates. LED2 will go out and LED1 will come on.

Once thyristor Thy1 has been triggered it will stay on even when the voltage is reduced. To reset the unit, simply switch off to let C1 and C2 discharge.

Typical voltages across C1 for different mains input voltages, with VR1 set to minimum, are listed in Table 1. A rise of 1V AC at the input produces an increase of approximately 0·15V DC across C1.

Use

The advice I usually give customers is: if the TV set goes off, check whether the red light (LED) is on. If it is, switch off the TV set, switch off the trip unit and wait a few seconds, then switch the unit on again. Assuming that the green light (LED) then comes on, it's safe to switch on the TV set. Should the red LED come on, unplug the unit, wait five minutes then try again. If the unit incorporates a meter (M1), check the voltage before switching the TV set on. All this may annoy the viewer when the favourite soap is on, but it will prove that the cause of the fault is external to the TV set, putting the onus on the electricity supplier.

I find it best to use a non-standard plug to connect the TV set to the unit. This prevents the user bypassing the unit and plugging the TV set into the mains supply directly.

The unit is designed to trip when there is a sustained overvoltage. There is no harm in incorporating protection against short-term spikes and surges. CPC can supply a plugtop that incorporates these features – order code FT00001.

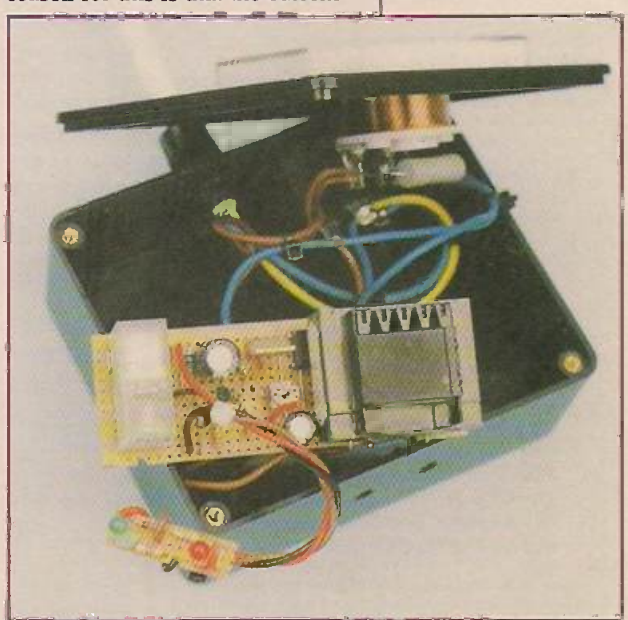
Construction

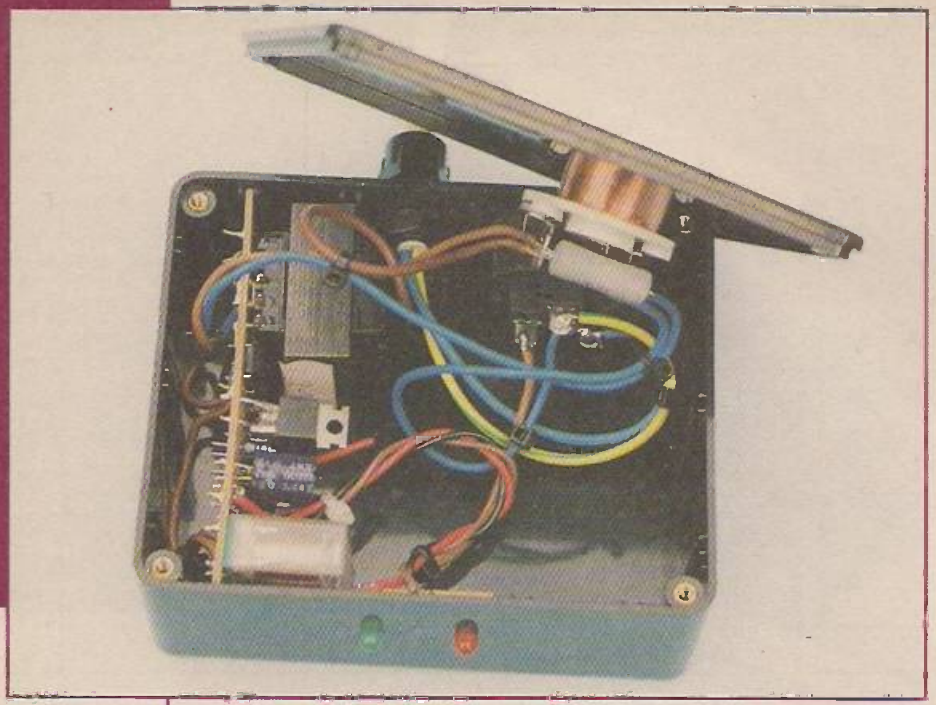
Construction is straightforward. I built the circuit on two pieces of 0·1in. pitch Veroboard measuring 94 x 34mm and 29 x 8mm. LED1, LED2, R6, R7 and ZD2 are mounted on the smaller board, all the other components except M1, R1 and SW1 being mounted on the larger board.

The LEDs support the small board. Two holes, spaced 2cm apart, were drilled in the front of the case. Epoxy resin glue was applied to the LEDs, which were then pushed through these holes. The larger board is supported by retaining guides in the case.

The live and neutral wires should be soldered directly to the pins of T1 and RL1, the adjacent tracks being drilled and filed away. The reason for this is that the current-

Below: Internal view of the trip, showing the two PCBs.





Internal; view of the trip, with the PCBs in place.

carrying capacity and inter-track insulation of the Veroboard is insufficient at mains voltages.

Component details

C1	47µF, 50V	R1	18kΩ, 5W
C2	100µF, 50V	R2	4·7kΩ
D1	1N4148	R3	4·7kΩ
IC1	7818	R4	1·5kΩ
LED1	5mm red	R5	220Ω
LED2	5mm green	R6	560Ω
Q1	BC546B	R7	1·2kΩ
VR1	10kΩ min. preset	ZD1	18V, 400mA
Thy1	BRX49	ZD2	12V, 400mA

BR1	Bridge rectifier, Farnell order code 371-180
M1	Panel meter, CPC order code PM11142
RL1	Relay, CPC order code SW00355
SW1	Switch, CPC order code SW00570
T1	3VA transformer, CPC order code TF109203
Case	CPC order code ENMB3/B
Cable gland	CPC order code CBGLM13
Plug	CPC order code PL-IEC 4732
Socket	CPC order code PL-IEC 68138

All resistors except R1 0·25W
* Part of meter assembly

Table 1: Voltage conditions.

Mains input	*Voltage across C1*
235V AC	29·15V DC
240V AC	29·9V DC
245V AC	30·65V DC
250V AC	31·4V DC
255V AC	32·15V DC
260V AC	32·9V DC
265V AC	33·65V DC

Autotransformer feed

If the customer's electricity supply is only marginally high, say 10 per cent, a temporary solution is to feed the TV set via a transformer with a 240V primary winding and a 24V secondary winding, making the connections as shown in Fig. 2. This converts the transformer into an autotransformer, which has a smaller size for its power rating than a standard transformer, at the cost of losing isolation between the windings.

A 50VA transformer would be suitable for a TV set, a 20VA or 25VA transformer being appropriate for a VCR or satellite receiver.

Acknowledgement

I would like to thank my colleagues, particularly Brendan Mannion and John Loughnane, for their help and constructive criticism. Brendan and John felt that the panel meter M1 is unnecessary for two reasons: it adds to the cost, and the customer wouldn't be able to interpret the readings. But I'll leave that up to you to decide!

In conclusion

The unit has proved its worth numerous times. It has sometimes confirmed that there is nothing wrong with the electricity supply. In this case it has at least removed suspicion from the electricity supply.

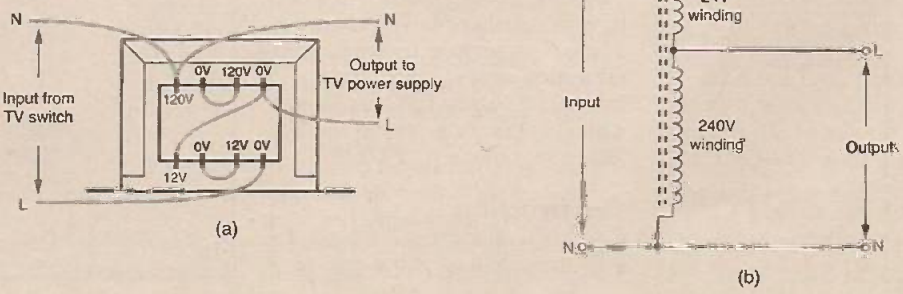


Fig. 2: Use of a transformer with 240V primary and 24V secondary windings as an autotransformer to feed a TV set. (a) shows connections with a transformer that has two 120V AC primary windings and two 12V secondary windings. The CPC TF705012, with 50VA rating, is suitable. (b) shows the transformer circuit.

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30-line TV – the myth and the reality

Having read Don McLean's recent celebration of Baird's 30-line television system, Chas Miller felt moved to set the record straight. Did Baird accelerate the acceptance of television by the general public? Or did he perhaps impede it?

Don McLean's paean on behalf of Baird's 30-line television system, in the March issue, was as interesting a piece of mythology as I have read for a while. Unfortunately, Don's enthusiasm for his subject appears to have made him approach it with well and truly rose-coloured spectacles. This in itself is possibly not inappropriate for a television system about which the kindest comment made during its brief working life was to describe reception as "a travesty in prawn pink". The record really should be put straight.

Don's assertion that the pictures of planets taken from spacecraft were mechanically scanned is mistaken. A mental picture of Nipkow discs trundling around in outer space may be attractive to some but is purely imaginary.

The pictures were obtained using an adaptation of the old Columbia Broadcasting System's sequential-frame colour television project. This system employed a high-quality electronic monochrome camera in conjunction with a colour-filter wheel to give successive red, green and blue images. These were resolved at the receiving end to produce full-colour displays.

The US National Television Standards Committeerejected the CBS system for public use because, mechanical questions apart, it could not provide compatible monochrome pictures on existing black-and-white receivers. This drawback was of no consequence with the virtually closed-circuit pictures transmitted by the space craft. The use of the adapted CBS system enabled valuable savings in space and weight to be made in comparison with the standard type of CTV cameras available at the time.

Returning to the original Baird system, by 1932 the inventor had developed what was an interesting mechanical toy to the stage where, after exerting pressure on the BBC, he was allowed to carry out a series of more or less test transmissions after normal broadcasting hours.

"The BBC Television Service (*sic*) needed only a camera in the studio and a spare medium wave transmitter" Don says airily, overlooking that the latter was something the BBC simply didn't have.

The allocation of broadcast band wavelengths in Europe was as tightly controlled then as now – perhaps more so. The BBC had at its disposal just ten MW channels, two of which were international common frequencies, plus another on Long Wave. It was solely due to the technical expertise of its Engineering Department that the BBC was able to give near complete coverage of the UK with its Regional and National Programmes.

To have attempted to transmit a regular TV service during normal broadcasting hours would have disrupted ordinary radio programmes. This was out of the question of course. So the move to VHF for television transmission would have been necessary whatever line system had been adopted.

In fact, during 1933, a transmitter installed on the roof of Broadcasting House was being used experimentally for high-definition television with sidebands of up to 500kHz.

The BBC referred to its 30-line experiments in less than enthusiastic terms in the 1933 Handbook:

"Television must be referred to... even if only because it calls for many requirements (other than technical) that ordinary broadcasting does not. To begin with, the studio itself is peculiar, in that the background for the artiste is a white sheet, whilst the floor is designed in large black and white squares – like a chess board. Special lighting is also needed. Then, in view of the fact that television in its present state gives better results when the object is coloured black and white, artistes' faces have to be made up with a dead white skin with the features marked out in black. Artificially blacked eyebrows are perhaps not uncommon today, but black lips have not yet become generally fashionable..."

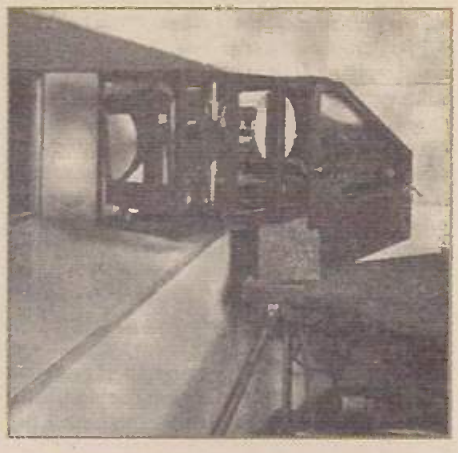
and elsewhere.

"...Singers sang in the position giving a head and shoulders image; dancers worked 20 feet away, with consequent loss of detail, and were allowed lateral movement of 12 feet. Frontal approach was impossible... scenery was introduced first by means of sub-title cards..."

Does this really sound like a system that was "mature and of a high professional quality?" And did the single photodetector really provide "a level of flexibility that would not be possible in electronic television for decades to come?"

There seems to be precious little flexibility in the bolted-to-the-floor Baird cameras as compared to the vastly superior EMI dolly-mounted electronic cameras which appeared just four years – not decades – later.

Unpalatable as it may be to Don and his fellow 30-line enthusiasts, there's a school of thought which holds that, far from advancing the cause of television, Baird impeded its acceptance by the general public. He did this by wildly over-optimistic claims for his system, the result being disillusionment when demonstrations were carried out.



A Baird camera used in 1933. Note that it's rigidly fixed to guide rails along the studio walls by a vice-like device. No great flexibility here!

Incidentally John Scott-Taggart, one of the leading lights of radio journalism in the 1920s and '30s and himself no slouch at self-publicity, and with a pronounced tendency to cling to out-moded technology, was not taken in for an instant by Baird's hyperbole. In the early 1930s he offered a reward of £10,000 – a vast sum in those days – to anyone able to prove to him that mechanical television could be made to give a really satisfactory level of performance. He never had to put his hand in his pocket.

Restoring vintage radio sets

In this concluding instalment of his series Ian Rees deals with tuning drive cord replacement and RF/IF circuit alignment

A task that most engineers in the vintage years used to hate was stringing cord drives. Early sets tended to have some form of mechanical reduction drive, which enabled fine tuning to be carried out. There was often in addition a 'bandspread' control. This was a small, auxiliary tuning capacitor that moved the tuning a few kHz either side of the main setting. Subsequently large tuning scales with station names, rather than arbitrary log or degree marking, were introduced, bringing with them a whole new cat's-cradle of string technology. The waxed string used at the time is long gone. For replacement purposes white nylon cord of the type used for sail making can be purchased by the spool from boat chandlers in a variety of sizes. It's stronger and better than the original.

Restringing

Provided you plan the direction the cord has to travel, restringing a drive without instructions is not that difficult. With the gang fully closed, the pointer will be positioned at the low-frequency end of the dial. With this in mind, you have to visualise which way the cord will come off the tuning drum. Follow its direction on to the pulleys, considering the direction – left to right or top to bottom. The direction around the tuning knob shaft is important: it is most disconcerting to turn the knob clockwise and watch the pointer go from right to left. Finally, its journey around the remaining guides or pulleys and back on to the tuning drum has to be in the correct direction. Sometimes more than one cord is used. In this case life can be simpler.

There are many ways of stringing the same drive. The end test is: does the pointer track smoothly with the tuning knob, following its direction? And when the end of the scale is reached, will the cord stay in place if the knob is turned farther? It's no good setting up a drive if someone comes along, cranks it past the end stop and the whole lot then ends up as a tangle of string inside the set. What's required is enough slippage on the tuning spindle to prevent excessive pressure at scale end. At the same time there must be enough friction to propel the pointer and gang efficiently to their tuning points.

Cord thickness, the number of turns around the tuning shaft and system tension all matter. A bad fault is to allow cord turns to overlap when spooling. This will at best result in a twang and pointer judder, at worst a total lock-up or dismounting of the drive. A small misalignment of the pulleys or too many turns around the drum can be the cause. Cord of the wrong gauge can be the problem, or maybe a wrong pulley direction has been chosen.

As with most things in restoration work, patience is required.

Suggested procedure

My approach is to start with the gang fully open or closed, make a small loop in the cord, and attach the end to one of the tags on the tuning drum. If there isn't a tag, tie the cord to the locking screw on the drum shaft. Feed the cord through the slot in the drum's groove, in the opposite direction it will be feeding off. Estimate how much cord will be required around the drum to reach the first pulley and go that way. Note that the cord has not yet been cut. Continue feeding the cord around the pulleys. Make two-three turns around the tuning shaft, in the correct direction. Continue around the rest of the pulleys, finally arriving at the tuning drum from the opposite direction. Again estimate the amount of cord that will be required.

At this point it's possible, gripping the cord and the edge of the drum in one hand and turning the tuning drive with the other, to see if everything is going in the right direction. If all is well, a spring is usually attached to the tuning drum and the end of the cord is fixed to it. When tying the cord to the spring, a small amount of tension is applied. The action of the drive can now be checked from end to end. The final step is to attach the pointer – this may add a bit more tension to the system. Note that some makers fit the spring or another spring in the cord length.

I use the method described above where I have partial or no knowledge of how the dial is strung. Sometimes the old drive is in place but not working, or is hung loosely, broken. In such a case I try to copy the original arrangement. The best situation of all is where a plan of the cord drive exists, complete with directions and the turns around the shafts and drums.

When you are satisfied that the stringing works correctly, it's a good idea to put a small spot of glue on each knot, to prevent them coming loose.

Note that later sets employ a solid, stepped pulley design. The purpose is to alter the gearing ratio between the stepped pulleys.

The pointer will usually still be attached to either the cord or the scale pan. When it's totally missing, it is worth making one. A piece of 2·5mm copper wire, from a piece of twin and earth cable, formed into an L shape can easily be made to ride the string.

Alignment

Like restringing, alignment is as much an art as a science. The principles of alignment are easy to understand and to carry out. But doing so does not always provide the hoped for results. Empirical methods and compromise then have to be adopted. If the manufacturer's instructions are available, follow them. Otherwise the following is a guide to the process.

Before you touch anything, consider whether the set's performance is poor enough to warrant adjustment. Symptoms blamed on misalignment often have their roots elsewhere, so you have to be sure that all other possibilities have been taken into account. Even valve replacement has little effect on alignment. Few other faults apart from human intervention will move the factory settings.

