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TELEVISION

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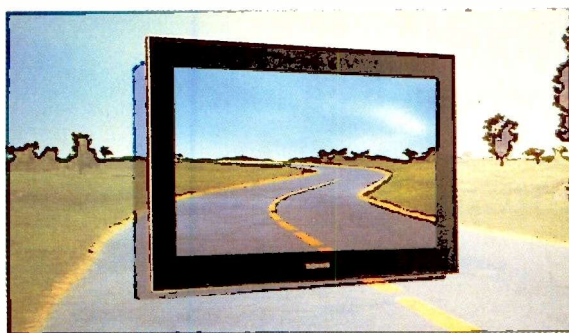
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Let battle commence

One wonders which, if any, of the broadcasters will benefit from the start of digital services. The amount of viewing is unlikely to increase: most people watch as much TV as they want to already. Neither is the amount of advertising likely to increase very much. Will people be falling over each other to pay more for TV? Experience suggests that this is unlikely: people already complain about the cost of pay-TV, whether cable or satellite.

The present ITV channels will see diminishing revenues. Cable should do rather better, if more people can be persuaded to get connected and pay more: there are the additional and useful benefits of telecommunications and internet connection. This brings us to those who are really in the front line, BDB or ONdigital as we now have to call it, and Sky Digital.

ONdigital has presented a neat, well thought-out plan. It will offer viewers an easy to receive, affordable way of getting an increased choice of channels with better picture quality. Easy to receive since a conventional TV aerial can be used and you just need either a set-top decoder box, which will come at a subsidised price of about £200, or an integrated digital receiver-decoder. Affordable since the subscription cost will be less than £10 a month.

The aerial will present a problem for many prospective subscribers, since the channels in some areas do not correspond with the present groupings. In these areas wideband aerials will be required. These tend to be expensive, since wider bandwidth means more aerial elements. There is no suggestion that such aerials will be subsidised. It has been estimated that some £100m might have to be spent on new aerials. That said, in most areas the present

aerial arrangements should suffice.

The only real disadvantage of Sky TV, apart from the cost, is the fact that a dish is required. Many people simply don't like dishes. This is strange, since there isn't nearly as much prejudice against conventional aerials, which can be just as obtrusive. And, as LNB performance has improved over the years, dishes have become smaller. In mesh form they are reasonably unobtrusive. The problem for Sky Digital is that its services will come from 28.2°E instead of 19.2°E. So you will either need to change the dish or install a second one.

Sky Digital was quick off the mark in dealing with this problem. Within a couple of days of ONdigital's public presentation of its service details and intentions, Sky Digital announced that it will provide and install digital dishes free of charge. New subscribers will pay an inclusive charge of about £200 for a subsidised set-top box and the installation of this and a dish. Existing subscribers will get the package for about £160. An effective answer to ONdigital's proposition.

The cost to Sky could be considerable. At £80-£100 per subscriber for the installation and dish, some £320m would be required simply to upgrade all current subscribers. This has, understandably, worried BSkyB's shareholders. But while the short-term costs will be high, the long-term looks a sound bet.

Things still look fairly even. Simply by installing a subsidised box, most viewers will be able to get digital TV from ONdigital. But there will be a maximum of thirty channels, including the present five, and the important movie and sports channels will be BSkyB ones. Enough channels, probably, but it doesn't look too generous compared with the 200 that satellite and

cable intend to offer. ONdigital starts with the advantage that there are 18m households that use conventional receivers and appear to want neither cable nor satellite. But will they want ONdigital either? A lot of selling effort will be required, with no guarantee of success. Cable looks safer. It can simply expand on its present base. So who will be the winner? I have a feeling that Sky has done it once again.

In the short run there is going to be a lot of confusion amongst viewers. The huge amount of advertising promised by ONdigital and Sky Digital probably won't help the average viewer much. It is quite likely that viewers will simply put off their decisions about what, if anything, to do. This could mean a slow market at the start, with little benefit to setmakers and the retail trade. But if some 40m analogue receivers will have to be replaced eventually, someone is going to benefit. In the short run those subsidies will not help the retail trade, since there will be little if any profit margin.

If ONdigital were to fail because it was unable to sell enough subscriptions to become profitable – it will require two million subscribers to break even – where would this leave terrestrial TV in the long term? Would the analogue transmitters be switched off in the absence of a digital alternative? An interesting question.

COVER PRICE

We regret to announce that the cover price of *Television* will be £2.70 from our next issue, dated October. Increased production costs have made this necessary, but we will continue to make every effort to ensure that *Television* remains good value.

