

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

TELEVISION

AND HOME ELECTRONICS REPAIR

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Digital AV in the home

PROJECT:

Stereo FM signal source

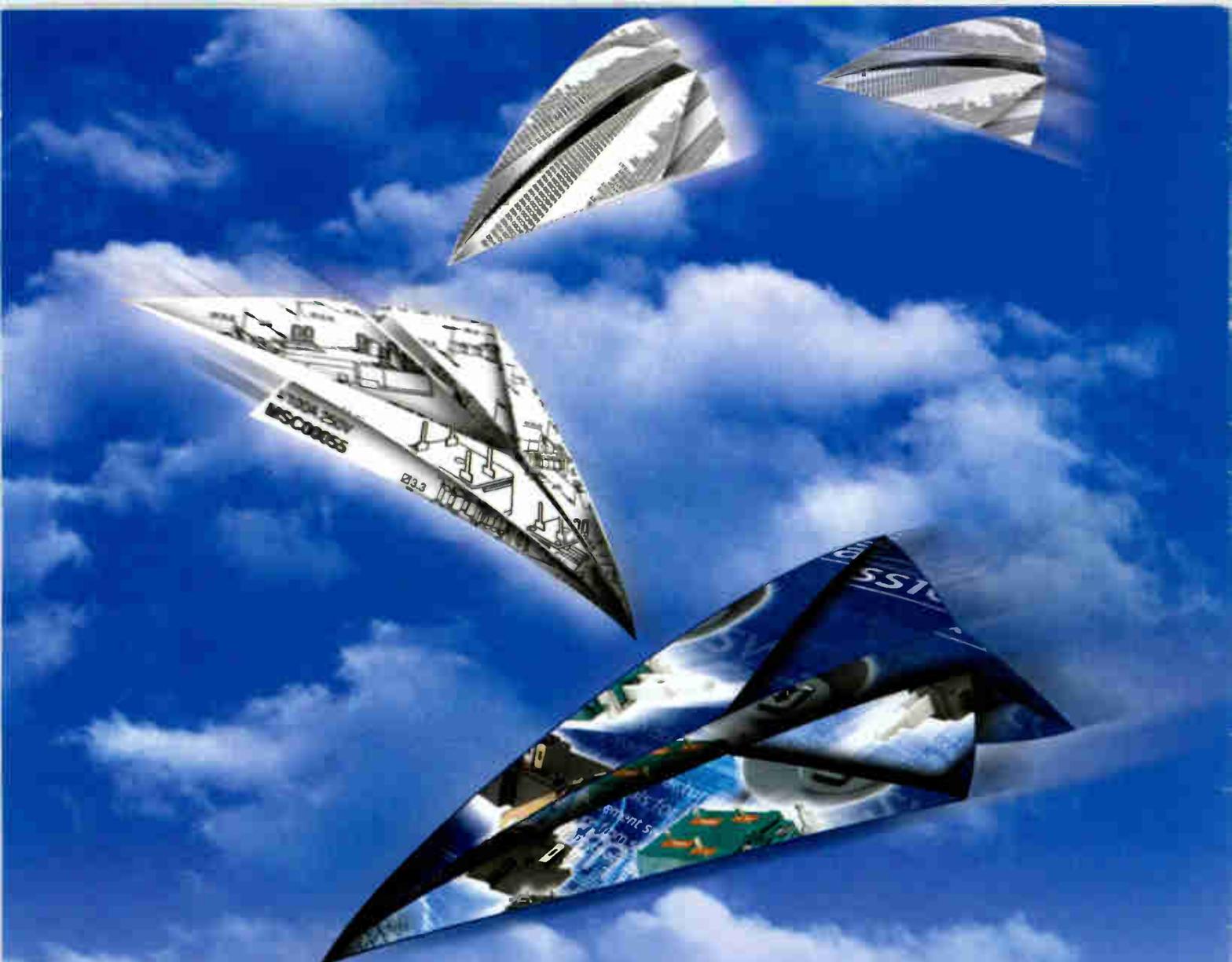
Data via cable TV

TEST REPORT:

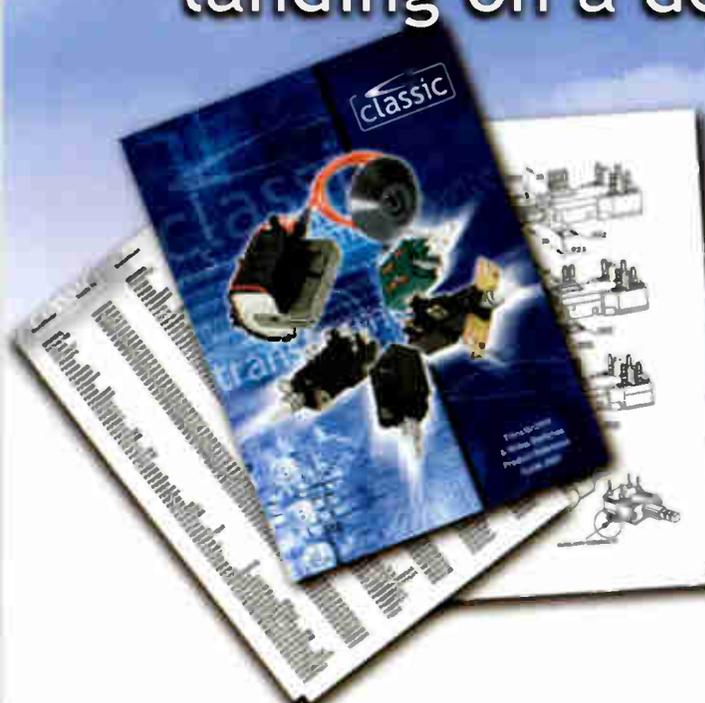
Burosch TV pattern generator



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CONTENTS

March 2002

Vol. 52, No. 5

259 Comment

Year of the PVR?

260 Teletopics



Digital TV adapter from Pace. Interactive TV. Densitron's combined TV/PC. Less TV viewing. New Hitachi projector. DAB coverage increased.

266 Test report: TV pattern generator

Eugene Trundle reviews the Burosch TV pattern generator, which provides a comprehensive range of patterns including a broadcast-standard, full-specification FubK test card. Output is at UHF.

268 DOCSIS – the data via cable interoperability specification

The DOCSIS standard is used when distributing data signals via cable TV systems. It ensures complete interoperability between networks, different makes of equipment and different kinds of data. J. LeJeune describes the principles.

270 Thomson's TX807 technology

This concluding instalment in the series by Mark Paul deals with the microcontroller circuitry, teletext and the audio output stage.

276 Digital communications in the home

Steve Beeching describes the current state of digital communication between consumer electronic devices and some of the problems that can arise, and takes a look at forthcoming developments.

278 Stereo FM signal source

Keith Cummins has designed a unit that produces a stereo FM output when fed with a stereo audio input. It can be used to feed FM receivers around the home, enabling stereo TV sound or music channels



from a digibox to be distributed and stereo sound heard with a remote mono TV set and co-sited FM equipment: it can distribute audio from a tape or disc; and it can be used as a test-signal source. There are VHF, baseband and scope outputs.

284 How to survive a virus attack

Part 2 of Peter Marlow's feature on the computer virus problem gives guidance on avoiding infection and what to do should an attack occur.

286 Christmas is over

More tales from Tom Baker. This time a Mitsubishi TV, a caravan electronic satellite-dish installation, and how to go about electrolytic capacitor replacement in the Sony SLVE715's power supply.

288 Letters

Design faults. The TV fire hazard. Spares supply. DVD player jitter rate. Connection problems.

290 DX and satellite reception

Terrestrial DX and satellite TV reception reports. Broadcasting and satellite band news. Shared-dish system update. Roger Bunney reports.

294 TV fault finding

298 Monitors

Guidance on repairing monitors and related equipment.

300 VCR Clinic

302 Jack's workshop

Interference to SkyDigital. An Amstrad DRX100 power supply problem. ITV on SkyDigital.

303 Test Case 471

304 Satellite notebook

The pace DVR500. Grundig GDS200 digibox fault reports. An EchoStar AD3000 installation.

306 Web service

Useful web sites for TV professionals, technicians and enthusiasts.

308 DVD player fault reports

309 Help wanted

310 Next month in Television

311 Audio faults

319 What a life

A new neighbour moves in. Gunter turns out to be a very clever TV engineer, but has difficulties with the locals. He manages to sort out some of Donald Bullock's problems however.



Picture courtesy Gary Leggett

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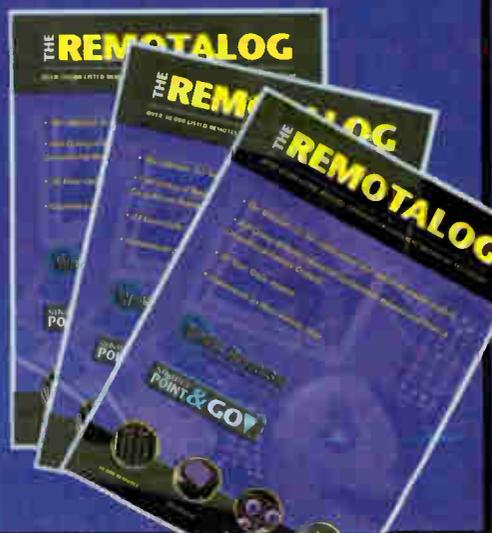
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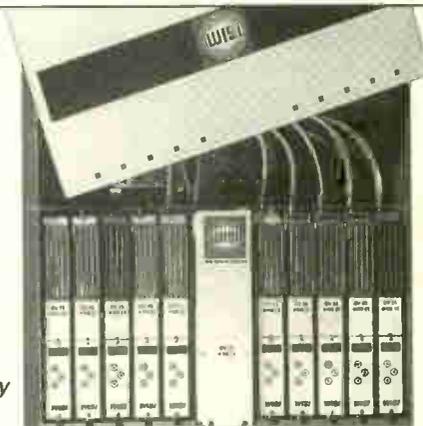
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Year of the PVR?

The personal video recorder (PVR), which uses a hard disk as the storage medium, made its first appearance in the US in 1998. TiVo, the market leader, started selling PVRs in the US in 1999. It launched a PVR in the UK in October 2000, and in July last year the Sky+ was introduced. The latter is a satellite-service dedicated PVR.

Until fairly recently PVRs had made little impact in the US. They cost three-four times as much as a VCR and generally involve a subscription as well – for software downloads and channel information. Installation is relatively complex, and it is not easy to get across to the public the advantages offered by a PVR. Basically these are easier access to stored material – quick access to programmes, scenes etc. – and the fact that, being software controlled, a PVR can provide sophisticated features such as the ability to pause a programme while recording continues.

In the US, fewer than half a million PVRs had been sold until late last year. This was not too bad for a new technology, but in comparison 36 million VCRs were sold in the US in 2000. Clearly the PVR is not about to take over. In the UK, sales of TiVo and Sky+ to date have been modest. But Andrew Cresci, who runs TiVo's UK operation, believes that 2002 will be the "year of the PVR", furthermore that PVRs will have become a mainstream product by the middle of next year. It has obviously been difficult for the likes of TiVo and ReplayTV, minnows in the media and consumer electronics fields, to get their message across to the public, which is probably also put off by the need to pay a subscription.

A dramatic surge in PVR sales in the US occurred late last year however. ReplayTV, which seems to have been the first company to market a PVR, was bought by SonicBlue, a California-based digital media company, towards the end of October. Subsequently a

new model was launched, the ReplayTV 4000, with a significantly improved specification (and a substantially higher price). It can record up to 320 hours of TV programming, can skip the commercials altogether, and has internet capability – it can record from the internet and can send stored TV material to other users.

These latter features upset the TV

The PVR is fundamentally more versatile than the VCR and, perhaps, the recordable DVD

establishment in the US. Three major US networks (ABC, CBS and NBC) and several media companies, including AOL Time Warner and Viacom, started a lawsuit against SonicBlue shortly after the announcement of the ReplayTV 4000, on the grounds that commercial skipping would cause loss of revenue while programme sharing via the internet was in breach of copyright regulations. When and how this legal challenge will be brought to a conclusion is anyone's guess – the law can take a long time to come to a conclusion in the US (a breach of copyright test case taken out in the early days of VCRs took some twenty years to be resolved). But the publicity generated by the suit gave a huge boost to PVR sales in the US. The problem of small companies getting their message across had been solved! SonicBlue's sales doubled overnight. There is now a shortage of the devices.

Meanwhile TiVo's fortunes have been helped in other ways, in particular by a deal with Sony. This enables Sony to build TiVo technology into any product it feels would be appropriate and sell such products worldwide. This could generate considerable revenue for TiVo. A further boost came from a deal with cable operator AT&T Broadband, which will market TiVo to its

subscribers in New England, Colorado and California. By the end of last October TiVo had 280,000 subscribers, 51,000 of whom had been added during the previous three months. One industry watcher has suggested that the number of US households with a PVR could rise to 3.5m by the end of the year. It's interesting that the churn rate is only one per cent, lower than with cable and satellite services.

The PVR is fundamentally more versatile than the VCR and, perhaps, the recordable DVD format, though this is still evolving. The main problem with both the PVR and the recordable DVD player is price. If production could be increased to the level at which the price could be brought down to be comparable with that of a good VCR, marketing would be easier and sales would undoubtedly take off.

It will be interesting to see how the PVR fares over the coming months. The technology certainly deserves greater success than has so far been achieved. The answer, as with so many consumer electronic products, could lie with cheap production in China. So far however those who own the technology seem to have been reluctant to license it out. Perhaps the agreement with Sony could be the breakthrough needed here. ■



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INDEXES AND BINDERS

Indexes for Vols. 38 to 51 are available at £3.50 each from SoftCopy Ltd., who can also supply an thirteen-year consolidated index on computer disc. For further details see page 310.

Binders that hold twelve issues of *Television* are available for £6.50 each from *Television Binders*, Pringle, Street Blackburn, BB1 1SA. Make cheques payable to "Television Binders".

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TELETOPICS

Digital TV adapter from Pace

Pace has announced that its digital TV adapter will be available at the end of March. It's expected to sell for about £100, with no need for a pay-TV subscription. The design is such that the adapter can be bought off-the-shelf and installed: the user simply unplugs the TV set's aerial lead, connects the adapter to the TV set's scart socket (Pace is also to

introduce an adapter for sets without a scart socket), plugs the aerial lead into the adapter then plugs in the power lead. The free-to-view terrestrial digital TV channels are automatically tuned in, a process that takes a few minutes.

According to Pace the adapter is able to convert any TV set for digital TV reception and can be upgraded for pay-

TV reception at a later date without the need to purchase extra equipment. The aim is to provide affordable digital TV for all. There is still the problem that a separate adapter will be required for each set in the household.

The BBC is helping promote digital TV with the launch of three non-subscription channels during March.

Other companies are likely to follow Pace's initiative. Cabot Communications, which is owned by the Turkish manufacturer Vestel, has designed a low-cost converter called Ping (plug-in and go).

Independent research carried out last November on behalf of Pace revealed that as much as half the population of the UK didn't realise that an analogue TV switch off is a possibility during the present decade, while a third of those surveyed had no idea of the benefits of digital TV.



New projector from Hitachi

The Hitachi CP-SX5500 compact LCD-panel projector uses new technology to achieve a high resolution (SXGA) with high brightness. Conventional light-transmissive LCD panels are less effective as the resolution is increased, mainly because the grid of control circuits between the glass substrates limits the efficiency with which the available light can be used. As a result the pixel aperture ratio becomes progressively worse (typically 40-60 per cent) with increased resolution. Instead, Hitachi uses light-reflective LCOS (liquid crystal on silicon) panels – with these the liquid-crystal elements are sandwiched between a glass and a silicon substrate. This enables the

liquid-crystal elements to be placed closer together. Since the panels can use more of the pixel area for light modulation, the

aperture ratio is increased to 92 per cent and the contrast ratio is boosted to 600:1.

For more details of the projector, which weighs just 5.6kg, contact Hitachi Home Electronics, Dukes Meadow, Millboard Road, Bourne End, Bucks SL8 5XF (phone 01628 643 000).

Less TV viewing

According to research carried out by the media buying agency Carot, TV viewing decreased last year for the first time since 1994. This applied to all age groups, though the most pronounced fall-off was amongst those aged 35-54.

Various reasons have been suggested, including the increased use of DVD players and other home entertainment systems and the fact that multi-channel

choice means that people are more inclined to switch off instead of just leaving the set on. The decline in TV viewing accelerated during the last quarter of the year, when there was an average fall in TV viewing of nine minutes per day in comparison with the previous year.

Listening to the radio has increased however. During 2001 it became the more popular medium, with more listening than viewing hours been recorded per week.

Tougher safety regulations

The Consumers' Association Research and Testing Centre (CARTC) has issued a warning to companies that import products from outside the European Union to prepare for the additional requirements of the revised General Product Safety Directive (GPSD), which is due to come into operation in the autumn of 2003. National regulations will implement the GPSD in the UK, and the Department of Trade and Industry will be consulting with all parties on the interpretation of the directive.

The CARTC points out that whatever

the outcome of this consultation the revised directive will have wide-ranging implications for the retail trade, especially for those who sell own-brand products. According to the CARTC, the implications will include a requirement for more effective market surveillance, with penalties for non-compliance; the provision of better information for consumers and authorities on products that are found to be unsafe or dangerous; improved product-recall processes; and improved consumer-protection processes.

Malcolm Bassett, head of consumer safety at CARTC, points out that "the EC is determined to clarify both the spirit and the detail of the directive, and enforce penalties on organisations that fail to comply with it".

This is all very well and presumably to the general good, but one can't help wondering why a new directive should require such clarification. Is it not possible to make the requirements clear to start off with? Or is it all a matter of translation difficulties? Anyway, you have been warned.

Densitron Technologies has introduced the Cassius Entertainment Centre, which combines an LCD display with a teletext TV, a stereo radio tuner, a CD player, a DVD player and an internet-ready PC, all neatly housed in the same slim (2.5in. thick) unit which also has built-in speakers. A remote-control unit is provided for TV use, while for PC use there are a wireless keyboard and mouse. There is thus virtually lead-free operation. The 15.1in. thin-film transistor LCD screen is equivalent to a 17in. CRT screen, and has a resolution of 1,024 x 768 pixels.

The TV and radio tuners provide Nicam stereo TV and FM radio reception with programme search, brightness and volume control being either via the handset or built-in controls at the side of the unit, which can provide an output for an external Dolby Digital 5.1 surround sound system.

The PC specification includes an 800MHz Intel Pentium III processor, 128MB of SDRAM, a 20GB hard drive, a floppy disc and a DVD/CD-ROM drive. Memory is expandable to 256MB. A V90 modem and 1/100 Base-T Ethernet LAN provide internet operation and networking. The comprehensive inputs and outputs include a PCMCIA slot, one COM, three USB, LAN, modem, printer, serial data, VGA, audio and video.

The centre is expected to sell for about £2,500. For further details apply to Densitron Technologies, Unit 4, Airport Trading Estate, Biggin Hill, Kent TN16 3BW. Phone 01959 542 000, fax 01959 542 001.



Interactive TV

Figures released by SkyDigital reveal that over 50 per cent of its subscribers are using Sky Active. According to Sky over seven million digital satellite users in the UK have pressed red** on their SkyDigital remote control units since January 2001. SkyDigital adds that over 86 per cent of Sky Sports subscribers have used Sky Sports Active – the Sky Sports interactive quiz generated 1.8m calls last year. The three hundredth interactive football game broadcast by Sky was Manchester United vs. Chelsea on November 24th. Over two million votes have been cast on Sky News Active since its launch in March 2001. Sky has lost two major retailers who had signed up with it however, Argos and Woolworth. Argos is reviewing its approach to selling through interactive services. Woolworth has decided to concentrate its interactive selling on the internet, but could return to Sky.

The BBC and Channel 4 are amongst third-party broadcasters who had interactive satellite TV successes via Sky last year. Within the first five days of the broadcast of the BBC's *Walking with Beasts* 750,000 interactive calls had been made, representing 26 per cent of those who watched the programme. 28,500 donations, totalling £473,000, were received by SkyDigital throughout the evening when the BBC's *Children in Need* was broadcast. When MTV's Music Awards Europe was broadcast 721,800 votes were cast, contributing to a 12 per cent rise in the viewing figure in comparison with the previous year. The BBC reported that over one million viewers used its Wimbledon interactive service during the first day and 900,000 on every other day of the tournament. There were similar successes with a

number of other programmes.

Channel 4 was the first terrestrial broadcaster to launch a commercial interactive service with return path facility for advertisers. The service went live via SkyDigital on January 31st with a fully-interactive advertisement for the Renault Clio. The service has been developed with Channel 4 by technology partners Go interact tv (formerly Sony Digital Interactive Broadband Services); it enables TV advertisers to meet requests for more detailed product information via subscribers' TV sets rather than the internet or telephone. The Renault car advertisement, shown from January 31st onwards, enables viewers to request a

brochure, book a test drive and view additional products.

DAB coverage increased

Digital One, the largest commercial digital radio broadcaster, has brought three new transmitters into operation – the total is now 59. The new transmitters are at Huntshaw Cross, serving north Devon; Mendlesham, serving East Anglia; and Caldbeck, serving northern Cumbria and parts of SW Scotland.

The BBC is also expanding its network of digital radio transmitters, and will launch five new national digital radio services by the end of the year.

High-performance DVD players

JVC has launched two new DVD players with a high-performance specification. Model XV-FA62 has a seven-disc carousel changer while Model XV-SA72 has a single-disc deck. Both provide DVD-Video and DVD-Audio playback and have a dual-laser optical pick-up to enable them to play CD, CD-RW and CD-R discs as well. The players can

also handle MP3 files recorded on CD discs, and incorporate Dolby Digital/DTS decoders. The high-speed (54MHz) video DA converter carries out over-sampling to ensure minimum loss, while JVC's VFP (video fine processor) provides flexible picture control. The audio digital processing includes an improved noise shaper.

WEEE warning

The Waste Electrical and Electronic Equipment (WEEE) Directive is due to be fully implemented in 2006. 65-80 per cent of every electrical and electronic product will then have to be recovered and recycled at the end of its life. The question is who should pay? The Federation of the Electrical Industry has warned that UK TV manufacturers could face a £2bn bill when analogue TV ends. Manufacturers, distributors and retailers could all be involved, but it seems that manufacturers will at present be expected to accept the main responsibility. It's not at all obvious why they should have to deal with "historic waste" and "orphan products". Waste has, after all, traditionally been a municipal responsibility. The problem is not only the recycling but the costs of collection and transport.

However responsibility is assigned, the cost will ultimately be borne by the customer in one way or another. Peter Evans, senior manager for the environment at Sony Visual Products Europe, has calculated that with the WEEE directive the cost of recycling a TV set would rise from £5-£7 to £15-£21.

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1459T	.PSU	ONWAKIT	AV29SX1EN	FIELD OUTPUT KIT	JVCKIT1	CT28AV1BDS	.PSU	MITSKIT3	D-16 CHASSIS	.SOPS	PHILKIT6
2002	.PSU	ONWAKIT	AV29SX1EN1	FIELD OUTPUT KIT	JVCKIT1	CT29AS1	TDA 8178S	MITSKIT2	HSM VIDEO	.SOPS	PHILKIT5
2009B	.PSU	ONWAKIT	AV29SX1PF	FIELD OUTPUT KIT	JVCKIT1	CT29A4	TDA 8178S	MITSKIT2	JSM VIDEO	.SOPS	PHILKIT4
2052T	.PSU	ONWAKIT	AV29TSIE1	FIELD OUTPUT KIT	JVCKIT1	CT29A6	TDA 8178S	MITSKIT2	KSM VIDEO	.SOPS	PHILKIT9
2152T	.PSU	ONWAKIT	C14E1EK	.PSU	ONWAKIT	CT29B2	TDA 8178S	MITSKIT2	LSM VIDEO	.SOPS	PHILKIT7
CTV501	.PSU	ONWAKIT	C14T1EK	.PSU	ONWAKIT	CT2983	TDA 8178S	MITSKIT2			
CTV701	.PSU	ONWAKIT	C21E1EK	.PSU	ONWAKIT	CT2986	TDA 8178S	MITSKIT2			
CTV840	.PSU	ONWAKIT	CS21M3EK	.PSU	ONWAKIT	CT33B3	TDA 8178S	MITSKIT2			
CTV841	.PSU	ONWAKIT	MATSUI			M5 SERIES	.PSU	MITSKIT3			
CTV485	.PSU	ONWAKIT	1455	.PSU	ONWAKIT	NEI/NIKKAI					
AKAI			1498	.PSU	ONWAKIT	CE25 CHASSIS	.PSU	NIKKAIKIT1			
CT1417	.PSU	ONWAKIT	2086	.PSU	ONWAKIT	C289FTXN	.PSU	NIKKAIKIT1			
CT2159U	.PSU	ONWAKIT	2098	.PSU	ONWAKIT	C28F41FXN	.PSU	NIKKAIKIT1			
CT2162UNT	.PSU	ONWAKIT	21V1N (BUZ90)	.PSU	GRUNDIGKIT1	PANASONIC					
CT2863UNT	.PSU	ONWAKIT	21V1T (BUZ90)	.PSU	GRUNDIGKIT1	IC561	TDA 8175	PANKIT1			
GOODMANS			21V1N (MJF18004)	.PSU	GRUNDIGKIT3	TX25XD60	.VERTICAL O/P IC	PANKIT2			
147TT	.PSU	ONWAKIT	21V1T (MJF18004)	.PSU	GRUNDIGKIT3	TC28XD60	.VERTICAL O/P IC	PANKIT2			
149T	.PSU	ONWAKIT	21V1T (MJF18004)	.PSU	GRUNDIGKIT3	TX28XD70	.VERTICAL O/P IC	PANKIT2			
1430RA	.PSU	ONWAKIT	21V1T (MJF18004)	.PSU	GRUNDIGKIT3	TX29XD70	.VERTICAL O/P IC	PANKIT2			
1430RS	.PSU	ONWAKIT	MITSUBISHI			TX-W26D3	.VERTICAL O/P IC	PANKIT2			
1430RW	.PSU	ONWAKIT	AV1 SERIES	.PSU	MITSKIT3	PHILIPS					
1450T	.PSU	ONWAKIT	CT1M5B	.PSU	MITSKIT3	310.10708		PHILKIT3			
1455TS	.PSU	ONWAKIT	CT21M5BT	.PSU	MITSKIT3	310.20491		PHILKIT2			
2019R	.PSU	ONWAKIT	CT25M5BT	.PSU	MITSKIT3	310.20496		PHILKIT10			
2029T	.PSU	ONWAKIT	CT21A2STX	TDA 8178S	MITSKIT1	310.31994		PHILKIT6			
2029TA	.PSU	ONWAKIT	CT21AX1B	.PSU	MITSKIT3	310.32252		PHILKIT5			
F16 CHASSIS	FRAME	GOODKIT1	CT21A3STX	TDA 8178S	MITSKIT1	310.32253		PHILKIT4			
F16 CHASSIS	LINE	GOODKIT1	CT21AV1BS	.PSU	MITSKIT3	310.32254		PHILKIT9			
F16	.PSU	GOODKIT1	CT25A2STX	TDA 8178S	MITSKIT1	310.32255		PHILKIT7			
F16	VIDEO	GOODKIT1	CT25A3STX	TDA 8178S	MITSKIT1	310.32256		PHILKIT8			
GRUNDIG			CT25A4STX	TDA 8178S	MITSKIT1	310.62262		PHILKIT1			
CUC 7350		GRUNDIGKIT1	CT25A6STX	TDA 8178S	MITSKIT1	ANUBIS A	.SOPS	PHILKIT2			
ORDER CODE			ORDER CODE			ORDER CODE			ORDER CODE		
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VALUE	CODE	PRICE	PER PACK	VALUE	CODE	PRICE	PER PACK	VALUE	CODE	PRICE	PER PACK	VALUE	CODE	PRICE	PER PACK
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100uF	.CAP118	£0.45	10	680uF	.CAP45	£3.15	5	3.3uF	.CAP139	£0.35	10	150uF	.CAP85	£2.80	5
470uF	.CAP29	£1.20	10	1000uF	.CAP46	£3.65	10	4.7uF	.CAP140	£0.35	10	220uF	.CAP86	£2.80	10
1000uF	.CAP119	£1.50	10	101500LF	.CAP47	£3.90	5	10uF	.CAP63	£0.50	10	330uF	.CAP87	£4.00	10
2200uF	.CAP120	£2.10	10	2200uF	.CAP48	£2.00	2	22uF	.CAP64	£0.70	10	470uF	.CAP88	£5.25	10
16 Volts				3300uF	.CAP49	£2.20	2	33uF	.CAP141	£0.85	10	680uF	.CAP89	£5.00	10
22uF	.CAP121	£0.35	10	4700uF	.CAP50	£3.65	2	47uF	.CAP65	£0.85	10	1000uF	.CAP90	£5.40	5
33uF	.CAP122	£0.35	10	6800uF	.CAP51	£3.90	2	68uF	.CAP142	£0.90	10	100 Volts			
47uF	.CAP123	£0.35	10	35 Volts				100uF	.CAP66	£0.85	10	0.47uF	.CAP91	£0.50	5
100uF	.CAP124	£0.60	10	1uF	.CAP130	£0.40	10	220uF	.CAP67	£1.75	10	1uF	.CAP92	£0.85	10
220uF	.CAP125	£0.80	10	3.3uF	.CAP131	£0.40	10	330uF	.CAP68	£2.45	10	1.5uF	.CAP93	£0.70	5
330uF	.CAP30	£1.75	10	4.7uF	.CAP132	£0.45	10	470uF	.CAP69	£4.35	10	2.2uF	.CAP94	£0.50	5
470uF	.CAP31	£1.75	10	10uF	.CAP133	£0.50	10	680uF	.CAP70	£4.90	5	3.3uF	.CAP95	£0.50	5
680uF	.CAP32	£2.10	5	22uF	.CAP53	£0.45	10	1000uF	.CAP71	£5.25	10	4.7uF	.CAP96	£0.50	5
1000uF	.CAP33	£2.10	10	33uF	.CAP54	£0.50	5	1500uF	.CAP143	£4.50	5	10uF	.CAP97	£0.95	10
2200uF	.CAP34	£5.25	10	47uF	.CAP55	£0.85	10	2200uF	.CAP72	£3.25	2	22uF	.CAP98	£1.05	10
3300uF	.CAP35	£5.00	5	68uF	.CAP133	£0.55	10	3300uF	.CAP144	£3.25	2	33uF	.CAP99	£1.55	5
4700uF	.CAP36	£6.10	10	100uF	.CAP56	£0.85	10	63 Volts				47uF	.CAP100	£1.75	10
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33uF	.CAP126	£0.40	10	470uF	.CAP135	£1.75	10	2.2uF	.CAP75	£0.35	10	160 Volts			
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68uF	.CAP127	£0.55	10	1000uF	.CAP60	£4.35	10	4.7uF	.CAP77	£0.35	10	10uF	.CAP147	£1.40	10
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120uF	.CAP128	£0.85	10	3300uF	.CAP62	£10.00	2	15uF	.CAP79	£0.95	5	33uF	.CAP149	£2.30	10
150uF	.CAP21	£0.95	5	4700uF	.CAP136	£3.50	2	22uF	.CAP80	£0.75	10	100uF	.CAP150	£3.25	5
220uF	.CAP42	£1.20	10	50 Volts				33uF	.CAP81	£0.85	10	400 Volts			
330uF	.CAP43	£1.40	5	1uF	.CAP137	£0.35	10	47uF	.CAP82	£0.95	10	1uF	.CAP107	£2.15	5
470uF	.CAP44	£1.90	10	2.2uF	.CAP138	£0.35	10	68uF	.CAP83	£1.30	5	2.2uF	.CAP108	£2.25	5
								100uF	.CAP84	£1.20	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			
												1uF	.CAP113	£2.80	5
												2.2uF	.CAP114	£3.20	5
												4.7uF	.CAP115	£4.95	5
												10uF	.CAP116	£5.50	5
												22uF	.CAP117	£4.15	2

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Fig. 1. The TPG in use.