Some cheap radio receivers were not very good when new. There is little to be gained by trying to tweak the tuned circuits if this fails to provide any improvement. If the waveband calibration and sensitivity are sufficient to provide reception of the main stations at reasonable volume without interference, leave the alignment alone. Many manufacturers painted or wax-locked the preset cores and trimmers after setting up. Where this locking is intact, I would be very reluctant to break the seals.

Equipment required

It's important to have the correct non-inductive trimming tools before you start, otherwise damage to the delicate dust cores etc. is guaranteed. A wallet containing all the tools you will need can be obtained very cheaply from CPC and other sources. Made of plastic, the tools are themselves very delicate and are easily broken in use. But I would rather break the tool than the trimmer being adjusted. Plastic knitting needles filed down to fit the cores are useful. When they break the end can be remade. Never use a metal blade.

Tuning wands are a help. Fig. 6 shows how easily they can be made. The first wand (a) consists of an insulated plastic shaft (knitting needle, ballpoint pen body etc.) with a small ferrite core at one end and a piece of brass screw studding at the other end. The ferrite can consist of several beads or an old IF core. The shaft serves as a handle. The cores at each end are glued in place. Inserting the wand's ferrite core in the former of an RF or IF coil increases the inductance: inserting the brass core reduces it. A change in sensitivity or tuning can indicate whether adjustment of the set's RF/IF core is warranted.

The second wand (b) is for use with ferrite-rod aerials. This time a piece of bare 3/8th inch diameter ferrite rod aerial a few inches long is required. Attach a 1in. loop of stiff insulated wire at one end with tape. Strip and twist together the ends of the wire so that it forms a shorted turn. Moving a coil that is paint- or wax-locked to a ferrite aerial is difficult. You can check whether a coil needs to be moved by putting the end of the wand's rod (the end where the coil is mounted) to the end of the aerial ferrite rod. On contact, the inductance increases: looping the shorted turn over the aerial coil reduces the inductance. Any improvement or otherwise shows whether the aerial coils need to be moved farther towards the centre of the rod (increased inductance) or away from the centre towards the end (reduced inductance).

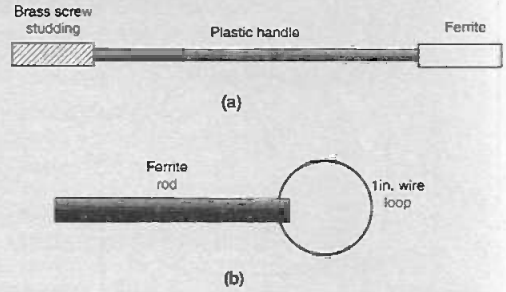


Fig. 6: Simple-to-make tuning wands, (a) for checking tuned transformers and (b) for checking a ferrite-rod aerial circuit.

Both wands provide a non-intrusive method of performance assessment.

There can be as many as twenty or more coil and capacitor adjustments in the average AM radio receiver. Some interact with each other. Without a calibrated RF signal generator and some form of output indicator, obtaining optimum performance is purely guesswork.

I use an old Nobrex 42 AM signal generator, which is as basic as things can be. But backed up with a frequency meter it gives an accurate signal.

Tuning for maximum output from the loudspeaker can be tiring and not very accurate. It's much better to disconnect the loudspeaker and connect an AC meter across the output terminals. I prefer to use an oscilloscope to monitor the signal across the volume control however. This enables the signal and noise to be seen separately, and the volume control can be turned down.

Manufacturers probably used a wobbulator for receiver alignment. The spot-frequency method is slow but can give just as good results.

There are several ways of feeding an alignment signal into a set. Inductive coupling is the best method if no instructions are available, as it requires no direct connection. Frame and ferrite aerials will pick up the signal directly. If the set is not fitted with an aerial of this type, the signal can be picked up by positioning it close to the set's tuning coil. Where the set's sensitivity is very poor, a direct connection to the aerial socket or the first grid of the frequency-changer valve will have to be made.

The construction of an alignment-signal coupling coil is shown in Fig. 7. It consists of eight turns of insulated 22 SWG wire wound on the 2in. diameter plastic lid of an aerosol can. Use PVC tape to hold the coil in place. A 300pF capacitor is connected in series with the coil and the inner conductor of the screened lead that connects the signal. The coil and capacitor leadouts are threaded through holes pierced in the plastic lid.

IF alignment

The starting point with receiver alignment is the IF transformers.

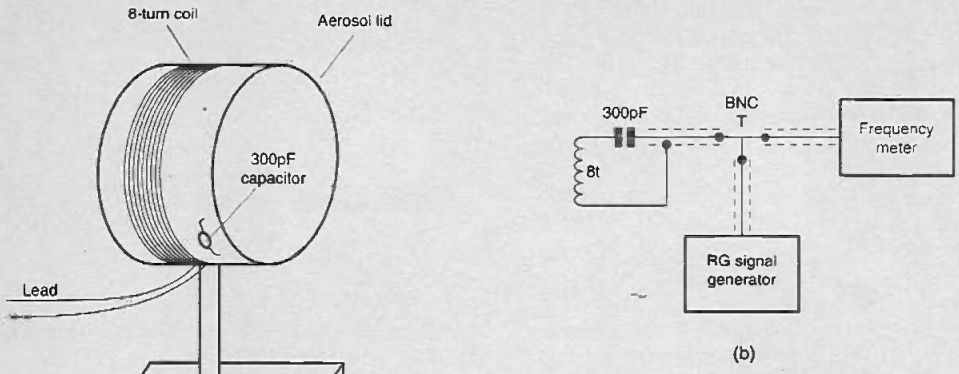


Fig. 7: Construction of an RF aerial coupling coil (a), with its connections shown at (b).

It's a good idea to check the tuning curve of the transformers first. It should have the classic steep sides and narrow peak. Set the signal generator to provide a 30 per cent amplitude-modulated IF signal – the usual receiver IF is 470kHz. Tune the radio to near the centre of its MW band (find a quiet spot). Position the coupling coil so that a clean, low-level signal can be seen or heard at the radio receiver's output. To prevent AGC action, keep the RF input signal very low. Otherwise, short out C11 (Fig. 2, page 528, July). If this causes problems, apply a small, adjustable negative bias voltage of about 0-3V DC. Swing the output from the signal generator slowly through the receiver's passband, and watch that it peaks at the correct centre frequency and falls away rapidly, by equal amounts, at each side until lost. If the tuning band is broad, skewed, kinked or off-frequency, the IF alignment may need to be set up.

With the arrangement as described above, alignment can begin. Start by adjusting the cores or trimmers of the final IF transformer (IFT2 in Fig. 2). Tune them for maximum output. Move to IFT1 and repeat. Do not allow the AGC to operate. Go back to IFT2, and repeat the procedure with the two transformers a couple of times until no further improvement can be achieved.

Hopefully, when the signal is removed and the set is tuned across its bands many stations will be received. If there is still room for improvement, RF alignment will be required.

RF alignment

RF alignment is not quite as easy as IF alignment. Before you commence, ensure that the station pointer is set correctly. Tuning scales often have marks that show where the pointer should come to rest at the ends of the scale. Datum settings, in kHz or metres, can also be found on scales and on the tuning drum (to enable setting up to be carried out when the chassis is out of its case and away from the tuning scale). The tuning scales will almost certainly be calibrated in wavelength (metres) rather than frequency (kHz, MHz). To convert wavelength to frequency, in kHz, simply divide 300,000 by the number of metres. For example 300,000/250 = 1,200kHz.

Before you start, it's a good idea to draw a layout that shows where the various trimmers and coils are and what they adjust.

Set the signal generator to 1,200kHz and connect its output as for IF alignment. Switch the set to the medium-wave band. Tune first at the HF end of the scale, at 250m. Adjust the oscillator preset trimmer (TCb, Fig. 2) for maximum output, then repeat with the aerial trimmer (TCa). Next set the signal generator's output at 600kHz and adjust the radio receiver's tuning at the LF end of the dial, at 500m. Adjust the oscillator coil (L2) for maximum output, then repeat with the aerial coil (L1). Keep the signal input below the AGC threshold by adjusting the coupling loop's position or using the signal generator's attenuator control. Repeat the adjustments a couple of times, or until no improvement can be achieved. Wax lock all the items adjusted.

Use the same procedure for the long-wave band. The preset oscillator and aerial trimmers will be found somewhere else in the coil pack. Don't touch the MW trimmers you have just set.

For short-wave alignment it's best to inject the signal via the banana aerial socket at the back. The principle is that same as with MW and LW alignment, but to be effective your signal generator will have to be a good one with an accurate attenuator and good screening.

TRF radio receivers

TRF radio receivers can be as complex as superhet ones. Some are multi-band and have three tuned stages ganged together. The waveband switching is awesome, as are the layout problems. A reaction control enabled positive feedback to be applied to sharpen the tuning, thus improving the selectivity and sensitivity. The volume control is often the reaction control. With simpler sets the oscillation could radiate and interfere with neighbouring radio receivers.

Alignment is similar to RF alignment with a superhet receiver. A badly-aligned TRF receiver may give no output at all. In this case the signal may have to be injected at the last RF stage first, followed by adjustment, then working back to the aerial input, aligning each stage in turn.

Reaction should be well backed off and the bandspread (if fitted) centred before you start. Each stage will be heavily screened, and great care must be taken not to disturb the wiring, otherwise instability may occur.

Not all RF stages will be tuned. A buffer valve is often included between the aerial and the first RF stage. It provides little gain and is present to prevent the set from radiating when the reaction control is close to critical.

A TRF receiver's audio stages are very similar to those already described.

Detection is usually carried out by the last RF valve, using a method called "leaky-grid detection". The valve concerned will be *RC*-coupled to the previous stage by means of a small-value capacitor (about 100pF) and the grid resistor (about 2MΩ). Detection is carried out by the valve's control grid acting as a diode anode. A choke or resistor in the valve's anode circuit blocks RF and allows only the demodulated audio to pass to the AF stages.

TRF receivers may be battery, AC or AC/DC operated, using power supply circuits similar to those previously described.

Valves and service data

The following firms can be tried for any valve requirements:

Colomor (Electronics) Ltd., Unit 5, Huffwood Trading Estate, Brookers Road, Billingshurst, West Sussex. Tel. 01403 786 559.

Langrex Supplies Ltd., 1 Mayo Road, Croydon, Surrey CR0 2QP. Tel. 020 8684 1166.

PM Components Ltd., Selectron House, Unit A, Jenkins Dale Industrial Estate, Chatham. Kent ME4 5RD. Tel. 01634 848 500.

Valve and Tube Supplies, Woodland Vale House, Calthorpe Road, Ryde, Isle of Wight PO33 1PR. Tel. 01983 811 386.

For service data, try the following:

Mauritron Technical Services, 8 Cherry Tree Road, Chinnor, Oxon OX9 4QY. Tel. 01844 351 694.

Savoy Hill Publications, 50 Meddon Street, Bideford, Devon EX39 2EQ. Tel. 01237 424 280 (phone/fax) or e-mail savoy.hill@lineone.net ■

£1 BARGAIN PACKS
Selected Items

HIVAC NUMICATOR TUBE, Hivac ref XN3. Order Ref: 865.

2In. ROUND LOUDSPEAKERS. 50Ω coil. Pack of 2. Order Ref: 908.

2in. ROUND LOUDSPEAKERS. 8Ω. Pack of 2. Order Ref: 908/8.

5K POT, standard size with DP switch, good length ¼in. spindle, pack of 2. Order Ref: 11R24.

13A PLUG, fully legal with insulated legs, pack of 3. Order Ref: GR19.

OPTO-SWITCH on p.c.b., size 2in. x 1in., pack of 2. Order Ref; GR21.

1000W FIRE SPIRALS. In addition to repairing fires, these are useful for making high current resistors. Price 4 for £1. Order Ref: 223.

BRASS-ENCASED ELEMENT. Mains working, 80W standard replacement in some fridges but very useful for other heating purposes. Price £1 each. Order Ref: 8.

PEA LAMPS, only 4mm but 14V at 0.04A, wire ended, pack of 4. Order Ref: 7RC28.

HIGH AMP THYRISTOR, normal 2 contacts from top, heavy threaded fixing underneath, think amperage to be at least 25A, pack of 2. Order Ref: 7FC43.

BRIDGE RECTIFIER, ideal for 12V to 24V charger at 5A, pack of 2. Order Ref: 1070.

TEST PRODS FOR MULTIMETER with 4mm sockets. Good length very flexible lead. Order Ref: D86.

LUMINOUS ROCKER SWITCH, approximately 30mm square, pack of 2. Order Ref: D64.

30A PANEL MOUNTING TOGGLE SWITCH. Double-pole. Order Ref: 166.

SUB MIN TOGGLE SWITCHES. Pack of 3. Order Ref: 214.

HIGH POWER 3in. SPEAKER (11W 8ohm). Order Ref: 246.

MEDIUM WAVE PERMEABILITY TUNER. It's almost a complete radio with circuit. Order Ref: 247.

MAINS MOTOR with gearbox giving 1 rev per 24 hours. Order Ref: 89.

ROUND POINTER KNOBS for flatted ¼in. spindles. Pack of 10. Order Ref: 295.

CERAMIC WAVE CHANGE SWITCH. 12-pole, 3-way with ¼in. spindle. Order Ref: 303.

REVERSING SWITCH. 20A double-pole or 40A single pole. Order Ref: 343.

LUMINOUS PUSH-ON PUSH-OFF SWITCHES. Pack of 3. Order Ref: 373.

SLIDE SWITCHES. Single pole changeover. Pack of 10. Order Ref: 1053.

PAXOLIN PANEL. Approximately 12in. x 12in. Order Ref: 1033.

CLOCKWORK MOTOR. Suitable for up to 6 hours. Order Ref: 1038.

TRANSISTOR DRIVER TRANSFORMER. Maker's ref. no. LT44, impedance ratio 20k ohm to 1k ohm; centre tapped, 50p. Order Ref: 1/23R4.

HALL EFFECT DEVICES, mounted on small heatsink, pack of 2. Order Ref: 1022.

12V POLARISED REPLAY, 2 changeover contacts. Order Ref: 1032.

PROJECT CASE, 95mm x 66mm x 23mm with removable lid held by 4 screws, pack of 2. Order Ref: 876.

LARGE MICROSWITCHES, 20mm x 6mm x 10mm, changeover contacts, pack of 2. Order Ref: 826.

PIEZO ELECTRIC SOUNDER, also operates efficiently as a microphone. Approximately 30mm diameter, easily mountable, 2 for £1. Order Ref: 1084.

LIQUID CRYSTAL DISPLAY on p.c.b. with i.c.s. etc. to drive it to give 2 rows of 8 figures or letters with data. Order Ref: 1085.

8μF 350V ELECTROLYTICS, pack of 2. Order Ref: 987.

WHITE PROJECT BOX, 78mm x 115mm x 35mm. Order Ref: 106.

I.F. TRANSFORMERS, 465kHz, pack of 4. Order Ref: 40.

AIR-SPACED TUNER, 20pF with ¼in. spindle. Order Ref: 182.

PUSH ON TAGS, for ¼in. spades, pack of 100. Order Ref: 217.

FERRITE AERIAL with medium and long wave coils, solder tags and mounting clips. Order Ref: 7/RC18.

LEVER-OPERATED MICROSWITCHES, ex-equipment, batch tested, any faulty would be replaced, pack of 10. Order Ref: 755.

SPECIAL SUMMER OFFER

Here's a lot of buy-one-get-one-free offers for the months of July and August, so here's some real bargains not to be missed.

COMPUTER DUST COVER
22in. long, 14in. wide, 6in. deep, nicely boxed, £1. Order Ref: D204.

12V 2A DC POWER SUPPLY
Cased with internal fuse, £6. Order Ref: 6P23.

SAFETY LEADS
Coiled, stretches to 3m, £1. Order Ref: 846.

DITTO but 3-core 13A, stretches to 1m, £1. Order Ref: 847.

POWER SUPPLIES
Cased with D.C. output, 4.5V 150mA, £1. Order Ref: 104.
6V 700mA, cased, £1. Order Ref: 103.
9V 150mA, £1. Order Ref: 733.
9V 200mA, £2. Order Ref: 2P114.
24V 200mA, £2. Order Ref: 2P4.
9.5V 500mA, AC output, £1.50. Order Ref: 1.5P97.

PM LOUDSPEAKER
6in. 4in., 4ohm, £1. Order Ref: 242.

HORN SPEAKER
8ohm, £3. Order Ref: 3P82.

LOUDSPEAKER CROSSOVER
40W, £1. Order Ref: 23.

1000W FIRE SPIRALS
Pack of 4, £1. Order Ref: 223.

BIG PULL SOLENOID
Mains operated, £1. Order Ref: 871.

BIG PUSH SOLENOID
Main operated, £1. Order Ref: 872.

DYNAMIC MICROPHONE
500ohm, plastic body with black mesh head and on/off switch, £2. Order Ref: 2P220.

FLASHING BEACON
12V for cars, £5. Order Ref; 5P267.

LIGHT ALARM
Warns when cupboard door opens, etc. £3. Order Ref: 3P155.

WATER LEVEL ALARM
For wall mounting over bath, etc., adjustable for water level, £3. Order Ref: 3P156.

SOLAR KIT
To make aeroplane, £7.50. Order Ref: 7.5P2.

FULL-WAVE BRIDGE RECTIFIER
35A 600V, £2. Order Ref: 2P474.

TELEPHONE ANSWERING MACHINE
Complete with power supply, £12. Order Ref: 12P38.

ROTEL HAIR CUTTER AND TRIMMER OUTFIT
Cutter and 8 accessories, £7.50. Order Ref: 7.5P16.

LIGHT DIMMERS
Replace a standard wall switch. One of each: red, yellow, green, blue, £2 each. Order Ref: 2P380.

TELEPHONE EXTENSION LEAD
Plugs into BT socket, £2. Order Ref: 2P338.

ENGINEER'S 13A BENCH PANEL
Accepts 2 x 13A plugs individually switched and illuminated, £2. Order Ref: 2P461.

TIME ON MAINS SWITCH
Can be set anywhere from 0 to 90 mins. and has calibrated knob, £2. Order Ref: 2P90.

QUICK HOOK-UPS
10 leads each with an insulated crocodile clip each end, £2 a set. Order Ref: 2P459.

MINI MAINS MOTOR WITH GEARBOX
1 rev per hour, £1. Order Ref: 500.
1/3 of a rev per minute, mains operated, £2. Order Ref: 2P460.
15 revs per minute, £2. Order Ref: 2P321.