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2SA1145	0.36	2SD1398	2.14	BC109A	0.00	BD243C	0.44	BUT18AF	1.37	CD4001	0.24	RG2	0.64	TD41518Q	4.27	TEA1039	2.11
2SA1286	0.60	2SD1426	3.51	BC141	0.36	BD244A	0.34	BUT56A	1.19	CD4017	0.47	RGPI0G	0.26	TD41519A	2.74	TEA2018A	7.24
2SA1370	0.43	2SD1427	2.91	BC147A	0.24	BD244C	0.43	BUV48A	1.97	CD4049	0.35	RGPI5G	0.33	TD41520B	4.50	TEA2029C	2.09
2SA1706	0.50	2SD1432	5.04	BC148A	0.35	BD245C	0.94	BUW11A	1.32	CD4052	0.29	RGPI5J	0.17	TD41524A	7.52	TEA2031A	4.26
2SA733	0.18	2SD1439	5.86	BC148B	0.11	BD433	0.21	BUW41B	1.39	CD4053	0.61	RGPI5M	0.44	TD41553Q	4.79	TEA2164	3.40
2SA872A	6.10	2SD1441	5.98	BC158B	0.12	BD434	0.39	BUW84	1.03	CN662A	1.29	RGF30M	0.30	TD41554Q	8.12	TEA2260	2.48
2SA933	0.36	2SD1453	3.85	BC168	0.04	BD436	0.52	BUX8A	1.03	CN882A	2.10	S2000A	2.57	TD41558Q	7.69	TEA5101A	6.48
2SA940	0.82	2SD1497	4.74	BC182	0.14	BD437	0.52	BUZ71A	1.03	CN8X3A	2.55	S2000A3	3.59	TD41670A	2.98	TKC106D	0.82
2SA950	0.18	2SD1541	4.96	BC182L	0.14	BD438	0.38	BUZ80	3.52	CN757	0.52	S2000AF	1.46	TD41675A	3.85	TKC246D	1.54
2SA966	0.41	2SD1548	5.95	BC184A	0.12	BD0681	0.43	BUZ80A	4.15	DTA114ES	0.31	S2055AF	3.74	TD4190A	1.63	TP1060	0.60
2SA992	0.31	2SD1554	3.25	BC184L	0.06	BD0826	0.43	BUZ90A	3.40	DTC124ES	0.77	SAA129302	10.37	TD41908A	5.61	TP110	0.35
2SB1010	0.35	2SD1555	2.65	BC187	0.47	BD0839	0.57	BUZ90AF	3.30	DTC144ES	0.19	SAB3035	1.71	TD42002	1.12	TP112H	0.77
2SB1066	0.82	2SD1556	5.11	BC212	0.09	BD901	0.52	BY127	0.18	FR605	1.90	SG264A	12.88	TD42005	1.83	TP120	0.40
2SB1143	0.77	2SD1651	2.38	BC212B	0.19	BD902	0.60	BY133	0.08	FXT749	0.43	SGSIF344	10.70	TD42006	1.06	TP122	0.40
2SB1243	0.60	2SD1858	0.43	BC212L	0.18	BD911	0.52	BY206	0.20	HA13019	3.85	SL1430	1.92	TD42030H	0.91	TP2955	0.89
2SB560	0.43	2SD1877	2.14	BC237	0.12	BDT64C	1.18	BY227	0.13	HA13117	2.05	SL1431	2.82	TD42030V	1.46	TP299E	0.77
2SB643	0.29	2SD1878	2.63	BC237B	0.19	BDT65C	1.68	BY228	0.26	HA13151	13.20	SN74141N	0.17	TD42050	4.56	TP3055	1.08
2SB647	0.57	2SD1879	3.16	BC238	0.11	BF194	0.22	BY2291000	1.31	HA51338SP3	7.69	STK4132I	10.00	TD42270	12.08	TP31A	0.36
2SB649A	0.77	2SD1884	3.35	BC238B	0.16	BF195	0.07	BY255	0.14	HM6251	1.42	STK4141I	10.23	TD42540	1.29	TP32C	0.40
2SB688	1.61	2SD1887	3.56	BC307	0.06	BF197	0.18	BY299	0.18	ICH281	0.26	STK4142I	9.40	TD42541	1.12	TP35C	1.82
2SB698	0.35	2SD288	0.85	BC307B	0.15	BF199	0.18	BY397	0.20	IR959A	15.79	STK4152I	10.95	TD42577A	3.45	TP41C	0.65
2SB716	0.43	2SD350A	1.97	BC308	0.09	BF258	0.04	BY398	0.16	IRFB40	5.98	STK4192I	14.64	TD42578A	3.20	TP42C	0.52
2SB772	0.50	2SD381	1.66	BC308A	0.09	BF420	0.21	BY399	0.12	KI66210AH	6.15	STK5332	2.82	TD42579A	4.91	TPL761A	1.85
2SB774	1.61	2SD400	0.34	BC308C	0.26	BF421	0.24	BY448	0.30	LA4270	2.73	STK5342	4.07	TD42581Q	2.57	TPL791A	1.25
2SB891	0.60	2SD401A	0.77	BC309B	0.10	BF422	0.19	BY449	0.12	LA4280	3.12	STK5372H	6.84	TD42582	3.85	TLP072CP	1.03
2SB892	0.35	2SD468	0.28	BC327	0.10	BF423	0.14	BYD14J	0.35	LA4282	5.11	STK5421	9.52	TD42583	1.12	TMP47C432AP8189	15.19
2SC1008	0.24	2SD667	0.38	BC328	0.14	BF459	0.43	BYD33D	0.16	LA4445	3.45	STK5481	8.12	TD42590	7.69	TMP47C434N3537	15.22
2SC124	0.48	2SD669A	0.64	BC337	0.14	BF471	0.37	BYD33M	0.26	LA4460	2.50	STK7253	7.69	TD42611A	0.64		
2SC1318	0.19	2SD718	1.90	BC338	0.06	BF487	0.57	BYV10-40	2.55	LA4700	4.27	STK7308	6.41	TD42611AQ	1.32		
2SC1473	0.21	2SD756	0.47	BC368	0.18	BF491	0.41	BYV95B	0.21	LA6324	2.05	STK7348	5.74	TD42653A	4.70		
2SC1573	0.52	2SD837B	1.12	BC369	0.18	BF494	0.12	BYV95C	0.28	LA6910	2.94	STR11006	7.37	TD43190	2.05		
2SC1675	0.14	2SD856	0.79	BC372	0.53	BF759	0.38	BYV96D	0.27	LA7830	1.88	STR4211	9.30	TD43330	14.21	TPU2732	10.05
2SC1685	0.21	2SD882	0.43	BC546A	0.11	BF869	0.38	BYV96E	0.53	LA7832	2.40	STR50020	9.48	TD43505	2.40	U2829B	3.40
2SC1740	0.16	2SD988B	6.41	BC546B	0.12	BF871	0.41	BYW56	0.31	LA7835	2.99	STR50103	4.48	TD43560	6.13	UC3842	1.46
2SC1815Y	0.11	2SD965	0.67	BC547	0.11	BF959	0.18	BYW95C	0.21	LA7837	4.19	STR50103A	5.56	TD43561A	3.85	UC3844	1.20
2SC2001	0.23	2SD965R	1.05	BC547A	0.04	BF960	0.30	BYW96E	0.50	LD7132	4.70	STR54041	5.15	TD43562A	4.62	UC3844N	1.91
2SC2023	3.18	2SK1117	3.40	BC547B	0.11	BF970	0.43	BYX55600	0.23	LED3G	0.10	STR5412	4.02	TD43565	2.74	UPC1318AV	3.85
2SC2073	1.03	2SK1118	3.40	BC548	0.11	BFR90A	0.68	BZV10	1.34	LED3R	0.10	STR58041	8.12	TD43566	6.41	UPC1365C	