TEST REPORT

Burosch TPG1

Now that broadcast test patterns are but a distant memory, and as people expect better and better performance from their big, heavy, virtually immobile and expensive TV sets, there's a need for an inexpensive portable source of test patterns. The Burosch TPG1 fulfils that need; I've just spent a week with one, in the workshop and in the field.

Hand-held and pocketable...

This is a hand-held, pocketable pattern generator that works from an external 12V DC supply. It offers six useful CCIR/PAL images for alignment and assessment of a TV receiver: white field; red field; 8-step grey-scale bars; standard colour bars; a 'multiburst', gratings of progressively finer vertical bars; and a complete FuBK universal test card with circle. Composite video output is available at a phono plug, and a modulated UHF carrier (channel 34) comes from a co-ax plug, complete with a 1kHz mono test tone.

There are no switches or conventional key buttons on this instrument: pattern selection is by 'membrane bubbles' on the top surface. Each is captioned and marked with a picture of the image it selects; the switch-on default is the composite test card.

The instrument is housed in a tough black aluminium case meeting IP (ingress protection) 65. Of German design and manufacture, it's available from CPC in the UK at a price of £185.14, excluding VAT. A suitable 'in-plug' power supply unit costs £5-40 excluding VAT from the same supplier.

The TPG-1 comes with an operating manual and a two-year guarantee. For more details see the specification box below.

On Test

I found this little device light and easy to operate: it can be held and keyed with one hand, Fig. 1. Current consumption was

measured at 250mA at 12V (3W) and the generator continued working down to 10V.

It's possible to make up a lead with a cigar-lighter plug for work on vehicles, and another for use with a separate battery if required. The mains unit fulfilled all my needs though. If you are working on a TV set, you're generally near a mains supply. In operation, the case gets a little warm because it acts as a heat sink.

Video output measured spot-on 1V sync-tip to peak white. I found no discernible departure from CCIR standards in terms of levels, amplitudes, burst timing, porches etc. These things are very important because modern TV designs can be surprisingly intolerant of relatively minor errors here.

The RF output of the test sample was 3mV, corresponding to 10dBmV or 70dBµV. The one I tested was to PAL-G standard with 5.5MHz sound carrier. Consequently I used a set of that type to check the audio, which came through clear and bright.

Presence of the FM sound carrier at 5.5MHz impairs the picture somewhat on a set aligned for System I, so the rest of my tests were done using the baseband (composite video) output.

As the white and red fields, grey-scale steps and colour bars are standard, they merit no more comment here except to mention that the colour bars conform to the EBU standard, 75% amplitude, 100% saturated.

Useful for checking frequency response, the multiburst pattern has nine segments: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4 and 4.3MHz. Since the signal itself has no chroma content it might have been better if provision had been made to switch off the colour burst for this particular pattern. This would have avoided the potential for heavy

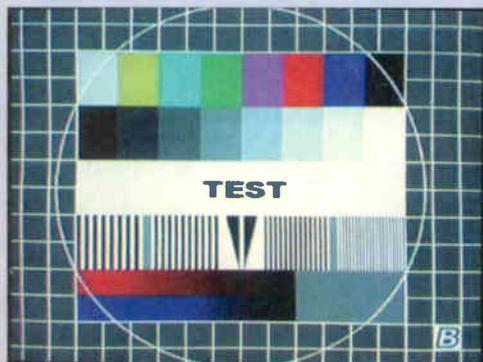


Fig. 2. Universal test card, clearly showing slight geometry, centring and registration errors in the TV set from which the picture was taken.

Specifications

Test patterns:	Six, including universal test pattern
TV Standard:	PAL/625/50
UHF carrier:	3mV at co-ax socket, UHF channel 34
Video level:	1V p-p at phono socket
Audio:	1kHz UHF FM-modulated sine wave
Power supply:	12V DC 300mA, external
Dimensions:	140 by 80 by 40mm (LxWxH)
Weight:	350gm
Case:	Solid aluminium, IP65
Operating temperature:	0-50°C
Guarantee:	2 years
Manufacture:	Burosch, Germany

cross-colour patterning on the last two gratings.

On the other side of the coin, leaving the colour channel open does facilitate a check of the rejection capability of the set under test. This is especially important in a set with digital comb filtering. The test waveforms here are sinusoidal, giving a 'softer' effect than the square waves which come from some card- and pattern-generators. The bottleneck, bandwidth-wise, in modern sets is in the low-level post-demodulator stages rather than the RGB amplifiers.

For me, the best feature of this little instrument, one which scores highly over competitive products, is the fully-featured test pattern, Fig. 2. This one is used by German broadcasters, and may be familiar to many from Astra analogue satellite transmissions. It boasts a sharply-defined circle, a 19 by 15-line white grid, colour bars (75/100%), grey steps, definition gratings and colour wedges for assessment of chroma amplifier linearity. Also, the unit features 'anti-PAL' areas which are colourless so long as the PAL decoder is

correctly working and aligned: shades of the Philips PM5544 pattern. This feature is unique in inexpensive instruments.

The circle is unbeatable for setting scan linearity, and is less stepped or 'coarse' than that of some patterns from other sources. With correct scan amplitudes the circle should touch the screen edges at top and bottom, with just under two squares showing at each side.

The grid lines are very narrow for ease of registration setting on both projection and direct-view displays. I would like to have seen a well-defined central cross or bright spot for setting static convergence though, since there is no separate crosshatch pattern provided.

The only other features this card misses out on are a 'streak' test for assessment of video LP response; the needle-on-black wedge near the centre checks for ghosting and signal reflection, while finer gratings than the test card affords are available in the multiburst option.

Careful examination of the transition points in, for instance, the colour bars, betrays a degree of cross-luminance and

colour patterning. This suggests that a little more bandwidth filtering would have done no harm. Even so, we cannot expect a sub-£200 instrument to perform as well as one costing seven times as much!

The patterns and reference signals are stored in two EEPROMs, so will not drift or change with time or temperature. The TPG1 generates 4:3 aspect-ratio images. This is not detrimental to everyday use; indeed it helps with checks on the scan-switching of a widescreen TV, and still permits all the necessary testing of that type of set. I'm told that there's little demand at present for a widescreen pattern, and it's true that the vast majority of TVs currently in use are 4:3 models.

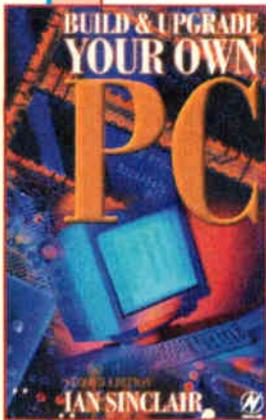
In summary

This is an excellent little bunch of tricks, good for use in the workshop and particularly in field service. It beats the similarly priced hand-held opposition hands down in terms of its fully-featured test image and multiburst pattern. Good value for money, and a very desirable little chunk of hardware... ■

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J. LeJeune describes the principles

The move to digital communications is in full spate: the government talks about abandoning analogue TV within the next decade, BSkyB has already done that and, unbeknown to the majority of telephone users, their calls have been going digital for over ten years. There is

nowadays much talk about video streaming, videophones, web-cams and sucklike, and a lot of new terminology has been introduced to cover their operation.

DOCSIS is one new acronym, associated with cable operation. It stands for Data Over Cable Service Interface Specifications, to which cable operators must adhere if they want their data to be acceptable on other networks. The specifications cover a variety of cable-borne data signals, and when adopted ensure complete interoperability between networks, different makes of equipment and different types of data.

DOCSIS started in the US. It's basically very simple but, as so often, those who use it have introduced all sorts of associated acronyms and complicated terms that tend to make it difficult to understand what's involved. Put simply, the basic structure of

DOCSIS is Internet Protocols over Ethernet, in other words internet rules for use with LANs (local area networks).

Standards involved

DOCSIS takes in various data standards: IEEE 802.3, 802.2, 802.3, LAN protocols and CSMA/CD standards, DIX – Ethernet Protocols, and RFC-791 Internet protocol data standards. When compliant with DOCSIS, cable modems and cable modem termination systems (the apparatus at the other end of the line from the cable modem) from a variety of manufacturers will all work together on the same network.

Modern cable TV networks are bidirectional, the downstream signal spectrum being at 65-860MHz while the upstream spectrum (return path from the user) is at 5-60MHz, or thereabouts. The downstream path can carry the normal TV

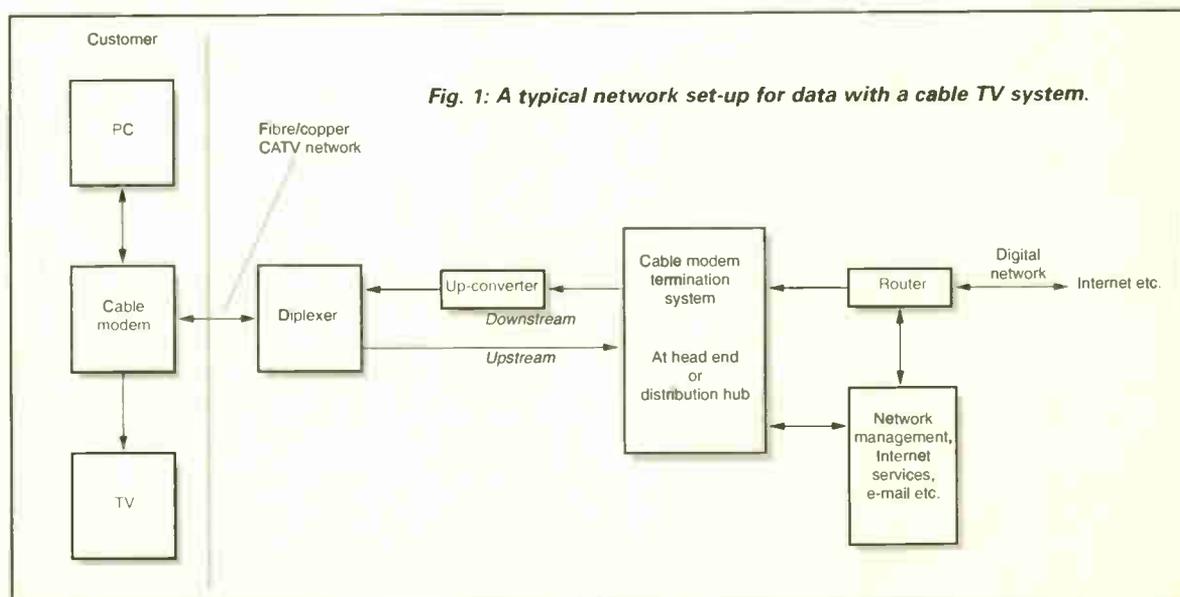


Fig. 1: A typical network set-up for data with a cable TV system.

channels, in either analogue or digital form, plus radio and data signals. It's the data signals that concern DOCSIS.

DOCSIS operation

Fig. 1 shows a typical network set-up for data via a cable TV system. When the customer switches on his cable modem it automatically scans the downstream (incoming) frequency spectrum, looking for the data channel. If it has operated on the network previously, information on this will usually be stored within the modem. On locating the DOCSIS data stream, the modem extracts information about the network's upstream (return) channel frequency, the type of modulation used, the symbol rate, FEC (forward error correction) parameters etc., and sends a message to the CMTS (cable modem termination system) asking for any other information it requires to connect itself to the network. A series of exchanges between the modem and the terminal equipment provide the modem with a data file that enables it to self-configure. Once it has configured properly, the modem is given authority to access the whole

network. It can then use the network like any other standard ethernet device. The CMTS has the ability to change operating parameters and refuse access.

Basic characteristics

The downstream (incoming) data stream uses either 64QAM or 256QAM (quadrature plus amplitude modulation with either 64 or 256 possible states). An 8MHz channel using 64QAM can achieve a transmission rate of about 32Mbits/sec. with error correction added. 256QAM increases the data rate to about 50Mbits/sec. but the network's noise level has to be about 7dB lower than for 64QAM. The downstream channel can be anywhere in the 65-860MHz spectrum, and is normally placed at the lower end.

The upstream (return) signals use either QPSK (quadrature phase-shift keying) or 16QAM, with one of five different standard symbol rates. The upstream's frequency spectrum extends from 5MHz to about 60MHz.

The European version, EuroDOCSIS, allows the use of a standard 8MHz wide channel in

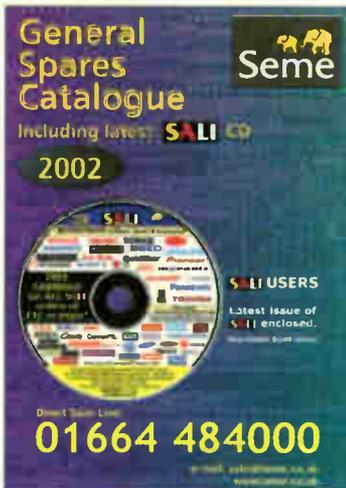
place of the American 6MHz one. Data transmission rates in the US are thus correspondingly lower.

Privacy is a necessary part of business communications, and the later standard DOCSIS 1.1 enhances the baseline privacy scheme incorporated in DOCSIS 1.0 by lengthening the code keys to 1024 bits and defining a digital certificate for each cable modem. The keys and the digital certificate are embedded in the modem software at the time of manufacture.

Upgrading

The flexibility of the system is such that modem software can be upgraded during initialisation or by request over the network monitoring system. Should the upgrade process fail at any point during the download, the system design enables the cable modem to remain in a useable condition. After the download the modem checks the new software file to ensure that it's suitable, since there can be many different modem makes and models connected to the system. A checksum system is used to ensure that data for the download has not been corrupted during transmission. ■

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Thomson's TX807 technology

In this concluding instalment in the series Mark Paul deals with the microcontroller circuitry, teletext and the audio output stage

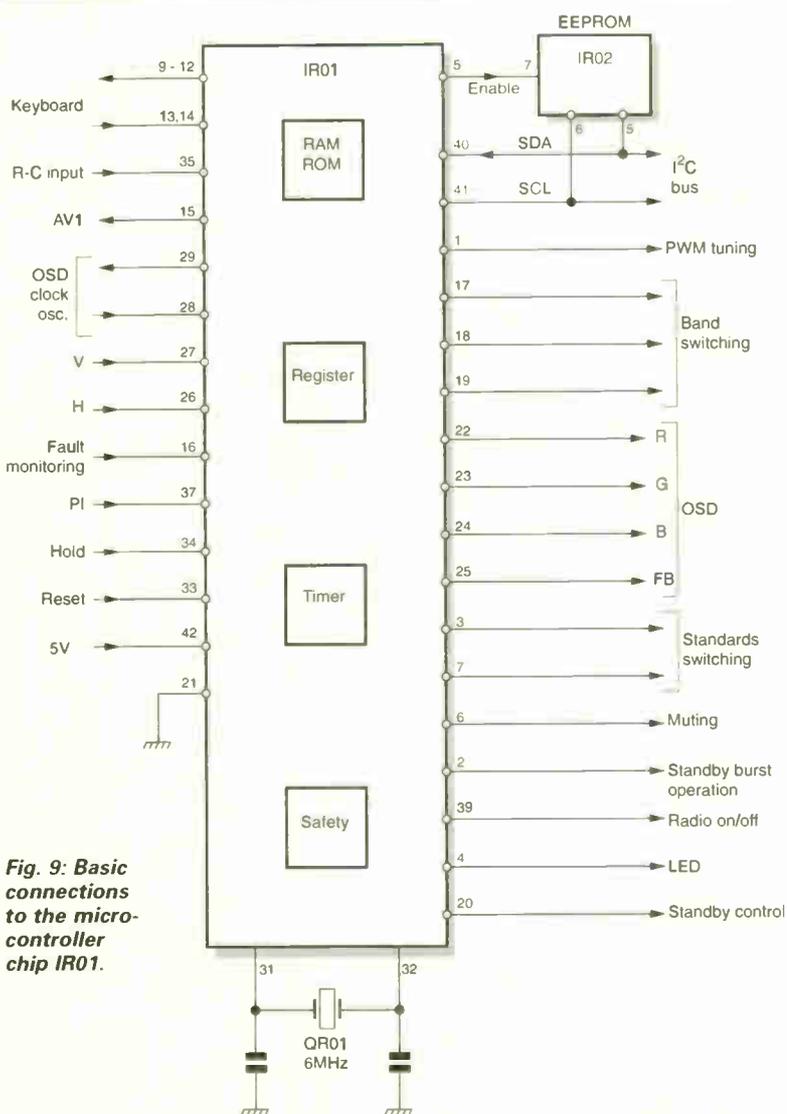


Fig. 9: Basic connections to the microcontroller chip IR01.

Management of the TX807 chassis is carried out by a Toshiba TMP47PI637 4-bit CMOS microcontroller chip, IR01. It's a 42-pin device with 32 input/output ports and a clock speed of 6MHz. The associated ST24W04 EEPROM memory chip IR02 is used for storage of the user parameters, for the service mode and as a back-up in the event of mains power failure. IR01 performs the following functions: remote control and keyboard management; standby switching; standards switching; voltage- or frequency-synthesis channel selection; volume, brightness, contrast and colour control; on-screen display signal generation; power supply control in standby; timebase monitoring watchdog.

Microcontroller circuitry

Fig. 9 shows basic connections to the microcontroller chip, Fig. 10 the power supply, standby control and reset arrangements. IR01 is powered by a 5V supply at pin 42. In normal operation this is derived from the 12-5V supply generated in the line output stage (see Fig. 4, January) via DL01 and a 5V series regulator circuit (TR01 and DR02). In standby the 5V regulator is fed from the chopper power supply generated audio supply (UA) via TL03, which is switched off by the VTU supply at its base once the line timebase is working.

The clock signal is generated by a quartz oscillator circuit, with the crystal QR01 connected between pins 31 and 32 of IR01.

RR46 and CR25 provide the reset time-constant (pin 33). When the supply rises sufficiently for TR02 and TR03 to switch on (voltage across CR01 close to 5.8V) CR25 charges via RR46. In the event of mains supply failure TR02 and TR03 switch off rapidly and the voltage at pin 37 drops to zero. IR01 then saves in the EEPROM the parameters required for switching the set on.

Pin 34 of IR01 monitors the supply at pin 42. If the supply falls below 4.5V, the set switches to standby.

The receiver is taken out of standby as follows. First a correction is required to Fig. 4: the output from TL03 is fed to IR01 and the line driver stage, not IV01. When the on command is received by IR01, the voltage at pin 20 rises rapidly. TR08 and in turn TR07 switch on, producing an 8.5V supply (VS) at the collector of TR07. This is the supply for the signals-processor chip IV01 which, once powered, produces line and field drive outputs. When the line timebase is operational, TL03 switches off and the 5V regulator receives 12.5V via DL01.

During IR01's reset period, the time-constant network CR04 and RR07 along with TR04 suppress the output at pin 20.

External commands and LED indication

Depending on the model, the TX807's keyboard has either four or eight keys which are arranged in a line/column matrix, see Fig. 11. IR01 provides outputs for the matrix at pins 9-12. Key commands are received at pins 13 and 14. The voltage at these pins is low in the absence of key operation. When a key is depressed, either a high level from pin 9 or a sweep-signal from pin 10, 11 or 12 is passed to pin 13 or 14.

Infra-red remote-control signals are detected by IK01 and presented to IR01 at pin 35. The code, which is transmitted every 80ms, consists of 12-bit serial words. Each word has four address bits, one call bit and seven data bits.

The front panel has a two-colour LED (DK01), red and green. In standby the red section is powered via TL03 and RR06. When the set is switched on from standby TL03 is switched off and the 12.5V supply from the line output stage powers the green section via DK05 and RK05/6. In the electronic key, programmable stop and safety modes DK01 produces flashes of light - 1s red flashes in the electronic key and programmable stop modes, driven by pin 4 of IR01 via TR09, and alternate red/green flashes in the timebase safety mode.

Fault sensing comes from the junction of RL27 and RL29 in the line output stage (see Fig. 4) and is applied to pin 16 of IR01.

Tuning

With voltage-synthesis tuning (CTT5045 tuner) pin 1 of IR01

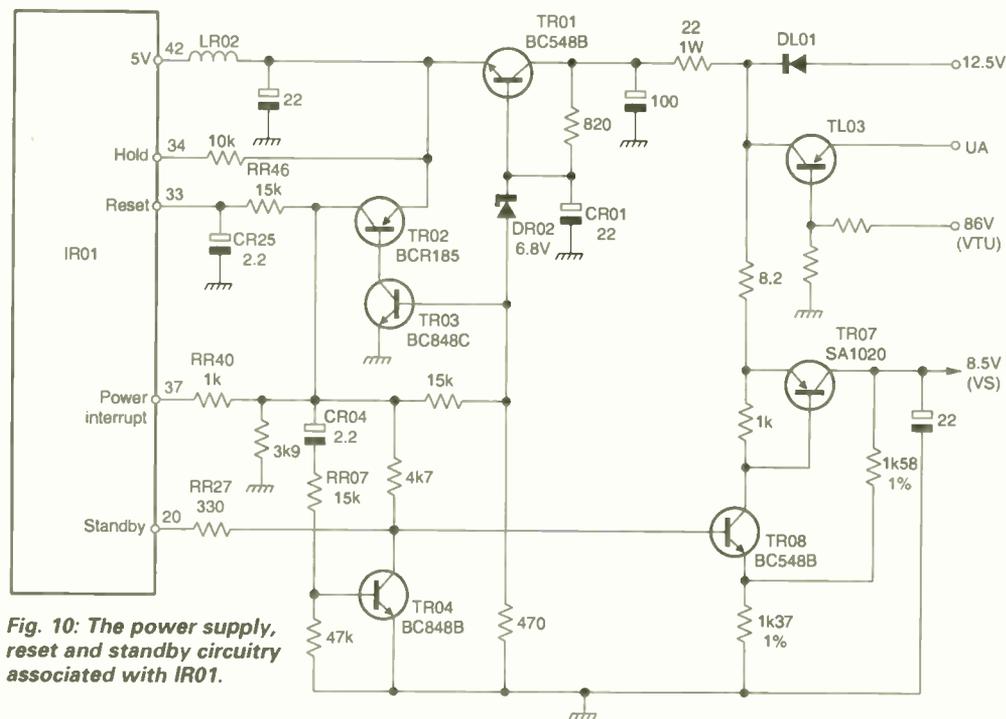


Fig. 10: The power supply, reset and standby circuitry associated with IR01.

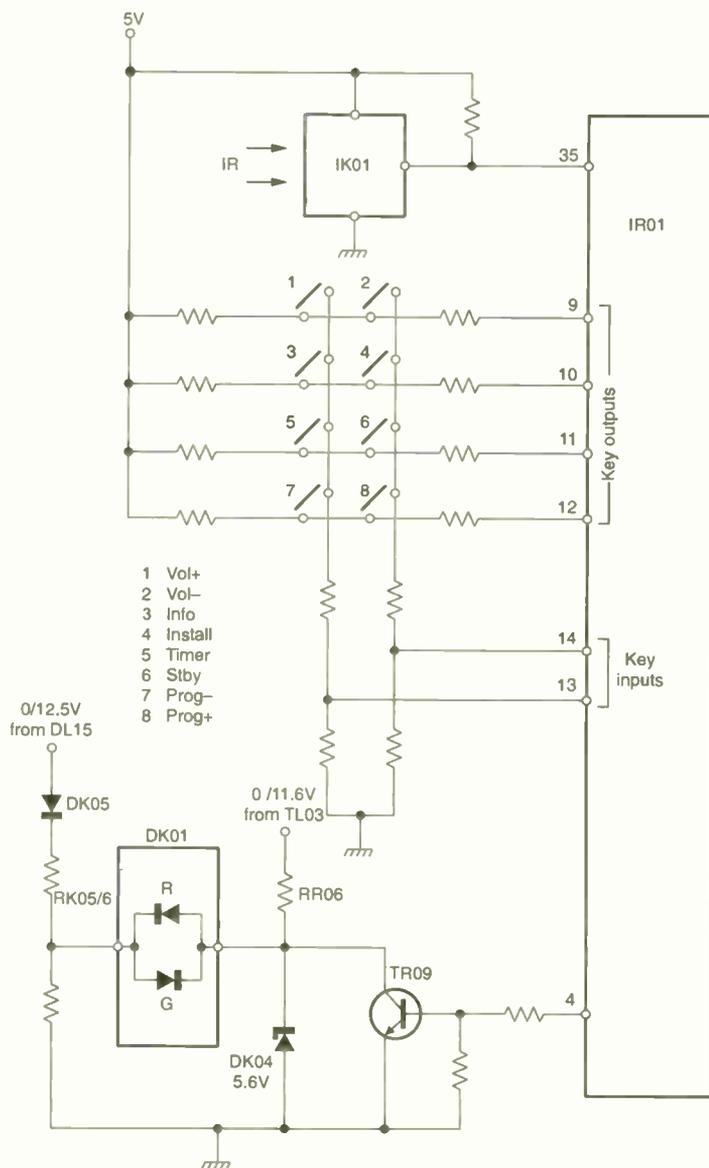


Fig. 11: User-control arrangements and the two-colour LED drive system.

produces 14-bit PWM which is applied to the base of TH01 to produce the tuning voltage (see Fig. 6 last month). Pins 17, 18 and 19 of IR01 provide band switching. AFC is carried out by the signals-processor chip IV01, which communicates with IR01 via the I²C bus.

Pins 3 and 7 of IR01 provide control signals for standards switching. These are fed to transistors that switch in/out various filters.

With frequency-synthesis tuning

the tuner (CTT5000) receives instructions on channel selection and standards management via the I²C bus. The 33V supply for the varicap diodes is fed to pin 9 of the tuner. Pins 3 and 7 of IR01 play the same role as with voltage-synthesis tuning.