IN-CAR UNIT
12V-6V, plus into lighter socket, £2. Order Ref: 2P315.

INSTRUMENT LEAD
2m long, white, £1. Order Ref: 8TOP1.

TRANSISTOR AMPLIFIER
By Newmarket, 12V operated, 3V output, £2. Order Ref: 1/26L2.

ULTRASONIC CAR OR HOUSE ALARM
Operates from its own battery. Nicely cased, is reasonably loud or can be coupled to external horn, £10. Order Ref: 10P76.

UNDERDOME BELL
Friedland, transformer or battery operated, £5. Order Ref: 5P232.

MAINS KLAXON TYPE ALARM
Free standing, £5. Order Ref: 5P226.

METAL BOX WITH LID
Slightly sloping, size 8in. x 3in. x 4in. approximately, £1. Order Ref: 209.

CLOCK MODULE
2in. l.c.d. display, requires 1.5V battery, goes back to zero when switched off so ideal for timing operations. Also has panel for other switching operations, £2. Order Ref: 2P307.

BELT-DRIVEN COUNTERS
For tape decks, etc., 2 for £1. Order Ref: 26.

MAINS OPERATED COUNTERS
6 digit, even numbers, £1. Order Ref: 28.

12V AXIAL FAN
Approximately 3in. x 3in., will suck or blow, £4. Order Ref: 4P65.

HEADPHONES
Extra lightweight, stereo, £1 per pair. Order Ref: 898.

W-SHAPED FLUORESCENT TUBE
30W or 40W, ideal to light house name, etc., £2. Order Ref: 2P314.

REVERSIBLE MAINS MOTOR
Beautifully made by the Japanese, probably about ⅛h.p. with a good length spindle, £4. Order Ref: 4P94.

PACK OF 5 ADAPTORS
Each takes 2 x 13A plugs, £2. Order Ref: 2P187.

TIME AND SET SWITCH
15A mains, £2. Order Ref: 2P104.

CLOCKWORK TIME SWITCH
Calibrated, settable up to 90 mins. Will switch 25A, £2. Order Ref: 2P90.

CASED POWER SUPPLIES which, with a few small extra components and a bit of modifying, would give 12V at 10A. Originally £9.50 each, now 2 for £9.50. Order Ref: 9.5P4.

3-OCTAVE KEYBOARD with piano size keys, brand new, previous price £9.50, now 2 for the price of one. Order Ref: 9.5P5.

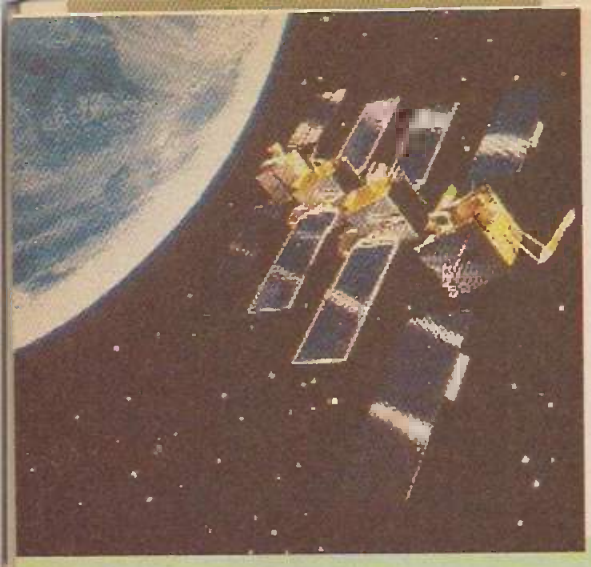
ONE ⅛HP MAINS MOTOR. Completely encased with good length spindle, £14.50. Order Ref: 14.5P1. Note these are heavy and only one can be included in our standard £4.50 parcel, so sorry if you can't collect then you must add £4.50 for each motor you order.

VERY SMALL 12V RELAY. About the size of an OXO cube BUT 8A changeover, sealed, p.c.b. mounting, 75 each. Order Ref: FR16.

TERMS

Send cash, PO, cheque or quote credit card number – orders under £25 add £4.50 service charge.

J & N FACTORS
Pilgrim Works (Dept. E.E.)
Stairbridge Lane, Bolney
Sussex RH17 5PA.
Telephone: 01444 881965
Email: jnfactors@aol.com



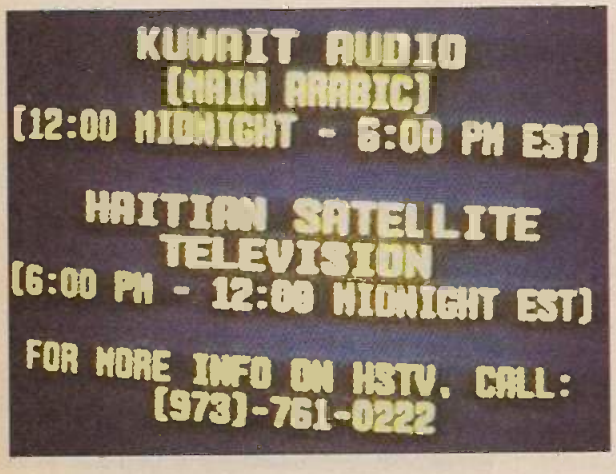
Terrestrial DX and satellite TV reception reports. Broadcasting and satellite belt news. DTT is getting the thumbs-down worldwide. Where to go for satellite footprint maps. Roger Bunney reports

DX and Satellite Reception

The month under review was a busy one, with reception of various types. Sporadic E propagation was fairly active, peaking in the middle of June but tailing off towards the end of the month – let's hope this was a temporary lull! Spanish TV continues to be received, despite the impending closure of TVE's VHF services. The SpE log for the month is as follows:

1/6/01	Many unidentified signals received in chs. E2, E3 and R1.
5/6/01	TVE (Spain) chs. E2, 4; RTP (Portugal) ch. E3.
7/6/01	NRK (Norway) E2, 3; SVT-1 (Sweden) E2; RAI (Italy) IA, B; Tele-A (Italian shopping channel) E2–; TVA (Italian shopping channel) E3–; RTP E3.
8/6/01	Tele-A E2–; TVA E3–; TVE E3.
9/6/01	TVE E3, 4; RTP E2, 3; RAI IA, B; TVA E3–.
10/6/01	TVE E3.
11/6/01	RAI IA, B; TVA E3–; Tele-A E2–; ARD (Germany) E2; ORF (Austria) E2a; RTL Klub (Hungary) R2; HRT (Croatia) E4.
12/6/01	NRK E2, 3.
13/6/01	RAI IA; TVE E3; Belarus R1.
14/6/01	RAI IA; RTL Klub R2; TVE E2; Tele-A E2–; TVA E3–; NRK E2; SVT E2, 3; LTV (Lithuania) R2.
15/6/01	RAI IA, B; TVA E3–; Tele-A E2–; C+ (Canal Plus. France) L2; TVE E2-4; RTP E3; SVT E4; NRK E2, 3.
16/6/01	RTP E3; TVE E3; RAI IA, B; TVA E3–; Tele-A E2–; ORT (Russia) R2.
17/6/01	RAI IA, B; RTL Klub R2; TVA E3–; RTP E3; TVE E2-4; SVT E2-4; NRK E2-4; ETV (Estonia) R2.
18/6/01	ETV R2; NRK E2-4; SVT E2; ORT E2; C+ L2; plus unidentified signals in chs. R2 and 3.
19/6/01	RAI IA, B; TVA E3–; Tele-A E2–; C+ L2; TVE E2-4.
20/6/01	TVE E3; NRK E2.
21/6/01	RAI IA.
23/6/01	RAI IA.
24/6/01	TM (Moldavia) R2.

A news feed about to be transmitted from Haiti TV to Kuwait via NSS K (21·5°W). This digital transmission was received using a 1·2m dish.



Garry Smith (Derby) has reported reception of Syria chs. E2 and E3 during the latter part of the month. The above log clearly illustrates the predominant north/south reception pattern previously noted during the present SpE season, with little reception from the east.

Satellite sightings

June was quiet once the general election on the 7th had passed. During a general election the airwaves are usually throbbing with news reports from around the UK. Pictures were seen from the election count hall at Sunderland during the late afternoon of the 7th via Intelsat 801 (31·5°W) – at 11·006GHz V, with SR 5,632 and FEC 3/4. I missed the election night count feeds as I was working as a vote counter at Eastleigh – ironical that Meridian had its on-site uplink truck BT-TES 43 outside the back door, with a two-man camera crew inside. My local constituency, Romsey, was a hot spot prior to the election and on the count night as it had changed hands (Liberal Democrat gain) at the last election and was expected to change again. It continues to provide news interest. At 5p.m. on the 26th, while I was returning home, I found a Newsforce uplink truck with camera in the market square, with its dish seemingly aligned at 21·5°E (Eutelsat II F3). Whatever it was had closed by the time I got back. What I did find was a live insert on the Jeffrey Archer diaries for Sky, at 11·693GHz H, SR 5,632, FEC 3/4, from UKI-511 SKY NEWS A.

While on the subject of live inserts, there was an unusual offering via Globecast on June 26th, using the NSS K (21·5°E) digital multiplex at 11·590GHz V (SR 20,145, FEC 3/4). It consisted of a Reuters linkup between Johannesburg, South Africa and the White House, Washington covering the S. African president's visit to the US. The live report involved linking in and out of a VTR playout in Johannesburg but the reporter's IFB feed (reverse programme sound from S. Africa) to his earpiece failed. The experienced reporter remained calm and asked

Rodney – the sat truck operator, who could hear the Johannesburg control room via a mobile phone – to cue him at the required points. It all went smoothly despite the one-way communication link! Incidentally Reuters has in the past used 11·487GHz H via NSS K for its Moscow to London circuit but has more recently been using 11·556GHz H (5,632 + 3/4).

Over the past few years SISLINK has encrypted its horse racing feeds. On the sunny evening of the 25th however there was a race meeting report from Kilbreggan, Ireland, through to about 9 p.m. SIS used encryption for some of the races but eventually the transmission became clear for the remainder of the evening. This reception was via Eutelsat II F3, at 11·668GHz H (5,632 + 3/4), from the SISLink-20 UKI-90 truck, with service identification P11668H01.

Eutelsat II F3 is like a busy crossroads. A scan across the Ku band via this satellite will often reveal a short-duration downlink feed. Once the Jeffrey Archer diaries feed mentioned above ended a scan revealed, at 11·671GHz H, '8MHz BASIC', colour bars and 'MEDIAWAVE MILAN 2001', but this ended without any programming being seen. Unfortunately the signal levels with these downlinks tend to be far lower than with broadcast channels. You need a very low-noise LNB for this slot, and problems may be experienced with dishes of diameter less than 1m.

It being summer, there has been lots of sports action. PGA golf tournaments are regularly carried by NSS K. On June 9th for example there was the Wegmans Rochester International from the LPGA 2001 State farm PGA, via the BT Washington circuit. Cricket fans could enjoy England v. Pakistan at the Old Trafford via Intelsat 801, at 10·960GHz V, 5,632 + 3/4.

The recently launched EuasiaSat-1 is now in orbit at 42°E, the Turkish slot. A Swiss channel from ProSieben, 'TV –The Technology Channel', is reported to be available at 11·723GHz V (20,000 + 5/6). There are apparently 26 other encrypted channels at this frequency, a hacker's playground!

While scanning Arabsat 2A/3A (26°E) I found an unusual multiplex at 12·015GHz V (27,500 + 2/3). The channels included ZEN-TV, KFSH, SAHAR and the Iranian first channel IRIB-1, with rather variable audio quality. It was surprising to find BBC World India amongst the other channels. Incidentally the Arab News Network (ANN) has ceased its analogue transmissions (11·977GHz V) via this satellite.

Military enthusiasts might have found a recent sighting by Roy Carmen (Dorking) of interest, via Eutelsat W2 (16°E) at 12·558GHz H with SR 5,532 and FEC 3/4. It involved the Russian artillery in Chechnya firing D13 howitzers at a high elevation to clear an intervening hill and help detection of the enemy. The video news package included troops singing to show their high morale! This was followed by shots from an APC (armoured personnel carrier) as it patrolled the nearby hills seeking terrorists. An inferior VHS video shot then showed the D13s being set up at a new location. Helicopter-delivered supplies, supported by Hinde Heli gunships, were shown. It seems that a "very open filming policy" was in use.

If you have a 90-120cm tracking dish there's a wealth of varied viewing available across the Clarke Belt nowadays.

Broadcast news

Digital terrestrial TV: Japan plans to close its analogue transmitters in 2011. The frequencies released will be used for other communications purposes. The Dutch government is to issue the first five 15-year digital multiplex licences this autumn. One multiplex will be used for public TV services, the others for commercial TV. Transmissions are due to start in mid-summer 2002. News is due shortly of the DTT parameters decided on by the French government. Successful licence bidders will be announced by March next year, a possible on-air date being August 2002. National broadcasters Canal+, TF1 and M6 will be allocated two channels each within the six six-channel multiplexes. In Scandinavia Telenor (Norway) is to start DTT transmissions next year while the Danish authorities have allocated digital bandwidth to the national broadcasters DR and TV2. Eighteen DTT channels, public and pay-TV, are currently being broadcast by SVT (Sweden). Public interest is low however: by June only 60,000 subscribers had signed up for the 18-channel package. The lack of interest could be because DTT is not being actively promoted in Sweden.

Spain: TVE is closing its VHF transmitters, with a move to UHF. The first phase of the programme includes closure of the Madrid-Navacerrada ch. E2, La Muela ch. E3 and Gamoniteiro ch. E3 transmitters – if my guess at Spanish translation is correct, these channels will already have gone dark. There has been no mention of ch. E4, nor the Canary Is ch. E3 transmitter, but these could be part of phase 2. For further information, check http://www.isesatv.com/migrar.htm

Check Eutelsat II F3 (21·5°E) for ITN news feeds.

Austria: The ORF Patscherkofel ch. E4 transmitter is to close.

Nepal: Since mid June all TV transmissions from India with news content, whether via satellite or terrestri-

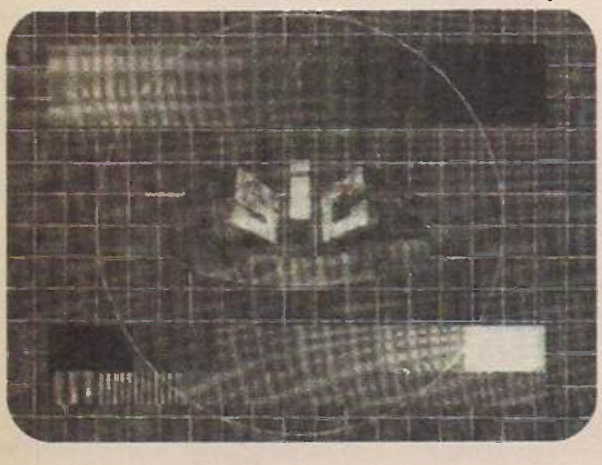
A recent shot of the Oxford (Beckley) TV transmitting mast, taken by Ian Beckett (Buckingham). Note the profusion of dishes and mobile communications aerials bolted to the sides of the lattice structure.

al relay, have been banned to viewers. This follows the death of members of the Royal Family and uncertainty about the exact circumstances.

Norway: Commercial broadcaster TV-2 is to continue using its current franchise – when new applications were invited it was the only bidder.

New Zealand: The plan to privatise the transmission of TVNZ has been abandoned.

This shot of the Portuguese SIC commercial TV test pattern was received as an e-mail jpeg file from Hugh Cocks in the Algarve.



Satellite news

Intelsat 901 has been successfully positioned in orbit to replace the vintage 705 craft at 18°W. It has high-power C and Ku band transponders with coverage of the Americas, Europe, Africa and the Middle East from its West Atlantic slot.

Astra 2C has been launched but its move to 28·2°E has been delayed while it provides backup for 1A at 19·2°E. Astra 1A is now in its thirteenth year and is nearing the end of its designed life span. Incidentally this means that we have now been watching DTH multi-channel satellite TV for thirteen years – time flies! The original Astra satellites enabled Sky TV to start up and revolutionised viewing in Europe.

Following the closure of the Seven Network the Australian government has chosen ABC, the Australian Broadcasting Corporation, to maintain its Australian Television International service to SE Asia. The government will provide annual funding of approximately A$15m.

Chinese Central TV (CCTV) is to maintain its worldwide Mandarin service via PanAmSat PAS-8 (Pacific Ocean), PAS-4 (India), PAS-3 and -9 (Atlantic), but the services via PAS-3 and -4 will move to PAS-10. There are plans to open an as yet unnamed Chinese-language channel based in Bucharest, Romania this December. It will provide pan-European coverage in Mandarin with Romanian subtitles.

Iraqi citizens are to be allowed to view foreign satellite programming, but only specific channels on a subscription basis. An Iranian opposition movement has been jamming the Iran National Television channel, which has been switching between Eutelsat W3 (16°E) and PAS-3 (43°W). The Tibah channel, based in Dubai, is expected to start transmissions early next year via Arabsat 2A/3A (26°E). It will promote the "modern face" of Islam, with religious and educational programming.

The digital dilemma

Digital terrestrial TV got off to a shaky start in the UK, being sidelined by the SkyDigital operation which works efficiently with cheap installation, ease of reception and lots of channels, using a small dish. ONdigital, the second starter in the digital TV stakes, provides fewer channels and suffers from patchy reception because of low transmitter powers. As a result ONdigital has far fewer subscribers that SkyDigital and a higher churn rate, estimated to be 25 per cent in comparison to SkyDigital's ten per cent. But the UK has, to date, the most advanced digital broadcasting systems in the world.

The US has opted for high-power DTT, with analogue and digital channels transmitted in parallel, often on an adjacent channel. High power means hundred of kWs, similar to the analogue services. By FCC decree, commercial US TV stations must provide a DTT service from May 2002. Non-commercial broadcasters are given an extra year to start DTT operation. Local TV stations with a relatively small number of viewers can delay DTT transmissions until 2006. After that the idea is that the analogue channels will be 'returned' to the government to be sold off – but only when 85 per cent of viewers have adopted DTT in a given area. So there could well be delays, because viewers are not enthusiastic about DTT.