Digital TV:

the Semiconductor Contribution

How developments in microprocessor technology have contributed to reduced set-top box cost with enhanced performance. Noel Hurley of ARM Ltd explains

Cost is probably the main factor that determines the viability of a digital TV service. In particular, without reasonably priced set-top boxes the public wouldn't be interested. The semiconductor industry has, in this respect, made a major contribution – by designing chips that can carry out the signal processing required, then by integrating and shrinking them to produce small chip sets that cost a fraction of earlier multi-chip solutions. In so doing new opportunities for further cost reduction have arisen – by rethinking the hardware/software design mix used in the set-top box.

Shrinking the Chips

The semiconductor industry is ruled by the laws of geometry. Small changes in semiconductor geometry result in large changes in die area. The cost of the chip is thus reduced. Table 1 illustrates this, showing how the Advanced RISC Machines Ltd. (ARM) solution for a digital TV set-top box chip set has evolved and will continue to do so. Initially three chips were required for post-demodulation signal processing in the set-top box. They were produced using a 1 μ semiconductor process. Theoretically it should be possible to shrink this vastly by using a single chip based on 0.18 μ semiconductor fabrication. In so doing the silicon cost would be reduced to only three hundredths of the initial three-chip, 1 μ solution.

Along with the die area reduction, the speed at which the chip operates is increased – a real win-win situation! This technology relies on the use of microprocessors

that are deeply embedded within VLSI chips rather than a stand-alone processor such as the Intel Pentium. Deeply embedded processors are smaller but not necessarily less powerful. The advantage is that they can be integrated with many other circuit requirements to create single-chip solutions.

By applying the geometric rules to embedded microprocessor technology, the performance level that could be achieved in the near future can be predicted with a degree of confidence.

The speed of the ARM ARM7TDMI processor has increased from 33MHz with 0.6 μ fabrication to 77MHz with 0.35 μ fabrication. The company predicts that 85MHz will be achieved with 0.25 μ fabrication and over 90MHz with a further reduction to 0.18 μ . This is achieved without making any change to the actual design of the chip (its 'architecture').

When design changes are made as well, the speed can be further increased. ARM has recently announced the ARM9 series of microprocessors, which can use the same software and make use of the same development tools as the current ARM7 series. Design improvements enable the ARM9 series to run at approximately twice the speed of an ARM7 device when the same type of fabrication is used. The first ARM9 devices, using 0.35 μ fabrication, operate at 130MHz: with a move to 0.25 or 0.18 μ , speeds in excess of 200MHz will be achieved.

Set-top Box Design

What can the set-top box designer do with this increased processing power? It could be used for product differentiation, for example to provide faster, whizzier graphics than other boxes or advanced search and display mechanisms for the electronic programme guide. The problem with doing only this is the customer's likely response to the value added to the product – will he pay more for the whizzier features? Probably not.

An alternative way of using the extra processing power is to reduce the cost of the box. The faster microprocessor can be used to replace other silicon hardware. ARM hopes to be able to replace the modem with a processor-run software routine. A V22 modem can be implemented by using a 14MHz ARM processor with software, a V34 or 56k modem by using a 50MHz ARM processor. This would enable the designer of a box to reduce its cost by removing the need for a modem chip.

Other areas that might lend themselves to microprocessor plus software implementation are the audio decoder

Table 1: Digital TV chip evolution.

Fabrication, μ	1	0.6	0.5	0.35	0.25	0.18
No. of chips	3	1	1	1	1	1
Silicon area, mm ²	200	72	50	24.5	12.5	6.5
ARM7TDMI, mm ²	–	4.8	–	2.1	~1	~0.6
Speed, MHz	–	33	40	~70	~85	?
Volume production	1990	1992	1995	1998	1999	2001
Relative cost	1	0.35	0.25	0.12	0.06	0.03