OSD signal generator

IR01 produces the signals required to display menus on the screen. Fig. 12 shows the arrangement used. Pin 25 of IR01 feeds fast-blanking (FB) pulses to the base of

TV01, which in turn drives pin 26 of the signals-processing chip IV01. When fast blanking is applied, IV01 ceases to produce RGB outputs from teletext, AV and off-air inputs. IR01 produces its RGB outputs at pins 22, 23 and 24 respectively. These are capacitively coupled to the buffer transistors TV02, TV04 and TV06, with clamping provided by TV03, TV05 and TV07 – the clamp pulses are obtained from pin 41 of IV01, via TV08. In the Asian version of the chassis a different arrangement is

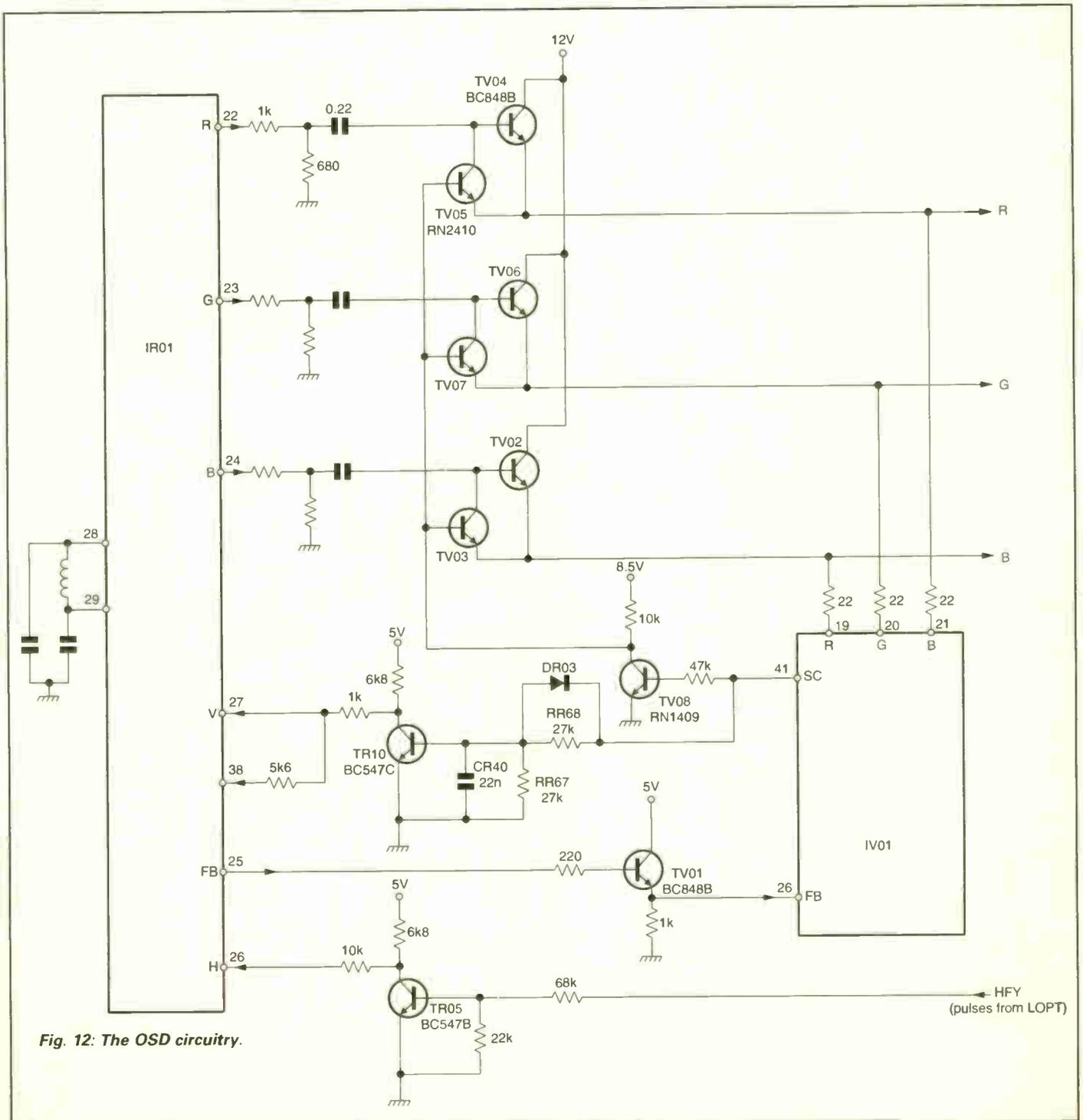


Fig. 12: The OSD circuitry.

used: IR01's RGB outputs are fed to pins 23, 24 and 25 of IV01.

A 7MHz clock oscillator circuit is connected to pins 28 and 29 of IR01. This sets the fast blanking, and is enabled in the OSD mode only.

Line pulses (HFY) from pin 7 of the line output transformer are fed to pin 26 of IR01 via the inverter transistor TR05. Field-frequency pulses are fed to pin 27. These are obtained from the sandcastle pulses at pin 41 of IV01, via the integrating network RR67/RR68/CR40/TR10. These two signals, H and V, are present with and without a video signal. They are required to set the position of the OSD window within the scanned raster. If the line pulses are missing there is no OSD. If the field-frequency pulses are absent at pin 27 or 38, IR01 will not produce OSDs, the screen remaining blank.

Other pins

The following is a list of functions for the other main pins of IR01.

Pin 2: Produces a burst-operation control signal for the power supply in the standby mode. It's fed to the primary side of the power supply via TP52 and the optocoupler – see Fig. 2, January.

Pin 5: Produces an output to control and enable EEPROM writing.

Pin 6: Provides audio muting when at 5V. With 14in. models muting occurs at switch on and in the standby mode; at other times muting is performed by the software in IV01. With 20/21in. models muting occurs at switch on, at channel change, with loss of signal and when in standby.

Pin 8: Provides a PWM logic control output which is applied to pin 10 of the AM sound IF chip II20, which is not fitted in system I sets.

Pin 15: Provides the source switching output for pin 8 of the scart socket.

Pin 16: Monitors the conditions in the line output stage, see earlier note.

Pin 39: Some models incorporate an FM radio. This pin provides FM radio on/off switching.

Pins 40 and 41: These are the

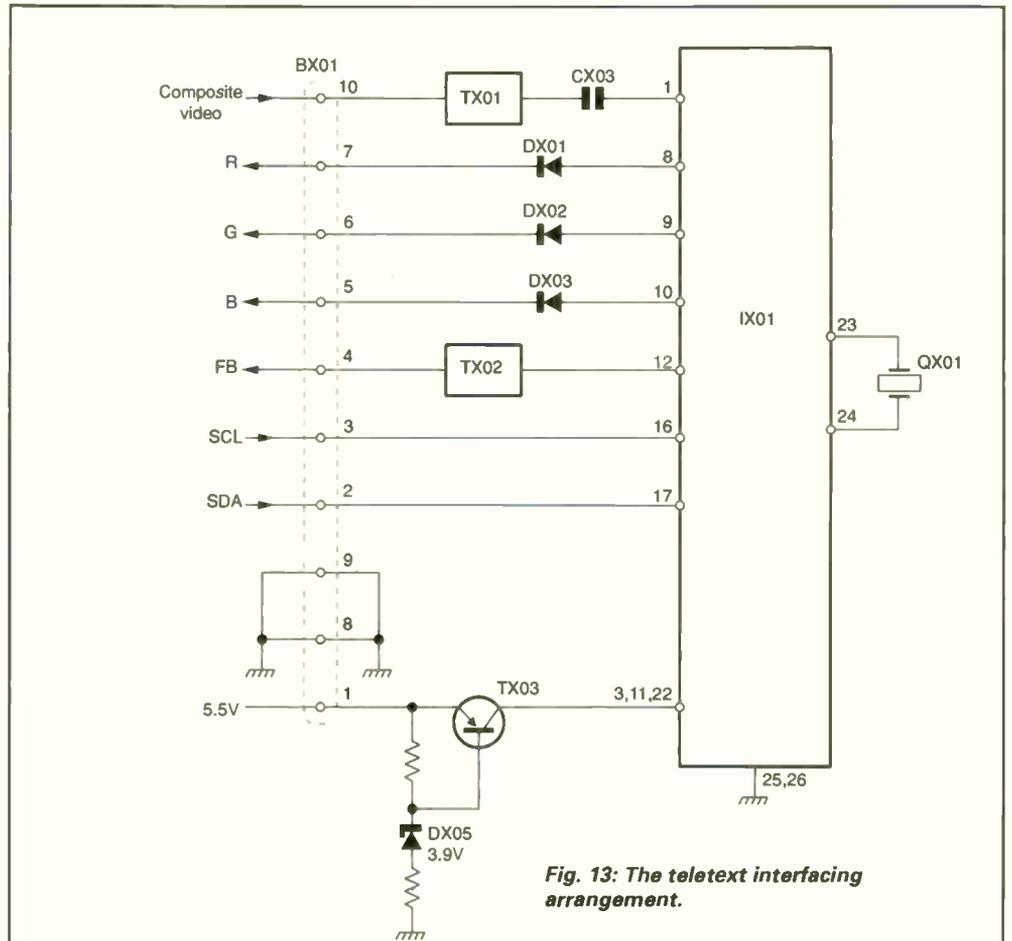


Fig. 13: The teletext interfacing arrangement.

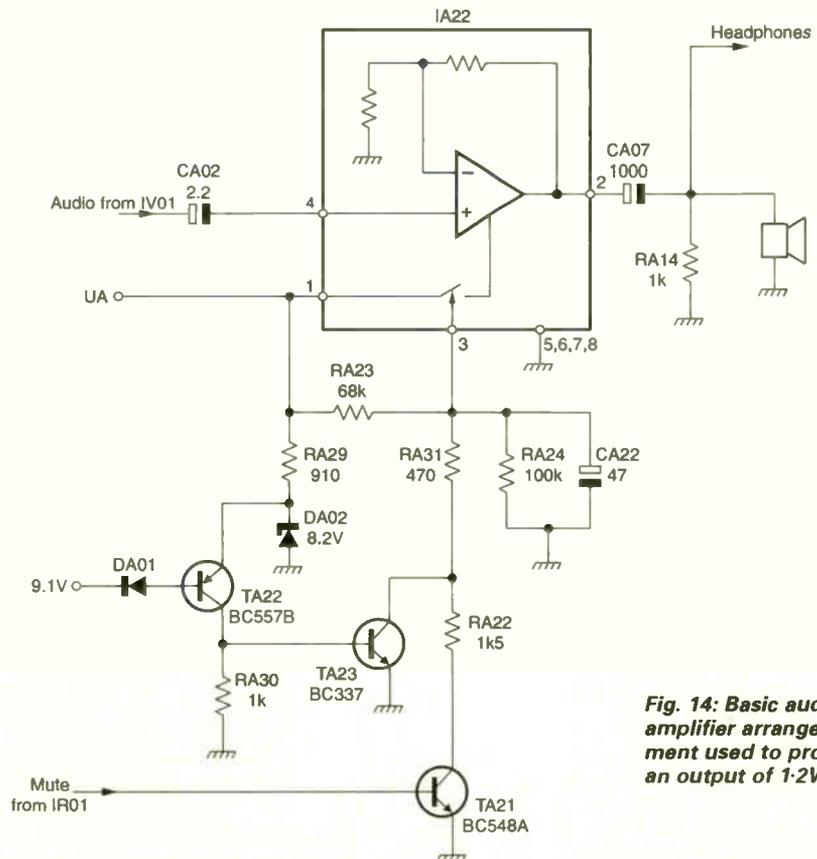


Fig. 14: Basic audio amplifier arrangement used to provide an output of 1.2W.

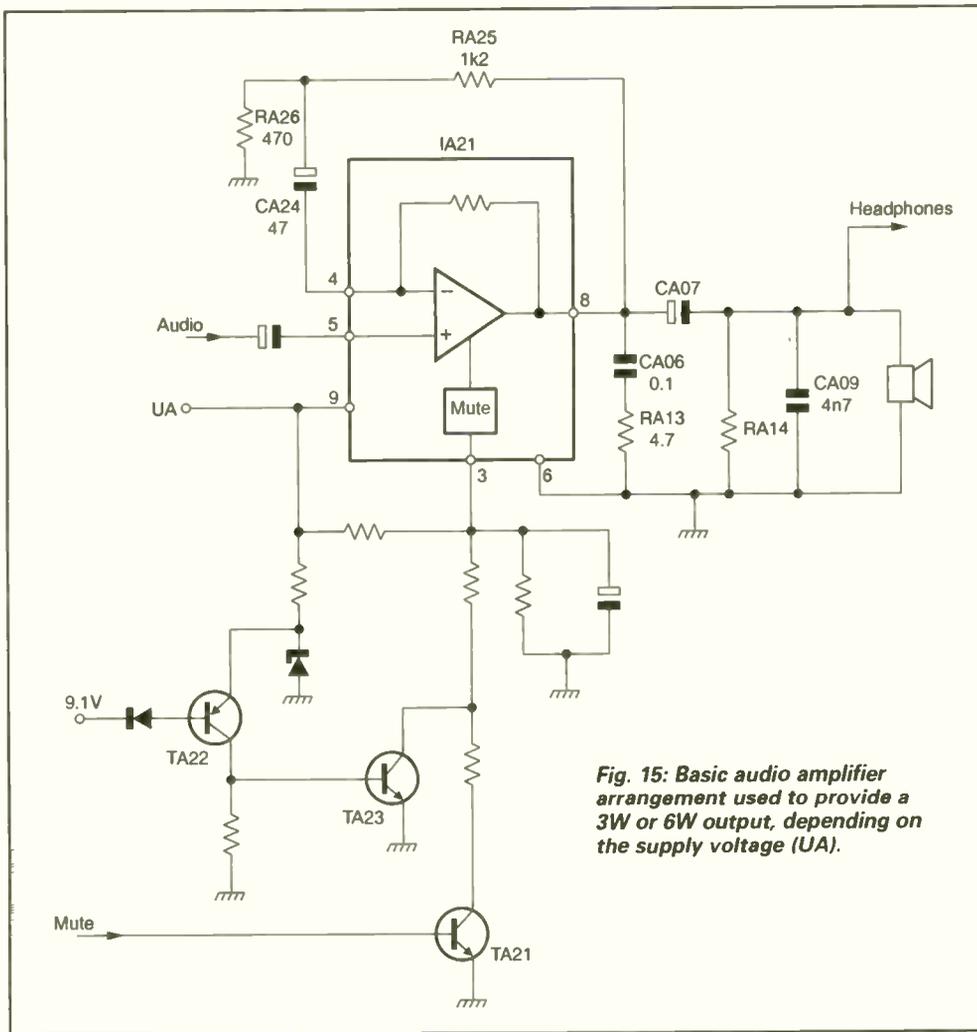


Fig. 15: Basic audio amplifier arrangement used to provide a 3W or 6W output, depending on the supply voltage (UA).

SDA and SCL connections to the I²C bus, for communication with the other I²C-connected devices – the signal-processing chip IV01, the teletext chip IX01 and the EEPROM IR02.

Teletext

The TX807 chassis has a separate teletext PCB which is connected to the main panel via a 10-way plug/socket (BX01/BV04). Fig. 13 shows the interfacing. A single-chip SGS Thomson decoder is used, type STV5348 (IX01). It's controlled by IR01 via the I²C bus and has an eight-page internal memory. No separate adjustments are required.

IX01 works with a 13.875MHz clock crystal which is connected to pins 23 and 24. The output from this oscillator is processed internally to provide all the other clock requirements. The chip is powered at 5V by the regulator TX03/DX05, which is fed from the 5.5V regulator in the line output stage. Typical current consumption is 60mA, with a maximum of 120mA. In the

standby mode the 5.5V input is not present, thus reducing the standby power consumption.

Composite video containing the teletext signal arrives at pin 10 of BX01 and is fed to pin 1 of IX01 via the BC558B emitter-follower TX01 and CX03 (0.1µF). The IC is a combined teletext slicer and decoder. The slicer separates the teletext data from the video signal. Once the data has been extracted, the selected teletext page is captured, stored and displayed, using the RGB and fast-blanking outputs (pins 8-10 and 12).

Audio circuitry

The TX807 is designed as a mono sound chassis, with a degree of flexibility built into the audio department. Either of two ICs can be used, providing 1.2W or 3W output with 14in. models and 6W with 20/21in. models. There is also a stereo version that delivers 6W per channel. This description deals with the mono versions only.

Fig. 14 shows the basic 1.2W 14in. arrangement, using a TDA7267 chip (IA22). Pin 1 is

used for the supply, which is obtained from the chopper circuit. The demodulated, volume-controlled audio signal obtained from pin 15 of the signal-processor chip IV01 is fed via CA02 to pin 4 of IA22.

The base of TA21 is fed with the mute output from IR01 (pin 6). Muting occurs when the receiver is switched on or switched to standby. TA21 is then switched on, connecting pin 3 of IA22 to chassis. Transistors TA22 and TA23 provide muting when the receiver is switched off. The 9.1V supply, from II01 (78L09), rapidly disappears at switch-off. Thus TA22 and TA23 saturate, connecting pin 3 of IA22 to chassis in the same way as with TA21. The aim is to prevent 'switching plop'.

This straightforward amplifier has a closed-loop gain of 32dB. The output appears at pin 2 and is fed to the loudspeaker via CA07. RA14 is included to ensure that the negative terminal of CA07 is connected to chassis at all times. IA22 incorporates thermal overload and AC short-circuit protection.

Fig. 15 shows the slightly different arrangement used to obtain a 3W or 6W output. This time the audio output chip is IA21, type TDA7253, which incorporates muting and a class AB push-pull output amplifier. The power supply is fed to pin 9 and the audio input to pin 5. Negative feedback is applied to pin 4 via RA25/RA26/CA24. The amplifier's closed-loop gain is about 28dB. CA09 is added to improve immunity to interference. RA13 and CA06 form a filter network to suppress HF oscillations caused by amplifier instability, which is always a possibility with a high-gain amplifier.

The muting system is identical to that in the 1.2W version and is again connected to pin 3 of the audio chip.

The supply voltages are 12V for the 1.2W amplifier, 16V for the 3W amplifier and 21V for the 6W amplifier.

Miscellaneous points

There was an error in Fig. 5 last month, where the drive input to the flyback generator from the power amplifier was omitted. In an article to follow shortly we'll deal with the large-screen ICC17 chassis. ■

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Digital communications in the **HOME**

Steve Beeching describes the current state of digital communication between consumer electronic devices and some of the problems that can arise, and takes a look at forthcoming developments in this field

The FireWire communication link (IEEE 1394) is increasingly being used to connect digital video camcorders to PCs. Streaming of digital video and audio segments from a camcorder to a PC for editing is now quite common, though getting it back again is more difficult when the camcorder's DV input facilities haven't been implemented.

There are, or will be, two IEEE 1394 specifications: IEEE 1394a for local cluster interconnection where the cable length is up to 4m, and IEEE 1394b for cables extending to 50m. AV products such as DVD recorders are to have IEEE 1394 DV connections, and these will eventually start to provide TV receiver inputs in the MPEG-2 format for direct playback. IEEE 1394 is capable of handling DV or MPEG-2 signals. Products require built-in digital encoders and decoders to make this interconnectivity possible.

There are now DVD writers for PCs and it's a straightforward step, using software, to convert DV to MPEG-2 and then record it on a DVD for playback via a standard DVD player and TV set, a facility so far lacking.

Some problems

As a digital camcorder engineer I get many calls from customers who have difficulty getting a digital camcorder to 'talk' to a PC. They may have fitted their own card and software but have no knowledge of IRQ (interrupt request) conflicts or the problems that can arise with compatible operating systems.

There was the man who hadn't eaten, washed or used any facilities for about eight hours! Following advice, he moved the card to another PCI slot in his PC. Things began to work, he had a shower, his wife started to talk to him and then fed him.

Nothing less than Windows '98 SE (second edition) will work with digital video signals. Windows ME or the new XP are more suitable operating systems. PCs with less than a 350MHz processor may not be suitable, as the processor and outer bus speeds are too slow – the latter must be at least 60Mbits/sec.

In addition the hard drive must be capable of high read/write speeds, better than 25Mbits/sec. Hard drives are quoted as having a high r.p.m. (7,200). A high read/write speed is required because the

data stream, consisting of video and audio plus control bits, can be at up to 30Mbits/sec, particularly where there is high scene detail and fast movement.

When pixellation errors occur on the transfer of DV material to a PC, or after the completion of editing, it is usual for the DV editing software company or the PC provider to blame the camcorder. This is generally but not always incorrect. According to one local 'expert' the camcorder's heads are always suspect. Why doesn't he pay attention to the fact that camcorder playback via a monitor is error-free?

Other calls have been about the problem that once DV data is stored on the PC's hard drive the customer can't get it off again because the camcorder "doesn't have DV input facilities". These may have been software disabled. Most of the JVC and Panasonic models I deal with can be reprogrammed by the slip of a key while you are chatting to the EEPROM. There are hardware devices and, on the internet, software programs that can be used to enable DV in. But if you alter the wrong data locations strange things can happen to a camcorder, or it just stops working.

The most worrying problem I've encountered so far is that some computers can damage a camcorder's DV communication port. I know this for a fact, but as I've yet to get my hands on an offending PC I don't know why. I suspect a PC card 6-pin connector that has power links next to the data receive/transmit twisted pairs, or shorts to the cable. Camcorder ICs don't like 12V up their ports.

Use of a DVD burner

One limitation to PC production of edited tapes of weddings and holidays is about to end with the ability to put the final version on a DVD. Panasonic has released a new DVD burner for use with a PC. The LF-D311 records DVD-R (write once), which can be played back by a standard DVD player or the rewritable DVD-RAM drive. The cost at the time of writing – you know how prices fall – is £419.99 plus VAT.

New authoring software is available from Roxio, which wrote Adaptec Easy CD. RoxioVideoPack 5 enables video enthusiasts to create navigations, chapters, author and then record in a range of DVD formats by converting DV material to MPEG-1 or -2. It costs about £350.

HAVi

The HAVi (Home Audio Video interoperability) standard enables any type of digital consumer electronics product to communicate with another. Using IEEE 1394 plug interconnection, any item within a HAVi network system can be controlled by another device. It's simply a matter of plug and play. The most common example so far is the i-Link facility used with

camcorders. It will no doubt soon be found with newer-technology items such as DV editing products and DVD recorders.

A PC with HAVi-compliant DV editing software can control camcorder functions so that scenes can be found for downloading and editing.

Wireless communications

Just as we are getting used to the IEEE 1394 communications bus with camcorders and advising our customers about the limitations, along comes something else: the use of low-power wireless communication links at RF. A licence is usually required to use any part of the RF spectrum, but bands that had been set aside for various facilities and then never used have become available. One of these is the ISM (Industrial, Scientific and Medical) band.

The Bluetooth wireless communications system uses 79 channels in the frequency range 2.4-2.48GHz for data and audio. It can provide cordless connections between mobile phones and laptop computers, desktop PCs and headsets; internet access for a laptop computer via a cellular phone; music CD playback via headphones; or a cellular phone to headphone link. Computer peripherals could be linked to a PC via Bluetooth wireless links. A link to a modem is possible for cellular phone, laptop computer or desktop PC connection to the internet via the public telephone network. Bluetooth can be extended for home automation, alarm systems and the simple doorbell, also the control of white goods and of course toys. The recently introduced HP DeskJet 995C printer has built-in Bluetooth wireless technology for use with compatible laptop computers.

Bluetooth is restricted to audio and data however, as the data rate is 1Mbits/sec. A newer system, known as Radio2 or HomeRF 2.0, increases the bit rate to 10Mbits/sec. HomeRF claims that the user can sit in the garden and download e-mails, MP3 files and low bit-rate video streaming without wiring or any knowledge of networking protocols. It's a consumer version of Bluetooth, using Bluetooth technology to provide a home network that's immune to general interference and doesn't affect neighbouring networks.

The advantages of wireless communication are mobility, flexibility over equipment positioning and ease of installation. If there are no wires, the cinema AV equipment can be adjacent to the viewer and not at the other side of the room with the TV set, making it easier to pop in a DVD. Games consoles do not need to be confined by a TV cable link, providing greater scope for movement.

HIPERLAN

The high-performance local area network (HIPERLAN), just beginning to emerge, is a wireless version of IEEE 1394. Leading

contender is HIPERLAN/2, which meets the IEEE 1934 specification. It uses the 5.15-5.725GHz band, with data rates of up to 25Mbits/sec. So far the system specification is for a base station to communicate with peripherals. This would mean that a TV set as a base station could receive MPEG-2 or DV video streaming from a number of sources, such as a DVD recorder/player, PC, DVB set-top box or camcorder, with no cable connections.

HIPERLAN/2 can operate in the isochronous (real-time audio/video) or asynchronous (non time-critical function control) modes. With HAVi standardisation, it will enable video sources to be remotely controlled via the TV link. This could be the start of burying the PC in a cupboard under the stairs, along with the hi-fi and video equipment.

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Stereo FM signal source

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

This article describes the construction of a unit which, when fed with a stereo audio input, provides a stereo FM output for distribution to normal FM receivers around the home. This enables stereo TV sound or music channels from a digibox to be distributed. Where a mono TV receiver is used in a different room from the digibox, stereo sound is made available via a suitable co-sited FM receiver. Alternatively, the unit can be used to distribute audio from a tape or disc. It can also be used as a test-signal source, and connections are provided for a baseband signal output that enables stereo decoders to be checked on a standalone basis. A scope output enables the baseband signal to be monitored using either an oscilloscope or a spectrum analyser.

The baseband and scope outputs are front-panel mounted while the audio input and RF output are at the rear of the unit. Setting-up adjustments have been kept to a minimum: there are two trimmers for the RF and subcarrier frequencies, a subcarrier level control, and phase adjustment for the pilot tone.

Block diagram

Fig. 1 shows a block diagram of the unit. Left- and right-signal inputs are amplified then filtered by low-pass circuits with a -3dB roll-off at 15kHz. This is followed by pre-emphasis then matrixing to produce sum and difference signals.

The sum signal, which is the mono component of the output, is

fed to the RF modulator via a summing amplifier. It also feeds a level-metering circuit that drives a front-panel mounted meter, to enable the input-signal level to be set correctly. The difference signal modulates a suppressed 38kHz subcarrier which, after filtering, is also fed to the summing amplifier. In addition a 19kHz pilot tone is generated and fed to the summing amplifier, whose output consists of the complete baseband multiplex signal: L + R audio, L - R modulated subcarrier and the 19kHz pilot tone. This signal multiplex modulates the main RF carrier.

Construction

Construction of the unit is based on the modular principle. The 456kHz master oscillator for the subcarrier and pilot tone is enclosed in a die-cast box, along with the dividers. The modulator and RF oscillator board is similarly housed. The power supply is on a small standalone board, while one larger board is used for the remainder of the circuitry - the input-signal processing, pre-emphasis, sum and difference matrixing, the subcarrier modulator, the pilot-tone generator and the summing amplifier.

Front-panel controls and socket connections are mounted on the main casing and wired to their respective points in the circuit.

I'll provide a full circuit description then follow up with constructional details in Part 2 next month.

Input-signal processing

Fig. 2 shows the left audio input-

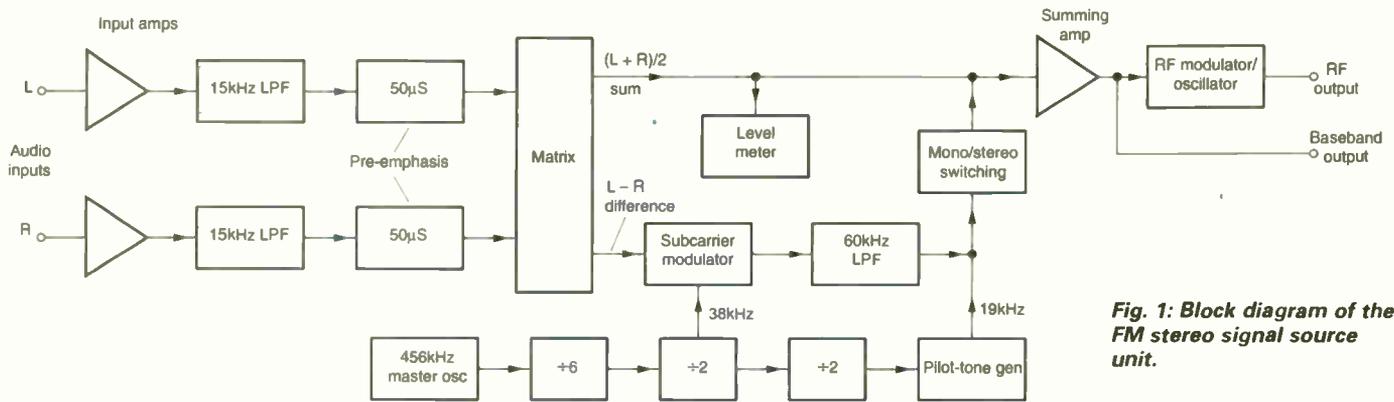


Fig. 1: Block diagram of the FM stereo signal source unit.

signal processing circuitry – the right audio input-signal processing is identical. Although it's quite simple, the circuit performs three separate functions: input amplification, 15kHz filtering and 50µsec pre-emphasis.

The input signals are passed to a ganged gain control, RV1a/b. IC1a provides input-signal amplification and matching to the T-filter L1, L2 and C4. The filter's output appears across R4 and is applied to the base of transistor Tr1. At low frequencies this transistor's gain is only some 2dB: it rises in accordance with the defined pre-emphasis characteristic provided by the time-constant of R5 and C5. This reduction in the negative feedback applied in Tr1's emitter circuit provides the required 50µsec pre-emphasis. C6 is included to filter out any RF breakthrough, and has negligible effect on the audio quality. C3 rolls-off the gain of the input amplifier above about 26kHz, again to reduce the possibility of RF interference.

At 1kHz the gain of the circuit, with the input-level control at maximum, is 15dB inverting, measured between the input socket and the collector of Tr1. Note that the 15kHz filtering is essential to prevent very high audio frequencies getting through and beating with the pilot tone or subcarrier to produce spurious aliasing artefacts that could be audible in the form of 'birdies'. The overall frequency response is shown in Fig. 3.

The inverted and processed right- and left-audio signals are then passed to the sum and difference matrix. Before dealing with this and the subcarrier modulator, I should describe the generation of the 38kHz and 19kHz signals.

The master oscillator

Fig. 4 shows the master oscillator and divider circuitry. The problem here was to work out how to design the circuit using readily available, cheap components. In particular the circuit must be stable: the specification for the frequency

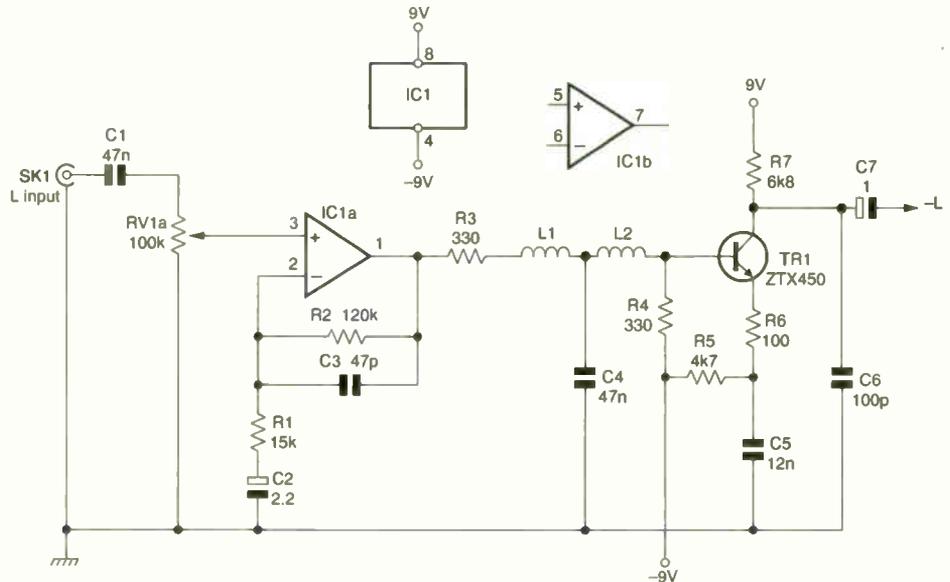


Fig. 2: The left audio-input signal processing circuit. The right audio-input circuitry is identical. Both are on the main board. SK1, C1 and RV1 are mounted off board.