The high-power approach to DTT has also been adopted in Australia, again with analogue and digital services on nearby channels. Robert Copeman has written about the present DTT situation there, which again is not encouraging. Analogue TV is still active in Band I, with transmissions in chs. 0, 1 and 2 – check RTQ-0, Darling Downs, Queensland (WIN-TV) at 46·17MHz, as under favourable conditions its transmissions have been received around the world. Major Australian cities use ch. 2 for the nationwide non-commercial ABC service. Digital TV in the major cities started in January this year and is due to spread to most other regions by 2004. The government hopes to switch off analogue TV in 2008, once viewers have rushed out and bought digital equipment. But most viewers seem to be happy with their analogue TV and see DTT as a means of providing extra, Pay-TV, channels.

The Canadians have also shown little interest in going digital. A recent report from Shaw Communications (Calgary) suggests that 40-50 per cent of the planned digital channels may not survive, while only ten per cent of those interviewed expressed a definite interest in switching to digitised viewing. There will be parallel analogue and digital transmissions in Canada until the country's receivers are all digital-capable: no analogue close-down date has been suggested. Where available, digital TV sets are expensive. The trade, supermarkets and discount stores are happy to continue selling inexpensive analogue TVs – that's what folk want!
The American countries are divid-

ed on the modulation system for DTT, with the US opting for 8VSB while most other countries are going for COFDM.

The proposal to close down the analogue transmitters in New Zealand in 2008 has been abandoned, following public opposition. For the time being the national FTA services will continue with analogue transmission while digital is used for Pay-TV services.

Latest news from Hungary is that DTT isn't likely to start before early 2004. Reasons for the delay are the cost of digital boxes and the lack of a regulatory framework. For news on DTT in other countries, see under the heading Broadcast News.

Clearly the move to DTT and an analogue TV switch off is proving difficult not only in the UK but worldwide.

SatMaps

The latest offering from Baylin Publications is the SatMaps CD-ROM, which provides footprint maps (EIRP, G/T and SFD) for over 600 satellites in the Clarke Belt. The information is easy to access with a PC, via Windows Explorer or Netscape Communicator, and is just as easy to access with an Apple Mac. Instructions come with the disc.

I had no difficulty in using it – the maps appeared instantly. But when I checked my favourite satellite, NSS K, there was just a blank page with a red star. A check on another friendly bird, Inteslat 801 (31·5°W), produced the information that it's at 64·5°E. though the footprints shown confirm the actual slot. The French Telecoms listings looked a bit thin. All this suggests that the disc isn't up-to-date. Other satellites I checked came up OK, but I didn't plough through the more than 600 covered by the disc. The problem of being up-to-date with a fast-moving subject is of course a difficult one. Satellites get moved around, shut down and replaced.

The disc is available for £29, post included, from Baylin Publications, 24 River Gardens, Purley, Reading RG8 8BX (telephone no. 0118 941 468).

If you subscribe to *TeleSatellite International* and have internet access you can check the current SatcoDX Global Charts at

www.Tele.satellite.com

An annual subscription costs £24 in the UK. You get six magazines a year, each with a CD-ROM that provides updated information on the whole of the Clarke Belt, and access to the SatcoDX website.

On balance, the latter option looks the better value.

Book notice

Austin Uden, who is well known in VHF circles for his extensive research on signal propagation, has published a new book entitled *Your Quick-Check Guide to Tropo Weather Forecasting*. It's a companion to his earlier book *The Barometer and DX*. The new book expands on the subject, explaining how to make the most of weather conditions to maximise VHF/UHF reception by studying weather maps, Volmet broadcasts, the regional weather pattern and related information. The aim is to be able to know when and where to look for elusive signals, even on a day-to-day basis when the weather pattern suggests that DX reception isn't possible – you don't always need high pressure for enhanced tropospheric reception!

Both books sell for £7.50 including postage. You can obtain the two for £13. They are available from Austin Uden, 12 Hampden Close, Aylesbury, Bucks HP21 8NS.

HELP WANTED

Wanted: Circuit diagram (photocopy OK) for the Ferguson TV/video combo type 441B/COMBO 99 MONO C3615UT. Bernard Mc Garry, 12 Main Street, Feeny, Londonderry BT47 4TD. Phone 02871 375 644 (day) or e-mail bg.mcgarry@ulst.ac.uk

Wanted: Original remote-control unit for the Sony SLV373 VCR (a second-hand one would do). A Sony SLF30 Betamax VCR. A field timebase board for the Grundig CUC740 chassis. R. Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP.

Wanted: Ex Radio Rentals embossed tool case, Mk 2 Escort tale gate clip-on sign (such as Visionhire) or illuminated van signs, and any big sphere TV sets from the Seventies, in any condition. Phil Barry, 6 Cowling Road, Burrill, Bedale, N. Yorkshire DL8 1RN. E-mail phil@colorfusion.fsworld.co.uk

For sale: Six volumes of Newnes *Radio and Television Servicing*, covering models prior to 1955 then to 1960. £18 plus postage. K. Orrell, 7 Duffield Road, Middleton, Manchester M24 1NQ.

Wanted: Service manuals or circuit diagrams for the following vintage radios: His Master's Voice Model 5101, AC superhet; Kolster-Brandes (KB) Model BR30T AC superhet. Philippe Mil, Pope Hennessy Street, Curepipe, Mauritius, Indian Ocean.

Wanted: Details of how to unlock the child lock protected mode with the Matsui VX1107 VCR. Eddie Duncan-Dunlop, phone 01656 772 418 or e-mail eddie@highlandelectrix.fsnet.co.uk

Wanted: Service information/circuit diagrams (photocopies OK) for the Sony SL-C9UB VCR. Does anyone remember the cause of this problem: the machine accepts a cassette and laces up, but when play is pressed the drum motor twitches and won't turn? R. Drew, 76 Laburnum Avenue, Taverham, Norwich NR8 6JZ. Phone no. 01603 261 073.

Wanted: Lid (A) assembly, cassette, for the Sony HST-D10S/HST-D20S, part no. A-432-377-8A. Also a tuning module for the Grundig Model 1645 (GSC200 chassis), part no. 29502-003-21. M.F. Knight, 55 Windermere Crescent, Allestree, Derby DE22 2SF. Phone no. 01332 552 948.

Wanted: For spares or repair, Quad 405 or 405-2 power amplifiers. Also Spendor BC1 speakers, Denon DL103 or DL103S pickup cartridges and old Sony PlayStations. Phone Mike on 01758 613 790.

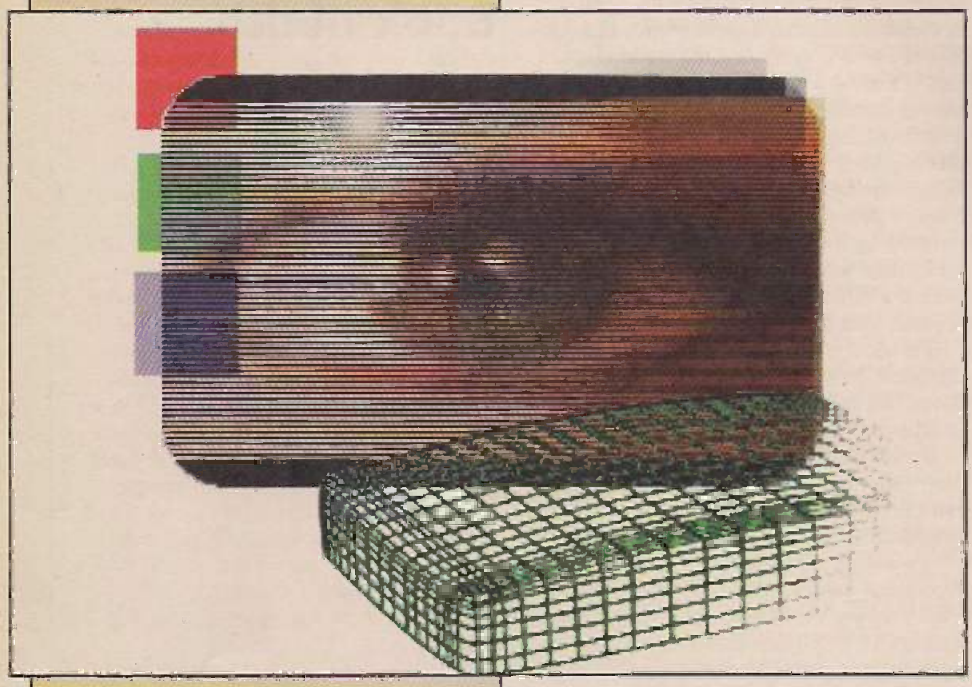
Wanted: Circuit diagram for the Blaupunkt Boston stereo radiogram type 14.922. Please call Gary Riley on 01484 328 296.

Wanted/for sale: Require volume/switch control for the Fidelity RAD 24; coil L8 for the Roberts Model R25; and a dual-concentric control with DP switch for the Murphy radio Model A484. Have for sale a Nokia TV Model SFN3578UK with spare tuner and remote-control unit, but with a NVM chip fault. Offers around £25. It's a 26in. model with Nicam, and is heavy. Buyer collects. Also available, as PC history: Opus PCII 286 plus 12in. Orange monitor and keyboard; a Philips PCD200 base unit plus keyboard; an Apple 11e with two disk drives and a box of disks; and a Canon BJ130 mono printer with booklet. Any offers? Buyer(s) collect. W. Milne, 20 Graham Road. Wimbledon, London SW19 3SR. Phone no. 0208 543 9542.

Wanted: Issues of *Practical Television* dated April and June 1950; February, March, April, May and August 1951; January, March and June 1952; May and December 1970. Contact Alan Moore on 0208 648 6657.

Wanted: Circuit diagram for the servo PCB used in the Sony Betamax VCR Model SL-F30 (or F30 supplement manuals). Also does anyone know a source of the Toshiba THS103 Hall-effect device? Alan Stubbings. 7 Church Road, Saxilby, Lincoln LN1 2HH. Phone 01522 586 790 weekdays, 01522 702 601 evenings/weekends.

For disposal: The following new, boxed CRTs free to collector: AXT51-001; 560EUB22; A51-161. They can be picked up either in Norwich or London, by arrangement. Phone David Huddleston on 0207 262 9247 or e-mail david@dhuddleston.fsnet.co.uk



TV FAULT FINDING

Reports from
Michael Dranfield
Philip Salkeld
Glyn Dickinson
Shane Humphrey
Chris Watton
John Coombes
Graham Boor and
Peter Tennant

We welcome fault reports from readers – payment is made for each fault published. See page 682 for details of where and how to send reports.

Sharp 76FW-53H

This 32in. widescreen set produced sound but no picture. When the first anode control was turned up a blank white raster appeared. I noticed that there was a problem with the field scanning – a foldover near the bottom of the screen. So I checked around the field output stage and found that the IRFR010TM flyback FET Q503 was leaky source-to-drain. A replacement restored the picture. It's a surface-mounted D-pack device, part no. RH-TX0172BMZZ.

I subsequently discovered that a field flyback pulse is applied to pin 11 of IC801, as "vertical protection". If IC801 doesn't detect a 50Hz pulse at 4V peak the RGB drives are blanked out. In the event of no picture, check pin 11 of IC801 first: this will tell you whether there's a field output problem. **M.D.**

Tatung VT2CC1

This set had what I thought was a simple fault. It wouldn't respond to commands from the remote-control unit and the front-panel buttons didn't work. Replacement of the TFMS4360N IR sensor restored remote-control operation and showed that the set was in the hotel-lock mode. To unlock, switch off at the mains, hold the front-panel P+ control down and switch back on. This failed to unlock the set however, and I soon found that some of the front-panel controls didn't work – pressing P+, Vol– and Vol+ did nothing.

When I scoped around the MN15151GBC microcontroller chip I found that the key-scan pulse for these controls was missing. It turned out that the chip was faulty. If the set had not been in the child/hotel lock mode I could have got away without a new microcontroller chip, relying on remote-control operation only. **M.D.**

Sharp 59CS05H (CS chassis)

I could see that this set had been elsewhere – someone else had been replacing parts. To cut a long story short, the TDA8375A IF/video processor chip IC201 had failed. After fitting a replacement the set powered up but the drive to the BUH515 line output transistor was wrong and the line output transformer was screaming in protest. The cause was traced to R712 (5·6Ω, 1W) in the rather unusual line drive arrangement. Someone had fitted a 1Ω resistor here. The set was OK once the correct value resistor had been fitted in position R712, but there was a slight buzzing noise on the sound. I had forgotten to replace IC201's screening can. **M.D.**

Nakio N2100TX

This set was dead apart from a slight ticking noise that came from the power supply. Checks showed that the HT supply to the line output stage was very low. The cause was the mains bridge rectifier's reservoir capacitor C5 (100µF, 400V). The voltage across it was only 230V, so it must have been open-circuit. **M.D.**

Sharp DV5103

After fitting a replacement chopper transformer in this set I found that the width was reduced and the line output transistor was getting hot. It turned out that I had fitted the wrong transformer. The one I had in stock was for Model DV5105. It looks the same and is pin compatible, but in the DV5103 the line driver transformer is fed from the 113V HT rail via a 3·9kΩ resistor while in the DV5101 it's fed from pin 11 of the chopper transformer. **M.D.**

Sharp 51DT25H

When this set was first switched on there would sometimes be lack of height or sometimes the TV stations would have drifted off tune. If the set was switched off and on again these problems would disappear. I felt that the cause was probably the NV memory chip, but I was wrong.

Sharp has a modification to cure this problem. Add a 3·6V zener diode between pin 63 of IC201 and chassis, with its cathode to pin 63, and another 3·6V zener

diode between pin 64 of IC201 and chassis, with its cathode to pin 64. Fit a 12µH peaking coil, part no. VP-CF120K0000, in place of wire link J122. Add a 7·5V zener diode between pin 30 of IC201 and chassis, with its cathode to pin 30.

Strangely, the Sharp technical bulletin makes no mention of cleaning around the anode cavity, where I believe the root cause lies. **M.D.**

JVC CJT21EK

This newish set was dead with no voltage at pin 4 (start-up) of the STRF6653 chopper chip IC921. A DC resistance check between pin 4 and chassis produced readings of 15Ω one way round and 150Ω the other. When the new STRF6653 chip arrived from SEME I found that the 150Ω reading was the faulty one. The new chip restored normal operation. **M.D.**

Toshiba 2505DB

The stations would all be lost intermittently, leaving a screen full of snow. Tapping the tuner made no difference, but this is where the fault lay. The 4MHz crystal inside, for the prescaler IC, was dry-jointed. **M.D.**

Mitsubishi CT21AV1B (EE3 chassis)

The set was dead with its green LED illuminated. Investigation showed that the power supply was running but there was no line drive. There's a modification for this problem. Change C702 from 1,000µF to 10µF, 25V and check that C955 has been uprated to 3,300µF, 16V. Replace the 220Ω resistors R702, R213 and R214 with 1kΩ, 0·25W resistors. **P.S.**

Bush 2857NTX

The strange fault with this set was sync crushing from cold. Voltage checks showed that the 11·5V supply was slightly low. The cause turned out to be R436 (6·8Ω, 2W) which had doubled in value. A replacement cured the fault. **P.S.**

Panasonic TX-W28R4DP (Euro-4 chassis)

A dead set with the line output transistor Q551 short-circuit is a known fault with this chassis. Fit kit TZS9EK001 and follow the instructions for the model you are repairing. **P.S.**

Philips 32PW6515/05 (SA10E chassis)

These fairly new sets are developing hum from the front speaker. When I spoke to Philips Technical, now in Germany, I was advised to remove wire link 9710 and short-circuit the free hole of link 9710 close to capacitor C2702 to wire link 9278 with a piece of PVC-covered wire about 11cm long. This did the trick. **P.S.**

Beko NR28128NX

The front controls worked correctly but there was no remote-control operation. Scope checks around IC951 showed that there was no activity here. A replacement cured the fault. I obtained it from a scrap Sony chassis, but SEME can supply Beko spares. **P.S.**

NEI 2891FTXN (CE25 chassis)

I have had this problem before: the set goes to standby intermittently. Find C154, which is next to the line output transformer, remove it and solder the wire link that was under it. **P.S.**

Grundig G1000 chassis

It is worth checking the mains bridge rectifier's reservoir capacitor C104 (47µF, 400V) whenever one of these sets comes in. If it's a black Siemens type it will probably fall off the PCB! Various symptoms can be present when C104 is defective, from intermittent power supply failure to grey-scale variations. **G.D.**

JVC CV14EKS

This portable uses a grown-up version of the dreaded Onwa chassis, with real components and a proper PCB! This one was dead, though HT was present at the collector of the chopper transistor. As there was no kick-start at its base, I replaced the 330kΩ feed resistor. No luck. After much component checking I noticed an additional 10kΩ resistor, R919, in series with the base circuit. It's not present in the earlier chassis, and was open-circuit in this particular set. **G.D.**

Sony KVX2572 (AE2A/B chassis)

This set came on with an EHT rustle, then tripped with the LED flashing. Resoldering the usual dry-joints didn't help, but I noticed a slight haze on the screen when I repeatedly switched on and off. This suggested that the line output transformer was OK. Fortunately a new STV9379 field output chip brought the set back to life. **G.D.**

Bush 1439

Field collapse was the problem with this just out of guarantee set. Having expressed my customary surprise that it had lasted so long, I replaced the TDA3653B output chip. This made no difference. I dug out a similar circuit, then found that there was no drive at pins 1 and 3 of the output chip, though the voltages here were present and correct. There's a cluster of small ceramic capacitors by the IC and, thinking of Panasonic sets long gone by, I decided to remove and check each one. Bingo! C623 (1nF) had a heavy leak.

Incidentally, have you noticed how few sets have the scan coils straight? The letterbox programmes seem to show this up. **G.D.**

Sharp 51AT15 (5BSA chassis)

This set had a small picture because the HT was low. There's no preset control, the HT voltage being sensed, for regulation, via a couple of two per cent zener diodes, D716 (27V) and D717 (75V). D717 was giving a good imitation of a 47V zener diode.

Incidentally the HT in these sets is usually nearer 112V than the 108V quoted in the service manual. **G.D.**

Hitachi C2874TN

Following routine replacement of the LA7838 field output chip I was rewarded with an apparently dead set that nevertheless produced a plopping sound from the left speaker. Since this was a rushed production chassis (apparently because Toshiba beat Hitachi to a Dolby model!) there are numerous components on the print side of the PCB.