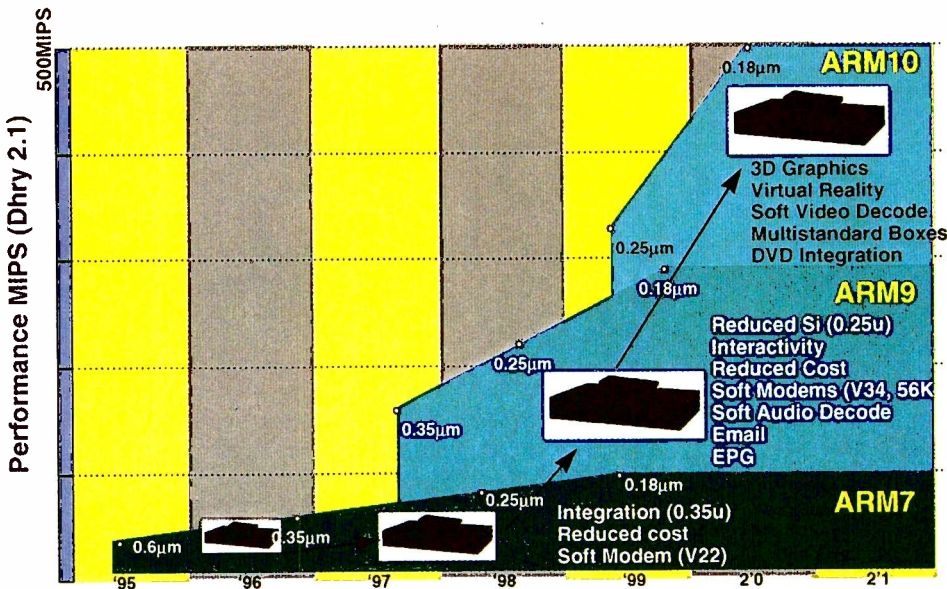


Fig. 1: ARM's digital set-top box "roadmap".

and, eventually, the MPEG video decoder. Once this becomes possible, it will be far easier for a set-top box manufacturer to produce a design that can be sold worldwide, further reducing costs.

When ARM10 series processors in 0.18µ form become available, in about 2000, it should be possible to integrate other digital entertainment systems, such as DVD and home theatre, in the set-top box. At last there would be only one remote control!

Fig. 1 illustrates the way in which ARM sees the processor technology developing.

The Future

At some point in the future the ability of a company to produce ever more complex single-chip processing solutions will no longer be determined by semiconductor technology. Increasingly, the tools used and the management and technical abilities available in a company will set the limits.

In the past, semiconductor companies have had to increase the expertise of their designers as more and more technology has been incorporated on a single piece of silicon, whether the design has been based on hardware or software. It has also been necessary to increase the size of design teams. This has imposed extra demands on the skills of project managers – all this at a time when there has been much pressure to reduce design cycles.

This has given rise to a new type of company that can trade its expertise with semiconductor manufacturers. Companies such as ARM have been involved in the design and licensing of microprocessor technology since 1990. Thus semiconductor manufacturers can concentrate on developing their own expertise, outsourcing design in areas where they have limited know-how.

As ARM sees it, the computing capability of set-top boxes will continue to increase in the near future. Single-chip solutions will incorporate 200MHz processors before 2000, and 300-400MHz processors will be used shortly afterwards. There will be a trend for hardware modules to be replaced by software routines run by these faster processors.

ARM Ltd. can be contacted on 01628 427 751, or you can visit the ARM web site at:

<http://www.arm.com>

Acknowledgement

The above article is an edited version of a paper presented at a Cable & Satellite '98 seminar by Noel Hurley, business development manager, digital entertainment, Advanced RISC Machines Ltd.

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TELETOPICS

Interactive TV

The World Wide Web Consortium (W3C) has released specifications for a Synchronised Multimedia Integration Language (SMIL). Use of the standard will make it easier to develop TV-like content for the internet by synchronising images, text and animation.

The BBC is to join trials of Web TV's internet-based interactive TV system. Access to the internet is provided by British Telecom, while Pace Micro Technology is supplying WebTV set-top boxes. The BBC is to provide broadcasting facilities and will produce information to complement its programmes. This will be made available as pages on the internet. A technology called TV crossover links, with data transmitted during the vertical blanking interval, will provide a link between these pages and the programmes. Viewers will see an on-screen icon and, by using a remote control unit, will be

able to call up and display the relevant web pages. Although the trial will be nationwide, only some two hundred households will be involved. WebTV is owned by Microsoft.

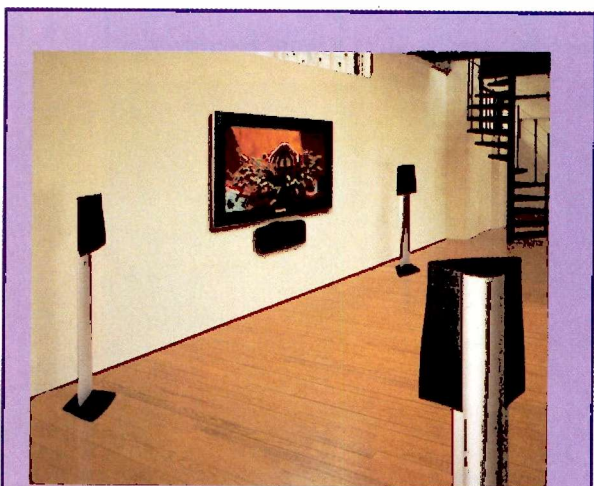
Microsoft has already been carrying out trials in conjunction with BT and Pace, but these were linked to WebTV's US service. As a further development later this year, the BBC will supply material from its digital TV services.

ONdigital (previously BDB – see elsewhere) is to offer interactive services about six months after its autumn launch. These will include information services such as weather and travel, interactive advertising and programme-based TV information. Transactional interactive services such as home shopping will be introduced later, also possibly full internet access.

Cable and Wireless Communications (CWC) is to invest £13m in

the interactive TV company Two Way TV, giving it a 50-1 per cent stake. As part of the deal CWC will add Two Way TV's range of services to its forthcoming 200-channel digital cable TV package: it will also act as a distributor of Two Way TV services to other cable and DTT operators.

Two Way TV specialises in interactive entertainment, enabling viewers to compete in real-time during game shows and live sporting events, also to take part in TWTV's own channel, The Games Lounge. Viewers can compete against others in their own home or, via a cable or modem link, with others around the country. The service can be provided on a subscription basis, as part of a service package or be self-funded, with viewers 'buying' credits. TWTV has spent three years developing the system, and has already conducted extensive trials in the Midlands.