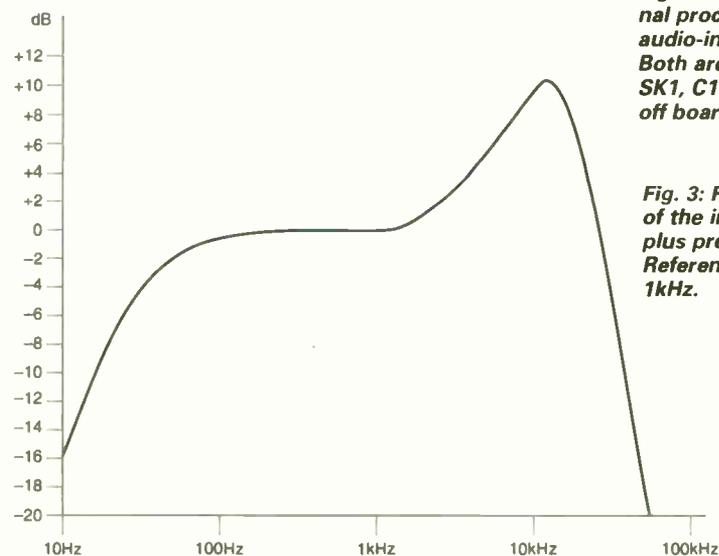


Fig. 3: Frequency response of the input filter circuit plus pre-emphasis. Reference level 0dB at 1kHz.

tolerance at 38kHz is ± 4 Hz. I didn't want to specify a crystal that would have to be specially manufactured, especially as small-quantity orders would be expensive. After much thought and number crunching, I came up with the circuit shown.

The frequency-determining element in the oscillator is the 455kHz ceramic resonator XL, which can be persuaded to oscillate happily at

456kHz by connecting inductor L1 in parallel with it. The circuit is basically a Pierce oscillator, tuned by C2, and appears to be very stable. To obtain 38kHz we have to divide by 12: this is done by dividing first by six and then by two, for reasons that will soon become clear.

Because of the division by 12 the oscillator tolerance is $\pm 4 \times 12$, i.e. ± 48 Hz, which seems to be easy to

achieve. With the unit set up and running on prolonged test, the worst error I've seen is $\pm 2\text{Hz}$ at 38kHz , which corresponds to $\pm 24\text{Hz}$ at 456kHz .

The dividers

The output from the oscillator is converted to clock pulses by transistor Tr2. These pulses clock the decade counter IC1, a 4017 chip, whose 6 output is connected to the reset pin 15. As a result, the device keeps counting to 6 then resets itself, producing one narrow pulse at its output for every six input pulses. We don't want a pulse at 76kHz however: we need a squarewave at 38kHz . The divide-by-two action of IC2a produces a 38kHz squarewave with its transitions corresponding to

every incoming clock pulse. Because the clock pulses are equally spaced, the result is a squarewave with a mark-space ratio of precisely 1:1.

This is important: the perfect squarewave contains only odd harmonics which, as will be apparent later, enables simple filtering to be used after the subcarrier modulator.

A further divide by two divider, IC2b, produces a perfect squarewave at 19kHz . This is used to generate the sinusoidal pilot tone.

To prevent the squarewaves' sharp edges producing excessive radiation, the 38kHz output connection is screened while the 19kHz output is attenuated by R6.

Now that the signal-input and subcarrier oscillator stages have been described, we can return to the main

circuit board and see how these respective outputs come together.

Matrixing

The remainder of the circuitry on the main board is shown in Fig. 5. IC2a/b are used to provide the difference and sum signals respectively. IC2a, fed with $-L$ and $-R$, produces a difference signal $-(L - R)$. Meanwhile $-L$ and $-R$ are summed in the resistor network R9/R11 and then buffered by the voltage-follower IC2b to produce $-(L + R)/2$. The significance of the $/2$ bit will be made clear later. Note that C19 is included to provide phase correction of the sum signal relative to the difference signal, which is phase retarded by filtering in the difference-signal path, described below.

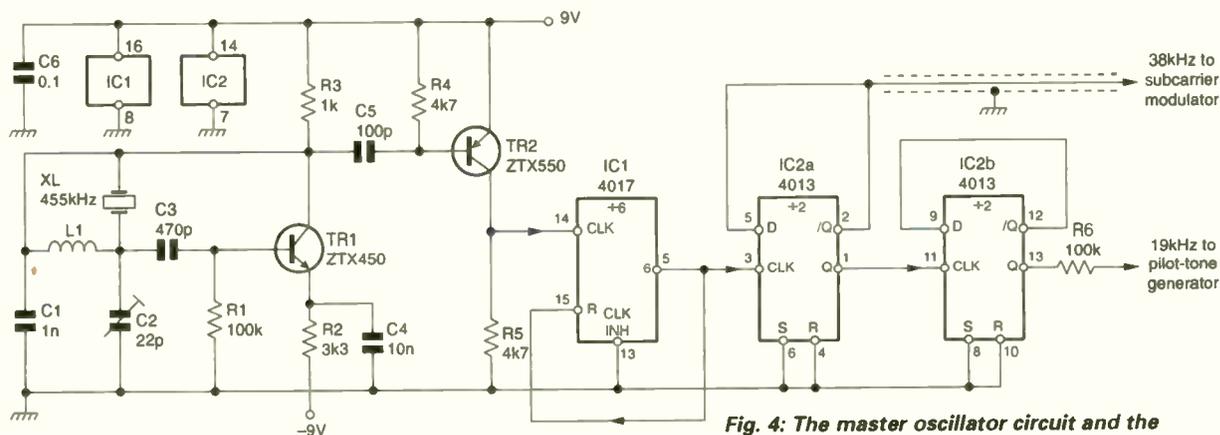


Fig. 4: The master oscillator circuit and the dividers.

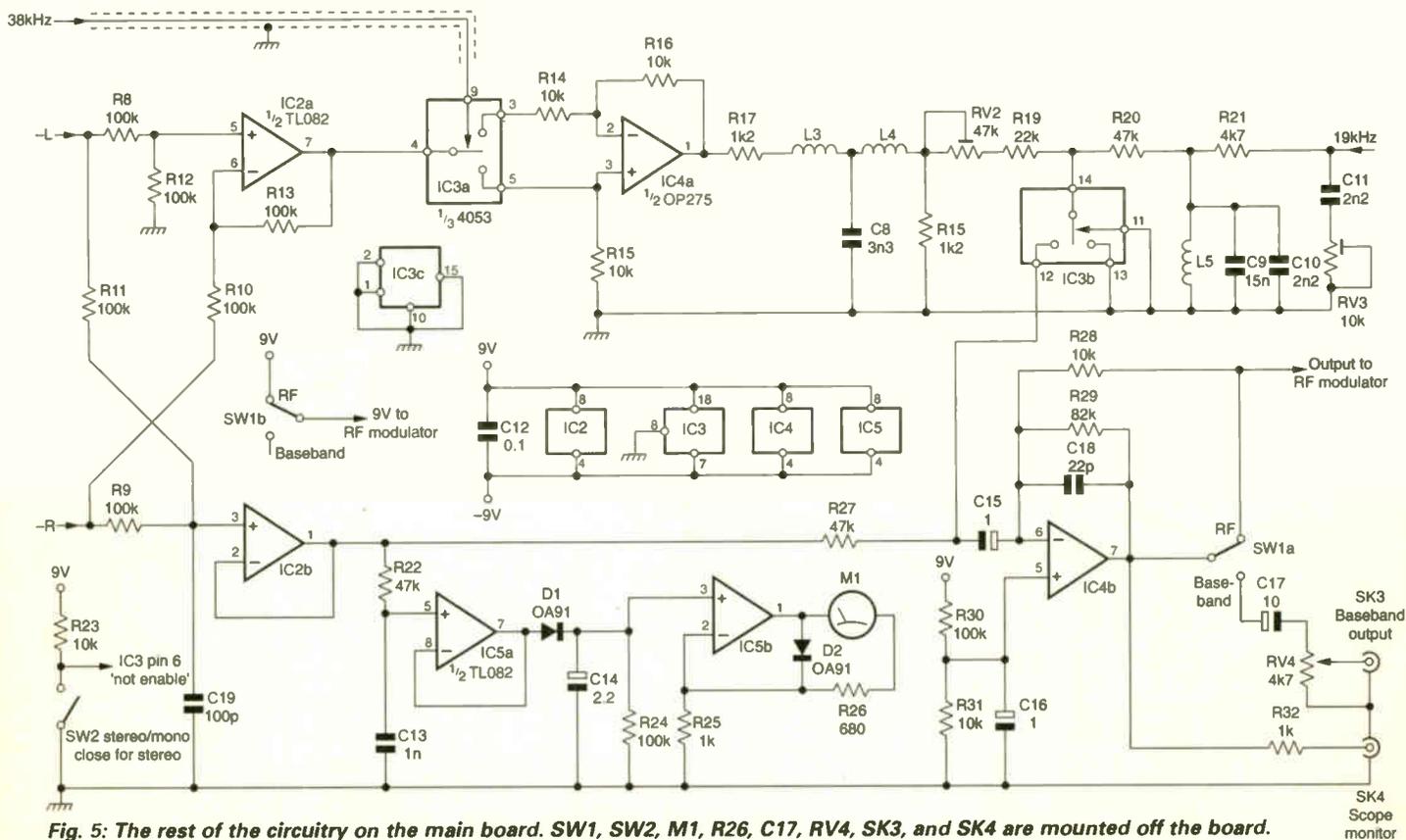


Fig. 5: The rest of the circuitry on the main board. SW1, SW2, M1, R26, C17, RV4, SK3, and SK4 are mounted off the board.

The difference signal is fed to the subcarrier modulator while the sum (mono) signal is fed straight to the baseband summing amplifier IC4b, which inverts the sum signal so that it's positive-going. This is the correct sense to apply to the RF oscillator/modulator, so that a positive input signal produces an increase in carrier frequency.

The subcarrier modulator

For L - R we have to generate a suppressed-carrier signal, i.e. one in which the carrier disappears (or falls to a much lower amplitude) in the absence of modulation. The classic way of doing this involves the use of two balanced transformers and a diode-ring modulator. But, after giving the matter considerable thought, I suddenly realised that the required operation could be achieved with an analogue gate and an op-amp. IC3a is the analogue gate and IC4a the op-amp.

The analogue gate works as a changeover switch which operates at 38kHz, connecting the difference signal to the inverting and non-inverting inputs of the op-amp IC4a alternately. When there is no difference signal the input to IC4a is zero irrespective of which path in IC3a is closed. Thus no difference-signal output is present at pin 1 of IC4a and little output at the 38kHz subcarrier frequency appears. The subcarrier is effectively suppressed, appearing as sidebands only when the difference signal moves away from zero. The difference signal is then converted to an envelope shape, symmetrical about the zero baseline.

The individual 38kHz cycles are square however, not sinusoidal. So the filter L3/L4/C8 is included. This removes the squarewave harmonics and reduces the shape to that of a sine wave, while introducing a 6dB attenuation that brings the difference signal to the same level as the sum signal.

The filter's corner frequency is 60kHz. The maximum modulating frequency is 15kHz, which will produce symmetrical sidebands at 38

+ 15 = 53kHz and 38 - 15 = 23kHz. You can now see why it's important that the 38kHz squarewave has a 1:1 mark-space ratio. The only significant harmonics of the lower sideband are third and above: $3 \times 23 = 69\text{kHz}$, which is above the filter's corner frequency. Yes, it's true - my spectrum analyser wouldn't lie!

The suppressed subcarrier signal is now ready to be fed to the summing amplifier.

Generating the pilot tone

We also need a 19kHz pilot tone which must be in the correct phase relationship with the 38kHz subcarrier. The pilot tone has to cross the zero line at the same time as the subcarrier: this means that the pilot tone has to be shifted by 45° with respect to the 19kHz squarewave from which it's derived. The circuit that does this is entirely passive, consisting of the tuned circuit L5/C9/C10 plus the phasing network C11/RV3.

The LC circuit is tuned slightly below resonance. This introduces a phase shift compared with the driving current, which comes via R6 (Fig. 4) before arriving at the phase-shift adjustment. The tuning, along with the separate phase-shift network, provides the required 45° shift. The sine wave that appears across the tuned circuit is very pure: distortion is 0.03 per cent, and is again odd harmonics at a very low level.

The pilot tone is fed to the summing amplifier via R20, along with the modulated subcarrier which arrives via RV2 and R19. IC3b is included as a stereo/mono switch. It goes open-circuit, along with IC3a, when the 'chip not enabled' line (pin 6) goes high. R23 and SW2 provide this function, which is useful when using the unit as a test set. Note that the third section of the analogue gate chip, IC3c, is not used, so all its connections are grounded.

Metering circuit

Before describing the summing amplifier and RF section I'll cover the metering circuit that monitors the sum signal. As the sum signal is always significantly larger than the difference signal when L and R audio inputs are fed to the unit, this is a satisfactory approach.

The output from IC2b is the sum signal with pre-emphasis. De-emphasis network R22/C13 removes the pre-emphasis, after which the signal is fed to the unity-gain buffer amplifier IC5a. The output from this is rectified by D1, charging C14. The discharge path is via R24. Since the time-constant of the discharge path is longer than that of the charging path, the metering circuit has a user-friendly characteristic which is easy to follow.

IC5b is a voltage-to-current converter which drives the meter. D2 provides overload protection and

Fig. 6: The RF oscillator/modulator circuit, which is based on a Velleman kit. Component reference numbers are as per the K1771 kit. Not all components are used. The 47µH inductor is fitted in position C8.

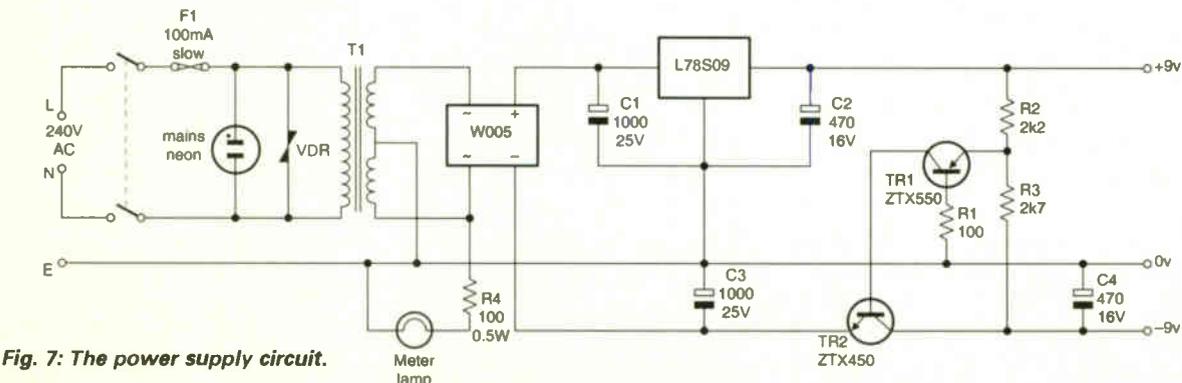
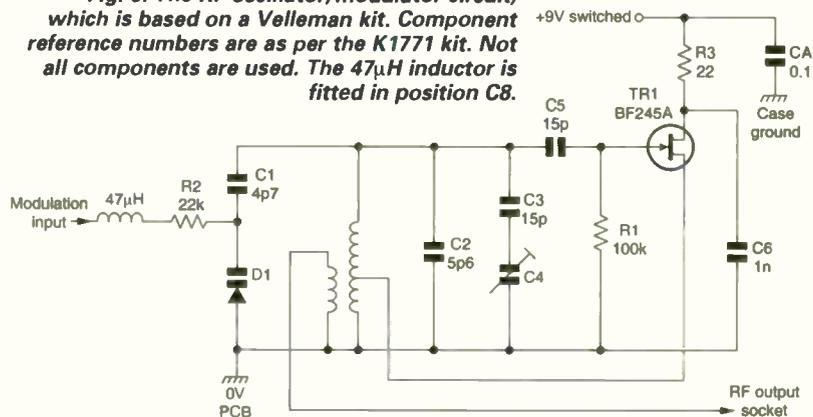


Fig. 7: The power supply circuit.

prevents the meter needle banging hard against the end stop. The meter is illuminated from behind by a small 12V lamp which is fed with a 6V AC supply: being so under-run, it should last forever.

The summing amplifier

The gain of the summing amplifier IC4b is switched by the RF/baseband switch SW1 on the front panel. When RF is selected, extra feedback via R28 is added. This ensures that the varicap diode in the modulator circuit is not overdriven.

With SW1 in the baseband position power is removed from the RF module, the gain of IC4b is increased and the baseband signal is connected to the output socket via C17 and the level control RV4.

The scope monitor output is available at all times, but the signal changes amplitude in accordance with the setting of SW1.

Note that IC4b is biased by R30/R31 so that its output sits on a positive DC pedestal of 0.8V. This voltage, along with the baseband multiplex signal, is fed to the varicap modulator diode, biasing it to the correct DC working point.

RF oscillator/modulator

The RF oscillator/modulator circuit is shown in Fig. 6. It's based on the Velleman Kit K1771, which was

originally intended for use as a radio baby alarm. I have used this kit before. The original modulator circuit is poor, but the RF section works very well and is stable, mainly I think because the oscillator coil is printed and is therefore mechanically rigid.

The kit comes as a small PCB and a set of components. Only those components relevant to this project are fitted and, as mentioned above, the varicap diode is fed with the multiplex signal plus a DC bias. It makes good economic sense to use this VHF kit, despite not using all the components, because the oscillator is reliable and will instantly operate correctly since the component positions are all precisely defined.

The RF oscillator employs a FET, Tr1, in a Colpitts circuit. The output is obtained from a small printed pick-up loop. For modulation, varicap diode D1 is connected, with C1, in parallel with the oscillator coil. Trimmer C4 sets the frequency.

A full setting-up procedure will be included in Part 2, which also provides information on the components that are used in the RF unit and those that are omitted. The partially filled PCB is fitted inside a die-cast box to reduce spurious radiation. A short length of coaxial cable links the board's output to the

RF output socket at the rear of the main unit. Note that CA provides local decoupling of the supply and is needed to prevent background modulation hum.

Power supply

The unit needs positive and negative 9V supplies which are provided by the circuit shown in Fig. 7. The mains input circuit consists of an on/off switch, a 100mA slow fuse, a mains-on neon indicator and a surge-suppression VDR. It feeds the primary winding of transformer T1, whose two 12V secondary windings feed a full-wave bridge rectifier that provides positive and negative outputs. Reservoir capacitors C1 and C3 precede the regulator circuits.

The positive supply uses an L78S09 regulator package while the negative supply is regulated by the mirror-image circuit consisting of Tr1, Tr2 and the associated three resistors.

The outputs are decoupled by C2 and C4. By keeping all the decoupling capacitor leads short, there is no need for further (HF) decoupling around the 9V regulator chip.

Power for the meter lamp is taken from the secondary side of the transformer. The feed includes a dropper resistor, R4, which results in the lamp being significantly under-run while still being bright enough to light the meter.

Performance

The specification, see Table 1, shows that the performance of the unit is very close to broadcasting standards. Listening tests and spectrum analysis of the multiplex signal confirm that the performance is in practical terms indistinguishable from an FM stereo broadcast. For example the fact that the unit's subcarrier suppression is better than 35dB, compared with the broadcast standard of 40dB, makes no difference to the perceived performance.

The 15kHz filtering and pre-emphasis are in conflict at band edge: this attenuates the pre-emphasis by about 2dB at 15kHz. Such is the price of relative circuit simplicity, but again this is difficult to perceive with listening tests. Bear in mind that a professional stereo coder costs in excess of £2,000. This unit can be built for about £100 in component costs plus the time required to construct it. It's easy to set up, and any competent technician or engineer should be able to set about the task with confidence. ■

Next Month

Constructional information and component lists will be provided in Part 2 next month, also the simple setting-up instructions mentioned earlier. Readers not familiar with the theory of stereo FM can refer to my article *FM stereo radio and RDS* in the February issue.

Table 1: Stereo FM signal source specification

Signals

Audio input sensitivity, both channels energised	100mV/channel at 1kHz
Audio bandwidth, post filtering	-3dB at 14kHz
Audio pre-emphasis time-constant	50µsec
Maximum RF deviation	±75kHz
Pilot tone level relative to maximum deviation amplitude	-20dB
Pilot tone frequency	19kHz ±2Hz
Subcarrier frequency	38kHz ±4Hz
Subcarrier suppression	Better than 35dB
Distortion artefacts*	Better than -50dB
RF output frequency adjustment range	100-108MHz approximately
Maximum baseband output, at meter level 4	3V peak-to-peak
Frequency response	See Fig. 3

Power requirement: 3VA at 240V, 50Hz.

Controls and indicators: On/off, input level, baseband output level, stereo/mono selector switch and RF/baseband selector switch on front panel, with power on and input signal level meter.

Connections: Baseband output phono socket and scope monitor BNC socket on the front panel; left and right audio-input phono sockets, RF output coaxial socket and mains input on the rear panel.

Internal adjustments: RF output frequency, subcarrier and pilot-tone master oscillator frequency (456kHz), subcarrier amplitude and pilot-tone phase.

*Measured using an HP3580 spectrum analyser.



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- 1 **Washington Post March**, Band, 1909
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- 3 **Marriage Bells**, Bells & xylophone duet, Burckhardt & Daab with orchestra, 1913
4. **The Volunteer Organist**, Peter Dawson, 1913
5. **Dialogue For Three**, Flute, Oboe and Clarinet, 1913
6. **The Toymaker's Dream**, Foxtrot, vocal, B.A. Rolfe and his orchestra, 1929
- 7 **As I Sat Upon My Dear Old Mother's Knee**, Will Oakland, 1913
- 8 **Light As A Feather**, Bells solo, Charles Daab with orchestra, 1912
- 9 **On Her Pic-Pic-Piccolo**, Billy Williams, 1913
- 10 **Polka Des English's**, Artist unknown, 1900
- 11 **Somebody's Coming To My House**, Walter Van Brunt, 1913
- 12 **Bonny Scotland Medley**, Xylophone solo, Charles Daab with orchestra, 1914
- 13 **Doin' the Raccoon**, Billy Murray, 1929
- 14 **Luce Mia!** Francesco Daddi, 1913
- 15 **The Olio Minstrel**, 2nd part, 1913
- 16 **Peg O' My Heart**, Walter Van Brunt, 1913
- 17 **Auf Dem Mississippi**, Johann Strauss orchestra, 1913
- 18 **I'm Looking For A Sweetheart And I Think You'll Do**, Ada Jones & Billy Murray, 1913
- 19 **Intermezzo**, Violin solo, Stroud Haxton, 1910
- 20 **A Juanita**, Abrego and Picazo, 1913
- 21 **All Alone**, Ada Jones, 1911

Total playing time 72.09

21 tracks – 72 minutes of music.

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Part 2 of **Peter Marlow's** feature on the computer virus problem gives guidance on avoiding infection and what to do should an attack occur

How to survive a virus attack

Last month I described a particularly nasty virus attack on my computer system and how I got over the problem – with the loss of about four days' work. A number of general observations were made. Here's some basic guidance on protection.

(1) Make regular backups. Invest in a ZIP drive or a CD-ROMewriter so that you can save your documents and files regularly. You never know when you might get hit, or your hard drive might fail one day.

(2) Invest in anti-virus software, and keep it updated (hundreds of new viruses appear each week). My preference is for Norton 2000 Anti-Virus (the 2002 release is now available, see below). It has an excellent feature called Live Update. This grabs the latest virus definition files from the Norton website on a scheduled basis.

The software sits in the background and scans incoming e-mails for known viruses. When you install it you are prompted to make 'rescue discs' that can be used to reboot a machine safely after a virus attack.

There is other good anti-virus software around – see below – but mostly for Windows 98 and above.

(3) Scan your hard drives regularly. Even though your scanner is checking activity in the background as you work, it may miss an unknown virus. A later update and scan may catch such a virus before it does any damage.

(4) Get a Firewall. This is essential if you

have a continuous connection to the internet. Some viruses enable hackers to gain access to your PC without you knowing it. If you surf a lot, you are particularly at risk.

I recommend Norton Personal Firewall. You will be surprised at the probing that will be reported. There are good free alternatives, such as ZoneAlarm.

(5) Keep yourself aware of new viruses. Silicon.com runs an excellent news site. Some viruses are easy to spot when they arrive attached to an e-mail. They can be deleted without causing any problems. But new ones are getting smarter.

(6) Use an e-mail program other than Outlook or Outlook Express. The open design of Outlook enables attachments to run little programs. This can be a benefit, but viruses exploit it too. Compuserve and AOL both use proprietary e-mail clients that do not suffer from these kinds of attack.

If you must use Outlook, there's a security patch available that you can

download from Microsoft. If you use Outlook Express, turn off the preview pane that opens up e-mails automatically as they come in. The procedure is as follows: click 'view' on the menu bar, then 'layout'; unstick the 'show preview pane' box; then click OK.

What to do when an attack occurs

Here are some suggestions about what to do should a virus attack occur.

(1) Don't panic. It's not the end of the world, and you can survive. You don't need to buy a new PC. Help is available. In any case, the unusual behaviour you see may not be caused by a virus.

(2) Disconnect the internet connection, in case the virus is a mass e-mailer and tries to send my documents to all your e-mail contacts.

(3) Shut down all open applications, but don't switch off the PC. Close any documents you are working on, and any

other open applications – the virus may have launched some of its own. Switching off or rebooting the PC without further checks may increase the damage.

- (4) Take a back-up of your important files. This should be done before you run your anti-virus software, as it might inadvertently delete some that are infected without trying to repair them. You should scan these backup files at a later date anyway.
- (5) Run your anti-virus software. This will check for a virus in system memory. If there is one, you will have to reboot the machine with the 'rescue disc' you made when you installed it.
- (6) Identify the virus and download the antidote software. You may have to ask a friend to browse the internet for you to get this information and download the fix, as you may want to get on yourself (see step 2 above).
- (7) Inform possible targets. If you have been affected, maybe without knowing about it at first, tell your contacts. They will curse you at first, but thank you later!
- (8) Restore erased or damaged files. Use your recent or emergency backups to restore your machine to how it was.

Why?

Viruses will be with us for a long time, and will get cleverer. Writing them is not a trivial task and requires a lot of skill. There have been some prosecutions, but some experts think that the battle is lost.

Why do the virus writers do it? Perhaps it's seen as a game or a challenge; perhaps it's done for publicity and notoriety; or maybe it's done to get at Microsoft. Ultimately we may have to shift from Windows to something more secure to stop our PCs grinding to a halt. ■

Products and help on the web

Anti-virus software:

Norton Anti-Virus 2002 at:
www.symantec.com/region/reg_eu/product/nav2002.html/
McAfee VirusScan from Network Associates, who bought out Dr Solomon, at:
www.mcafee.com
Sophos Anti-Virus, which is ideal for the business user, at:
www.sophos.com
Sophos was proclaimed Company of the Year at the 2001 Real Business/CBI Growing Business awards.
Free protection will be found at:
www.frisk.is

Firewalls:

Norton Personal Firewall 2002 at:
www.symantec.com/region/reg_eu/product/npf2002.html
ZoneAlarm from Zone Labs at:
www.zonelabs.com

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Christmas is over

Christmas is over for another year. If the number of jobs you had has fallen by as many as mine did, I can certainly sympathise with you. And whatever happened to the days when the TV engineer was regarded as being God-like, all knowing and all powerful? Not that I'd call myself God: it's just that nowadays I seem to be the last instead of the first person consulted when something goes wrong. Here's an example.

Last week a fellow I've known since my schooldays called in. "Morning Tom" he said, "can you have a look at my television for me? It's not urgent. I've been out and bought another one at Asda to replace it. Cost only about £300 for a new 28in. set. If the old one costs no more than £20 to repair, do it. Otherwise bin it."

The set in question was a **Mitsubishi CT21A3STX** (Euro 12 chassis). It's a 21in. Nicam model, and this one was dead. I had a quick look and soon found that the chopper transistor Q901 and the diode in series with it (D908) were faulty. In

addition a couple, at least, of electrolytics would have to be replaced and there would probably be a few dry-joints around the regulators and the field and sound output chips.

Now comes my dilemma. How can I repair the set for the amount my customer is willing to pay when the spares kit alone costs nearly £15? No matter how short of work I am, the days when I would work for £5 an hour are long gone. Call me stupid if you like but, even with my maths, I cannot see how spending £300 or so is more cost-effective than paying £45. So I phoned him with my estimate, expecting him to say "bin it". After a bit of humming and harring he decided, reluctantly, to have it done. I can just imagine the words his wife would come out with (I've known her too since my schooldays!) when she found out that he'd spent all that money on a new set when he didn't have to.

An electronic satellite system

Just before Christmas I was asked to fit an electronic satellite dish to a caravan. Needless to say I jumped at the chance,

More tales from Tom Baker. This time a Mitsubishi TV, an electronic caravan satellite-dish installation, and how to go about electrolytic replacement in the Sony SLVE715's power supply

thinking that it was an Oyster unit which is self-seeking and positioning. When I was given the unit however it turned out to be the electrical version of the type I described in the December issue (from Maxview Limited of King's Lynn). Although installation was basically the same, operation is totally different.