I spent some time checking that I hadn't damaged any of them before I realised that this was a new fault. The main power supply wasn't working, because the chopper transistor's start-up/bias resistor R901 (82kΩ, 0·5W) was open-circuit. The plopping noise was caused by the fact that the audio output stage was working with no input – it has its own power supply. **G.D.**

Panasonic TX29AD1 (Euro-2 chassis)

There was no sound or picture, just a ticking noise that came from the back of the set. The noise was coming from relay RL6101, which is on board M. On several past occasions I've found that power supply tripping with this chassis has been caused by line output transistor problems. On this occasion however the relay itself was faulty. **S.H.**

Panasonic TX32PK2C (Euro-4 chassis)

The rear surround sound speakers weren't working. On investigation I found that the TDA2030AV IC for the rear speakers, IC2704, had overheated badly and part of the encapsulation had actually blown

apart. After fitting a replacement I checked the speakers and leads carefully for shorts before switching on. All was well **S.H.**

Hitachi CL2864TA

The customer reported that the set had "gone bang", then went off. On investigation I found that the power supply was tripping and F902 in the 148V supply to the line output stage was open-circuit. A 60W bulb connected as a dummy load for the 148V rail brought the power supply to life, suggesting that there was a fault in the line output stage. Checks and substitutions in this area did nothing to stop the power supply tripping however.

I decided to check the supplies derived from the line output transformer. The resistance reading between the 200V output and chassis was a highly suspect 31Ω. The RGB output chip IC800 on the CRT base panel was the cause of the trouble. Once IC800 and F902 had been replaced the set worked normally.

IC800 is listed as type TEA5101A in the manual, but Hitachi supplied type TEA5101B as a replacement. **S.H.**

Bush 2052T

There was lack of contrast even though the bar graph showed that the adjustment was set at maximum. The cause of the trouble was R316 (100kΩ. 0·5W). You'll find it between the power supply relay and the field output chip. **C.W.**

Fidelity CTV920

If there are vertical bands on the picture, about an inch wide and an inch apart, replacing C50 (100µF, 25V) will cure the effect. It's the reservoir capacitor for the supply to the 12V regulator IC9. **C.W.**

Thomson ICC17 chassis

This set was dead. After checking the standby power supply I found that the low voltages were present but the main power supply wouldn't start up. The cause was a small crack on the customer control panel. As a result there was no supply for the standby LED and the remote-control receiver unit. **C.W.**

Hitachi C2558TN (G8Q chassis)

If the set is stuck in standby, the following items in the chopper power supply should be replaced: IC901 (UC3844), Q901 (BUZ91A), Q902 (SGSIF344) and the optocoupler OC941 (CNX82A). **J.C.**

Sony KVM1420U (BE2A chassis)

The complaint was "snowy picture/noisy sound". The picture was certainly poor, and gave the impression that a slight ghost image was present. Checks on the tuner showed that its operating conditions were OK. The DC conditions around the IF/timebase generator chip IC502 were also correct. The cause of the trouble turned out to be the SAWF SWF101. The only check is by substitution. **J.C.**

Grundig P37-730 (CUC7301 chassis)

The picture would go bright and might also pulse. I traced back from the SW pin at the CRT base panel connector to the two surface-mounted transistors CT181 (BC58B) and CT186 (BC848B) on the main panel. These both had to be replaced to restore normal operation. **J.C.**

Mitsubishi CT25AV1BD (EE3 chassis)

This set came in with the line output transistor Q552 short-circuit and the TEA2031A EW correction chip IC551 faulty. Once these items had been replaced there was only slight control over the width and no EW correction. R510 (100Ω, 2W) was found to be overheating, the cause of all the trouble being shorted-turns in coil L501 (6,800µH). **J.C.**

GoldStar CIT2175 (PC07X2 chassis)

The problem with this set was field collapse. The voltages around the LA7830 field output chip IC301 were correct, and a replacement made no difference. The drive comes from the TDA4502A IF/timebase generator chip IC201. Scope checks here showed that the field drive and ramp waveforms were incorrect. The DC conditions around this IC were correct, but a replacement restored the field scanning. **J.C.**

Baird RR5191N (Ferguson ICC7 chassis)

This ex-rental set came into the workshop with the complaint no or intermittent sound. The set was put on test and after some time the fault finally appeared. Slight flexing of the Nicam PCB would restore normal operation. The cure was to replace all the wire links on this board. **G.B.**

Matsui 1436XA

This 14in. portable was dead. All it needed was a replacement start-up resistor, R652 (390kΩ). On test however I noticed a slight crackle on the sound. The cause of this was eventually traced to the 6MHz filters in the sound IF circuit. Replacement restored normal, clear sound. **G.B.**

Samsung CI5079

The job sheet said that this set was dead. We've had a few of them with the same fault. The cure is to replace IC801, HC801, L803 and ZD801. The chip supplied by Samsung for the IC801 position was this time a different type, requiring the mica sheet and heatsink compound to be removed. I'm not sure whether this change is to improve reliability or because the original type has been discontinued. Certainly the equivalent type that used to be available can no longer be obtained. Time will tell. **G.B.**

Panasonic TX25AD2 (Euro-2 chassis)

A field call had been requested for this set. When I arrived at the house I found that the picture had a distinct lack of width with severe EW distortion. As nothing obvious could be found, the set had to be taken back to the workshop. The cause of the trouble turned out to be C593, a little 0·01µF disc ceramic in the EW drive generator section of the set. It had gone short-circuit. **G.B.**

Bush 2059NTX

No colour was the reported fault. When I switched the set on there was a monochrome picture with a lot of wavy lines swirling about. I noticed a very discoloured electrolytic capacitor. C125 (100µF, 16V), near the 12V regulator IC103. A replacement cleared the lines and restored the colour.

For improved reliability C909 (47µF, 25V) and C910 (10µF, 50V) in the power supply were replaced. But the set would not switch to standby, because the HT switching transistor Q907 (2SC2335) had failed. Once this had been replaced everything worked correctly. **G.B.**

Ferguson ICC5 chassis

The symptoms were ragged verticals on text only, and only after the set had been in operation for ten minutes or so. Out came the freezer and the heat source. Use of these revealed the culprit, which was DV68 on the text PCB. Note that several different text panels were used with this chassis. **P.T.**

Goodmans TVC14VP (Daewoo CP310 chassis)

The symptoms with this TV/VCR combi unit were an audible click from the relay at switch on, then reversion to standby. The cure was to replace the HT preset VR801 (4·7kΩ), D807 (BYV95C) which is in series with it, the 2SD1555 chopper transistor Q801 and the TDA4601 chopper control chip I801. The components in this area should all be checked for dry-joints. **P.T.**

Sony KV2521U (AE1 chassis)

The sound was OK but there was no picture, because the tube's first anode supply was missing. The cure was to replace the first anode supply rectifier D803 (RGP01) and R807 (1kΩ, 1W) which is in series with it. **P.T.**

AUDIO FAULTS

Reports from
Robin Beaumont
Geoff Darby
Dave Gough and
Russell J. Fletcher

Aiwa AM-HX30 MiniDisc player

This personal player appeared to recognise that a disc had been inserted. But a clicking noise came from the mechanism, as if the optical pickup was trying to drive itself past the limit stop.

Once a service manual had been obtained I was able to access the service mode, which allows step-by-step start-up of the playback process. The pickup would focus on the disc, but when the disc servo was enabled there was no disc rotation. Measurements on the tiny three-phase motor, from the connector on the PCB, showed that one coil was open-circuit. When I carried out further dismantling I found that the flexible cable wasn't properly soldered to the motor. Correcting this, followed by careful reassembly, completed a successful repair. **R.B.**

JVC CA-MX1L

This two-part audio system had performed well for many years but had now developed intermittent sound from one or both channels. If the case was tapped anywhere, the fault would come and go. The cause of the trouble turned out to be the loudspeaker muting relays, which were intermittent and had to be replaced. Similar relays can be found in other JVC products. They can usually be recognised by their orange cases.

If the CD section of this model has any intermittent problems, resoldering the focus and tracking servo driver transistors will often provide a cure. The circuit reference numbers are Q701/2 and Q733/4. **R.B.**

Sony MZR55 MiniDisc recorder

The initial problem with this personal recorder was intermittent sound from one channel. By the time it reached our workshop it wouldn't play discs. The dry-joints on the headphone socket were easily dealt with, but when an attempt was made to play a disc the machine was noisy. It seemed as if the rotating disc was fouling the mechanism or the disc caddy.

Close inspection of the turntable revealed that the plastic surface had deteriorated. As a result the disc hub didn't sit on the turntable correctly. A new spin motor was required. **R.B.**

Kenwood RXD-NV500

This unit wouldn't play CDs. The cause was quite simple – a defective spindle motor. To get to the deck to change this item requires a fair amount of dismantling. When you do this, beware. The flexiprint is 60cm long and comes right up to the top of the unit. It's stretched quite tightly across the sharp edge of the PCB, and is held down just before its connector by a sticky pad. Just to make matters worse, it's paper thin and tears easily. Don't ask me how I know! **G.D.**

JVC CA-MXJ75R

This one was brought in because there was no right output. Don't be fooled, as I was. Both channels were present at the inputs to IC401, the source-select chip, but only one signal emerged. The chip was OK however.

It transpired that this IC also contains the electronic balance-control stage, which can be adjusted only via the remote-control unit. The owner hadn't brought this along of course. Once it had been obtained, pressing the shift and bal-L buttons produced a balance display on the VFD, enabling the sound to be re-centred. This restored correct outputs. **G.D.**

Denon DCD635 CD

This stand-alone hi-fi separate wouldn't display the TOC, though you could hear the spindle motor turning. On further investigation with the lid removed I found that the CD was turning very slowly. When the spindle motor was tested with the bench supply it seemed to be OK. Closer visual inspection of the laser assembly revealed the presence of a small 47µF, 4V surface-mounted capacitor. Anyone who has had experience of camcorder repairs knows how troublesome these capacitors can be. A replacement restored normal operation. **D.G.**

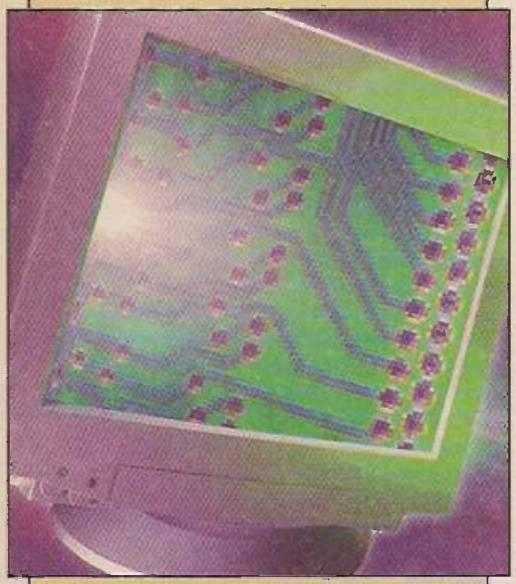
Technics SL-PG48A CD player

We've had several of these units recently with the symptom "dead" or, strangely, "plays the first track only". The item to check is C11 (2,200µF, 16V) in the power supply. **R.J.F.**

Kenwood KA4040 amplifier

If there's no output because the protection relay isn't energised, you will find that one or more of the output transistors is short-circuit. The fault will not be confined to the final stage however. As a matter of course, replace the µPC1298V driver IC and look for burnt safety resistors – R83/85 in the left channel, R84/86 in the right channel, all 10Ω. The transistors are difficult to come by, but we have used equivalents to good effect: a 2SD1047 can be used to replace the 2SD1717 and a 2SB817 to replace the 2SB162.

If you have right channel failure, don't miss the safety resistors which are tucked away out of view near the front control PCB. **R.J.F.**



MONITORS

Fault reports from
Ian Field
Geoff Butcher
Chris Avis
Jon Collins
and
Gerry Mumford

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

Reports can be sent by post to:
Television, Fault Reports,
Anne Boleyn House,
9-13 Ewell Road,
Cheam,
Surrey SM3 8BZ

or e-mailed to:
tessa2@btinternet.com

PVS/LVI

This Sony-based microfiche was dead. A very common cause is failure of D808, which the genuine Sony service manual says is type RGP10G. But in every case I've come across to date it's been a BYD33G. The chassis is a converted TV, and D808 was prone to overheating before LVI added to its load a three-terminal 12V regulator to supply the camera interface PCB. In both TV sets and this conversion the diode often gets hot enough to blacken the PCB severely, and leaky enough to cause random failure of PS801 (ICP-N15 or T1A Wickman). When D808 has cooled, it usually proclaims its innocence by not showing any leakage.

One of the PVS in-house engineers had looked at the fault and 'upgraded' D808's reservoir capacitor C823 from 22µF, 50V to 220µF, 25V. It had now 'heaved' its rubber seal! I fitted the correct type of capacitor, then tackled D808. The cure is to fit the fastest available TO220-style rectifier with a PIV of at least 200V. A BYW29-200 works all right. Anything slower than 35nsec will run hot even when rated at 16A or more!

Since fusible resistor R820 (0·47Ω, 0·25W) never ever blows no matter what other destruction is going on around it, fitting in its place a choke salvaged from the secondary output ripple filter of a scrap switch-mode power supply will dramatically reduce D808's stress and overheating.

There's a very small disc-ceramic protection capacitor in parallel with D808. It also runs very hot and contributes to the blackening of the PCB. The TO220-style replacement rectifier is a closer fit to the capacitor's mounting holes. This is very handy: it can be fitted there and a better-quality capacitor of the same capacitance and voltage rating can be accommodated in the original rectifier mounting holes. **I.F.**

NEC Multi-sync 3D Model JC1404HMA-1

The mains input fuse had blown violently, leaving the inside of its glass tube metal-plated! Cold checks quickly revealed that there were no short-circuit semiconductor devices, but I noticed that the crowbar protection thyristor across the mains bridge rectifier had a few suspect solder joints around its gate-damping components. I decided to try powering up with a 60W bulb across the fuseholder. The bulb wouldn't supply enough current to run a monitor like this but, with the cable between the power supply and the main PCB disconnected, I found that the power supply started up and produced correct voltages at all its outputs.

It seemed that the most likely cause of the blown fuse had been random firing of the crowbar because of the poor soldering around its gate pin. So I attended to this and fitted a new fuse. At switch on there was a loud bang and a cloud of steam as the mains reservoir capacitor burst! I decided to search for the cleverly-concealed voltage-rating label underneath the monitor and, yes, it was a 120V model.

A phone call to the customer revealed that it had been purchased "very cheap" from someone at a nearby US airbase. When I explained what had happened, the customer suggested that if it was that bad it could be scrapped for parts. I didn't want to raise his hopes without checking to make sure, but I was certain I'd seen the unmistakable shape of an NEC switch-mode power supply module on the 'graveyard' pile.

When I eventually found this item there were no markings on it, and in fact it was very possibly a pattern spares exchange unit. It had several extra outputs, and those nearest the ones I needed were higher than required. The original power supply module provided 170V, 85V and 24V, this one 96V, 24V, 12V, 5V and 220V. Fortunately when I fitted it I found that the preset adjuster had sufficient range to bring the outputs down to the voltages required. All the connectors were different, so the correct types had to be grafted on to the monitor's cable loom, using heatshrink sleeve.

The monitor worked perfectly with the new power supply installed. My only concern was that the old power supply had hefty bolt-on secondary-side rectifiers while the replacement had smaller, wire-ended ones. To put my mind at ease, I subjected the monitor to vigorous bench tests with regular checks on the temperature of the rectifiers. They remained surprisingly cool throughout. **I.F.**

Daewoo 431X

The first time this monitor came in it had a blown mains fuse. As I couldn't find any other fault I fitted a replacement, patted its head and sent it back to its owner. Six weeks later it was back again, dead.

This time the chopper transistor and one of the mains bridge rectifier diodes were short-circuit, and part of the PCB track to the chopper transistor's drain pin had burnt out. After replacing these items and the chopper control chip, which had also failed, I had a display but there was an intermittent squealing noise with interference lines on the picture. The squeal would usually occur at start up and disappear after a few seconds. Tapping the PCB almost anywhere would set it off again. After much fruitless resoldering and gnashing of teeth I eventually found that the mains bridge rectifier's reservoir capacitor was going open-circuit intermittently. **G.B.**

Compaq 476

There was intermittent loss of line sync: the fault could sometimes be made to come and go by tapping the PCB. Initially I carried out some resoldering around the line timebase generator, without success. I eventually found that the cause was dry-joints at the 5V regulator IC202. I have now had this fault on two occasions.

Here's a tip. When you have to resort to blanket resoldering it can be difficult to remember which joints have been soldered and which ones haven't, making it easy to miss a few joints. I start by using a fine marker pen (Staedtler Lumocolor 313) to mark all the joints I decide to resolder in an area. It's then obvious which marks have been disturbed by resoldering and which haven't. As a trace of marker is left around the joint after resoldering, you can also see which joints had been left unmarked. **G.B.**

Philips 4CM4770

The problem with this 17in. monitor was loss of line sync. Two attempts at fixing it were required because, infuriatingly, it cured itself the first time it was on the bench. At the second attempt however the fault stayed put long enough for me to be able to discover that there were healthy line sync pulses at the base of the surface-mounted emitter-follower transistor 7317 on the CRT base panel but none at its emitter. A replacement transistor cured the problem.

The original transistor was unmarked, and I didn't have the service manual. But the exact type doesn't seem to be too critical. I used a BC817. **G.B.**

LG 99T/CF900

Apparently this monitor had gone "pop" when moved and reconnected. There's no on/off switch, just an off button. When this button is pressed the monitor consumes just 5W.

The standby supply is generated by a separate little self-oscillating power supply which is based on a TOP210PFI 8-legged device. There was a scorch mark here, between pins 5 and 6. A spurt of soot had covered the adjacent diodes D916/919, and things looked bad. After a good clean-up however no further destruction came to light, and the MOSFET etc. in the main power supply all checked out OK. Even the sooty diodes had survived, though the 5A mains fuse had blown.

Significantly there was a slot in the glassfibre PCB between the two pins that had arced – they do have high voltages across them in operation. I cleaned the slot and used a small file to enlarge it slightly, then fitted a replacement IC. The TOP210PFI is not listed by my usual suppliers, but is available from RS Components at a modest price. When ESR checks on the electrolytic capacitors in the surrounding area were carried out C935 (100µF, 25V) in the main power supply produced a high reading. I fitted a replacement, but doubt whether this component had contributed to the fault.