Thomson Multimedia has launched what it claims to be the thinnest, lightest wall-mounted TV, the Wysius. The flat display screen, which is 106cm diagonally, 9.6cm thick and weighs 42kg, uses plasma technology. A process developed by NEC, Capsulated Colours Filters, prevents phosphor impurities reducing picture sharpness. The suggested price is £11,500, or £13,500 as part of a complete home cinema system.

Satellite News

The Radio Regulations Board of the International Telecommunications Union has ruled against Eutelsat's claim to the 29°E orbital slot. Eutelsat had planned to use this position for its Eutelsat-1 craft, which could have interfered with the Astra 2A and 2B digital TV satellites at 28.2°E. The RRB said that Eutelsat had not made use of the 29°E slot originally allocated to it within the allotted time period. The Board has instructed the Radiocommunications Bureau no longer to take Eutelsat-1 into account when considering changes to the Broadcast Satellite Service Plan. Eutelsat is contesting the decision, which it claims does not comply with ITU regulations, via the French Administration. Astra 2A is due for almost imminent launch. Currently Astra 1D is being used for digital TV transmissions at 28.2°E.

The Nordic Satellite Company NSAB has leased its Sirius-3 satellite to SES (Astra) for up to twelve months. It will be sited at 28.2°E for use as a back-up for 2A. By October 1st 1999 it will be transferred to NASB's orbital slot at 5°E, where it will replace Sirius-1.

Power Saving

According to US government research, standby operation wastes at least eleven per cent of the power consumed by domestic electronic equipment such as TV sets, VCRs and PC monitors. VCRs are the worst offenders: almost ninety per cent of their power consumption is used in the standby mode, waiting for someone to issue a command.

To minimise the problem Philips Semiconductors has come up with a chopper power supply chip, called the GreenChip, that reduces the consumption of a piece of equipment in the standby mode from 5-10W to only 1-2W. A second GreenChip can reduce the power consumption to between 0.1-0.5W. The chips will be available with power ratings up to 200W.

VHS Formats

JVC has finalised the specification for its Data VHS (D-VHS) format, with technical advice from Hitachi, Matsushita and Philips. D-VHS uses a bit-stream system to record digital signals directly on tape, without compression, decompression or decoding. The basic technical format was standardised in April 1996. It includes three recording modes. A D-VHS recorder that conforms to the standard mode was launched in the States in December 1997.

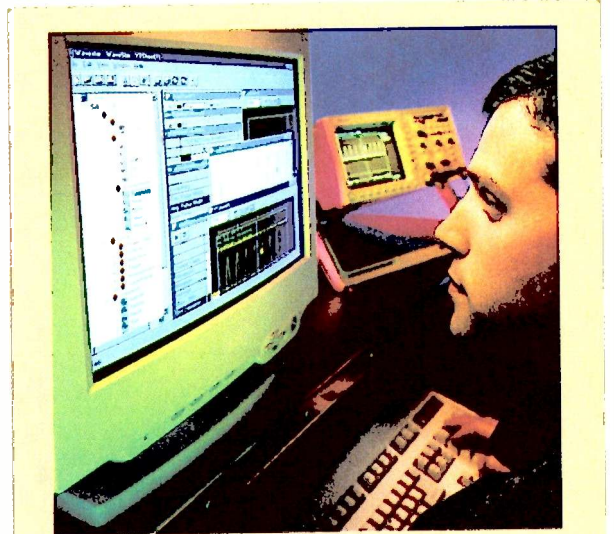
The standard mode has a data input rate of 14.1Mbits/sec, giving up to seven hours' recording time with newly-developed DF420 tape. The tape speed is 16.67mm/sec. The high-speed mode (33.35mm/sec) has a data rate of 28.2Mbits/sec. It can be used for recording high-definition images (resolution up to 1,000 horizontal lines) or for multi-

channel recording. The low-speed mode has four selectable data rates: LS7 at 2Mbits/sec offers up to 49 hours of VHS-quality recording at a tape speed of 2.38mm/sec; LS5 at 2.8Mbits/sec offers 35 hours' recording time at a tape speed of 3.33mm/sec; LS3 at 4.7Mbits/sec offers 21 hours' recording time at a tape speed of 5.56mm/sec; while LS2 at 7Mbits/sec offers 14 hours' recording time at a tape speed of 8.34mm/sec. JVC points out that this range of options assures D-VHS compatibility with a wide range of future applications.

JVC, the French pay-TV company Canal Plus and a French technology company are working on the development of a D-VHS recorder with a built-in, DVB-compliant digital receiver. JVC's first European D-VHS model is expected to be released next year.

CAI '99 Trade Fair

The dates for the Confederation of Aerial Industries' 1999 Trade Fair have been announced: 15-17th June, at The Heathrow Park Hotel, Bath Road, Longford, West Drayton, Middx. For further information phone Ann Little on 0181 902 8998 (fax 0181 903 8719).



For a short period, until December 31st 1998, Tektronix will be supplying with its TDS300 oscilloscope a connectivity interface option and WaveStar software at no extra cost. The WaveStar software is designed for use with the Windows 95/NT PC operating system. It provides easy control of scope functions and automatic data capture without the need for programming. The all-in-one interface caters for popular peripherals. Tektronix UK Ltd can be reached on 1628 403 453 (fax 1628 403 458). The www site is <http://www.tek.com>

Digital TV

British Digital Broadcasting has adopted the name ONdigital for its terrestrial digital TV service, which is expected to start in November with fifteen channels initially, later to be expanded to about thirty. There's to be a £40m launch advertising campaign, with as much again invested in marketing and subsidies. The company has collaborated with major TV manufacturers in developing an open-standard for integrated digital TV sets (idTVs) – Sony, Hitachi, Panasonic and Philips plan to launch idTV models by the end of the year. There will also be set-top boxes for reception. The first idTVs are expected to retail at about £1,000, but sets costing £500-£600 should become available in mid-1999 as production levels increase. Pace, Sony, Toshiba, Grundig, Nokia and Philips will be supplying STBs. ONdigital says its STBs will be able to receive all the BSkyB digital channels by early summer next year – ONdigital and BSkyB are discussing a Simulcrypt agreement. The STBs won't be able to receive BSkyB's interactive services or Electronic Programme Guide however.