As I said last time, a picture is worth a thousand words. So a few are shown here. Apologies for the quality – it was foggy at the time. The main differences between this system and the manual one are that the dish is raised and lowered electrically, and that the control unit has an LED numerical output that shows the angle of the dish relevant to the caravan. But you still have to turn it from inside the caravan. The company supplies a map leaflet with a sticky back to attach close to the control unit, to give you an idea of the angle of elevation relevant to where you happen to be, including Europe.

A few days after I'd completed the job the customer phoned up. He wasn't very happy. After spending all that money to have a satellite dish installed on his caravan he still couldn't get his digibox to work. I gathered from what he said that he'd tried for hours, unsuccessfully, to get a picture.

So I fired the old PC up and looked for the answer at the SatCure website. It didn't take me long to find out what I needed – the site is very helpful. I ordered a digital satellite meter and a compass, which arrived next day. I then read the instructions and had a play with my own digibox, so I would know what to expect when I visited the customer's house.

I went over there the following day – the caravan is at the side of the house. He told me that he'd spent another fruitless hour

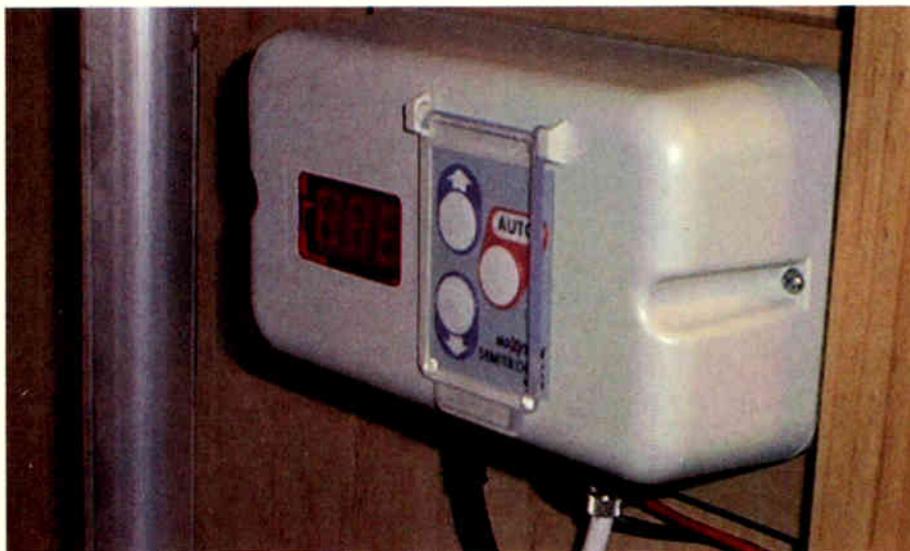


Photo 1: The control unit inside the caravan.

trying to get a picture and that his wife was upset and annoyed with him and the satellite system, because their one and only digibox lives in the caravan. So she couldn't watch the repeats of *Dallas* and *Ready, Steady, Cook*. Sometimes I feel like a Relate counsellor, saving dodgy marriages.

It was a lovely day for the job. Wet, cold and windy. He had already set the elevation according to the chart so, rather than spending time outside with the compass looking for 28.2°E. I turned the dish and sighted it by eye, to roughly the same angle as the dish on the house, then went inside the warm, heated van. I connected the meter in series with the digibox and carefully moved the dish from inside, looking for maximum meter movement and listening for an increase in the meter's tone output. When I was convinced that I had it right, I put the digibox back in circuit and was very relieved to see the picture it produced. I went into the services menu, pressed 4 then 6, and confirmed that the signal strength filled two thirds of the box and the signal quality produced a similar indication. It had taken me no longer than a quarter of an hour, from start to finish.

My customer was very happy with the outcome, but annoyed that the instructions with the unit hadn't mentioned these extra items that were needed. He promptly paid me for the satellite meter and compass, and my call-out fee. I wish all my customers parted with their money as gratefully as he did.

The Sony SLVE715

Earlier this week a customer brought in one of these high-quality VCRs. He described the fault as "chewing tapes". I thought, as you would, that the cause would be the usual problem with the little cast-aluminium arm sticking. Sure enough, once I had taken the lid off I found that it was solid. I removed, cleaned, re-oiled then replaced it, checking that its operation was nice and smooth. It was. So I plugged the machine in – and noticed that there was no display.

The machine worked well mechanically but, within minutes of being switched on, there was an unpleasant smell. I've had it before. This time, though the smell was similar, I knew that Tiddles wasn't to blame. After unplugging the machine I moved my nose to the area where the power supply is sited. This confirmed that the cause of the problem was leaking electrolytics. Those of you who have done this job before won't need reminding how awful it is. For those of you who haven't had the fault before, I'll try to explain what you have to do.

First, order an electrolytic repair kit from a Sony spares supplier, e.g. SEME part no. RK186G or Sony part no. A-6759-574-A. Remove the power supply from the VCR.



Photo 2: The dish in the lowered position.



Photo 3: The dish in its raised position

taking what seems like ages to get the bottom and top off, because Sony soldered them on. I like to remove the cage, which is effectively the outside of the power supply, as the components are then easier to get at. Then try to remove all the glue that Sony likes to use to stick the capacitors to other components.

Unsolder all the electrolytics from the secondary side of the board – you don't have to be too careful about noting their values and circuit positions, because Sony incorporates a leaflet inside the packet with this information on it. Once they have all been removed, clean the board with methylated spirits to remove all the electrolyte that has leaked out on to it. I use a toothbrush and cotton buds, with my trusty magnifying glass – my eyes aren't as good as they used to be. Take care and clean both sides of the PCB, as you may have to replace some components whose legs have rotted off. Inspect the board really carefully, as it will be almost impossible to check for problems once the

board is back in its case.

Normally I find that it's necessary to replace one or two rotted shorting links on the top of the board, and sometimes missing track that the acid has eaten away on the bottom – use thin insulated wire.

When you are happy that you've replaced all the capacitors the right way round – checking twice isn't a bad thing to do – reassemble the board back into its cage. Take great care over resoldering the earth lugs, and remember to refit the plastic insulator strips that go between the print side and the metal bottom of the case.

When you are satisfied that everything looks OK both electrically and visually, fit the power supply back into the VCR, switch on, cross your fingers, and try it. Hopefully it will work first time, and both you and your customer will be happy. ■

List of satellite kit suppliers

Transleisure Ltd

Stiller House, Cross Green Way,
Cross Green Way, Cross Green
Industrial Estate, Leeds, LS9 0SE
Tel: 0113 240 1155
www.transleisure.co.uk

ROADPRO

Andy Harris, 37-39 Peckham Road,
Camberwell, London, SE5 8UH
Tel: 0808 100 0226
www.roadpro.co.uk

Clearview

Mr Van Reysen
380 Walton Road, West Molesey,
Surrey, KT8 2JG
Tel: 0208 941 4042
www.clearview.co.uk

Maxview Ltd

King's Lynn
01553 813 300



LETTERS

Design faults

Two correspondents in your January letters column draw attention to what are actually product design faults. Mark Davies mentions the Response surveillance camera and its scart connector. When I worked in the returns department at Maplin, where I was responsible for testing all returned video and related products, I too found that the video ground was missing – it should be connected to pin 21 (plug shield). I contacted Response and explained the problem and was told that it would be attended to. That was two years ago. No action appears to have been taken.

Peter Hanlon mentions the chopper power supply in the Amstrad Model CTV3021N, based on a TDA4605 series IC. The -3 version of the IC simply indicates a master mask version, with no

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obvious changes in basic characteristics. It shouldn't, in most cases, make any difference which version of the chip is used in this type of power supply. The 270/220/330kΩ resistor is another matter however. When I worked for NEI the 270kΩ resistor, R109 in the chassis concerned, was noted for failing, killing the BU508 chopper transistor but, fortunately, not the TDA4601 IC. Despite our technical department's protestations, the designer refused to recommend that a metal-film resistor should be used in this position. His argument was that the power dissipation was below that required. Sadly he missed the point.

Carbon-film resistors have a 'working voltage' irrespective of dissipation. An 0.25W carbon-film resistor's working-voltage rating is 250V DC. As the voltage across the resistor in the circuit was 360V, it would obviously fail sooner or later, going high in value of open-circuit. Only a metal-film resistor is suitable in this position, as metal-film resistors are in most cases rated at 500V DC. If one isn't available, don't use a 2W carbon resistor. But, as a temporary repair, two carbon resistors in series can be used. If the value

required is 270kΩ, then 120kΩ + 150kΩ can be fitted as a temporary solution, thus dividing the voltage across each in the ratio of approximately 40/60 per cent.

Needless to say eventually, after lots of failures, agreement was finally reached on the use of a metal-film resistor. But it's strange that even now setmakers are unwilling to accept that a metal-film resistor is needed in this position.

*Denis Mott,
Huddersfield.*

The TV fire hazard

Denis Mott's article (January) on this subject was of great interest to me, particularly after my article on the subject in the February 2001 issue. I agree that the line output stage is probably the area most vulnerable to dry-joints that can lead to a fire, and Denis is quite right about the effects of carbonisation. These dry-joints are more likely in chassis from some manufacturers than others, and there can be variations in the areas affected. This suggests manufacturing faults rather than the fact that high pulse currents flow through the connections.

Components are not above suspicion, especially the blue rectangular capacitors manufactured by Philips. The mains switches used in some Philips sets are prone to burning.

A fault that's starting to crop up quite regularly with some Philips CRTs is a dry-joint at the line-scan connection of the scan-coil socket mounted on a small PCB on the tube. These CRTs are used by a number of setmakers, including Philips, but some wire the cables from the main PCB directly to the scan coil connection tags instead of using the socket. Most of the sets affected have been those with the Philips FL1.0 series and later chassis. In all but one case I've found that the line output transistor has gone short-circuit, shutting the set down. In each case I've asked the customer whether there had been any clues that the set might be about to fail, and in each case the answer has been no.

As far as I know this PCB and its socket are not available, nor are the cable loom and plugs that are connected to it. I

Spares supply

I read with interest Michael Maurice's letter (February) and sympathise with him and others in the trade who have difficulty in obtaining spare parts for 'budget'-brand equipment. In defence of ourselves and the other distributors mentioned I have to point out that, like it or not, the days are gone when a manufacturer would keep stocks of spares for each model for many years after it ceased to be sold. We find that in many cases manufacturers and importers keep only a limited supply of parts for a limited period, then they themselves have to order parts for us to distribute. This can take many weeks, hence the delays experienced by your correspondent and the frustration felt by us all in not being able to provide the service expected.

Manufacturers for whom we distribute genuine parts, including Schneider, do their best to minimise the problem. But consumers today demand innovation and improvement at the lowest possible price. This puts pressure on manufacturers, one result being that a less than satisfactory spares inventory is held. The public has always expected spare parts to be readily available no matter what quality product they choose to buy or its price. It is difficult to re-educate consumers about this, particularly when the purchase has a leading brand name on it – though, as we know, the product may use a 'budget' chassis.

Spares distributors suffer as much as everyone else from delays and lack of availability. I can assure you that we and the majority of our competitors always do our best to satisfy the needs of the trade.

*Ron Blyth, Wizard Distributors,
Manchester M16 9EN.*

repair these sets by removing the socket, cleaning and retinning the pins, cleaning the PCB then refitting and resoldering the socket, using a piece of wire to hard-wire the affected pin to the coil tag. But is this an acceptable method? Strictly speaking the CRT should be condemned, and one should estimate for a new one. We have to live in the real world however, and no one would accept an estimate for a new CRT. Suppose the customer sought a second opinion and the next engineer repaired the set without replacing the CRT? You would look like a fool at best and a con man at worst. Neither would do your reputation any good.

More and more manufacturers are designing their sets to be put into standby for long periods, even arranging for a degaussing circuit to be activated for a few seconds when the set is brought out of standby.

As I have said before, it's my opinion that poor manufacturing coupled with the need to use the cheapest materials available – the public wants its TV sets to be ever cheaper – are the main contributors to the development of faults that result in sets catching fire.

*Michael Maurice,
Wembley, Middx.*

With respect to the faulty set fire discussed by Denis Mott in his article in the January issue, it would not necessarily be apparent that the set had started to smoulder at the time it was unplugged. The fire must, in the case quoted, have started before the set was unplugged, but such smouldering might not be apparent. I suspect that Denis Mott overestimates the amount of smouldering needed to escalate slowly into a full-scale fire.

It seems that for complete safety an appliance must, if there is any doubt, be removed from the building. In the case discussed in the article this would have been the obvious step to take had the risk been known.

*Brian Gilbert,
Hampton, Middx.*

Denis Mott's article on the TV fire hazard (January) was excellent. Though I realise that it presented his own personal views, they were all common sense and should be taken seriously. I have a different view on one point however.

On the subject of standby operation, Denis Mott says he has never seen a TV fire that was started by the power supply then, later, strongly suggests that the viewer switches the set off at night. In an ideal world I would agree. But saying "never leave a set in standby" is rather like saying "never cross the road". Where I live there is a very high percentage of elderly and disabled people who, once the carer has left, have no way to reach the

Stunningly-good pictures?

It depresses me to read letters praising "stunningly-good" digital pictures (November, page 32). Does the writer watch only cartoons, or perhaps have a 25-year old set with its original CRT? If you look at live moving pictures on a grade one monitor in the RGB mode you can see that digital processing degrades the picture far more than PAL ever did.

When colour transmissions became a regular feature in the late Sixties I used to compare RGB and PAL studio pictures side by side. The degradation with PAL was very noticeable. But we now have excellent comb filters in our PAL decoders: this makes the difference much less obvious, especially with still shots.

The numerous digital artefacts and an appalling loss of chroma bandwidth make digital viewing very uncomfortable for me. A further point is that terrestrial digital reception is very unreliable here – at only three miles from the transmitter.

My top-of-the-range Sony DVD player produces a tolerable picture on a 32in. Sony receiver in the RGB mode. I would not however class it anywhere near the standard achieved with a live PAL broadcast. Unfortunately even these are subjected to digital processing between the studios and the transmitters, so comparison is nowadays impossible in the home.

When consumers accept appalling quality as the norm, the industry is only too happy to oblige. It seems that we are never to see pictures in the home as they should be.

*Chris Cory, T.Eng.,
Thatcham, Berks.*

wall socket. I spend quite a lot of my time telling them not to be too concerned about leaving their TV sets in standby, and point out that they have a VCR and/or a satellite receiver that has to be left switched to standby, not to mention clock radios, music centres, microwave ovens and a number of other small electrical items around the house. I reassure them that the items left in standby are no more likely to cause a fire than the wiring in the walls, and that manufacturers are not allowed to make dangerous TV sets. My pet warning is about double adapters.

*John Hopkins,
Felixstowe, Suffolk.*

Thomson TX807 chassis

I found Mark Paul's explanation of the operation of the Thomson TX807 chassis very helpful. One word of warning however. If you get one of these sets in without the remote-control unit and it just sits there with the standby light slowly flashing beg, borrow or steal a remote-control unit and push standby before you delve into the power supply, micros and line output stage. The set has been put into standby before being disconnected from the mains supply. Guess how I found out!

*Jim Lesurf,
Dagenham, Essex.*

DVD player jitter rate

Nick Beer brought up the subject of the jitter rate in the DVD fault reports in the January issue. When we first started to look at DVD players we obtained some very good information from Panasonic. With respect to the jitter rate, it quotes

'082' (8.2 per cent). I have found that this is exactly right, and that correctly working units barely deviate from this figure, which is a far better one to take than any quoted in service manuals.

Based on this information, if I was presented with the problem Nick had – a player that failed to play some discs and had a jitter rate that was within the 12 per cent specified in the manual – I would not have hesitated about replacing the optical block, irrespective of whether the unit played other discs all right.

*Geoff Darby, Monitech,
Earls Barton, Northampton.*

Connection problems

This little episode has taught me to check connections properly before trying to tune in a customer's 'faulty' equipment.

The customer had acquired a new VCR and had attempted to tune his TV set to it. He'd lost the TV picture, while the VCR produced only a snowy picture. When I disconnected the VCR and retuned the TV set I obtained perfect pictures. But when I reconnected the VCR the picture almost vanished in snow. There were no obvious clues with the VCR so, assuming a tuner fault, I tried another VCR. Same results! This had to be something silly. Looking behind the TV set and VCR, as I should have done before, I found that the customer had somehow managed to get the VCR's RF output lead plugged into the wall socket – the RF connections to the VCR were reversed!

Once the leads had been swapped over the TV set and VCR produced excellent pictures.

*Mark Mobbs,
North Walsham, Norfolk. ■*



DX and Satellite Reception

Terrestrial DX and satellite TV reception reports. Broadcasting and satellite band news. Shared-dish system update. Roger Bunney reports



A Fox news feed received via PAS-3R (43°W).

December was a very active month for analogue terrestrial DX-TV reception. Enthusiasts in the south and south-east parts of the UK benefited from an intense three-day spell of tropospheric activity, from the 9th to the 11th. Numerous W. German Band III and UHF stations were received on the 9th. On the 10th reception was more from the north east, including NRK (Norway) chs. E5, 6, 8 and 9 and DR (Denmark) chs. E10 and 12. Band III and UHF TV signals were also received from France and the Benelux countries. On the 11th the main reception was from Denmark (chs. E5, 7 and 10), Germany and RTL (Luxembourg) ch. E7. Sporadic E propagation on the 5th produced an unidentified film on ch. E2 in the mid afternoon. During an evening opening on the 6th programme material was received in ch. R1, from 2045 hours, again unidentified.

More significant however were the F2 layer conditions during the month. There were high-level signals in ch. R1 throughout, though on many days conditions didn't develop until mid morning, when most of us would have been at work. Ch. E2 has also provided many signals, from before 0900 onwards. Cyril Willis (King's Lynn) has been trying a new (internet) method of channel identification, using a scanner to check frequency offsets. The method has still to be perfected, but he has already confirmed Thailand with the vision carrier at 48.2499MHz and Iran at 48.2396MHz. Despite careful monitoring however not a single video buzz was heard in either NZ ch. 1 or the Australian ch. 0 (45.25 and 46.25MHz vision respectively).

On several days, in particular after the 21st, Cyril also experienced F2 back-scatter reception in ch. E2, from the early afternoon. The signals originated from the NW. US 50MHz radio amateurs were monitored on a number of occasions.

Here at Romsey massive ch. E2 signals were received on December 30th. There were pictures from Syria but, at the audio carrier frequency (53.75MHz), only strong Arabic Koran chanting was present. This obviously didn't match the video. It could have been Dubai audio. Very odd.

Ryn Muntjewerff (the Netherlands) received ch. E3 signals from Malaysia, Iran and Thailand (TV3) and in addition sighted a Khazakistan-TV ch. R1 caption.

As I type this on New Year's eve 2001 chs. E2 and R1 are both 'wide open'. There were strong F2 signals during the morning period, though the MUF for transatlantic propagation barely rose above 36MHz. The following morning however there were Russian communications signals at up to 48MHz. Again, very odd.

How strong have these F2 signals been? I measured Syrian ch. E2 vision (48.25MHz) at 1030 hours on December 30th, using a horizontal wideband dipole (no preamplifier) to feed a field-strength meter at 75Ω. Despite wide signal-level swings over just a few seconds, the signal was peaking at 0.7mV. Swings were between 50μV and 700μV over perhaps 3-4 seconds. Using a standard discone aerial, which has predominantly vertical polarisation, I found that the signals were much more stable. This illustrates how even basic aerials can provide exotic signal reception.

My thanks to Iain Menzies, Peter Schubert, Ryn Muntjewerff, Ian Beckett, Paul Barton and Cyril Willis for their reception reports.

Satellite sightings

After the tragedies in late 2001 and the events in Afghanistan, which produced an abundance of news feeds, December was relatively quiet. News feeds from Afghanistan have been considerably reduced, with only a few up-linkers intermittently 'on carrier' via Europe*Star-1 (45°E) and broadcasters sharing time with the satellite units still in Kabul.

It has been customary to see various Christmas greetings via transatlantic and European circuits but, with the EBU now using MPEG 4:2:2, many have disappeared. The only real greetings test card was from Quick Link Connections on December 26th –

a Happy Holidays caption seen at 11.590GHz V (SR 20,145, FEC 3/4) via NSS K at 21.5°W (a Globecast lease).

A Sky news flash on December 22nd led me to check PAS-3R (43°W) for breaking news on the attempt to bomb the American Airlines flight 63 from Paris De Gaulle to Miami, which was diverted to Boston. Fox News US always seems to carry breaking news first, from its terrestrial network affiliates, and produced the first updating statement from an airport official. Check the Fox lease at 11.579GHz H – it has the unusual SR 19,875 with FEC 3/4. Three other signals share this frequency: Fox News Edge, Future-Channel 4, which that night was carrying sports news, and FSN-Houston which carried test bars – I assume that this is Fox Satellite News from Houston, Texas.

Those into French political affairs would have found an evening political meeting carried via Intelsat 801 (31.5°W) on December 6th of interest: called *La France Qui Change*, numerous politicians made prolonged speeches. I came across it at 11.025GHz V, with SR 5,632 and FEC 3/4, a familiar French TV network downlink frequency. The service identification is 801.CANAL240F2. It's unusual as the French TV feed symbol rate is generally 6,111 rather than 5,632.

Israeli-Palestinian unrest continues. Breaking news can often be seen via the APTN Hot Bird (13°E) downlink at 12.581GHz H (5,632 + 3/4). With London-uplinked signals, which seem to benefit from a high EIRP, it's possible to receive signals using a dish as small as 65cm. But the Jerusalem uplink APTN Jerusalem/Path One at the same, shared frequency is often at much lower strength, while the other Israeli uplink, Satlink Millenium, would be difficult to lock with a dish of less than 90cm diameter. Edmund Spicer (Littlehampton) says that the latter two signals show only a 30 per cent signal level with his Manhattan Plaza receiver and refuse continuous lock. There was more on the Milosevic trial at the same frequency during the second week of December, with Intrax HOL-12 providing the uplink. This signal was very strong, lockable with a 65cm dish. Serbian speech and an English translation were on the LH and RH channels respectively. It's not all bad news at 12.581GHz. Nick Brigden reports reception of a Robbie Williams OB at a newly opened Warner Village cinema at 2200 hours on December 6th: at the end of the transmission there were colour bars with the identification APTN London.

Winter can bring flooding. Roy Carmen (Dorking) reports seeing a dreadful mud-slide in Northern Italy, with homes and a village destroyed, via a new Eutelsat W2 (10°E) feed at 10.955GHz H (SR 2,820, FEC 3/4): the uplinker was identified as Tadiran Scopus. He saw pictures from a boat show in the US via Eutelsat's Atlantic Bird 2 (8°W), at 12.729GHz H, with the unusual digital parameters 6,823 SR and 7/8 FEC. Thank goodness for digital receivers that provide both SR and FEC auto search!

Broadcast news

UK: A new RSL TV station, My Television Portsmouth, is transmitting to Portsea island on ch. E29. The transmitter appears to be atop a water-front high-rise at Gosport. Transmissions are from 0600-2400 daily, with news from ITV at 0700, 0800, 0900, 1200, 1400, 1700 then hourly until 2200. The duration of the afternoon news periods can vary depending on programmes. More information is available at the website www.mytvnetwor.co.uk

China: Experimental digital transmissions are being carried out in Beijing, Shenzen and Shanghai. The intention in China is to go digital with cable networks initially, then follow up with satellite and terrestrial services.

Czech Republic: Digital TV transmissions are expected to start in April 2003, with nationwide coverage by early 2006 and an analogue switch-off during 2012. Public broadcaster CST and the commercial stations Prima and Nova will go digital.



An initial news break on the shoe-bomb episode during American Airlines Paris-Miami flight 63 on December 22nd. Again Fox via PAS-3R.

Germany: Six digital terrestrial TV (DVB-TV) broadcasters are now in operation in Berlin.

Satellite news

The Europe*Star-1 satellite (45°E) provided considerable coverage during the Afganistan conflict. Recent tests have confirmed that it can provide a single-hop UK-Australia path for news feed

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been written with repair technicians in mind. The book covers data compression theory, 8-VSB and COFDM modulation, the MPEG-2 compression algorithm and, perhaps more relevant to us, the operation of set-top boxes for TV use. But an understanding of mathematics and computer theory is necessary to grasp the theory covered.

There are seven main sections: programming data stream structure; COFDM; the architecture of STBs; ATSC principles (this is the US terrestrial digital system); a comparison between DVB-T COFDM and ATSC 8-VSB; HDTV; and standard theory. A glossary of digital terms towards the rear is a help. The solidly-packed book runs to 231 pages including an index, is approximately A5 size and has soft card covers.

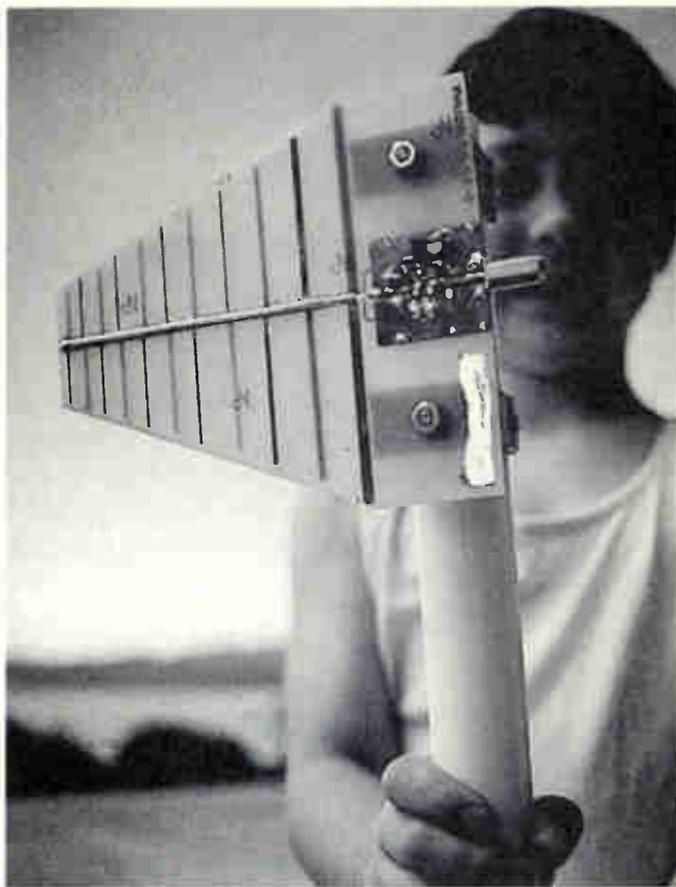
The specialised nature of the book explains its relatively high price of £30 including UK postage. It is being distributed in the UK by Baylin Publications, 24 River Gardens, Purley, Reading RG8 8BX, phone/fax 01189 414 468 or e-mail

vincentbay@hotmail.com

For postage by air to continental Europe add 10 per cent to the price. Add 30 per cent for air mail to countries outside Europe. Optional insurance costs £3.

The book is also available from Foyles, Charing Cross Road, London; Blackwells, Oxford; and the Modern Book Company, Praed Street, London (phone 020 7402 9176). ■

A PCB log-periodic aerial recently introduced in New Zealand for SDStv use, incorporating a preamplifier with a gain of 15dB. The total gain (aerial plus preamplifier) is 21dB. The assembly is protected by a weatherproof housing (not shown).



Antenna Toolkit

Second Edition

Joe Carr has provided radio amateurs and short-wave listeners with the definitive design guide for sending and receiving radio signals with Antenna Toolkit 2nd edition.

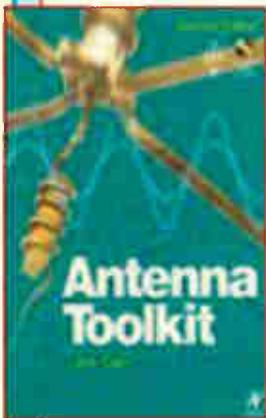
Together with the powerful suite of CD software, the reader will have a complete solution for constructing or using an antenna – bar the actual hardware! The software provides a simple Windows-based aid to carrying out the design calculations at the heart of successful antenna design. All the user needs to do is select the antenna type and set the frequency – a much more fun and less error prone method than using a conventional calculator to solve formulae.

The new edition has been revised to include further cases of propagation, additional antennas and also two new chapters – Small Loop Antennas (a topic of considerable interest, which has been the subject of much recent debate in the amateur radio press); and Yagi Beam Antennas (widely used at HF and VHF). The CD software has also been updated.

Joe Carr's expertise in the area of antenna design is legendary. Antenna designers, whether hobbyist or technician, can be assured they need look no further than Antenna Toolkit for the complete guide to understanding the practicalities of using and designing antennas today.

Preface: Radio signals on the move: Antenna basics: Wire, connection, grounds: Marconi and other unbalanced antennas:

Doublets, dipoles and other Hertzian antennas: Limited space antennas: Large loop antennas: Wire array antennas: Small loop antennas: Yagi beam antennas: Impedance matching: Simple antenna instrumentation and measurements: Getting a good ground: Index.