Standing well back, I plugged in. There was no smoke or flashes, just the welcome rustle of EHT. **C.A.**

Digital PCXAV-WZ

This monitor, made by Mitsubishi, powered up with a green LED indication and a click from the relay but no EHT. The 2SC5244 line output transistor Q503 was short-circuit. Further checks showed that Q522 (2SJ449) and Q523 (ET453) in the width and pincushion-correction circuits were also short-circuit. I replaced these items and powered the monitor, but the same symptoms were still present. Further investigation revealed that the axial fuse F501 was open-circuit. It's marked on the track side of the PCB as a wire link, not a fuse. **J.C.**

Acer 7176l

The green LED at the front was lit but this monitor was otherwise dead. It has two entirely separate switch-mode power supplies, one to supply the lower and the other the higher voltages. The latter had blown up, destroying the 2SK793 chopper FET Q602, the UC3842 controller chip IC602 and the fusible feed resistor R619 (0·5Ω, 1W). This seems to happen quite often with these monitors, and can damage diodes D707-8 (UF5408) on the secondary side of the circuit.

Once the faulty items had been replaced the monitor powered up, but there was partial line collapse because the 2SC4542 line output transistor Q311 was leaky. After fitting a new transistor I found that there was excessive width with EW bowing. The pincushion-correction output transistor Q313 (TIP47) and its driver transistor Q312 (2SD669A) were both short-circuit. There were also big dry-joints on the yoke plug. Once these matters had been attended to the monitor produced a perfect display. **G.M.**

ADI VD645

These monitors often suffer from brightness problems. The symptoms are a peak white raster with flyback lines, the brightness control having no effect, and the video-mute spot-killer circuit failing to work at switch off. The cause is always the sub-brightness potentiometer VR853, which goes open-circuit. This is not surprising, as the tiny component has 100V across it in normal operation. It's a 100kΩ miniature horizontal preset. **G.M.**

CTX 1565SE

The fault report with this monitor said "picture stretched in DOS but OK in Windows". Actually in the 640 x 480 mode the line linearity was way off, but it was OK in the higher modes. The cause was a massive dry-joint at relay RL701 in the line output stage. **G.M.**

Dell D1626HT (Sony chassis)

This gigantic 20in. Trinitron monitor was dead apart from the front LED, which lit up green. A visual inspection of the power supply PCB revealed that C640 (470pF, 1kV) had split in half. This was because the MX0841 dual-FET Q640 was short-circuit. In addition the fusible feed resistor R640 (0·1Ω, 0·5W, Sony part no. 1-202-933-61) had blown.

Replacement of these items restored normal operation. The Japanese Shindengen MX0841 dual-FET is virtually unobtainable in the UK. You can however obtain it from AudioLabs in the US, at www.datadart.com **G.M.**

Smile CA6514DL

There was no blue in this monitor's display. The cause was the 2SC3953 driver transistor Q404 in the blue output stage. It's quite a common fault with these monitors, being equally likely in the red or green channel. **G.M.**

VideoSeven N95S Model KM800U

This 17in. monitor had poor focus at the centre of the screen, though the focus at the edges and in the corners was perfect. In common with many larger monitors nowadays, a dual focus pin tube is used. Some time was spent adjusting the two focus controls on the LOPT to sharpen the image, but this was impossible. The adjustments simply moved the blurred patch around the screen.

I decided to check the active-focus circuit and found that diode D500 (type PR1200 – use a FUF4007) was leaky. A replacement made it possible to achieve perfect focusing over the entire screen area. **G.M.**

Acer 7154e

This monitor was dead apart from the green LED at the front being on. A power supply inspection revealed large dry-joints at D702, which is a power rectifier on the secondary side of the circuit. It's a big TO220-cased device. **G.M.**

VCR CLINIC

Reports from
Eugene Trundle
Roger Burchett
Robin Beaumont
Ronnie Boag
John Coombes
Peter Tennant
Chris MacRae and
Glyn Dickinson

We welcome fault reports from readers – payment is made for each fault published. See page 682 for details of where and how to send reports.

Sony SLV-ER7UY

We've had a couple of these machines in the workshop with the same symptom: the deck shuts down a few seconds after a function is selected, or at a random time during any form of tape motion. In both cases the cause was dry-joints at drum motor plug CN1 on the under-deck of the MD56 PCB. **E.T.**

Hitachi VTF645E etc

The VTF645E shares with various other Hitachi models the **US deck**. A problem that's now becoming common with this deck is no spool rotation, with tape spillage during eject. Usually you will find that the reel-drive pulley/clutch assembly (part no. KX11443) has slid down its shaft and is out of engagement.

If the same symptom is present intermittently, the possibilities are: a damaged back-tension band; faulty change and/or gear drives KF10513 and KF10501; or even a faulty capstan motor. **E.T.**

Daewoo DVF502

This machine spent many days on the soak-test bench before it revealed the cause of intermittent deck failure. We finally saw that the cause was very simple – the loading belt occasionally slipped. SEME stocks it under part no. BELT4154. **E.T.**

Ferguson FV95HV

Since this machine had died during a thunderstorm and simultaneous power cut, we feared the worst. No short-circuit semiconductor devices were found in the power supply, but a scope check showed that it was pumping at a rate of about 1Hz. I was relieved to find that replacement of the electrolytic capacitors CP007 (10µF, 50V) and CP008 (100µF, 25V) on the primary side of the power supply cured the fault. **E.T.**

Aiwa HVFX1500

This VCR would sometimes stop during loading or eject and shut down. A mode switch problem of course. It's easy enough to dismantle and clean the switch once the deck has been removed. **R.Bu.**

Philips VR600/05 (Apollo 11 chassis)

The dealer who sent this machine to us said that the recorded pictures were poor. He thought that playback was OK, but our test-pattern tape revealed line jitter and low luminance level. The fault was present when using the scart output, thus eliminating the RF modulator. Oscilloscope checks showed that the video waveform was poor, with low-amplitude sync pulses, severe ringing on syncs and LF video loss. The E-E signal was normal.

Most of the video processing in this machine is carried out by the LA71527M chip IC7007. It can be difficult carrying out measurements on the underside of the board while the machine is playing back, but I was able to establish that the video output waveform at pin 25 was good while the return video waveform at pin 26 was distorted. The only components between these two pins are a de-emphasis network, the emitter-follower transistor Tr7002, and capacitor C2012.

C2012 is a 4·7µF electrolytic. The fault cleared when I bypassed it, so I fitted a replacement. On test the original capacitor read completely open-circuit. **R.Be.**

JVC HRJ625

If the symptom is failure to accept tapes, replace the change arm assembly and the mode switch. **R.B.**

Akai VSJ217

There was no rewind and tape was left out on eject. The cure was to replace the broken clutch assembly. **R.B.**

Sanyo VHR278

This machine would cut out in the fast forward and rewind modes and leave tape out on eject. The cure is to replace the complete mounting clutch, part no. 613-175-0661. **R.B.**

Tatung TVR774N

If the fault is no E-E sound, try replacing the NV memory chip. This usually provides a cure. **R.B.**

Ferguson FV67

The complaint was no results. On investigation I found that there was no voltage at the base of TT26 though there was 6·5V at its collector. The cause was IT25 (U2559B). Check it by replacement. **J.C.**

Panasonic NVFS1

If the complaint with one of these VCRs is no results, check C1045 (47µF, 10V). It tends to loose capacitance or develop a high ESR. Another symptom caused by this capacitor is intermittent operation. **J.C.**

Philips VR676

This model is fitted with the **Queen deck**. If one of these machines won't accept a cassette, remove the lift assembly and check the long metal bar with a cog at each end. These can crack, with the result that the cassette jams when inserted.

Unfortunately they are not available separately. You have to order a complete lift assembly, item 150, part no. 4822 443 64112. **J.C.**

Ferguson FV33H

In many cases the cause of no results is the fact that the STR10006 chopper chip IC1 is short-circuit. Sometimes the 39V zener diode D25 doesn't go short-circuit quickly enough to protect IC1. When you find that IC1/D25 are short-circuit, check whether R9 has gone open-circuit. **J.C.**

Samsung SV421K

If there is no display or a dim one, the item to check is C37 (100µF, 16V). In one recent case I found that the capacitance had fallen to 25µF while the ESR reading was very high at 20Ω. **J.C.**

Panasonic NVHD660

There was a cassette stuck in this machine, with no eject action. The diagnostic display showed H02, which means no capstan drive. But, after dismantling the cassette housing, I found that the 2SD25440PQA 12V regulator transistor Q1007 in the power supply section was the cause of the trouble. It's mounted on the main PCB and, if incorrectly positioned, the action of the shaft unit can rip its legs off. **J.C.**

Hitachi VTF645

If there are no outputs from the power supply check whether C6 (1µF, 250V) is open-circuit. **J.C.**

Sanyo VHR277

If the complaint is no results, check the power supply to ensure that there are no capacitors with their jackets shrunk or dried up. If there are no problems of this sort, check whether circuit protector PF512 (1A) is open-circuit. **J.C.**

Hitachi VTM720

Any number of faults in the power supply could cause the no results with no display symptoms. In this case however the cause turned out to be a faulty mode switch. **J.C.**

Toshiba V813B

This VCR wouldn't record – all other functions were OK. The actual symptom was repeated recording for two seconds with two-second pauses in between. If the VCR was left, this would continue for as long as it was on timer or straight recording.

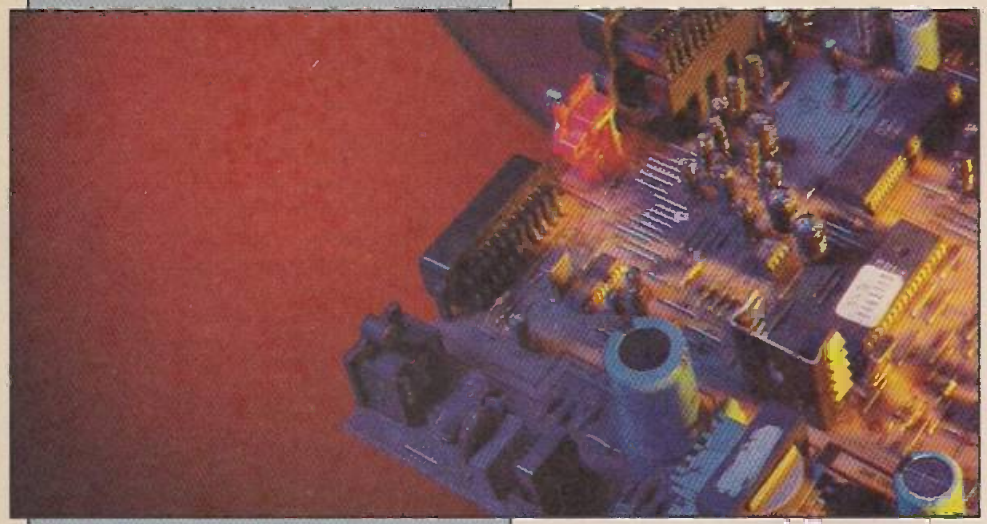
It took some time to discover the cause. After stripping out the deck and PCB I found that there was a hairline crack in the PCB, at the left bottom edge near the lower drum assembly. **P.T.**

Matsui VP9407A

A customer gave me this almost new VCR. He thought it was faulty and had bought another one. All that was wrong was that the RF output had been disabled. To set the RF output or enable it, hold the on button on the VCR down until the display flashes off, then select RF output with the VCR's channel down button. **C.MacR.**

Hitachi VTM722 and 822 series

These VCRs can suffer from odd faults such as unstable audio, sticking in the LP mode, servo hunting and so on. Once the fault area has been isolated, replace the 4·7µF capacitors there and the fault will be cured. These capacitors usually leak. Oddly, it only seems to happen with the 4·7µF capacitors. **G.D.**



JACK'S WORKSHOP

Jack Armstrong

Grundig digibox power supplies

The Grundig GRD200 and GRD400 series Sky digiboxes were reasonably reliable during their first year of service, but I am now getting one or two in the workshop each week because of power supply problems. Symptoms vary, and can include a whining noise from the chopper transformer and channels missing with the "no satellite signal" message instead. There have also been reports of picture break up.

Whatever the symptom, the cause is almost always one or more faulty electrolytic capacitors in the power supply. I'm tempted to say "I told you so", as I predicted that this would happen when these digiboxes were first released – because the electrolytics are crammed into a small area amongst warm heatsinks. But other digiboxes, such as the DRX100, use similar construction and don't, as yet anyway, suffer from power supply electrolytic capacitor failures.

In my opinion the root cause of the problem is more likely to be that the electrolytic capacitors used in the Grundig power supply are of poorer quality than those used in other digibox power supplies. Switch-mode power supplies generate pulses with very fast rise times. These must be absorbed by the electrolytics. If an electrolytic capacitor's ESR is too high the pulse energy will, under this kind of assault, be dissipated inside the capacitor in the form of heat.

Photo 1: Grundig digibox power supply with three straight heatsinks. Use Relkit 33a.

Photo 2: Grundig digibox with two heatsinks, one right-angled. Use Relkit 33b.

Fortunately the capacitors concerned are quite easy to replace – once you've removed all the glue! Note however that the negative lead of these capacitors is denoted by a crosshatched semicircle on the PCB. In Pace receivers this marking denotes the positive lead. It's very easy to confuse the two.

The faulty capacitors may be obvious, as they tend to bulge – and often have a brown stain on the aluminium top where venting has occurred. Any capacitor that shows such obvious signs of deterioration should be replaced *before* mains power is applied.

To save us all a lot of trouble, SatCure (01270 753 311) now has available Relkits that contain all the capacitors required. Most of them are a fraction larger than the original ones, as low-ESR types are supplied. In fact one capacitor is an ultra low-ESR type, to prevent repeated failure.

There are at least four different versions of the Grundig power supply. They are catered for by SatCure's Relkit 33a and 33b. Kit 33a is for the power supply that has three straight aluminium heatsinks, see Photo 1. Kit 33b is suitable for the rest, which have just two heatsinks, one of them bent at right-angles, see Photo 2.

For more information on these kits, refer to the SatCure Sky digibox web site:
http://www.satcure.co.uk/gds200.htm

Modem problems

It's the lightning season again, and I've had reports of digiboxes failing. If the result with a Grundig box is failure of the modem, the symptoms may be as follows. Normally start up is indicated by the green LED on the motherboard and the front-panel standby LED coming on then going off after a couple of seconds. The standby LED then comes on again, followed by the green LED. This time they remain on. If there's a motherboard or modem board fault however the on-off sequence will often continue, with both LEDs going off and on every few seconds. I've never known a power supply problem to result in the LEDs flashing like this. GenServe (01793 886 322) can repair the modem board assembly. The cost is in the region of £75.

Pace receivers don't have a separate modem board. A telephone line surge can cause failure of IC U700, the optocoupler, and the nearby zener diode. As with most digibox faults, the symptom is usually stuck in standby. I don't have the skill (or eyesight) to be able to remove U700, so I send receivers with this fault to Pace for repair. A phone-line surge occasionally destroys other components as well – I don't want to get involved with repairs that could turn into a nightmare.

ZIF tuner

The zero-IF tuner in later Pace digiboxes seems to be prone to failure, with symptoms that range from some channels missing to the all-too-common stuck in standby. Replacement tuners were in short supply when I spoke to Pace, but you can get faulty ones repaired by MCES in Manchester (0161 746 8037) or Kesh Electrics in Northern Ireland (02868 631 449).

Panasonic digiboxes

I haven't had many Panasonic digiboxes in for repair and don't know whether this is because they are rare or very reliable. The RF2 connector seems to break off rather easily, and the 3·6V zener diode across the 3·3V supply occasionally dies for no apparent reason. When I was at university I was told that low-voltage zener diodes can't be made with a sharp 'knee' characteristic. As a result the zener point is ill-

defined and cannot be relied upon. I'm not sure what this means in practice, but know that my old, arthritic knees can't be relied on either!

Software problems

The current (July) Sky digibox software seems to be causing problems. Many users have reported that their receivers lock up or switch themselves to standby. My own Pace 2200 digibox did strange things after the Personal Planner software upgrade, but disconnecting the mains supply for a few seconds cured most of the problems. The Personal Planner cannot be relied upon however. When it has been set for a specific programme the VCR will often record a blue screen.

Panasonic digiboxes seem to be worst affected by these software problems. Although I can't get an official statement from anyone, rumour has it that BSkyB is working on a solution.

Tuner failures

While the number of Pace tuner failures has increased, the number of Amstrad DRX100 tuner failures has slowed to a trickle. I'm not sure whether this is because people are taking up BSkyB's £50 exchange offer or because most DRX100 receivers have now been fixed. It will be interesting to see if the repaired tuners begin to fail again next year!

Apple matters

Apple is opening retail stores in America. Here's why. Apple currently has about five per cent of the personal computer market. That might not sound a lot, but is higher than either BMW or Mercedes' share of the car market. It means that some 25 million people around the world use Macs. Apple wants to convince the other 95 per cent that "Macintosh offers a much simpler, richer and more human-centric computing experience". It believes that the best way to do this is to open Apple stores in their neighbourhoods.

The stores will let people "experience firsthand what it's like to make a movie right on a Mac; or burn a CD with their favourite music; or take pictures with a digital camera and publish them on their personal website; or select from over 300 software titles, including some of the best educational titles for kids; or talk to a Macintosh 'genius' at the Genius Bar; or watch a demonstration of Mac OS X, the revolutionary new operating system, on a giant 10-foot diagonal screen. Because, if only five of those remaining 95 people switch to Macs it will double Apple's market share."

Fine words indeed. Judging from past experience, we can expect to see similar Apple stores in the UK in about ten years' time!

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

Test Case 465

The Test Case workshop was not at its best. For one thing Sage was off sick, booked into the local hospital because he was suffering from some sort of difficult-to-diagnose ailment. Speculation suggested that it might be to do with all the red wine he drinks. The others certainly missed his diagnostic powers, even though the summer workload was relatively light. Real Technician was further concerned to discover, one bright Monday morning, a complete PC outfit and a digital camcorder (Canon DM-MV20) on the awaiting-repair bench. Some have greatness thrust upon them, he thought, as he read the job card.

Three problems were described. First, an edited 'movie' took many hours to *render*, that is to be assembled on the hard disk. Secondly, when it was complete its playback appeared to run at about twice the normal speed. And thirdly the final production could not be exported back to digital tape for archiving. Wow! And all Real Technician had been expecting was the usual diet of dead TVs and VCRs with dirty heads.