Some parts of the UK may not be able to receive all three ONdigital multiplexes (B, C and D). Those in areas where reception of multiplex D is reduced or not possible may pay less than those who can

receive all three. Information on programming and charges is expected next month.

About 70 per cent of UK homes should be able to receive some sort of DTT service. Only about 55 per cent will be able to receive all the digital multiplexes however. In many areas a wideband aerial will be required to pull in extra signals. It's estimated that up to 3.5m homes will need to install a new aerial – the cost could amount to some £100m.

BSkyB's digital satellite TV launch in June was a low-key affair that received little public notice. This is not surprising, as there were no digital set-top boxes in the high-street stores and, during the initial period used to test the system, no advertising. Those who have managed to tune into the test transmissions report several problems, including poor picture quality and non-functioning electronic programme guides.

BSkyB has added more channels to its digital TV line-up. So far seventeen new channels have been added, following deals with Discovery, Flextech and UKTV, the joint venture between the BBC and Flextech. Flextech is providing four channels, UKTV six and Discovery seven. The latter's channels include Discovery Channel, Discovery Home and Leisure (these will have expanded hours), Animal Planet, a time-shifted version of Discovery

Channel and three special-interest channels under the Discovery Showcase banner.

According to a report by Continental Research, by the year 2003 2.8m UK homes will be paying for digital terrestrial TV, there will be 2.6m digital cable TV subscribers and 2m digital satellite TV subscribers. In contrast the government's green paper on broadcasting and communications concludes that it is "very difficult to predict with accuracy the speed and direction of change". A refreshing bit of honesty.

The BBC spent £96m last year on developing digital TV services, including News 24 and the BBC Online web site. The Corporation plans to spend £200m a year over the next five years on digital broadcasting.

The Independent Television Commission has suggested that BSkyB could use the spare digital terrestrial TV channels allocated to Channel 5. Because of the investment cost, Channel 5 is unlikely to use two of the three DTT channels allocated to it.

Screen Subtitling Systems of Ipswich has launched a new range of DVB-compliant subtitling equipment designed for DTT services. DVB subtitling is transmitted in bitmap form rather than the code-based method used for conventional teletext subtitling.



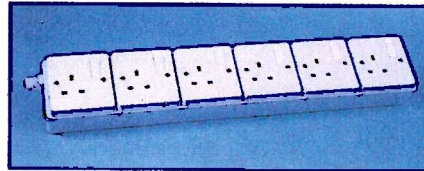
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A typical page from CPC's on-line catalogue.

CPC goes On-line

CPC's new on-line catalogue provides faster ordering and up-to-the-minute information on product prices and availability

Specialist spares distributor CPC of Preston has launched a fully-integrated, searchable on-line electronic catalogue which provides details of over 60,000 main products and 900,000 original manufacturers' spares that are available from the company.

Features

Features of the system include on-line ordering and password-protected access to account details. This significantly reduces the paperwork required and speeds order processing. The information on product prices and availability, and the technical specifications, are kept up-to-date as the system's server database

is directly linked to CPC's central computer system.

The catalogue has been designed to ensure that customers can find a specific part or product quickly and easily, via several search methods. These include a comprehensive index, a key-word search and a CPC order code facility. Users can also identify original spares from leading manufacturers, including Aiwa, Amstrad, Grundig, Philips, Sony and Toshiba.

For ease of use the catalogue has clutter-free pages, high functionality levels and a full on-line help system. Access to the pages is from CPC's web site, at

<http://www.cpc.co.uk>

which also provides company information and news announcements.

The on-line catalogue incorporates an index of equivalent related products, and cross-reference data. This enables a component or spare part to be identified from the make and model of the equipment concerned. If an item is not available, a suitable equivalent is suggested. Where the same item is available from a number of manufacturers, the user is offered a full choice.

Further features of the catalogue include technical graphics, access to special promotional offers, and a facility that enables account holders to check estimated delivery times for items on back order.

For security reasons account holders are issued with a unique password, which is sent by e-mail. Use of this password enables a customer to log on to the catalogue and then check his/her account details and status.

Non-account holders have access to the catalogue by logging on as a guest. To place an order, they have to set up an account and apply for a personalised password. The account application form can be obtained from CPC, filled in on-line or downloaded from the CPC internet site.

As with the paper catalogue, all orders that arrive before 7 p.m. receive same-day despatch.

Technical queries can be dealt with by e-mail. This enables CPC's technical support team to provide a personalised and thorough response.

Operation

Chris Haworth, CPC's managing director, comments that "in view of the ever increasing number of world wide web users and the growing popularity of internet-based ser-

VICES, the on-line catalogue and its facilities are seen as a good opportunity for CPC to improve further its service to customers. There have been many electronic product growth predictions. It is CPC's intention to be at the forefront of this technology in the distribution industry."

The internet server system used by CPC consists of several high-performance Windows NT workstations that hold the catalogue database and have an elaborate security firewall. The server has a wide bandwidth connection to the internet and a permanent, real-time kilostream connection to CPC's IBM AS/400 computer. The data connection to the AS/400 is via a multifunction firewall, using 100Mbps/sec ethernet technology: this supplies new prices and inventory information to the internet server in real time.

Internet catalogue organisation and the addition of new products are carried out by CPC using a unique internet-based administration tool. The use of this software enables CPC to make both trivial

and complex changes to the internet catalogue's database in real time.