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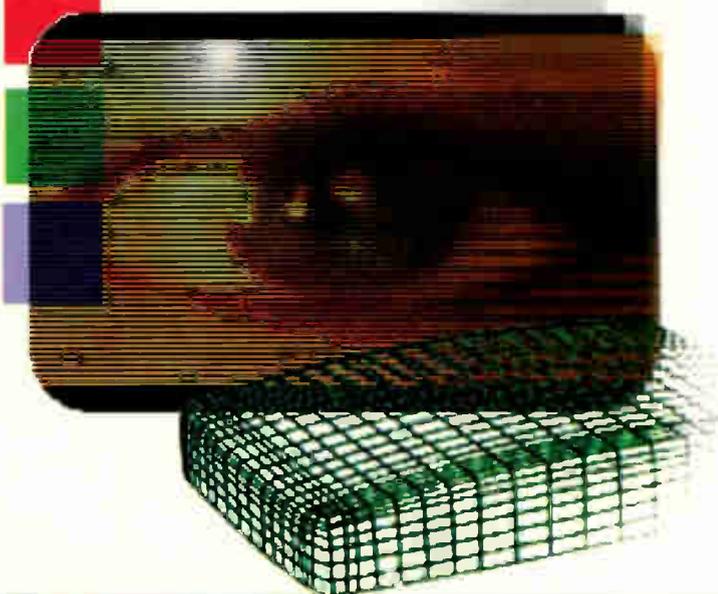
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We welcome fault reports from readers – payment for each fault is made after publication. See page 298 for details of where and how to send reports.

Bush 1433 (11AK20S chassis)

If the problem with one of these sets appears to be poor HF response in the video output circuitry, check the following resistors on the tube base panel: R931, R932 and R933. They are all 150kΩ. You will probably find that one of them is open-circuit. M.D.

Aiwa VXT1000

If the STK7348 chopper chip in one of these TV-video combi units fails intermittently, replace C88 (3,300pF, 1kV) in the snubber network. In one set I had recently this capacitor appeared to be perfect when checked with a capacitance meter but broke down when checked with my insulation flash tester. M.D.

Sharp DV5150 (S3B chassis)

If the top part of the field scanning is expanded, with the auto grey-scale RGB test lines showing, replace C712 (100μF, 35V). It's the reservoir capacitor for the 24V supply. M.D.

Matsui 2180TT

There was sound but no picture. A check on the first anode voltage showed that it was low at 200V. When the first anode lead was disconnected from the tube base the voltage remained low, so I replaced the line output transformer. But the fault was the same as before. Very strange! After about ten minutes an out-of-focus picture started to appear. The penny then

dropped. The tube base socket was electrically leaky, pulling down the focus voltage and in turn the first anode voltage – the A1 potentiometer is in series with the focus control, on the chassis side, a standard arrangement with most LOPTs. When I opened up the tube base socket it was green inside, a sign of dampness. A replacement socket from a scrap set cured the fault. M.D.

Toshiba 2512DB

If there are EW problems, replace all five electrolytics on the stand-up EW PCB before looking any farther. M.D.

Thomson ICC17 chassis

This 32in. widescreen Ferguson set had an EW geometry problem, with the width at maximum. Checks revealed that the EW modulator diode DL22 (BYW76) was leaky and that the BD241C driver transistor TL41 was defective. But there was still an EW problem when replacements had been fitted. Further checks showed that there was no parabolic waveform at the base of the BC546B pre-driver transistor TL42, which was faulty. There was still no parabolic waveform when TL42 had been replaced, and cold checks showed a dead short across the shunt zener diode DL42 in its base circuit. DL42 wasn't the cause of the trouble however. The TDA8855H jungle chip (IF strip, colour decoder and timebase generator) IV01 was to blame. It's a 64-pin flat-pack device.

After three attempts with my Pace desoldering station I'd still failed to remove it. I then realised that it was glued to the PCB, and had to resort to pin-by-pin lifting to remove it. A replacement cured the fault. Just as well, as the original IC was now totally wrecked! M.D.

Sony K VX2572U (AE2B chassis)

This set was dead – when it was switched on the standby LED blinked thirteen times. A quick check with the manual revealed what this means: vertical protection is in operation. The cure was a new field output chip (IC1501, type STV9379, part no. 8-759-192-71). P.S.

Philips 28PW6324/05R (SA8.0E chassis)

The symptoms with this widescreen set were sound and a dim raster. My first check was to try a scart input. There was no difference, ruling out front-end problems. Using my sense of touch, I then noticed that the RGB output chip's heatsink on the CRT base panel was getting red hot. It ran cool when the tube base was pulled off. Tapping the tube's neck quite firmly brought the picture back.

Further tapping produced red streaks across the screen. There was possibly a grid-cathode short, but the only remedy was to replace the tube. Poor insurance company! **P.S.**

Sharp 59DS03H

These sets are starting to come into the workshop with the dead-set symptom. You will find that the 3.15A mains fuse is open-circuit and the following items are short-circuit: the chopper FET Q701 (part no. RH-TX0166BM22), the zener diode D712 (part no. RH-EX0419BM22) and the BUH515 line output transistor (part no. RH-TX0144BM22). If you are lucky the set will work once these items have been replaced. It could be stuck in standby however. In this case go straight to Q702 (BC338) in the power supply. You will find that it's short-circuit base-to-emitter. **P.S.**

Bush 2857NTX

Nicam 'popping' is a known problem with this model. The cure is to replace the 13.104MHz crystal X001 on the Nicam board. **P.S.**

Philips 21GR2350 (G90AE chassis)

I've repaired dozens of these sets but have never before had a no sound fault. The cause turned out to be the TDA8191 intercarrier sound/audio output chip IC7220. Wonders never cease! **P.S.**

Mitsubishi CT28BW2BD

This set would try to start up then revert to standby. It's not the easiest chassis to service. By trial and error I discovered that D507 (BYD33G) was short-circuit. It provides the 28V supply for the field output IC. **P.S.**

Beko 28328T

If the picture takes a long time to appear, replace R213/4/5 (22k Ω) on the tube base PCB. If this doesn't cure the problem, replace the line output transformer. The SEME code number is LOPTX1173. **P.S.**

Panasonic TX25MD3 (Euro-2M chassis)

This set was stuck in standby. The cure was simple, to replace Q1212 (BC847B) which drives the power supply switching relay. But it had blown apart, and I couldn't find any reason why.

When I switched the set on all was well apart from a whistle (at about 10kHz) on the sound. A very expensive replacement audio processor chip cured this fault.

Was there a connection between these

faults, and will the set bounce? Who knows?! Watch this space! **D.H.**

Goodmans W288NS

This newish widescreen set was dead with the mains input fuse blown. Initial checks showed that two of the mains bridge rectifier diodes were short-circuit, so I replaced all four with upgraded diodes. As there were no measurable shorts I replaced the fuse and switched on. The fuse blew violently, and a strange smell came from the chopper transformer. I fitted a new transformer (it's available from CPC), a new fuse and switched on again. This time the fuse remained intact, but the power supply was dead. A new TDA4601 chopper control IC completed the repair. I've always found it best to replace this IC with the type originally fitted, i.e. Siemens in these sets. **C.D.**

Bang & Olufsen LX5500 (type 3903)

According to the customer this set had become hard to turn on from standby and was now stuck in standby. I didn't have any service information, so I decided to check the capacitors in the power supply. C20 and C25, both 47 μ F, 50V, measured low. Replacements cured the fault. **C.D.**

Matsui 28WVDP (Grundig CUC2059 chassis)

Another newish widescreen set that was completely dead. Both internal mains fuses were blown, because the BUZ90A chopper transistor T60006 was short-circuit. I checked the high-value resistors in the power supply and found that R60001 (270k Ω) was open-circuit. Once these items had been replaced the set ran reliably. **C.D.**

JVC AV21F1EK

A very dull, greeny-looking picture would eventually appear, after waiting for several minutes. Voltage checks at the CRT's cathodes revealed little. I decided to try another tube and was rewarded with an excellent picture, which you get with these sets. **C.D.**

Bang & Olufsen LZ5000 (type 3766)

This set displayed field flyback lines and had height and linearity problems. Having no service information, I decided to check the capacitors in the field time-base circuitry. The following produced low readings: C44, C45, C47, C48, C49, C54 and C26. Replacements cured the fault symptoms. **C.D.**

Grundig P27-649/12

This 10in. mains-battery portable worked

all right with a mains supply feed but wouldn't start with battery power. After chasing around the power supply for a while I found an auxiliary switch behind the mains switch knob. It starts up the set on battery only. The fault was cured by resetting the contacts and adjusting the switch position.

The cause of many complaints about failure to start with battery operation can be traced to inadequate wiring or connections. If the voltage measured at the set drops below the low-voltage cut-off point (usually about 10.5V) for even a short time the set may not start. When testing on the bench, be sure to use an oversized power supply or, better still, a fully-charged battery. **R.B.**

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

I should have had my suspicions about this set when it arrived in several cardboard boxes! The dealer reported a power-supply problem which, it transpired, was caused by a faulty zener diode across the feedback optocoupler. Numerous other faults were repaired, then the set was returned to its owner.

A few weeks later it came back. It refused to start up, with the red LED flashing fast. This indicates a protection fault. There are two ways of starting one of these sets when it's in this condition: either use the dealer service tool (DST) to put the set in the service default mode, or short the test pins on the small-signal panel, next to IC7600. Provided the fault is not one likely to cause damage – loss of field scan for example – the set will then start up. In this case use of the DST wouldn't start the set, but shorting the test pins did. This is a clue, because certain error codes are ignored only when the internal test pins are used.

The set was now running in the service-default mode. In this state all the analogue control values are set to mid-point and the set is tuned to 475.25MHz. I could use the DST to read the error code, which was 74 – series switch faulty. The series switch is a MOSFET in the HT feed to the line output stage. It can switch this supply off under certain fault conditions, controlled by the main microcontroller chip. The switch is checked when the set starts up: if it doesn't respond as expected, the set will shut down. Usually the problem is a shorted switching transistor (Tr7470), but not in this case.

The presence of line flyback pulses is detected on the digital deflection panel (DDP), which tells the microcontroller chip if there's a problem. After much dismantling I was able to reach the compo-

ment side of this panel to carry out oscilloscope checks. I found that the op-amp which detects the flyback pulses, IC7360, didn't produce any output during the short period when the line timebase ran. The pulses are fed to pin 2 via diode D6316, to turn it on. In this case the associated 10nF reservoir capacitor C2334 gave an open-circuit indication. It's a surface-mounted ceramic capacitor. A replacement cured the fault.

The last part of the repair was to go back into the service mode and clear the old fault codes from the error buffer, to avoid confusing the next technician on the scene. **R.B.**

Toshiba 255R7B

This elderly set produced a good picture most of the time, but the line phasing went astray intermittently, producing a broad black band at the right-hand side of the screen. I resoldered a number of obvious dry-joints and replaced the capacitors around the TDA2579 timebase generator chip, but none of this helped. The cause of the fault was eventually traced to dry-joints at the pins of the IC itself. **R.B.**

Sony KVE2532U (AE2 chassis)

The picture displayed a variety of 'digital' effects: poor sync, mosaic, and odd colours. I went straight to the digital comb filter, where the luminance output consisted mostly of chroma information. This was an early version of the circuit, with the comb filter in a multi-legged hybrid IC. Later versions of the chassis have a surface-mounted package. Fortunately the part is still available, and the replacement cleared all the symptoms. **R.B.**

Panasonic TX32PG30 (Euro 7 chassis)

The set was stuck in standby – there was no degaussing, and no relays operated. This suggested a problem with the central control system, which is on plug-in PCB U. I would have liked to plug in a replacement panel, but didn't have one available. So I had to diagnose the cause of the fault properly!

Several useful monitor points are taken to a test plug on the main PCB, next to the control module. I found that the 5V and 3.3V supplies were OK, but the reset line going into the board was stuck half way between the rails. Unplugging the board restored the reset, so it was being loaded by something on the board.

Most of the power and data lines on the board are decoupled by tiny surface-mounted filters, which consist of two coils and a capacitor in a package the size of a surface-mounted resistor. LC1118, which feeds the reset line, was leaky. **R.B.**

Sharp DV5131 (S3B chassis)

This set was stuck in standby, which means that the power supply is working

but the 5V and 12V supplies are not being switched on by transistors Q703 and Q707. Fusible resistor R744, which biases these transistors, was open-circuit. But a replacement restored only the 12V supply. The 5V supply was at less than 2V. This supply comes via two 1N4004 diodes, D732 and D733, one of which was almost open-circuit. I decided to replace the two of them, after which the set worked normally. **G.D.**

Grundig CUC7301 chassis

When rebuilding the power supply in one of these sets remember to check the condition of C626 (47µF, 385V), the mains bridge rectifier's reservoir capacitor. Otherwise the new parts will have a lifetime of only a few seconds! **G.D.**

Bush 2874NTX

There were three coloured lines across the screen and no picture. The cause was the TDA8351 field output chip. With this fault the 100Ω fusible resistor next to the IC also fails.

Before returning the set to the children's home from which it had come I spent a little while wondering why the front-panel controls didn't work. The child lock was on of course! It's worth remembering that the set will be stuck in standby. If this happens and you don't have the remote-control unit to hand you could spend a long time searching for a non-existent fault. **G.D.**

Ferguson T14R (TX805 chassis)

The jolly bin man brought this immaculate set along. He'd found it with some rubbish and decided I'd like it. When I tried the set I found that it tripped slowly, with the LT supplies appearing for a second before dropping again. A new line output transformer was required. After fitting this, the inevitable aerial socket and obtaining a new remote-control unit there wasn't much by way of profit! **G.D.**

Sony KVA2512U (AETC chassis)

A fault you can get with these sets is sound crackles with the OSD flashing on and off. If you've checked the soldered connections to the audio output chips IC251 and IC261 and the 5V regulator IC604, which is hidden by a chassis extrusion, try replacing CV1101 on board A1 (Nicom decoder). It's one of those orange trimmers that are not as reliable as they should be. I fitted a 39pF fixed capacitor, which worked for me. **D.F.**

Ferguson 59K5 (ICC5 chassis)

The problem with this set was very intermittent failure to start or tripping whilst on. What made matters worse was that the set tended to fail only when assembled. In the end I managed to instigate the

fault with the chassis standing vertically and slightly flexing it. In this condition the protection input at pin 28 of IL14 (TEA2029C) was being activated. The cause turned out to be loss of base bias at TL17, as one end of RL18 (4.7kΩ MELF) was lifting clear of the PCB. You will find it near pin 1 of the line output transformer. **I.B.**

Panasonic TX25MD1 (Euro-2 chassis)

The report said that this set was dead. In fact the power supply was running but there was no supply to the line drive circuit, because F851 (1.25A fuse link) was open-circuit. A resistance check showed that there was a 4Ω short-circuit across this supply. At first I suspected the field output chip IC451, which is also fed from this 28V supply, but the cause of the trouble was a short-circuit between the primary and secondary windings of the line driver transformer. Normal operation was restored once a new transformer and fuse link had been fitted. **I.B.**

Toshiba 2505DBT

The field scanning was very distorted. The bottom was folded about a third of the way up the screen, the top was folded down a little, and there were black lines across the field. The main capacitors in the field output stage has already been replaced. A check on the field drive at pin 8 of the TA8739P field generator and EW correction chip Q371 showed that a great deal of noise was present. The feedback to pin 6 had a ramp, as it should, but with HF sitting on top of it. Checks in the field feedback network revealed that C317 (1µF, 50V) was leaking electrolyte. A replacement restored correct scanning. **I.B.**

Hitachi CPT2476 (G6P chassis)

The only result when this set was switched on was a quiet noise from the power supply. The HT read about 25V, which rose to about 50V when the feed to the line output stage was disconnected. The cause was a dry-joint at the anode of the chopper circuit efficiency diode D902. It looked fine, but when the diode was pressed the blob of solder could be seen to lift away from the print. Resoldering restored normal operation. **I.B.**

Tatung 180 chassis

This receiver, a Decca DBS9892, would run for several hours before producing the dead-set symptom. Any movement of the chassis made the fault come and go. I found that the supply to the line driver stage disappeared when the fault was present. The supply goes via pin 1 of connector M001 on the AV PCB, then off to the audio output PCB, before returning to pin 15 of M001 and then to the line driver circuit. There was a dry-joint at pin 15 of MN001. **I.B. ■**

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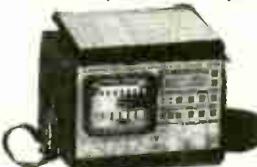
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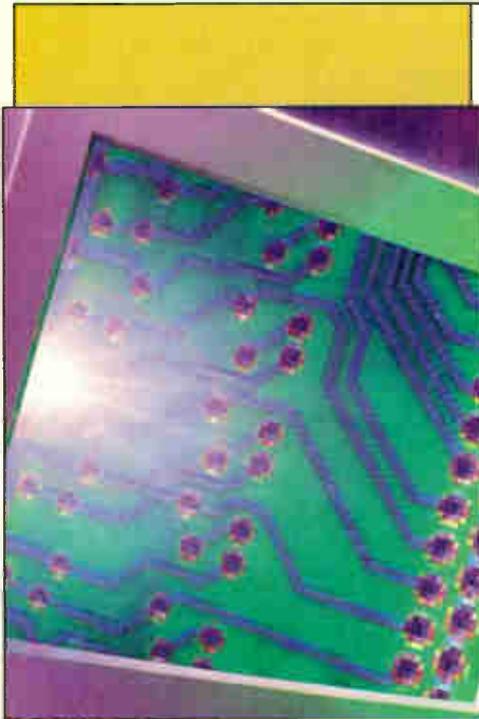
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Sony CPD17SF2

The EHT could be heard charging up when this monitor was switched on. But after a few seconds it would decay again and the green and amber LEDs would both flash continuously. Checks in the power supply revealed that the 12V output was missing, with the 0.12Ω fusible surge limiting resistor R605 open-circuit. The cause of the trouble was the TDA8172 frame output chip IC504, which was short-circuit. G.B.

Taxan EV410LR

Low tube heater voltage is caused by C811 and C814 (both 470μF, 16V), usually the latter. The Samsung M34KUK35X13-K tube is not noted for its long life however, at least not in my experience. R.B.

CTX 1565D

In the August 2001 issue Ian Field mentioned one of these monitors with the 'recall' button permanently on. I used to do trade work for a company where most of the repairs were to 1565Ds. It was quite common to find the recall button permanently on, but I could never find a specific reason. I did what Ian did – added a spacing washer. My guess is that constant heavy-handed use of the button had something to do with it. None of the 'repairs' ever bounced back.

Failure of C701, which couples the line drive to the output transistor, is very common (October 2001 fault reports). Seven out of ten of the repairs I carried out with this model involved replacing C701. It is in fact the first thing to check with a dead monitor. R.B.

Multiscan L5032LD

There was insufficient height – about 3cm at the top and bottom. An OSD check showed that the amplitude setting was at maximum. In this event the things to check are C505 (47μF, 63V, 105°C), C506 (470μF, 17V, 105°C) and R518 (1Ω, 2W). The capacitors fall in value while the resistor goes high in value. You'll find both capacitors inside the TDA4866 frame output chip IC501's heatsink envelope. A.R-W.

Datas IC0423SV

The customer said he had brought this monitor back from South Africa. At switch on the front LED came on for a second then went out. I'd never come across this chassis before: it seemed very Hitachi, and the line output transformer and CRT were both of Hitachi manufacture. The cause of the problem was a faulty LOPT and 2SC4769 line output transistor, which was short-circuit all round. Once replacements had been fitted the monitor worked quite well, though it

was clearly marked on the back for use in the southern hemisphere only. A.R-W.

Apple M9101Z/C

When one of these 14in. monitors is dead the usual cause is that R3121 (270kΩ, 1W, high-voltage type) is open-circuit. It's in the separate, side-mounted power supply, which seems to be identical to that in the Philips 3CM9609. A.R-W.

Elonex MN069 (Acer A9S chassis)

This monitor had been refurbished by a local trader over a year ago. It was brought to me by the present owner. When I switched it on the EHT rustled up and the CRT's heaters were glowing, but there was no evidence of a display. Scope checks showed that there were no waveforms at the video outputs, which also had excessive DC levels. To save time I borrowed a CRT base PCB from a scrap Acer A8W chassis. This produced a very dim, out-of-focus display – with the first anode preset at maximum! It often happens that a failing CRT flashes over, which is probably what had happened to the original CRT base PCB.

The original CRT was a Samsung M34KUN35X92 (J)-K. The very similar Acer A8W had a Chunghwa M34AFA83X03K/CPJ370BVAP1S-TC. When this was fitted there was a good display apart from insufficient blue. I went through the stock room in search of a better replacement CRT, looking for any Acer monitors with an identical front-button layout. The one I found used a 15in. Hitachi M36KUU35X92. As the main PCB fitted into this cabinet very happily, I decided to rebuild the monitor as a 15in. model. The tube's scan yoke obviously had different characteristics, as the field scan was narrow. This was easily corrected by adding a 4.7Ω resistor in parallel with R254. But unfortunately this CRT had a severe focus fault that wouldn't respond to focus electrode flashing, and the attempt to do this damaged the B+ PWM flyback MOSFET Q317 (IRF640). With a flyback-type B+ regulator, the MOSFET can be kept out of harm's way by removing it. The line output stage will still be supplied with a B+ voltage, but this will be much reduced – which reduces the EHT available for flashing/brushing the focus electrode. Full EHT can be obtained by temporarily running the line output stage from the 90V supply – run a flylead from the cathode of D701 in the power supply to the cathode of D317 next to the B+ chopper coil.

As all this failed to revive the 15in. CRT, I decided to try recovering the blue-gun emission in the A8W CRT. There is usually something to be gained from upgrading the CRT's heater supply com-

ponents, but care is required when selecting a Schottky-barrier type replacement diode (for D705 in this circuit) as the flyback pulse at the heater winding exceeds 60V. Schottky diodes with a rating higher than 60V aren't common, and the PIV rating must exceed the sum of the flyback pulse and the forward rectified voltage, not just the reverse flyback voltage. The first step in preparing for a Schottky diode upgrade is to construct a diode-capacitor peak detector to measure the reverse flyback voltage. Adding a resistor in parallel with the capacitor turns the peak detector into a snubber network, which can be fitted across the Schottky diode. I have found that, in the majority of cases, calculating a resistor value to dissipate 1W at the measured peak voltage usually damps it down to a value that can be tolerated by a typical Schottky-barrier diode. Although the drop in voltage means that the resistor will be dissipating considerably less than the initially calculated 1W, it makes sense for safety's sake to use a resistor with a rating of at least 2W.

The greater efficiency obtained by using a Schottky-barrier rectifier in the CRT heater supply circuit can make all the difference. In this case it was just possible, after running the CRT in for a prolonged period, to obtain an acceptable grey-scale balance. I.F.

Royal X1448

The change in line frequency for Atari use seems to put greater strain on the power supply and the line output stage. These monitors provided steady business in the days when there was still a good demand for VGA mono screens. This one was dead. D106 is a vulnerable component, and its failure can result in self-destruction of the self-oscillating power supply.

In the early days D106 was 'house coded', but since taking on Atari repairs I've often found a BYT56M in this position. As this diode was already operated at close to its limit, and the Atari conversion pushes it closer, the search has been on to find a suitable upgrade. The BYT56M's ratings are 3A, 1kV and reverse recovery time (Trr) 100nsec. Trr seems to be the most critical rating: provided a replacement is not rated at less than 3A, failure is more likely to occur if the diode can't cope with the switching speed. As this is still a bit of an unknown quantity, I fit a 16A TO220-style rectifier and aim for a Trr rating of less than 75nsec – preferably as low as 30nsec if I can find a suitable device. Whatever type of rectifier I use, reliability is greatly improved by extending the leads to accommodate a ferrite sleeve (the tuning slug salvaged from a scrap width coil).

Most of the companies that carry out Atari conversions increase the HT output from the power supply to get adequate width. The safer way of providing the correction required is to remove the ferrite slug from the width coil – and re-adjust the output from the power supply if this has been tampered with! So the problem of where to obtain the ferrite slug is easily solved.

The power supply in this monitor had blown up. Q101 (2SC3150) had gone short-circuit, destroying R109 (1.5Ω, 1W) and Q102 (2SC1213). The 4N35 optocoupler used in this design (IC101) is well protected, but I always check it from force of habit. C109 (10μF, 50V) is suspect with a PSU blow-up. Although it was OK, I fitted a replacement and added a parallel 0.47μF multilayer-ceramic capacitor to reduce self-heating because of C109's ESR. The rebuilt power supply worked first time, so I left the monitor on soak test while I nipped out.

On my return the screen was blank – the BUT12 line output transistor had failed. As there didn't seem to be any other damage I fitted a replacement and put the monitor back on soak test. A few minutes later I glanced across – just in time to see the fuse flash! The chopper and line output transistors had both failed. Despite having used a sturdier, wire-wound replacement for R109 this item had also been damaged – this time it had risen in value to 6Ω instead of going open-circuit, and failed to prevent damage to Q102.

It seemed a good idea to carry out an upgrade. I used a BUW12 as the chopper transistor and a BUW12A as the line output transistor. Although it probably wouldn't make much difference, I opted to use a BD437 to replace Q102. After that the monitor worked reliably.

I subsequently discovered that most of the reliability problems which affect the line output and power supply sections are caused by excessive switching losses in the line output transistor. Here's a solution.

As the line driver transistor is driven by the open-collector output of an MC1391 PLL line oscillator chip, with a pull-up resistor, it can as easily drive a power MOSFET as the original bipolar type. The current in the line driver transformer's primary winding is not a function of the transistor's gain and the available base-drive current. As long as the rising edge of the drive squarewave for the MOSFET crosses its gate-switching threshold, the driver transformer's primary current is a function of its resistance and the available voltage (subject to the MOSFET being able to carry the current). As a MOSFET doesn't suffer from base-emitter junction minority-carrier transi-

tion delays, it switches much faster than a bipolar type.

Initial tests involving the addition of an efficiency diode to the existing bipolar transistor provided some improvement, which suggests that the 'body diode' inherent in the substrate of an enhancement-mode MOSFET will also contribute to the improvement.

Almost any TO220-cased n-channel MOSFET will do, but it's best to use one with a rating of at least 5A.

Before devising this modification I found that the power supply and line output heatsinks both ran very hot – and the monitors were quite likely to blow up! Both heatsinks run very noticeably cooler after the modification, which I now carry out to every one of these converted monitors submitted for repair. There have been no return failures. I.F.

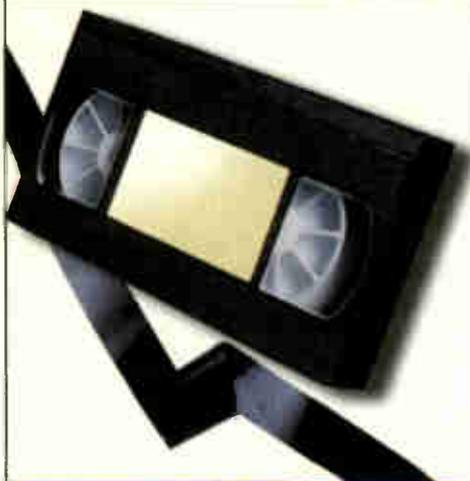
Videal PV7721M

The customer said this monitor "crackled then died". The basic cause was identified during the routine inspection and resoldering – there was a crater in the soldered joint at the negative lead of the mains bridge rectifier, caused by arcing. But when this and numerous other defective solder joints had been remade the monitor was still dead.

Although there was no sign of light from the tri-colour LED, the power supply was pulsing. I then found that the 2SC5251 line output transistor was short-circuit. The screw to undo this transistor is inaccessible without dismantling the whole monitor. As the CRT's base PCB is glued to the neck of the tube, the safest approach is to dismantle the screening so that the glue can be cut away. To make life as difficult as possible, some of the solder lugs are twisted and it's very difficult to get a pair of narrow-nosed pliers into the confined space to straighten them. But I needn't have bothered – the soldering at the CRT base connector was so bad that a sharp tug would have pulled the PCB off the connector's solder lugs. The soldering to the Class A output transistors was also so bad that a soldering iron wasn't needed to remove them.

When I finally got back to the task of replacing the line output transistor I found that the designer had installed yet another impediment to serviceability: the frame output heatsink is positioned in a way that makes access to the line output transistor's fixing screw as awkward as possible.

A passing observation: the solder in this monitor didn't show the characteristic 'stringiness' of lead-free solder. I think the manufacturer had applied it as thinly as it was possible to get away with! I.F. ■



VCR CLINIC

Reports from
Eugene Trundle
Stephen Dixon
John Coombes
Geoff Butcher
Bob Flynn
Dean Ratcliffe
and **Michael Maurice**

We welcome fault reports from readers – payment for each fault is made after publication. See page 298 for details of where and how to send reports.

Samsung SV213B

The following symptoms, which are usually intermittent, are caused by dry-joints at the tape-end sensor photodiodes S601 and S602: refusal to accept a cassette; re-entry of the cassette which then jams after eject; and tape damage at rewind end. While the PCB is out it's also worth checking the soldering of the centre LED LD601. E.T.

Samsung VIK346

The job card with this one said "white lines across the picture". But when I got the machine to my bench it was barely alive, with just the smallest glimmer in the fluorescent display panel and a motor that just about stirred when a cassette was offered. The cure was to replace several capacitors in the power supply, in particular C35 (470 μ F, 16V). E.T.

Sony SLVE720UX

I've recently had two of these machines whose RF gain went low intermittently, producing grainy pictures in the E-E and record modes. The tuner used in this model is expensive. A cheaper solution is to flux and resolder the connections between the PCB earth lands and the lugs on the screening can. E.T.

Samsung SV615B

We have a number of these machines out on rental. A couple have been returned to the workshop with the intermittent jammed deck symptom – in the fully-loaded position. In both cases the cause was a faulty mode switch assembly (SW601), part no. AC34 22001E. E.T.

ITT/Nokia VR3761

This VCR would cut out after a few seconds. The cause was the spool sensors. With this machine the tape counter is operated via the ACE head. S.D.

GoldStar GHV1290I

There was intermittent poor wind and rewind with this machine. The digitron display would eventually go out while the power LED remained on.

Checks on the outputs from the power supply showed that it was OK, but the 5V supply at the syscon chip IC501 and the digitron chip IC601 read 3-4V. The cause of the fault was traced to high-resistance print between pin 11 of P5101 (reg. 6V supply) and C502, on the system control PCB. The offending print was beneath glue. S.D.