When the PC and digital camcorder reached the front of the queue they were taken to RT's repair bench, where they were fired up. The PC was found to be fitted with a FireWire capture card, and was loaded with an edit program. These had come as a package, which also contained assorted software in the form of titling and 'effects' tools. In addition there were a FireWire link lead and some user instructions, the latter to enable the operator to climb a steep learning curve quickly. RT did this to the best of his ability.

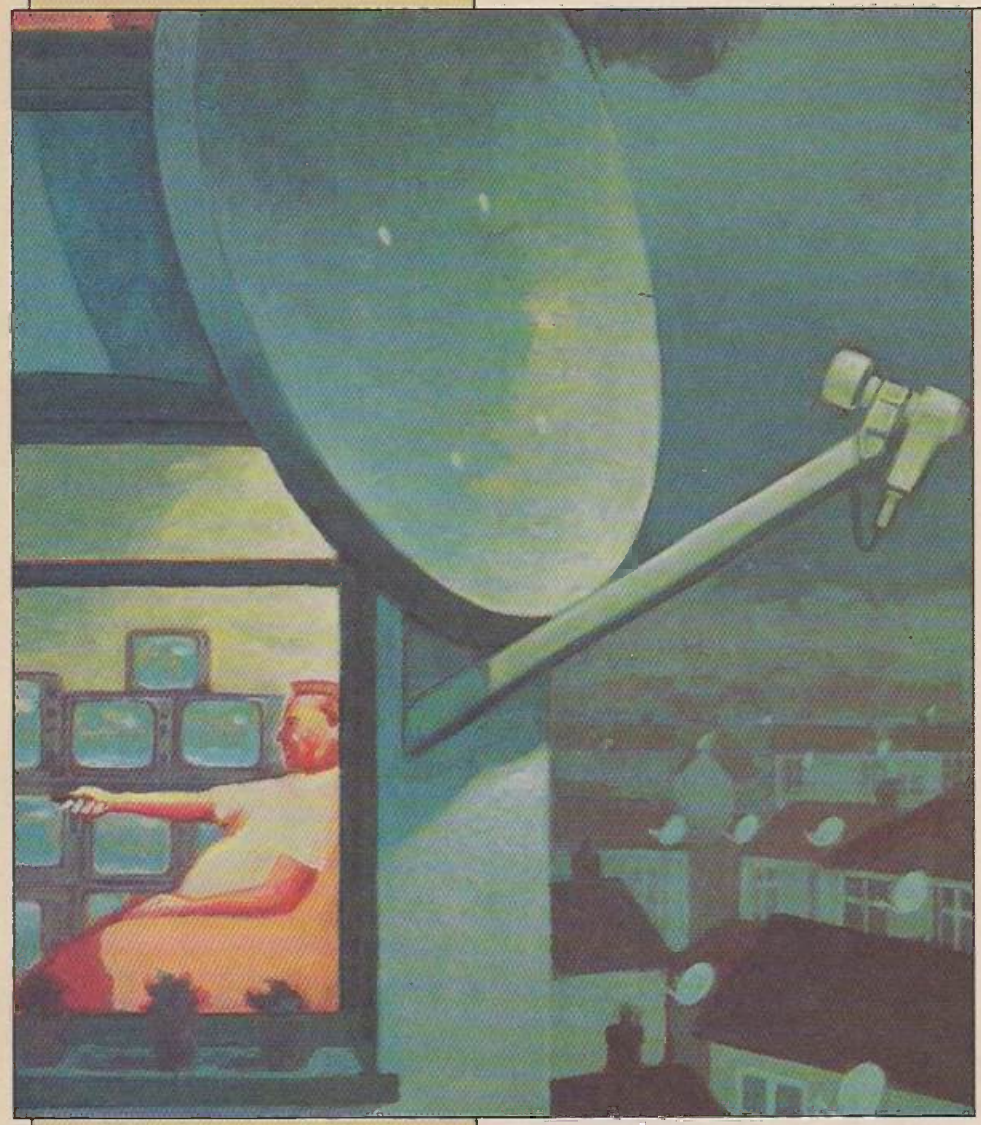
The capture card translates IEEE 1394 video and sound data which arrives via the FireWire link into a form that the PC can recognise. The edit system earmarks chunks of sound and vision data for later positioning in a 'timeline' specified by the user and stored in an edit decision list. The software provides a variety of corrections, transitions, titles, captions and effects: instructions for these are stored alongside the sound and vision data to which they relate. This lot is held on the hard disk memory for later processing, or rendering, which can take many hours as each frame is taken from the hard disk, individually processed, then returned to another location on the hard disk. The final phase ('make tape') plays back the data from the disk, translates it to IEEE 1394/FireWire format, and passes it back to the camcorder or other digital video (DV) recording device. Some cards also provide analogue signal interfacing.

A thirty-minute 'production' was already present on the hard disk. Sure enough it did play back in a fast, jerky fashion. And yes the Canon camcorder did seem unable to accept the data from the PC for recording on tape in digital form.

RT went to the edit system's set-up menu and, to the best of his ability, checked the settings there. He didn't find anything untoward. He then went to the settings and tools of the PC's Windows 98 operating system, where *defragmenting* the hard disk would have helped to some degree.

For answers to the other problems RT managed to enlist the help of Doc Colin, who is a computer enthusiast, and salesman Peter Patter's friend, who is deep into computer-video systems.

Do you have any ideas about this, in terms of either hardware or software fixes? For the solutions, turn to page 696.



SATELLITE NOTEBOOK

Reports from Christopher Holland and Gordon McCrea

Personal planner

The personal planner was recently sent to digiboxes via an over-the-air software upgrade. It enables the user to instruct the digibox, when in the TV guide mode, to show a reminder that the next programme of interest is about to start or, alternatively, to change over to the programme automatically.

Just after the software upgrade to my Panasonic TU-DSB30 I found in the planner a 'phantom programme' that couldn't be deleted from the list and didn't have a channel number listed against it. Rebooting the digibox from the mains didn't remove the programme, but I found that when the viewing card was removed, the digibox was rebooted and the card was then inserted after the normal "please insert the card" message on ch. 998 the phantom programme had been removed from the planner.

A customer who had the same problem with a Panasonic digibox rang us up about it. He was able to remove the phantom programme in the same way, by following the instructions we gave him over the phone. **C.H.**

Remote-control TV setup codes

Setting up a digibox remote-control unit for a customer's TV receiver can sometimes be difficult when the set is not a familiar one. Fortunately help is now available from the digibox itself.

Press the interactive button and select the recently added option 6, Sky Enquiries, see Photo 1. You then arrive at the Sky Enquiries Home page, see Photo 2. Select the Technical Assistance option, see Photo 3, and go to the "Your Sky remote control" option. This brings you to the Your Sky remote control page, see Photo 4. Select "How can I set up my Sky remote con-

Photo 1: Interactive page with the recently added Sky Enquiries option 6.

Photo 2: The Sky Enquiries Home page.

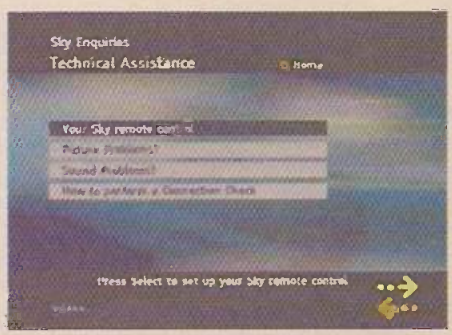


Photo 3: The Technical Assistance page.

trol?" Next select "Setting up your Sky remote control to operate your TV", see Photo 5. You are then prompted to select a manufacturer, starting with an alphabet, see Photo 6. If you choose say B as the option you get a list of brand names that begin with B, see Photo 7. To take Baird as an example, Photo 8 shows a number of remote-control setup codes that can be entered.

I've found it helpful to write down the codes shown before trying them out, because when you press the Sky remote-control unit's TV button, as you have to do before entering the code, the digibox reverts to the TV channel that was being received prior to entering the interactive menu. You might then have to repeat the procedure, which can be a bit tedious if the code that finally works is the last one on the list! C.H.

Table 1: New digital channels from 28·2°E.

Frequency (GHz)	*Satellite/ beam*	*Pol.*	*Channel*
11·508 (D3S)	Eurobird	H	Premiership Plus (433)
11·585 (D7S)	Eurobird	H	Best Direct, Sinhala, Aljazeera (EPG nos. TBA)
11·680 (D12S)	Eurobird	V	Digital Classics TV (461)
12·324 (32)	Astra 2B N	V	Real Radio (tests)
12·402 (36)	Astra 2B N	V	Student Broadcast Network (tests)

N = north beam. TBA = to be announced.

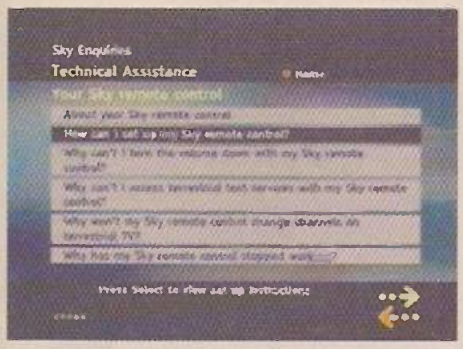


Photo 4: Your Sky remote control option.

Photo 5: Technical Assistance – setting up your Sky remote control.

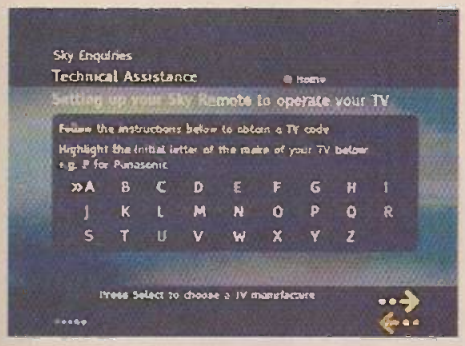


Photo 6: First stage of setting up the remote control.

Digital channel update

Table 1 lists new channels available via Astra and Eurobird, with the transponder number in brackets after the frequency and the EPG number in brackets after the channel name. C.H.

Pace DTR735 ONdigital box

We've had a few of these boxes that would intermittently lock completely. A mains reset would occasionally produce the "update error" message on the front-panel LED display. In this event a close examination of the flash memory pin connections may reveal dry-joints, especially around U253. These chips are easy to resolder if you run a flux pen down the pins and follow up with a well-practised movement of the soldering-iron tip.

For useful soldering information it's worth taking a look at the Metcal site (www.metcal.co.uk). G.McC.

Pace 2500S3 digibox

The 2500S3 is the latest, silver (though early ones were grey) digibox from Pace. There are two boards inside, the power supply now being off the main board. The latter has the new STi5512 processor which, with 256 pins, has considerably reduced the component count on the board. It incorporates a programmable transport-stream demultiplexer; an ST20 32-bit CPU; an MPEG-2 decoder; Macrovision copy protection; a Sky 1 conditional-access module; an improved graphics display system; an MPEG-2 encoder; and interfaces for external memory, IEEE 1394 connection, an I^2C bus, teletext and smart cards. This processor runs hot, and when it fails you have a box with which the red standby LED lights up but nothing else happens.

The STi5512 is a ball-grid array (BGA) device, which means that the pins are actually in ball form arranged as an array beneath the IC. Unless you have suitable equipment to replace a BGA, this job is best left to a specialist.

The box can refuse to start for other reasons. There could be a power supply fault. Another common cause is the ZIF (zero IF) tuner which, when it fails, can produce a lot of incorrect I^2C data. The box will have the same red LED display. The difference this time is that the STi5512 processor is working and, if you press a button on the remote-control handset, you should see the remote-command LED (also red) lighting, though the command will not work. The tuner can be sent to Kesh Electrical, 6-8 Main Street, Kesh, Co. Fermanagh, N. Ireland BT93 1TF (phone no. 02868 631 449, fax 02868 632 003) for repair. The company says that a repaired and tested replacement will be sent out on the same working day as receipt of the faulty one. G.McC.

Photo 7: Brand options under B.

Photo 8: The Baird example.

WEB SERVICE

To reserve your web site space contact Pat Bunce

Tel: 020 8722 6028 Fax: 020 8770 2016

E-MAILS p.bunce@cumulusmedia.co.uk

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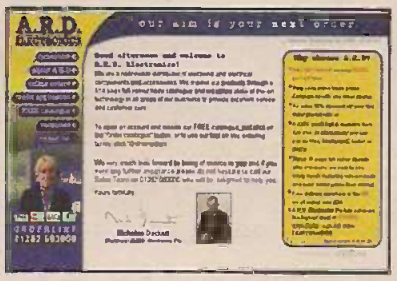


A.R.D.'s Website details all the information you need to know about this new and exciting electronic component distributor. It shows how to: open an account (credit or cash), obtain a trade catalogue and place orders (both online and direct)

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/enginfo

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

Doknet Service manuals

http://www.doknet.com

This Dutch site says it has 350,000 service manuals and 1 million service parts. You interogate the data base 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

As the leading distributor for the TV, Video and Audio trade in Ireland, we supply over 2000 shops & service dept with Audio-Video and TV spares, Semiconductors, Test Equipment, Service Manuals, Remote Controls etc. At present we stock over 30,000 different lines

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 manfactured by Goot Japan for the UK market. Goot uses advanced production technology to manufacture high quality soldering iron products for industrial, prfessional and general purpose use.

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 PICmicro(R) microcontroller programming (C and assembly).

M.C.E.S.

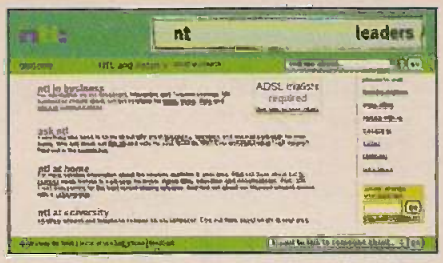
http://www.mces.co.uk

The MCES site gives details of our range of service including Tuners, Video Heads, RF & IF Modules plus latest prices and special offers.

NTL

http://www.ntl.co.uk

Go to this site for information on NTL's Broadcast, Interactive and Telecom



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

Mauritron Technical Services

http://www.mauritron.co.uk

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.

PC Universe

http://www.pc-universe.net

PC Universe supplies core computer components at "WORLD-beating" prices. Our range of reliable brand name products is available to order online 24-7.
Nationwide delivery. Free Tech support at all levels. Call LO Call 0845 4585817

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.

Switch-it-on

http://www.switch-it-on.co.uk

We sell multiregion dvd players to trade and public, also tv, videos, hifi and

playstation 2. We design our own upgrades on dvd and we sell all spare parts. All makes and most models stocked.

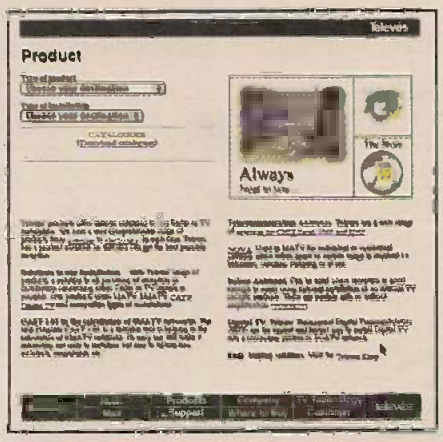
Timecast

http://realguide.real.com/stations/

This site contains listings of TV and Radio stations available on the Internet. There are also some fixed cameras positioning in locations ranging from game park, high streets and people's houses - not exactly captive viewing! But an interesting thought - are PCs and TVs going to eventually "get married"?

Televes

http://www.televes.com/ingles/ingles.htm



Televes website was launched as an easier way to keep in contact with our World-wide Network of Subsidiaries and Clients. This site is constantly updated with useful information/news plus you can download info on our range: TV Aerials & accessories, Domestic and Distribution amplifiers, Systems Equipment for DTT and Analogue TV, Meters and much more.

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/uktvrepair

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 compute batteries and printer parts. The vast majority of items are in stock, and can be purchased on-line via this site's shopping facility.

Repairworld

http://www.repairworld.com

Repairworld is a US based fault report database which is updated bi-weekly. It operates on a subscription basis and describes itself as an "affordable solution for all technicians". There is apparently no minimum number of months for which you have to subscribe. You can see some samples of the material for free, monitors, VCR, DVD and Camcorders being of particular relevance to UK users. The site provides a "chat room" where you can talk via your keyboard to others "in the room".

Vintage Wireless Co London

http://www.vintagewirelesslondon.co.uk

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This includes your company's name, web address and a 25-word description.
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This price includes the above mentioned information, plus a 3cm screen shot of your site, which we can produce if required.

To take up this offer or for more information ring:

Company name	Web address			

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FERGUSON VIDEO

FV90 LV HAND SET £3.00
FV80 LV HAND SET £3.00
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BATTERY CONVERTER TA606 £15.00
24V DC/240V AC £15.00
BENCH POWER SUPPLY VARIABLE
0-30V 3A-TWIN METERS P/P £5.00 ea £50.00
BRIDGE RECTIFIERS 10 FOR £1.00
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STC ALKALINE 10p
DESOLDER PUMP £2.00
DIGITAL CAPACITANCE METER CMC200 200PF-20MF £28.00
FILTERS – 455 & 480 EACH 10p
GAS SOLDER IRON-PORTASOL HOBBY £10.00
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PLASTIC FRONT WITH FLAP – 8.900 £3.00
POWER SUPPLY-VS1000-VS1100 £5.00
POWER SUPPLY, LONG OR SHORT CHASSIS 1991/1992 MODELS £3.00
POWER SUPPLY – SWITCH MODE – DOUBLE DECKER £5.00
20 OFF MIXED NOKIA ITT
SALORA FINLEX SERVICE MANUAL £10.00 POST 4.00
MAINS ADAPTOR 12V AT 500 M/A
NEGATIVE CENTRE £1.00
NEGATIVE CENTRE £1.00
POSITOR EQV 98009 – SALE PRICE 25p

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ADAPTOR – VPT – TEXT – VA354 £2.00
AC MAINS & BATTERY-VA365 P/P £3.00 ea
CAMCORDER BATTERY, HIGH CAPACITY 9.6V 1800MA-VA310 £3.00
CAMCORDER BATTERY CHARGER 9.6 VOLTS VAZ65 EACH £6.00
CAMCORDER CAR ADAPTOR CHARGER – AND BATTERY-VA308 £5.00
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Valve radio design

I was very interested to read Ian Rees's article on restoring vintage radio receivers in the July issue. It made me feel quite nostalgic, recalling the days when, as a teenager, I made pocket money by repairing radios. Sometimes I would walk miles, with a radio balanced on my bike saddle, and was pleased to make thirty bob (£1.50). Ian has provided some excellent advice, but I'm a bit unhappy about the circuitry around the 6Q7 valve V1. Because the overall radio circuit is split into two parts (Figs. 1 and 2), the problem is not immediately obvious.