Conclusion

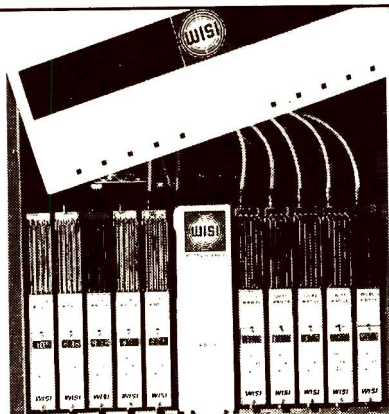
CPC has spent over a year re researching and experimenting with this technology, with the aim of developing the most effective solution. The site is to be monitored, and what is discovered about users' habits and trends will be analysed to ensure that the catalogue continues to meet customers' needs.

CPC is one of the UK's leading specialist spares distributors to the consumer electronics, computer, education, industrial and office equipment markets. The company operates from a modern 80,000 sq ft distribution complex in Preston, Lancashire. Its full-colour catalogue, which lists details of more than 62,000 products in 2,124 pages, is mailed to almost 45,000 trade customers free of charge. There is a trade counter at the company's Preston location.

CPC can be reached by phone on 01772 654 455. The fax no. is 01772 654 466.

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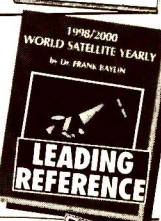


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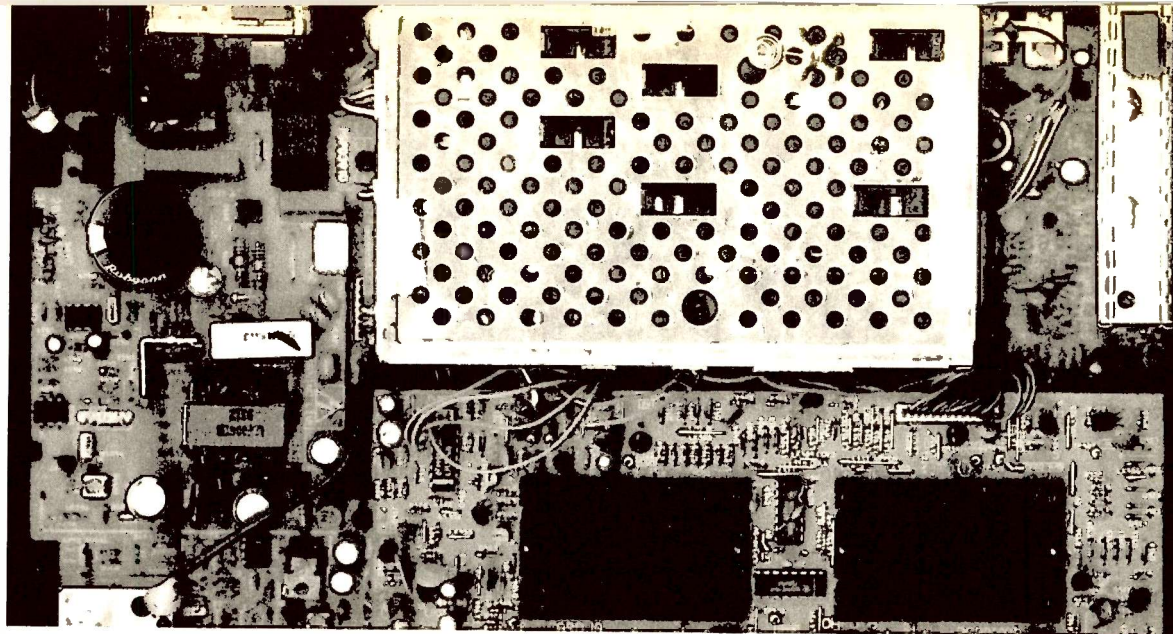
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Satellite Notebook

**Reports from
Philip Blundell,
AMIIE(elec)
C.J. Guy and
Hugh Cocks**

Grundig GIRD2000/Pace SS9000

There were no signals, just hiss on the sound and snow on the screen. It was not possible to check the tuning and LNB settings as the menus were broken up into lines. There was an LNB supply, but the satellite tuning voltage was stuck at 29V – measure it at the positive end of C134. The voltage didn't alter, as it should, when channels were changed.

Checks around the LM7001 tuning chip U20 showed that the reference signal from the tuner was missing. You can normally measure 1V peak-to-peak with a scope at pin 11, using a $\times 10$ probe. A new satellite tuner kit was required to update the original Hitachi type. **P.B.**

Pace MSS1000

Distorted sound was the complaint with this satellite receiver. The cause was C10 (100 μ F, 35V) in the power supply. It's the reservoir capacitor for the -21 V line. The -8 V supply used on the sound board is derived from the -21 V line. **C.J.G.**

Grundig GRD150

The owner of this receiver complained that the local Band III signals that passed through the modulator were attenuated. He also wanted the modulator to be retuned to the local 5.5MHz intercarrier sound frequency (system B/G) instead of the UK 6MHz (system I). We don't see many of these receivers here, and those that we do see are usually connected via a scart lead. This one was used to feed several sets around the house however.

I found a modulator with the

same pin connections in a scrap Far Eastern receiver. It worked well, passing the Band III signals, and was already tuned to the 5.5MHz sound frequency.

Fortunately the Grundig receiver doesn't radiate much interference in Band III. Some VideoCrypt receivers produce a considerable amount of interference. The result is patterning on off-air signals. Normally the cure is to ensure that all coaxial connections are of good quality. Pay particular attention to the bonding of the braid to the body of the coaxial plugs on the lead to the TV set. **H.C.**

Pace DVR500

According to the customer his Dutch digital receiver produced a "flickering picture". When I visited the house I found that this was quite a good description. A basic black-and-white image was present, with flickering, displaced colours overlaid. It was the same on all channels. The receiver responded normally to menu commands.