Aiwa HVGX150K

This machine would cut out after nine seconds. The cause was traced to a faulty take-up photosensor. S.D.

Aiwa HVGX150

If the problem with one of these machines is poor video with the sound all right, check the surface-mounted video driver transistor Q553 (2SA1037). It tends to go short-circuit. In some cases you will find signs of transistor and/or PCB overheating. J.C.

Sony SLV625

The usual cause of tape chewing with these machines is a faulty pinch roller. In this case however transistor Q203 (2SA943Q) in the 9V supply was the cause. J.C.

Panasonic NV200B

A problem you can get with these machines is failure to accept a tape. When a cassette is inserted the machine switches itself off, with F03 in the display. This indication means that the mechanism locks during mode transition, except for eject. The cause can be the loading motor, but in this case the loading-motor coupling was faulty. The part no. is VDP1434. J.C.

Hitachi VT450E

Playback of prerecorded tapes was fine, but there was very poor sound with the machine's own recordings – the level was low, and there was a lot of background hiss and hum. I worked my way back to the IF module, where I found the cause of the problem. C20 (100 μ F, 16V), inside the module, had leaked electrolyte which had found its way on to the copper side of the board. As a result here was a partial short-circuit of the audio signal, which passes underneath C20. G.B.

Ferguson FV62

When this machine was asked to play a tape everything was correct mechanically but the E-E picture remained on the screen. As a quick move I cleaned the vanes under the drum motor, having had some weird effects before because of problems here. Once the dust had been removed the playback picture had returned. B.F.

Akai VSF280EK

If one of these machines turns off when asked to move from one mode to another, replace the mode switch assembly. B.F.

Hitachi VTM502E

The playback picture kept clearing and breaking up, as though there were no off-tape control pulses. Voices sounded as if they were under water! A check through the control-pulse path revealed the cause of the trouble, which was the BC848B surface-mounted transistor Q7469. B.F.

Akai VS422

Poor rewind, especially near the start of a tape, can be caused by wear on the review brake spigot, where it runs along the main lever under the deck. It wears to a flat edge. Because of this it brakes the take-up spool when it should be off. While replacing the review brake (item 4 in the exploded deck diagram) it's a good idea to clean and lubricate the take-up spool shaft. **B.F.**

Philips VR806

This VCR had blown the fuse in the plug but not the internal one. I found that the STP3NA60FI chopper FET was short-circuit, but there was no obvious reason for its failure. D6160 (1N4006) looked as if it had been getting warm. It measured OK however. There was also a possible poor connection at R3159.

I replaced the FET, the MC44603P control chip and D6160, resoldered R3159, then gave the machine a very long soak test. This proved that everything was now OK. **B.F.**

Panasonic NVHD685B (Z mechanism)

This VCR had a tape that wouldn't eject inside it, though the machine would do everything else. The deck would jam when it moved to the eject position. The only obvious clue was the multiple

tracking errors all over the picture when play was selected, because the tape arms weren't locating fully.

As this chassis was a new one to me I ordered a Z mechanism manual from SEME, part no. VRD9802005C2. It includes a section on removing a jammed tape. Once I had done this I was able to examine the mechanics and found the cause of the jamming: the plastic teeth of the take-up loading arm (part no. VXL2670) had broken where they fit into the loading rack. Replacement of the loading arm was simple and cured the fault. **B.F.**

JVC HRJ435

There was no power because Q902, type 2SC3616(ML), was short-circuit base-to-emitter. A replacement restored normal operation. **B.F.**

Philips 20PV164

The VCR section of this TV/VCR combi unit intermittently failed to follow commands: mechanical movement could be heard, followed by tape ejection. When the deck has been removed the leads are long enough to operate it and be able to observe the mechanics.

In the fault condition the tape went down OK, then went into the play position, but the drum motor was struggling to rotate. The cause was poor

connections at plug-socket 1930 which is on a PCB that's mounted behind the heads. Resoldering cured the problem. **B.F.**

Matsui VP9401

This machine was dead with F502 open-circuit. A replacement restored life to the machine, but there were no mechanical functions and it went to standby after about three seconds. On investigation I found that the loading-motor drive chip IC1004 was getting very hot. After fitting a replacement I checked ICP051 in the power supply and D16 in case it was short-circuit. The machine was now OK. **D.R.**

Hitachi VTM930

This machine wouldn't accept a tape and occasionally loaded up on its own. I initially thought that the cause would be the mode switch, but in fact one lead of the end-of-tape sensor had broken. A new sensor restored normal operation. **M.M.**

JVC HRJ635EK

After being switched on this machine would try to eject the carriage, even when it was already in the eject mode. If you tried to install a tape manually it would be immediately ejected. The cause of the problem was the mode switch. A replacement restored normal operation. **M.M. ■**

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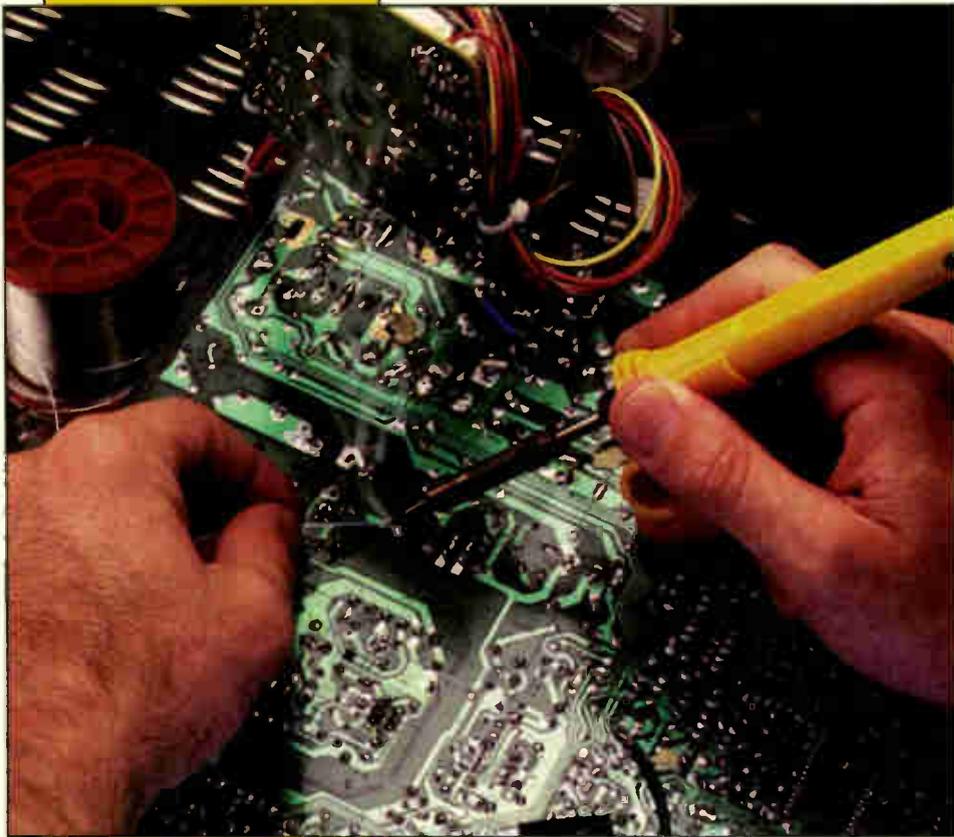
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JACK'S WORKSHOP

Jack Armstrong

Interference to SkyDigital

As a rule I don't do call-outs. Most people don't like to pay me £60 an hour, so it's simpler to sit at the workbench and earn it there. I had a call from a neighbour in the next street however, so I didn't like to quote the normal charge – in the end I walked round the corner for free!

His complaint was about mysterious interference to some channels with his SkyDigital system. It happened mostly during the evenings. The interference completely obliterated some channels – UK Gold, MTV, VH1, CNN, Eurosport, Sky Sports etc. – while others were OK. When the picture broke up, the receiver tended to lock up and couldn't get the channel listings. Signal quality dropped to zero when this happened. The chap across the road suffered from the same problem.

It turned out that another neighbour has a newish BMW 525 with an illegal police radar jammer in it. This was left on in the evenings and all night (powered by the BMW's never-off cigarette lighter – those good Germans like to smoke any

time, any place, without having to start the engine!). This explains why the interference disappeared early in the morning, when he left for work, and returned mid-day when he came home for lunch. The chap across the road had noticed that there seemed to be a link between the car being present and the interference. When the BMW's owner was asked to move his car the interference immediately disappeared: he no doubt noticed that the police radar detector was on and switched it off. The interference hasn't come back since. The car's owner claimed that just starting the engine cleared the problem, but I will draw my own conclusions.

The neighbour had already asked the Radiocommunications Agency to look into the problem, by filling in an RA179 form. The outcome should be interesting!

Amstrad DRX100 power supply

Dean Lowes wrote to me recently about an Amstrad DRX100 digibox which had a dead power supply. I drew his attention to the circuit diagram that appeared in the

January issue (page 175), and in return he sent me details of the repair.

On initial inspection he found that the 1L0380R chopper chip was dry-jointed at all its pins, and that two of the pins were short-circuited. In addition the inrush current surge limiting thermistor TH1 had a piece missing, and the 2A mains fuse was open-circuit. He decided to fit the Relkit 34 capacitor kit from SatCure, four new 1N4007 bridge rectifier diodes, a new chopper chip, thermistor and fuse. But when he switched the digibox on the red standby light at the front started flashing. So something else was faulty. He decided to replace the optocoupler (type C317). Once this had been done the digibox worked correctly – presumably because power supply regulation had been restored.

The following items were obtained from SatCure (www.satcure.com): Relkit 34; 2A anti-surge fuse; 1N4007 diodes; 1L0380R IC. The 10R-3A inrush thermistor fitted was obtained from RS, part number 210 702. The optocoupler came from the spares box.

ITV on SkyDigital

ITV is now available as part of the SkyDigital package, either with a Sky card or with an FTV (free-to-view) card. To obtain the latter, phone 08702 438 000 with details of your digibox (serial number and version number – both available from the menu screen) and your UK postcode. You must have a current licence of course.

Your postcode determines which ITV regional channel is programmed into your smart card. Sometimes the choice is rather odd. For example people in the southern part of Chester might get Welsh TV, while people living in Crewe will get Midlands TV from Sutton Coldfield.

Fortunately all the regional programmes are broadcast, but it can be tricky receiving them. Try the following.

Press services, press 4 system set-up, press 4 add channels.

The frequency is highlighted in yellow. Use the remote-control unit to type in 10906. Go down with the green button and highlight polarisation. Choose V. Do the same for Mbaud and choose



Photo 1: The new channels menu.



Photo 2: The other channels menu.

22. Do the same for FEC and choose 5/6.

Highlight find channels and press select. The new channels menu (see Photo 1) then appears. Select and store each one you want.

Press backup, choose other channels (see Photo 2) and a range of ITV regions (but not all of them) will be available for selection. Do exactly the same as before, using 10832, H. 22 and 5/6. Then use 10891, H. 22 and 5/6.

To get back to normal Sky programmes, keep pressing back up.

You won't get all these other channels from the normal 'all-channels' menu, so you have to keep accessing the ITV regions using 'other channels' (press

services then 6).

Details of all the Sky multiplexes available are available at www.lyngsat.com/dig/skyuk.shtml

A use for old analogue receivers

Tony Briant tells me he recently purchased a cheap colour surveillance camera from Makro. For its price (£25) the output is very reasonable – he can read the number plate on his car parked in the drive. But there's a problem.

Tony has an amplified distribution system in his house. It has inputs from a digital satellite receiver, cable (for the terrestrial channels) and several VCRs. So, between channels 30 and 39, there's no space that can be used to display the camera's output cleanly.

Tony checked with the CPC catalogue and found a wideband modulator at about £40, rather more than he was prepared to pay. His initial solution was to use a modern Sharp VCR in the loft, with its RF output set to channel 68. Use of a perfectly good machine in this way may not seem to make much sense, but Tony has quite a lot of VCRs that customers "didn't want to spend more than a few pounds on". As a result it was an acceptable solution.

While taking some old Pace analogue satellite receivers to the local tip recently he noticed a sticker on an MSS100 with instructions for setting up the RF

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

<http://www.satcure.com>

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

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

Information and parts for ICE (in-car entertainment) equipment can be found at

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

modulator. It then dawned on him that, as the Pace menu-driven modulator covered the entire UHF spectrum, it would provide a very cheap and relatively compact way of modulating an AV input to feed an RF system.

He subsequently disconnected the Sharp VCR and connected the tiny wedge-shaped receiver in his loft space, switched the decoder inputs to AV – using the remote-control unit – and set the output to channel 68. ■

Test Case 471

Since the price of ordinary VCRs has come down to such a low level – supermarkets nowadays sell them at below the £80 mark – repair is in many cases not economically viable. This is the case with 'basic' models at least, as the cost of a major part plus handling charges, VAT etc. can often come to as much as that of a replacement machine.

Yet VCRs still come in for repair! Cherished ones, posh ones and rental ones at any rate. Real Technician found half a dozen of them on the awaiting-repair bench one Monday morning recently. Rentals come first, so a slow-running Hitachi machine and a cassette-jamming Akai VCR were quickly dealt with and moved over to the awaiting-delivery shelf. The cause of the Hitachi machine's problem was capacitors in the power supply. The Akai VCR had a broken FL cradle driver.

Patient number three was a JVC HRD720EK. It's an old-timer now, but in the opinion of the Test Case Workshop worthies it's a very good one. This was a chargeable job that required an estimate. The symptom was written down as "picture ragged and broken up". Probably dirty heads thought RT, as he carried the machine to his bench.

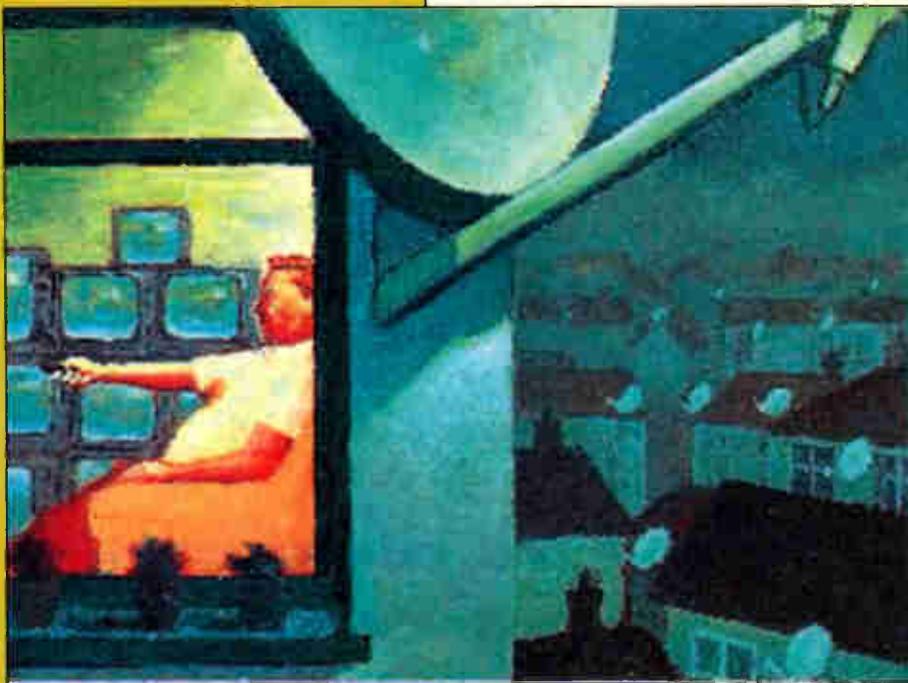
He inserted a known-good cassette (currently *Mary Poppins!*) and found that the playback picture was fine except for the bottom 20 per cent or so, which was lost behind a solid band of noise and hash. It didn't look like the usual sort of tracking problem,

because the top edge of the noise band was sharply defined – and the tracking control had no effect on it. RT ejected the tape, pulled down the magnifying lamp, and examined the tape guides and drum closely. Nothing untoward was visible. He inserted the cassette again, then selected play. The guides went home fully and showed no looseness, misalignment or signs of trouble. The slant poles were both present and correct. There didn't seem to be any point in trying to adjust the guides at this stage.

RT looked again at the screen of the bench monitor. The whole of the bottom half of the picture was now obliterated by snow, worms and dots. What sort of weird problem was this? Once more the cassette was removed, reinserted and played. This time the picture was almost clear of interference, with just a narrow noise bar at the top, but the picture was now juddering up and down a bit. Plainly some sort of random tracking fault was present, but one that had nothing to do with the physical condition of the tape path. Why did the effect change with each playing of the cassette?

Real Technician got out the service manual and examined the servo circuit. It's not a complex one, being contained in a single chip whose heart consists of a series of pulse counters. Nothing seemed to be wrong with the various pulses and drives associated with it, at least as far as RT could discern with the aid of his oscilloscope. After some more fruitless checks and much head-scratching, RT replaced the complete deck with a known-good one from a scrap machine. Just to help with the diagnosis you understand, not as a repair. The picture was now OK!

It took a while to establish the cause of the trouble with the original deck. This turned out to be something that clever-clogs Workshop Sage had encountered before! Any ideas? For the solution, turn to page 310.



SATELLITE NOTEBOOK

**Reports from
Hugh Cocks
Pete Haylor
and Michael Dranfield**

Pace DVR500

I recently had a Pace DVR500 digital satellite receiver in for repair. Because of an electricity supply problem it had been subjected to a mains input voltage way in excess of what is normal. But the VDR adjacent to the mains input had done its job and blown the fuse, so repair was straightforward.

The DVR500 was one of the first digital satellite receivers. It was designed for use with the Irdeto encryption system, which was used in the Netherlands from 1996 for what was then the Filmnet/Multichoice service. This has now become Canal Plus, with Mediaguard encryption, though both systems remain in use. The Irdeto service is being slowly wound down and has a more limited range of channels.

The DVR500 was never available directly in the UK. It looks remarkably similar to the old analogue Model MSS200, see Photo 1. Photo 2 shows the

rear connectors. There's no scart connector. Pace opting for RCA/phono output sockets, probably because a large number of these receivers were being exported to South Africa where a similar Multichoice service is available and where scart connectors seem to be much less common than in Europe. By the end of the DVR500's production run however a single scart socket had been added. The Irdeto conditional access module (CAM) is slotted into the middle, top of the receiver.

Photo 3 shows the remote control unit, which is similar to the MSS one but with different labelling. It's type RC14, the MSS one being type RC10. Photo 4 shows the Multichoice viewing card, which is slotted in at the front left of the receiver, in the same place as with the MSS200.

Photo 5 shows the PCB layout. The board is the same size as in the old

VideoCrypt PRD receiver. The CAM slot (with no CAM inserted) can be seen connected to the main PCB via ribbon cable. The power supply uses a TOP type chopper chip and is similar to the MSS100 with the addition of the VDR near the mains input socket – some blackening can be seen near the mains bridge rectifiers where the old VDR had been, a replacement not having been fitted at the time when the photo was taken. The conventional IF/tuner module looks substantial compared with today's zero IF modules. I've never come across a faulty one yet – that's progress for you!

Photo 6 shows the main menu – there was a software update a few years ago updating all Multichoice references to Canal+. If you select option 6 and key in the preset pin number (9949) the installation menu appears, see Photo 7. Fortunately for non-Dutch speakers, the menu has two language options. Strangely when the receiver was launched in 1996 only English was available: imagine trying to sell a Sky digibox in the UK with only Dutch menus!

The channel order can be set by the user. Photo 8 shows the channel-sorting menu. There are more than six channels of course: you use the main down button on the remote-control unit to go to the next six. The channel you want to move is highlighted. It moves to the right-hand column (shown empty) and is then moved down to the required position and slotted into place using the remote-control unit.

Photo 9 shows what's referred to as the manual channel tuning menu, what we now know as the receiver's default frequency. The one shown is for the Dutch network at the 19.2°E Astra 1 slot. The DVR500 has a number of these default frequencies. To go to say a free-to-air German channel, enter its frequency in the manual channel tuning



Photo 2: The rear connectors as fitted to earlier versions of the DVR500.

Photo 3: The DVR500's remote-control unit.



Photo 4: The Multichoice viewing card.



Photo 1: The Pace DVR500 was one of the first digital satellite receivers, introduced in 1996.



Photo 5: PCB layout inside the Pace DRV500.

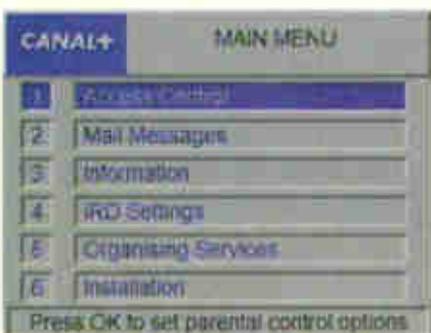


Photo 6: The DVR500's main menu.



Photo 7: The installation menu.



Photo 8: The channel sorting menu.

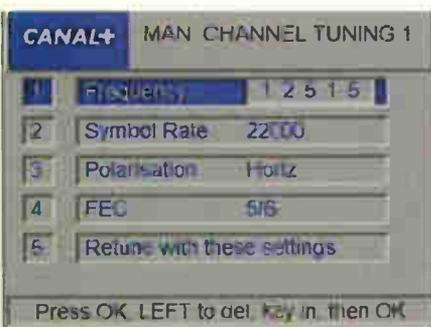


Photo 9: The manual channel tuning menu.

menu number 2. The receiver will then scan for available channels. These will be put into the Home Network 2 option (the Netherlands being Home Network 1), which can be switched to using the remote-control unit. It isn't possible to go from one Network to another directly, which makes channel-zapping a bit awkward.

Photo 10 shows the UHF tuning menu which, conveniently, provides a test signal and frequency as well as a UHF channel readout. Tuning below channel 28 isn't possible. I wonder whether the receiver's designers were concerned about interference to the digital tuner's 480MHz IF when the modulator is tuned to ch. 21/22 (around 480MHz)?

Photo 11 shows reception of the Netherlands 2 morning text information service, with the on-screen programme information banner.

After a year or so the DVR600 replaced the DVR500. Operation was similar, but the DVR600 had a sloping front panel that gave it a sleeker look. **H.C.**

An oldie but goodie

Mr Smith is an elderly gent of some 70 plus years. His satellite system is a very old analogue one with a separate positioner and receiver. He wanted to replace the latter with an EchoStar AD3000, so I called to check the dish and motor. The dish's bearings had worn badly, but everything else seemed to be OK. So he told me to get the receiver for him: he would repair the bearings.

When I inspected the dish a week later he had made new bearings which ran as smoothly as a new dish. So the receiver was installed. But the dish would move only in small hops. The cause was traced to a cracked reed switch: once this had been replaced the dish ran correctly.

A new LNB was obtained for the new holder which he had made in brass and machined to fit. The fit was so good that the focal point remained the same! **P.H.**

Grundig GDS200/1

This digibox suffered from a whistling noise on the audio. The cause of the



Photo 10: The UHF tuning menu.

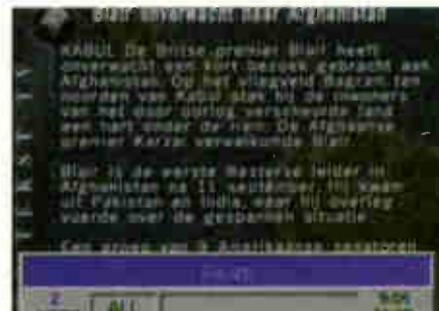


Photo 11: Reception of the Netherlands 2 morning text information service, with the on-screen programme information banner.

problem was massive HF ripple (800mV) on the 12V rail. Replacement of C13 (470µF, 25V) with an ultra-low ESR capacitor cured the fault. As a good rule-of-thumb with these digiboxes, any rail with more than 50mV peak-to-peak of ripple has a faulty smoothing capacitor associated with it. **M.D.**

Grundig GDS200

When a horizontally-polarised channel was selected the display said "no signal received". Operation with vertically-polarised channels was OK. Checks showed that the tuner was producing both in-phase (I) and quadrature (Q) carrier outputs for the AD converters, while the LNB voltage was correct. So it seemed that the tuner was OK.

Power supply electrolytics are a common cause of problems with this digibox – you can usually spot a faulty one as it will have a bulge or a brown stain on the top – but this time they all appeared to be OK. Checks on the supply rails showed that the voltages were all spot on. But AC ripple checks with an oscilloscope told a different story. Although the 5V supply was correct at 5.08V, it had 200mV of HF ripple on it. The culprit was C12 (470µF, 16V), which had fallen in value to 320µF. A replacement cured the fault.

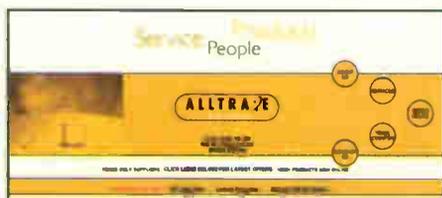
The lessons to be learnt are that digital circuits don't tolerate ripple, and that voltage checks on the supply lines are not conclusive. It's my guess that the electrolytic capacitors in the GDS200 digibox are standard instead of low-ESR types. Pace and Panasonic digiboxes use a special type of capacitor, indicated by the negative stripe being gold in colour. **M.D.**

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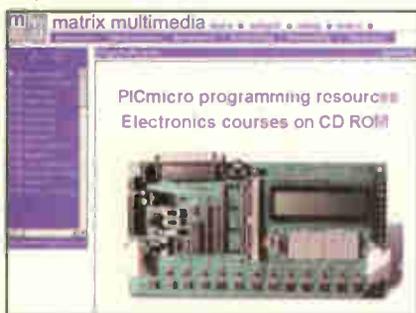
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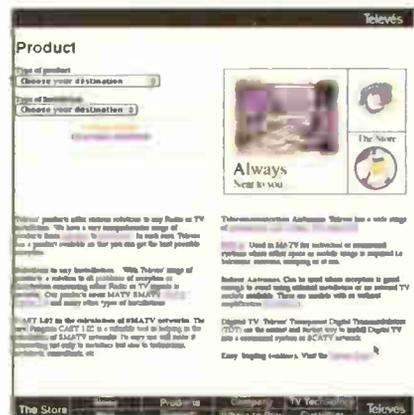


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DVD

**Fault reports from
Geoff Darby
Martin S. Davis
and Nick Beer**

We welcome fault reports from readers – payment for each fault is made after publication. See page 298 for details of where and how to send reports.

Toshiba SD110EB

There was no scart sound and no front-panel display. Otherwise the player did basically work. Checks on the power supply outputs showed that the -31V line at pin 8 of connector CN802 was low at about -24V, while the -9V line at pin 3 of CN801 was very low at -2V. The latter supply is derived from the former via 22V-worth of zener diodes, D836 and D837 in series, so -2V is what you would expect with -24V at the input.

When I followed the -31V line back I came to Q827, the supply switch transistor. It's fed by R834 (390Ω, 1W). At the other end of this resistor the voltage was correct at -40V. R834 was getting rather warm, but its value was correct. This suggested that the cause of the problem was an excessive load on the supply.

Resistance measurements across the -9V and -31V lines were inconclusive. There certainly weren't any readable shorts. When I disconnected the -9V line, the -31V supply rose to the correct level. I followed the -9V line across to the main PCB and came to IC912, a dual op-amp for scart audio buffering. This chip's negative supply comes via Q913. A dead short could be read at pin 4 of IC912, but Q913 had made it impossible to detect this at the power supply. The prime suspect was the chip itself, but when pin 4 was lifted the short was still present. The cause of the trouble was the only suspect left, C928 (100μF, 16V). A replacement capacitor restored full, normal operation. G.D.

Pioneer NS-DV55

The customer's complaint about this

DVD/hi-fi/home cinema system was that many controls didn't work following a power cut. When I tried it in the workshop it did indeed behave oddly. If 'vol up' on the remote-control handset was pressed all you got was a loud rushing noise in five volume steps. You couldn't play a disc using the remote-control handset, but discs would play when started with the front-panel button and the remote volume control was then OK. These are just a couple of examples. The controls produced results that varied from normal to bizarre, and you didn't always get the same wrong operation at different attempts.

There seemed to be a problem with the system control processing, so I got in touch with Pioneer Technical to see if a master reset sequence is available to get back to the factory settings. I was told that the problem is known with units manufactured before January 2001. A revised system control processor (IC11) was then introduced, type PD3410C.

The cure is to fit reset modification board part number GXX1198. When you order this be sure to ask for the fitting details, which are in Service Bulletin ref. PGB-186. I found that installation was straightforward. When the player had been reassembled and powered the new PCB forced a full system reset. After that everything worked normally. G.D.

Philips DVD711

We've had several of these DVD players in with the 'dead set' symptoms – no operation, no front display and no audible ticking sound from the power supply. In each case the cause of the fault has been a short-circuit diode on the secondary side of the power supply, D6231. It's type BYW98, which is rated at 200V, 30A, and the Philips part no. is 4822 130 11584.

The protection circuitry is obviously very discreet in its operation! M.S.D.

Panasonic DVDRV20

This quite new machine produced blocking/ mosaicing vision, not only with playback but also with the DVD-logo screen when no disc was inserted. Now Nick's no. 1 rule is that big chips don't fail, and that the bigger the chip and the more it does the less likely it is to be the cause of a fault. But I'm now going to have to change this rule, adding "unless Nick says it's faulty", because this particular fault was caused by IC3001 on the "Module CBA" under the mechanism. It's a surface-mounted device that measures 28mm square and has 208 legs.

I managed to obtain a suitable nozzle for our hot-air tool, but had some difficulty with desoldering because of the closeness of the end legs to the corners. The two correctly-sized nozzles our supplier sent had large gaps at the corners. N.B. ■

HELP WANTED

The help wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement department about this feature.