Since all sections (two diodes and a triode) of V1 share a common cathode, if the earthy end of RV1 is taken to chassis, as shown, the detector diode will be reverse biased by the voltage across R3. This will prevent reception of weak signals, and distort strong ones. The earthy end of RV1 should be connected to the cathode of V1. But this is not the end of the story. While a DC bias is in order at the cathode of V1, no AC component is permissible here since this will modulate the rectification action of both diodes. So R3 needs to be decoupled by a capacitor of about 25µF. Thus degenerative (i.e. negative) feedback cannot be used here. Note that reverse bias applied to the AGC diode will delay the onset of AGC, providing the best signal-to-noise ratio with weak signals.

Ian mentioned that negative feedback is usually applied somewhere, to reduce harmonic distortion, but it can't be applied to V1 for the reasons outlined above. Instead, a typical approach would be to leave the 6V6 output valve's cathode bias resistor undecoupled, or apply cathode feedback from the audio output transformer's secondary winding. Sometimes a dedicated winding was used. The latter technique was applied very successfully in the Quad 22 valve amplifier, reducing the third-harmonic distortion in the output stage by more than 8dB.

Ian's comments about the dreaded barretter also brought back memories. In many old AC/DC receivers a barretter was positioned near the power supply and output stages, which were close to the loudspeaker. The speaker produced a large external magnetic field. This didn't matter if the radio was operated with a DC supply, but when mains supplies were converted to AC in the late Forties and early Fifties many radio receivers broke down. Usually, the barretter had failed. People complained that the "new AC" had broken their radio sets. In a way this was true. To obtain the required constant-current characteristic, the barretter's element, which looked like a zig-zag lamp filament, was made of iron wire. When the element was conducting AC close to the speaker's magnet it would, being ferromagnetic, vibrate vigorously at 50Hz and shake itself to bits.

Most people bought an AC/DC radio only because they were originally on DC, so the barretter problem didn't become endemic until conversion to AC took place. There were two basic solutions: fit a new barretter in a position away from the speaker, or simply replace it with a ballast resistor. The absence of a constant-current characteristic in the latter case didn't seem to matter, provided a thermistor was also fitted to limit the inrush current when the valves were cold.

Lastly, an aside on something quite different. I recall that my grandfather was annoyed when his mains supply was changed from DC to AC, because he was then no longer able to charge his car battery in winter by connecting it in series with an electric fire! Grandpa would sit by the electric fire, smoking a cigarette, while the car battery gassed freely alongside. Miraculously, there was never an explosion – and he lived to be 94.

Keith Cummins,
Chale Green, Isle of Wight.

Recycling brown goods

With reference to the proposed European Union legislation on the disposal/recycling of brown goods at the end of their life. I feel very strongly that the responsibility for this should lie with the manufacturers. It might encourage them to build products with a reasonable service life rather than with designed-in obsolescence. Any service engineer will confirm that the repair, in effect recycling, of products is very low in the list of manufacturers' priorities. Brown goods nowadays seem to be designed to be difficult to repair, and technical help is seldom available. Sony are even to end the issue of service manuals in the form that most engineers want and can afford.

If manufacturers bore the cost of disposal, the viability of repair might be increased. Let's not forget that repair is environmentally-friendly recycling. There shouldn't be any VAT on it – but that's another matter.

Justin Smith,
ATV, Hillsborough, Sheffield.

Sub-standard components

J. Lesurf's letter (August) about a faulty chopper control chip (type TDA4605, not as stated on page 630) in an Amstrad colour TV set prompts me to write about an experience I had with a Mitsubishi Model CT29B2STX. It required a lot of attention, which included replacing all the electrolytic capacitors on the primary and secondary sides of the chopper power supply and fitting a new EEPROM chip. The set then refused start up. So I replaced the 2SD1887 chopper transistor and the TEA2261 control chip. At power up the standby light came on. When I switched the set out of standby there was a bang and a flame came from the side of the new transistor. The top had blown off the new TEA2261 chip, and every component between this chip and the base of the chopper transistor was burnt.

I obtained new replacements, this time from Cricklewood Electronics, and rebuilt the power supply. Fortunately all was OK when I switched the set on.

Reprogramming the EEPROM completed the job.

When I tackled the supplier of the power supply semiconductor devices I had fitted initially his response was "I didn't manufacture the parts, how can I be responsible?" I'm told that some of these semiconductor devices, imported from the Far East, are 'graded' components.

The moral is, as I have pointed out before in these pages, to choose your components carefully and buy only from reputable sources.

Michael Maurice,
Wembley, Middx.

Poor DTT take-up

In the August issue Richard Barsby commented (letters page) on DTT's shortcomings and the poor take-up by the public. Another reason is the ghastly teletext service, which is such a pain I'm sure no one uses it. One thing that's missing in particular is page 888, which is ideal for us oldies or for watching bedroom TV without disturbing your partner. It's also used as a tool by students learning English as a foreign language. Analogue teletext is almost perfect. The small delay in finding pages is nothing compared with DTT loading times.

On the churn rate, the problem could be to do with the 'green' policies of the broadcasters – they recycle their programmes so often that there's no point in using your VCR. *Discovery Wings* is by far the worst, I've noticed.

What will happen in December when my pre-paid digibox contract expires? How can I watch BBC Knowledge without paying for stations in which I have no interest?

David Paye,
Canvey Island, Essex.

Restoring vintage radio sets

I would like to say how much I have been enjoying Ian Rees's articles on vintage radio receiver restoration. It's a brilliant achievement to restore an old radio set to working order.

Like Ian, I too believe strongly that wax-paper capacitors should be replaced, also the notorious Hunts' Mouldseal metal-foil capacitors (the plastic shell becomes brittle and fragments).

There has always been a difference of opinion between 'purists' and restoration engineers – whether a set should be left in its original form or properly restored, with new components. Personally I prefer to have a set that works! Many other vintage products are restored with new parts, steam locomotives for example, and as long as the replacement components don't look too out of place I can't see what the problem is. I have used polypropylene capacitors, as Ian suggests, as replacements for wax-paper capacitors and have found them to be OK. You will need smaller capacitors however to replace the metal-foil type.

I've found that capacitors and resistors cause most of the problems with valve radio sets. Some 9-pin miniature valves used in the Fifties and Sixties, especially IF amplifier and detector-demodulator types, can be troublesome however. The use of cheap resistors and capacitors in the sets of this period didn't help.

You can visit my website at http://www.mikesradio.freeservers.com where some of the receivers I've worked on are illustrated. It also tells the story of my upbringing – my late father was a radio and TV engineer (valves). It was great for a young boy in the Fifties to be able to experience such wonderful radio receivers. I also enjoy helping others in their quest for spares.

Mike Horne,
Leeds.

Answer to Test Case 465

– page 687 –

Some knowledge of computers and application-specific software is becoming essential, even for 'GP' technicians in our trade, as the sorts of problem that faced RT are not untypical of what you can expect to be asked about nowadays.

Defragmenting the hard disk certainly speeded up the rendering process somewhat, but didn't provide a complete solution to the problems. The 'fast' playback was because the system dropped frames at an alarming rate while capture was taking place: the system couldn't cope with the incoming data rate.

The ultimate solution would have been a faster and 'wider' PC. But shutting down all 'background' applications and programs during capture, and enabling DMA (direct memory access) for the hard disk, helped a lot. Rendering time could also have been shortened by installing a better-specified hard disk and upgrading the Pentium II processor used in this PC. These steps were not sanctioned by the owner, but increasing the RAM capacity to 128MB smoothed things a bit more.

The refusal of the camcorder to accept a data input at its FireWire port was simply because it was not geared up to do so! The facility had been disabled during production, to avoid the import duty premium of a recorder as opposed to a camera. Most such camcorders can be DV-in enabled by means of a hardware widget or a software program from a specialist company such as

NEXT MONTH IN TELEVISION

Panasonic's PDP TVs

How would you like a TV set that has perfect colour purity, perfect convergence and perfect focusing across the whole screen? Would you like it to have a viewing angle of 160°, and be able to mount it on the wall? These are the inherent advantages of using a plasma display panel to present the TV picture. Brian Storm investigates the Panasonic approach to PDP technology.

Servicing the NEI CE25/28 series chassis

Alan Dent provides a detailed servicing guide for these CTV chassis, which were used in a number of NEI and Nikkai models. The three slightly different versions of the chassis were produced in either Spain or Turkey.

Hard-disk video recorders

The well-established videotape and optical-disc recording formats have now been jointed by hard-disk recording systems such as TiVo and Sky+. George Cole describes the various technologies available in the UK and elsewhere, including combined VCR/hard-disk products and combined DVD-Video player/hard-disk recorders.

Toshiba service briefs

Know-how from Toshiba Technical on the company's TV and video products.

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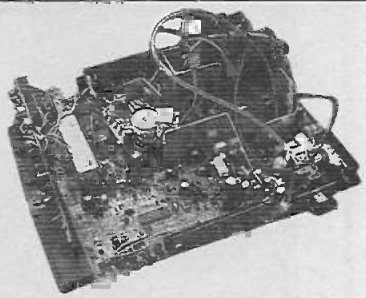

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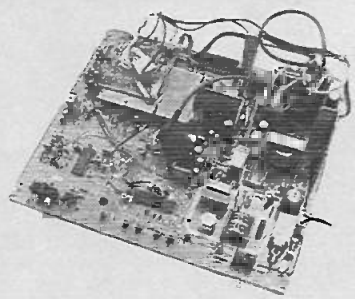

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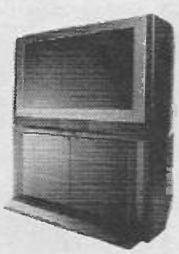

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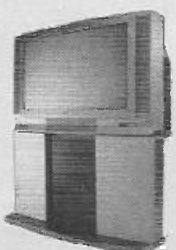

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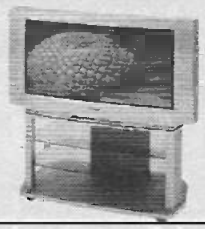

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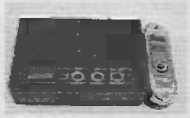

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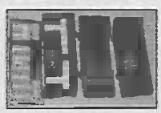

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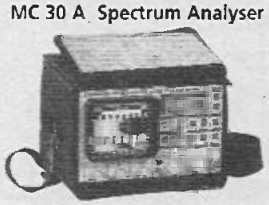

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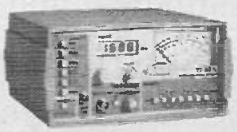

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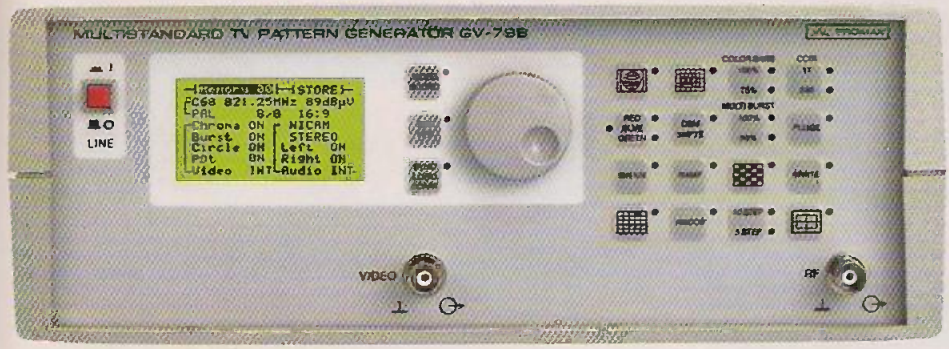

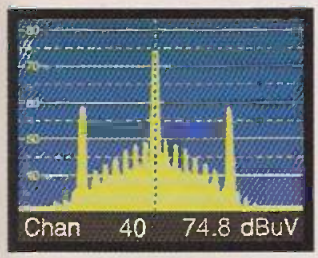

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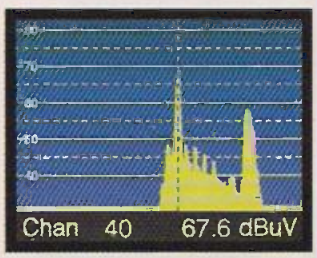

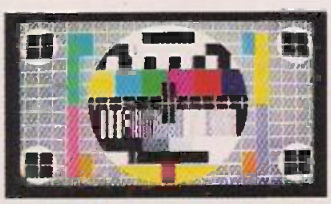

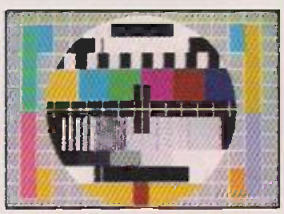

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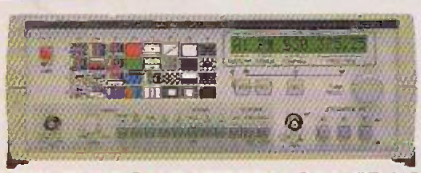

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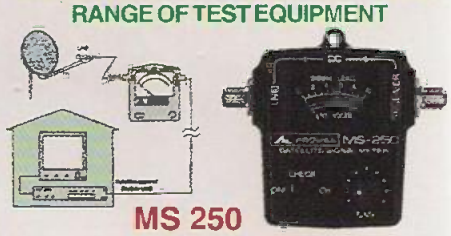

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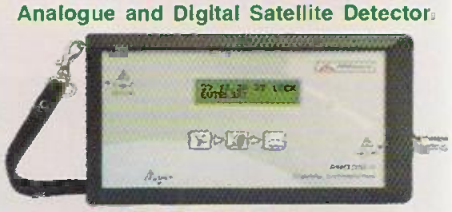

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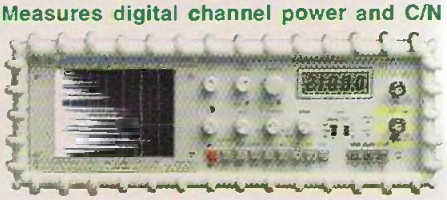

MC 377+

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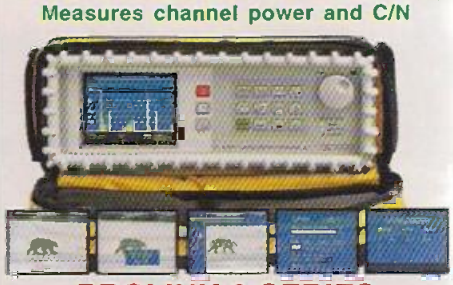

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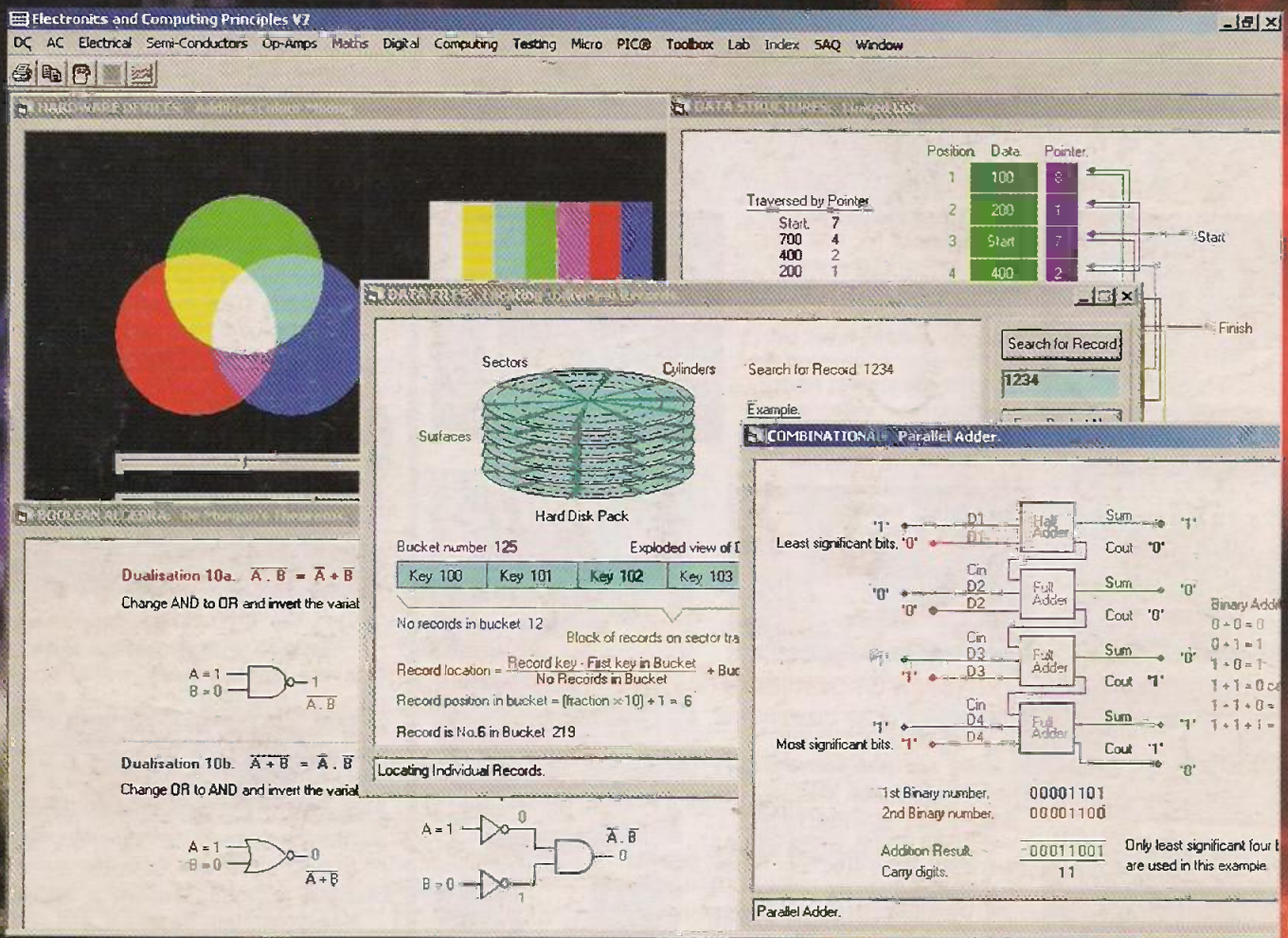

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