Wanted: Circuit diagram/service manual for the SE101 oscilloscope made by S.E. Laboratories, Feltham. Photocopy OK. All expenses paid. R. Dyke, 32 Poplar Drive, Alsager, Stoke-on-Trent, Staffs ST7 2RW.

Help required: Can any would-be Sherlock Holms help me identify a Sanyo-built Nicam/HiFi VCR badged Baird/Radio Rentals RR VC153NX? It dates from about 1991 and has a centre-mounted deck with LED VU meters to the left and a fluorescent clock/counter display on the right. The drum's part no. suggests that it might be a VH29SP, VHR190, VHR766/767/774/775/ 776/ 777/786 or 796. Any help gratefully received. Nicholas Arnold, 30 Mere Road, Oxford OX2 8AN. Phone 01865 556 991 (after 7.30pm), fax 01235 539 750 or e-mail

nick.arnold@bushinternet.com

Wanted: Any information on a Heathkit Mohican GC1A short-wave receiver, i.e. circuit diagram etc.; also a fully-working PCB for the Hitachi TV Model C2509T. Colin Wadey, 9 Ridgeway Close, Southwick, Sussex BN42 4QQ. Phone 01273 591 304 or e-mail colinwadey@aol.com

For disposal: Sony KX-20PS1 monitor plus outboard tuner and teletext decoder. Profeel series, plus literature. Tube has red video only. Offers for a good home, buyer collects (London SW19). Bill Milne, phone 020 8543 9542.

Wanted: Main board (765D M/B REV:B 95/10/11) for a CTX 1765D monitor. Can anyone supply or suggest a supplier? Paul Scott, e-mail paul.scott15@ntlworld.com

Wanted: For spares or repair, Quad 405 or 405-2 power amplifiers, Quad FM3 and FM4 tuners, Spondor BC1 loudspeakers, Denon DL103 pickup cartridges. Phone Mike on 01758 613 790.

For disposal: Antique Philips console TV set dating from the 50s, also a valve oscilloscope. Both are free to a good home. Michael Dranfield, 6 Calesdale Close, Buxton, Derbyshire SK17 9RH. Phone 01298 73 989 (daytime).

Wanted: Service information for the Heathkit RA-1 short-wave valve receiver, which dates from the 60s. A photocopy of the circuit diagram would be

helpful. Has anyone a couple of push-pull output transformers for sale, suitable for use with EL84/EL34 valves? Used ones would be OK. Also EL84/EL34 valves. R.N. Baker, 17 Chapel Lane, Upwey, Weymouth, Dorset DT3 5NA.

Wanted: Power supply panel for the Amstrad Model VCR9140, preferably working. Also an SIWBA60 bridge rectifier and UF3002/RU4YX diode for an LG/GoldStar VCR Model P2341, and an original remote-control unit for this model. J. Alder, 37 Palm Avenue, Fenham, Newcastle-upon-Tyne NE4 9QT. Phone 0191 241 0167.

Wanted: Circuit diagram for the Sony PVM-1440QM video monitor. The power supply shuts down at switch-on. Also a lower drum assembly for the Mitsubishi HS-S5600 time-lapse VCR. Phone Andie Wilkes on 0121 605 0720 (evenings) or 01926 404 935 (day), or e-mail andiewilkes@yahoo.com

For disposal: Set of new modules for the Grundig Safety Chassis. Various other Grundig spares available. Also a large collection of triplers and droppers for other makes. Phone Alan Bray on 020 8907 2920.

Wanted: Tuning board for the Grundig CUC220 chassis, part no. 29504-003.02, or information on where I can obtain an IC type SC84202. All expenses paid. Mike Sleeman, 10 Pine Road, Chandler's Ford, Eastleigh, Hants SO53 1LP. Phone 02380 253 870 or e-mail mikesleeman@prcford.freereserve.co.uk

Wanted/for disposal: Require service manuals for the Samsung TV/video Model TVP3350IF and the Bush TV Model 2866NTX (photocopies OK), also an IC001 YC module (part no. 1-467-887-21) for the Sony VCR Model SLVE700UK. Have for disposal TV/video/audio manuals, remote-control handsets, test equipment, spares etc. To send for lists e-mail soundandvisionian@hotmail.com or send SAE to Ian Harrison, Sound and Vision, 321 Old London Road, Hastings, E. Sussex TN35 5LP. Phone 01424 435 462.

Wanted: Service manual and source of spares for the Philips LaserVision Model VP600, which dates from 1982. Also a

Philips N1500 VCR, any condition considered. All expenses paid. Phone John Clappison on 01964 622 734 (Hull).

Wanted: Oscilloscope, minimum specification 10MHz, dual-trace type preferred. Phone L. Watkinson on 01288 341 254 (Devon).

Wanted: Chopper transformer for the Matsui Model 2196N (a used one would be OK). The same transformer is used in the Crown Model CRP21. Does anyone know how to remove the child-lock with the Matsui televideo Model TVR162TS? Phone Doug Carson on 01229 774 749 or e-mail

douglcarson@FSBDial.co.uk

Wanted: Type NVM3060 IC for the Minoka Model MK1498N colour portable TV. Phone J. Fedorak on 01274 602 337 (Bradford).

Wanted: Tube type A59ESF002X11 for the Panasonic TV Model TX25AD2P. Also a remote-control unit for the Toshiba Model V703B VCR and an SDA5273CP IC for a Sony TV set. Phone 02920 496 815 (Cardiff).

For disposal: Canon portable VCR VT10 and VR10 as original, including carrying case and instruction book. Panasonic VC10 camera with case. Also videos and back issues of *Television*. Best offer. Phone Jack Richman on 020 8590 4947 (Ilford).

Wanted: I would like to control a Pace digital cable box from another room. Pace does not know of any commercially available remote-control extender that will interface with its digital cable box. Control of the box is by bursts of pure IR instead of the modulated IR used with other systems. Can anyone suggest a method of obtaining control of the box from another room, either via cable or not? There must be thousands of these boxes in use, and surely there would be a demand for such a system. Martin Page, 33 Bush Road, Buckhurst Hill, Essex IG9 6ES. Phone 020 8279 8908 or e-mail martin.page@cwctv.net

Wanted: Front control flaps for the Ferguson FV14T VCR or a complete machine; a Nicam board for the Finlux 3600 TV chassis; and a complete front and remote control unit for the JVC HR960EK VCR. Phone Richard on 0116 281 3681.■

Answer to Test Case 471

- page 303 -

This was a strange VCR fault indeed, not one that Real Technician had come across before. It helped a great deal however that everything apart from the deck assembly itself had been eliminated during the initial diagnosis: RT could have spent half a day in amongst the electronics and still not found the cause of the trouble! After some more experimentation and swapping of bits, a long process probably best not recounted here, RT discovered – purely on a trial-and-error basis – that the drum motor was responsible.

The repair choices seemed to be to fit a new motor, at a cost that would probably not have been sanctioned by the customer, or to leave in the motor from the scrap deck. The cost of this would have been much lower, but there would have been no certainty about future reliability. RT would have to have a discussion with the owner.

At this point Sage appeared and saw RT with the faulty motor in one hand and the telephone in the other. The upshot was that a little 3.3µF surface-mounted electrolytic capacitor in the original motor assembly was replaced. This did the trick: the machine went back to the customer at a reasonable cost, with its own drum motor inside. RT was mortified to learn that Sage had carried out this repair several times in the past – he even had a strip of these unreliable capacitors sitting ready in the stores!

NEXT MONTH IN TELEVISION

Free Satellite Accessories supplement

Our free supplement is devoted to all things satellite: What equipment does what, service aids, gadgets for your customer, product availability and suppliers, and more. Text and research by Eugene Trundle

Servicing the Mitsubishi TFS6795K monitor

This monitor, which was also released as the Dell VC7EN, had a production run that lasted for several years. It's quite complicated, including just about everything you might find in a computer monitor, and thus provides a good introduction to the subject. In Part 1 Donald M. Henry tells you how to tackle the circuitry on the video and sync boards.

A new peril – logo burn

The problem of screen burn has been with us since the earliest days of the CRT. Various strategies had reduced it to a minor nuisance – until the advent of the fixed station-identification logos, icons and badges used by certain DTV broadcasters. Eugene Trundle alerts us to the danger and describes what can be done to minimise the damage.

The Las Vegas CES

George Cole reports on new consumer electronics technology presented at the 2002 Las Vegas CE show. The latest flat-screen, digital and interactive TV, DVD recording, consumer hard-disk and audio developments were on display.

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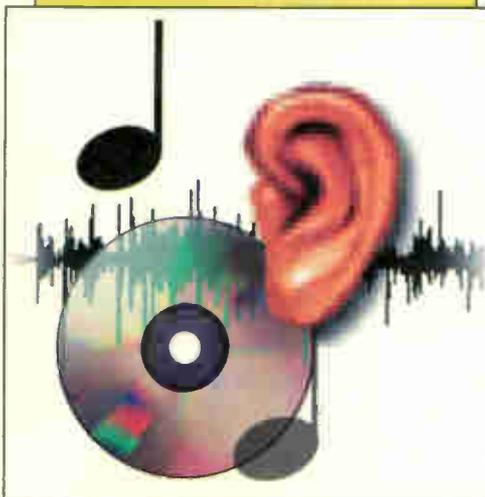
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AUDIO FAULTS

Reports from
Chris Avis
Russell J. Fletcher
Geoff Darby
Ian Bowden and
Keith Wevill

We welcome fault reports from readers – payment for each fault is made shortly after publication. See page 298 for details of where and how to send reports.

JVC UX-T100

The symptoms with this micro system were standby light on but no power up or display. I found that the output from the 6V regulator IC703 on the processor board was less than 4V. A replacement cured the fault: it's type KIA78S06P. I obtained it from Willow Vale under order code 87006KD. C.A.

Citronic SM330 and SM450 mixers

These now elderly units suffer from various ailments, all of which are straightforward. Noisy faders are common, also open-circuit failure of faders, giving the symptom of one or both stereo channels not functioning with any of the inputs. One of the most common complaints is buzzes, crackles, frying-egg effects etc., either intermittent or permanent. The usual cause is elderly IC sockets into which the op-amps are plugged. The ICs themselves are very reliable, so the easiest cure is to solder them into the PCB directly. R.J.F.

Fender guitar combo Model 85

We have had a number of these with the complaint of crackling during operation. The cause of the problem is either cracked or dry-jointed power resistors in the power section. R.J.F.

Aiwa NSX-S77

Aiwa has marketed a number of three- and five-CD player units. This model employs yet another chassis. As so often, the symptoms were no display with the standby light on. When the on button was pressed, the display flashed up briefly and the standby relay clicked. These symptoms, as I've mentioned before, can have many causes.

Failure to come on will occur when the /hold line to the microcontroller chip is pulled down. This line comes from the fault-detector circuit, which consists of Q063-7 and D061-2. It monitors many things, such as the output stage DC offset, the presence of AC from the transformer board, and thermal conditions in the output stages. Thus a fault in almost any stage will give rise to the locked-off condition. Fault-finding usually consists of disconnecting the inputs to the fault-detector circuit until you find the one that's causing the shutdown. You can then check the faulty stage to find out why it's flagging a fault condition.

In this case the /hold line was released when the AC detect input was disconnected. The unit then powered up and worked normally – the AC was not actually missing. The cause of the problem was D062, a surface-mounted

double-diode that produces the negative input for the fault detector from the AC (D061 produces the positive input). A replacement restored normal operation. G.D.

Sony MZR50 MiniDisc recorder

I had two of these units with the same fault, failure to record. The causes were different, but the result was the same: the overwrite head wasn't being driven down into contact with the disc in the record/edit modes. In one unit there was an open-circuit length of print in the FPC connected to the stepper motor that drives the head lever. It appeared to have been cut through by contact with the sharp edge of the core of a small surface-mounted coil on the main PCB. Correct operation was restored once a new FPC had been fitted. With the second unit the cause of the fault was simply that the lever, which has a rectangular slot in it, on the mechanism driven by the stepper motor wasn't engaged with the finger on the slide lever in the lid assembly. The lid had to be removed so that the finger could be bent inwards slightly and re-engaged. I.B.

Sony MZR50 MiniDisc recorder

The complaint with this recorder was that it had a disc stuck in it. When the unit was powered however the mechanism reset itself correctly and the disc could be ejected. After some use it failed again – when it had been in the record mode. I found that the overwrite head raise/lower mechanism hadn't raised the head fully, so the lid was locked. The cause was a dent in the lid. It was hitting the head lift/lower slider mounted in the lid. The problem was cured by removing the lid and pushing out the dent. I.B.

Quad 405

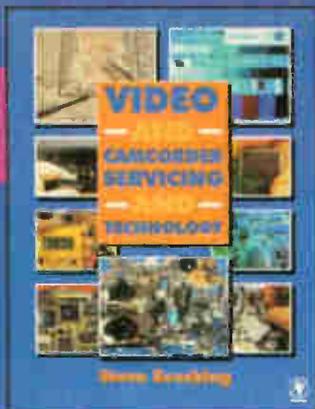
There was no output from one channel, with the heatsink running very hot, because the output-protection circuit was in operation. The cause was R7 in the positive supply to IC1: it was open-circuit. As a result the output was shifted towards the negative supply.

The protection circuit is designed to protect the speakers, by detecting a DC offset in an amplifier's output and triggering a triac which shorts the output, preventing the speaker receiving up to 50V DC. K.W.

Quad FM4 tuner

Inability to tune over the full range, with tuning drift, was caused by a dry-joint at L20, which provides a DC return for the tuning supply to the local oscillator. K.W. ■

BOOKS TO BUY



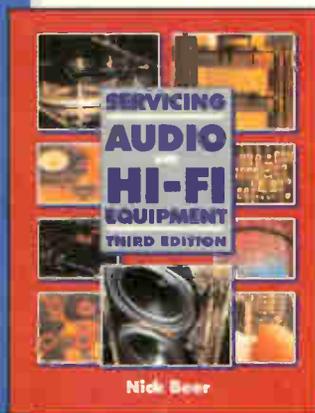
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well covered elsewhere: here the emphasis is on the practical business of fault diagnosis and repair.

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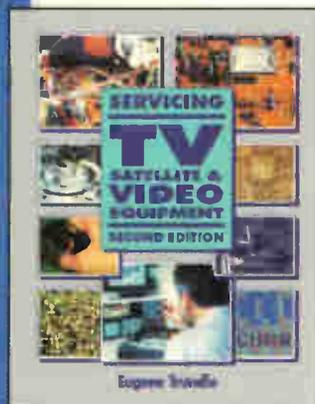
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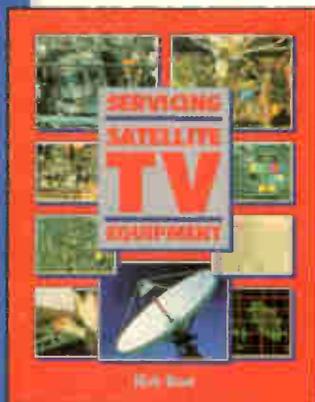


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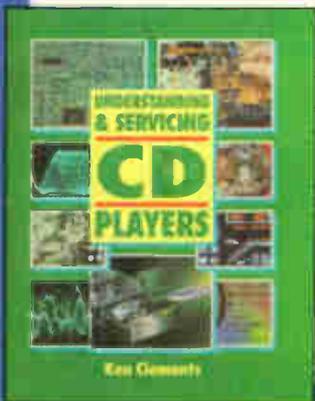
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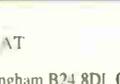
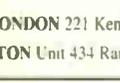
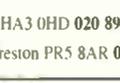
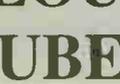
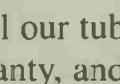
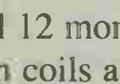
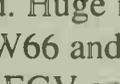
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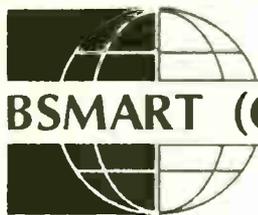
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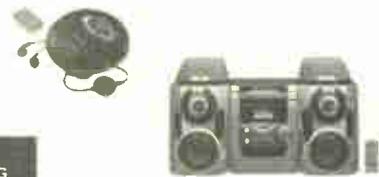
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Switch position 'Ref'

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

WHAT A LIFE

A new neighbour moves in. Gunter turns out to be a very clever TV engineer, but has difficulties with the locals. He manages to sort out some of Donald Bullock's problems however

Women are like that. Especially Greeneyes. They notice things then tell you about them, in detail. Often things you don't want to know about. It happened to me the other day, while we were in Spain.

"Some new people have moved into the empty house across the way" she told me. "They seem to be German. He's fitting a huge dish. Heard him telling his neighbour that before he moved here he had the biggest television shop in Hamburg."

"Filthy swine" I said.

A bit later our gate swung open and our new neighbour walked up the drive, stiffly. Unlike me, he's a slim and uptight together. His rimless glasses make him look intelligent. That didn't appeal to me either.

He greeted me with a smile, clicked his heels and wagged his finger at me. "Ah, you are in. I haf found you out" he said in a rich, deep voice.

"I am and you have?" I said, looking about me and pinching myself to make sure I was not out.

"I am Gunter Gullet, a ferry gud telefission mechanic unt aerial man from der Fazzerland" he boomed. "I lof my verk. It's in my blod. Although I haf moved here I vant to carry on, starting mit aerial verk. I vant to do lots of jobs and vill make plenty of money, yes, but vot drives me is lof of my verk. I sink you are like me, yes?"

"No, I am noddings like you" I said. "I don't vant to mend anyzing. I haf mended hondrets and sousands of zings in ze past. Now I vant a life zat is quiet and no prats. Unt anodder sing. People here don't like paying for aerial verk. Der zun counts more zan televisions here."

He chuckled merrily at me and made to go. "I vill keep in toch" he said.

A huge Panasonic

As he left a tall, thin wretch struggled up the path with a huge 25in. Panasonic TV set. He was gasping and pink-faced with the effort. First Gullet, now this one I mused.

"Fot you vant?" I growled. Realising that I had overstepped the mark, I tried to hide it

with a coughing attack. "Er, can I help you?" I continued.

"You are being Dan Butcher who is mending television sets?" he asked in a soft voice. "This set, he is speaking and showing me little writings on the screen but nothing else."

I looked at him carefully. Clearly another foreigner, but from which country? "Ver – er – where you from?" I asked.

"I am being from number seventy six, down the street" he replied, smiling.

I figured that it would be quicker to mend his set than get too involved, so I asked him to bring it in.

It was a TX25MD3, which is a Euro-2 chassis set. Sure enough there was sound but no picture. There was an on-screen display however, which ruled out field collapse with the usual blanked-out screen. Then I noticed that the sound was a bit scratchy, so I started to check the signals circuitry. As I did so there was a tap on the door. It was Gullet.

Seeing the set and observing the symptoms he beamed knowingly. "Ha, so you haf a dry-joint on L4707 in the IF strip" he boomed. "but zer, I talk too much, yes? You would know this fault?"

"Er, yes, actually" I replied. "Now let me think, ver is, er, L4707?"

As I started to peer about he tapped L4707, at the far side of the chassis, with his finger. There was a dry-joint there all right,

"Yah, yah" he cried, bouncing up and down. "I told her I voz very clever unt she said 'climb up unt ment my aerial zen, unt do it at vunce'.

and resoldering it cured the fault immediately.

When I finished the resoldering I noticed that he had sat down and was looking a bit thoughtful.

"Do you know Mrs Creaser at number sixty six?" he asked, "der voman mit der giant Rottviler dog zat slobbers all over your clothes?"

"Der cross-eyed vun mit der big mouth?" I asked.

"Yah, yah" he cried, bouncing up and down. "I told her I voz very clever unt she said 'climb up unt ment my aerial zen, unt do it at vunce'. So I vent home and collected by ladders unt climbed up. It voz hard unt hot verk, but I mended her aerial mit a lot of care. Zen, ven her picture vas gut. I charged her. Only the price of a schnapps. 'You charge too much' she says, 'you voz on ze roof only vun minute. Sat is fifty sounsand a day.' I say to her 'madam, ve don't haf to quarrel, I vill unrepair it for you.' 'Go away' she says, 'or I vill set my Rottviler on you'."

I nodded understandingly, and off he went.

Another giant Panasonic

"Yoo-hoo" came a cry from the gate. "I'm Bert Springer. Are you Mr Bullfight?"

"Could be" I replied, "what's your trouble?"

"Set's in the car there. Green picture with sloping lines across. Yesterday the picture kept going to a white line and disappearing. Today the set suddenly smelt of burning then died. My neighbour says it's the condenser, but the gas man says it's the valve. When my insurance man called he reckoned it was the transformer. My Daphne's young man blames the tube. He's very clever, you know. Going to build his own house and make himself a watch and a car. Said he'd mend the set if he had one of those oscoscope things."

It took three of us to get the 29in. monster in. The set turned out to be a Model TX29AD1DP – another one with the Euro-2 chassis. As I took the back off Gullet came back, looking pained.

"Again I haf trobbel. I explain my cleverness unt fit a giant dish at number ninety vun for a huge Portuguese man zat stinks of garlic. zen I tune der set to every programme in ze sky. Ven I finish he say 'I am vanting channel sesent fees as well'. 'Channel sesent fees?' I ask, 'fot is channel sesent fees?' 'Channel sesent fees, you must know!' he says. Zees foreigners are difficult to understand, no?"

"Doesn't mean anything to me" I said.

"So vot could I do? Noddings, zat is fot I could do. So he don't pay me also."

Then he looked at the Panasonic set on the bench. "Ah, zis set I know, like you. Gets trobbel mit der resistors on der tube base."

"Too true" I said, darting my eyes at the tube base. R3388 (3.3kΩ, 0.5W) in the feed to the green gun had burnt away, leaving only its legs, and so had R3386 (560Ω, 0.25W) which feeds Q3384 in the green output stage.

"I daresay zer are dry-joints on der field output chip too."

"Oh sure to be" I said, "they're common enough with this one, aren't they?"

He set off down the path, and as soon as I heard the gate click I examined the field output chip. It was heavily dry-jointed. Once I'd resoldered it and attended to the tube base resistors the set worked perfectly.

A Sharp ES set

Some time later another customer arrived. Strange little fellow. "Sharp" he said.

"Not very" I replied. "used to be when I was younger."

"Sharp telly, in the car" he continued. "Picture went short and shut down."

I collected the set, put it on the bench and suggested he called back next day. It was a 66ES03H. I didn't know it and didn't have a circuit diagram. So I started to look around on the main board. As I was doing this Gunter turned up again. He had a plaster on his chin.

"Vy you keep coming to see me?" I asked.

He opened his eyes wide, pulled himself

up and clicked his heels. "It's ze only place I don't get trobbel" he said, "I am ferry gut television man. but no one here appreciates me. Now I hav more agony."

"Vy?" I asked, "er, why?"

"Der fat voman at der big house on der hill. 'Ah, Gunter, I have noddings on my set' she say. 'Ah', I say, 'it will be der LNB, I zink.' But I do not hav vun with me, so I go home to borrow ours from our dish to try zere. My vife vas vatching Esther Poltergeist unt Terry Vogan and she scream and shout very much indeed."

I nodded understandingly.

"But I am borrowing der LNB for only a vile" I tell my vife. "Zat is ven she threw the vase at me. Ven I take it to ze big house - ze LNB, not ze vase, ze voman is swimming in der pool. 'Oh' she say, 'so zat is der LNB. Let me see zis LNB', and ven I hand it to her she drops it in zee pool'.

Then he noticed the Sharp set on the bench.

"Ah, vun of zese!" he cried. "Ze picture collapsed, zen it shut down, yes?"

I looked at him steadily. "You're reading my mind" I said.

"Fell, you know vat zis will be, same as me" he said. I smiled and nodded and turned my ear his way while I craned forward.

"Of course, it will be der surface-mount IRFR9120 transistor Q701, on der copper

side of der board" he said, "unt ze 1-5A circuit protector zat feeds it. But you will know zat."

"Naturally!" I said. "Funny how we both think the same. I expect you're going now, to tell your wife that the LNB is a little damp."

When he'd gone I replaced Q701 and the circuit protector. Up came a perfect picture.

The next Sharp

"Helaye there, are you Mr Blooper hisself?" called a voice. I looked towards the gate and saw an enormous man coming up the path. He was about twice the size of Cyril Smith. I began to wonder whether I was getting all the nutters today or only my share, but he interrupted me.

"Sharp" he said.

"We've done that one" I replied, "now I'm sure you have a problem. Tell me about it."

"It's me telly, Sharp C66CSD8H. Takes several minutes to come on. It's in the car outside.

I collected it and put it on the bench. Then I plugged it in, switched it on, looked at my watch and waited. After about ten minutes it struggled to life. As I took the back off I willed Gunter Gullet to appear. Sure enough he was soon back again.

"Zer is no justice in zis world" he complained. "Every way I turn I am hafing

trobbel unt problems. I am bitterly disappointed. Zere seems to be a conspiracy against me."

"I understand the feeling exactly, but tell me more" I said, purposely drawing his attention to the Sharp set.

"Ziz man says 'haf a look at zis set I haf just bought for nearly noddings at Solara's food store. Do you know how to tune it to every station zer is?' I tell him 'of course I do. I am very clever'. And I unpack der set and tune in every station zer is and some zere isn't. Ze pictures are vunderful. Ven I finish he say 'now go away unt I vill see how it settles down'."

"People are treating you terribly" I said, nudging the Sharp even closer and stabbing my finger at it. "Er, ha, ha, slow to come on, you know" I added.

He looked down at it. "It will be der usual, I daresay" he said, "ze sousand microfarad, 10V reservoir electrolytic C714. On ze secondary side of ze power supply. Don't you zink?"

"Sure to be" I replied, dragging over my box of electrolytics. "Absolutely sure to be, Gunt..."

He narrowed his eyes and looked at me. "Fot you call me?" he asked.

"Gunt, short for Gunter, naturally."

He relaxed and smiled. "Of course, yah, Gunt, zat is me! Zat is kind of you to say to me." ■

ADVERTISERS' INDEX

Alban Electronics	BC	JW Hardy	258
Aerial Techniques	291	LA Electronics	313
B Smart (Crawley).....	314	Levenhome T/A Commcare.....	275
Campion Electronics.....	314	Martin Turner Direct.....	285
Central Wholesale.....	315	Seme	269
Coastal Aerials.....	297	Sendz.....	IBC
Colour Trade	314	Stewart of Reading	297
Cricklewood Electronics.....	258	Teletest.....	269
D'Lec	313	TW Electronics.....	IFC
East London Components.....	297	Wallis UK	258
Economic Devices	275	Wimborne Publishing.	LI
Electronic World TV.....	313	Wizard.....	315
Euras International.....	275		
Express TV	315		
Grandata	262-265		

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25D716	£1.00	BDX 646	50p	BU705	£1.00	BY229	5p	CLE871A	£5.00	M708 ABI	£1.50
25D787	30p	BDX 658	50p	BU801	50p	BY255	5p	FE3B	5p	M708 LBI	£1.50
25D789	30p	BF8695	20p	BU806A	£1.00	BY299-200	15p	HA1140	£1.00	M37204ECSP	£1.00
25L8020	£1.00	BF870	20p	BU807	50p	BY299-800	30p	HA1185	£1.00	MS858BP	£1.00
25D808	75p	BTW 41	15p	BU808DF1	£1.00	BYT71-800	15p	HA1196	50p	MN650	£1.00
25D880	30p	BT Phonic Batteries	£1	BU824	50p	BYV 19-30	15p	HA11485ANT	£1.50	SI3522V	£1.00
25D1264	50p	BU105/04	80p	BU826	£1.00	BYV 28-200	15p	HA11804INT	£1.50	SAA1061	£1.00
25D1266	£1.00	BU108	£1.00	BUK444/800	£2.00	BYV 95B	10p	HA513384P1	£2.00	SAA301B	£1.00
25D1398	£1.00	BU112A	50p	BUK445/600	£2.00	BYV 95C	12p	HA513385P3	£2.00	SAA5010	£1.00
25D1415	£1.00	BU1126	50p	BUK454/600	£1.00	BYV 96D	10p	HK F4520	50p	SAA5231	
25D1427	£1.00	BU180A	45p	BU1T11	50p	BYW 20-08-9	£1.00	HCF4520BE	50p	(TEXT)	£2.00

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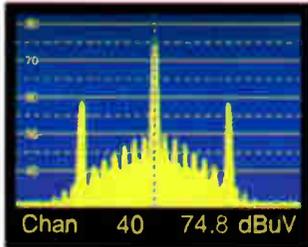
Specific P/P charges are PER ITEM • For UK addresses add P/P to order then 17.5% VAT to total. This applies to EC unless VAT No. is given • Exports - P/P at cost • Postal Order/Cheque with order. Unless otherwise specified add £1.70 P/P to SMALL ORDERS + Additional P/P for HEAVIER GOODS. Technical information by telephone only • Government/School Orders on official headings. Callers to shop - 212 London Road, Southend-on-Sea Open Saturday Only 10-12noon - 2-5pm.

PLEASE ADD 17.5% VAT TO BOTH THE GOODS TOTAL AND P/P CHARGE

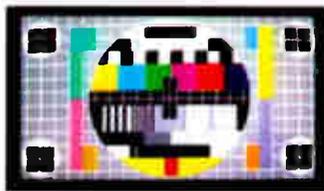
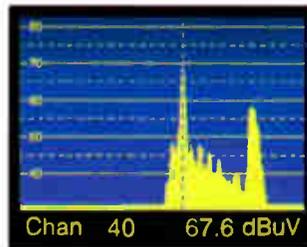


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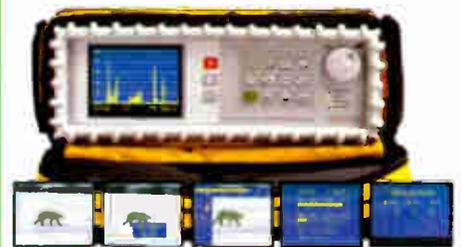
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