The remedy was to disconnect the mains power for a minute then reconnect it. I told the customer to repeat this procedure if the fault recurred. So far it hasn't.

There were no obvious power point sparking problems. I wonder whether similar effects will be seen shortly with BSkyB digital receivers in the UK? **H.C.**

A Cable Problem

The owner of a Pace MSS100 receiver said that it was displaying the 'pink screen' LNB short-circuit warning, which had appeared suddenly in the middle of a programme. During the phone call I

was able to establish that the blue 'no signal' message appeared when the coaxial IF download was disconnected.

On the only previous occasion when I've come across the pink message with an MSS100 the fault was in the receiver itself. However there was no such message when I connected the receiver to a standard LNB via a short length of coaxial cable. Only the 'no signal' message was displayed: pressing the F then store buttons removed the message and produced a normal amount of snow on the screen. This almost disappeared when the LNB was disconnected. Time to head for the dish! When the LNB's output was disconnected at the roof end, and the old cable was reconnected to the receiver, the short-circuit message returned. The coaxial cable run to the roof was thus the cause of the fault.

It went to the roof space via a plastic tube that was buried in the wall, with an exit point very close to the fireplace. Although it didn't seem to be a tight fit, no amount of pulling would remove the old cable from the tube. The householder had had some very hot fires during the winter months, so the cable and tube must have melted where it ran close to the fireplace. The replacement cable run was installed well away from this area. **H.C.**

LNB Problems with Digital TV

A French digital receiver was being used for reception of the Canal Plus service via Astra. There was a problem with some channels. They would sometimes be all right, mainly in the evenings, but at other times they would appear "partly" –

as broken up square sections on the screen. This is the effect produced by a weak digital signal. It's something we're all going to become familiar with in the near future!

The receiver's installation signal strength indicator read between 4 and 5, i.e. nearly maximum. Consistent pictures can normally be seen on all channels even with a reading below 4. The branch of a tree in the garden possibly obscured part of the 1m dish. It had been trimmed back, but this hadn't cured the problem. The dish was correctly aligned.

I decided to have a look at the analogue signal output from the LNB. The cause of the problem was evident as soon as a receiver had been connected - there were lots of sparkles on all channels, right across the band.

The cure was similar to that with a problem I'd had a few weeks previously. Remove the Cambridge LNB's outer cover and tighten up the inner one. This produced clear analogue channels and consistent digital ones. On the digital receiver's display the signal

strength was a touch higher at just below maximum.

The effect is caused by feedback within the low-noise amplifier section of the LNB. If the cover is not tightened down well, intermittent 'howl round' (to use audio terminology) can occur. The problem partially cleared at night because the LNB's case would, with the colder air, have contracted slightly. **H.C.**

Pace PRD800 Decoding Problem

This receiver wouldn't decode VideoCrypt channels - reception of uncoded channels was OK. When you are presented with a fault of this type it's essential to find out what the VideoCrypt circuitry is doing. Connect test point TST2 to chassis - it's in the middle of the PCB, adjacent to U19. This will force all the video signals to pass via the VideoCrypt circuitry, whether encoded or not. The decoder circuitry is normally bypassed when the signal is clear.

When I did this there were whitewashed, over-contrasted pictures with unencoded signals. At

this point I dug out the service manual. The power supply section is well thumbed, but the VideoCrypt section had hardly been touched!

The incoming video signal is DC coupled to pin 11 of the analogue-to-digital converter chip U20. It should sit at a DC level of 1V, which is critical. The voltage reading was about 3V however. So I replaced U20, and for good measure the zener diodes D43 (4.3V) and D44 (2.4V) which are connected to pins 12 and 7. VideoCrypt reception was now OK. The receiver was left on soak test for a long time with TST2 still shorted to chassis, so that even if there was no need for decoding the VideoCrypt section would still be in circuit. Everything continued to be work correctly.

U20 normally runs quite warm, which may have contributed to its demise. With the fault present its temperature rose. I found, by experiment, that the chip overheats violently when D43 and D44 are not connected - even for a brief period! **H.C.**

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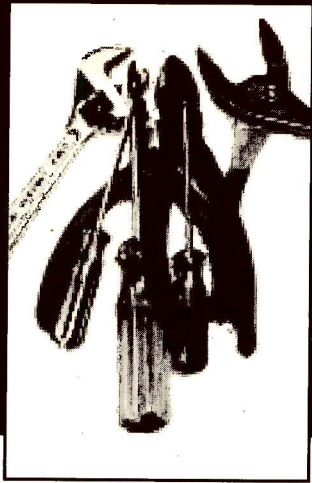
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John Edwards'

Casebook

Grundig CUC3800 Chassis

The tripler had failed. In view of the set's size I decided to quote a price, obtain a replacement then return to fit it. Bad move. When I returned and fitted the tripler next day I found that there was EW bowing. R571 (4.7Ω) had burnt out. Back to the workshop for the resistor and, just in case, a replacement EW chip (IC555). Two types are used in this chassis, depending on tube size. Guess which one I had in stock?! Later that day I returned and fitted the resistor, which smoked when I switched the set on. The customer was not impressed, and accused me of ruining the tube! Two days later I fitted the chip. The set and its owner then returned to normal behaviour. Home jobs are a hiding to nothing.

Sony KV1401U

The customer said that his set went bang when he switched it on. The mains fuse F601 was OK, and there was no short-circuit reading across the mains bridge rectifier's reservoir capacitor C604. When I switched the set on AC was present at the output from the mains filter coil but not at the input to the bridge rectifier.

Then I noticed a black burn mark across the print that led to the surge-limiter resistor R601. When I scraped this clean I saw that there was a thin crack across its width. I bridged the gap with a wire, then measured the resistance across the AC input to the bridge rectifier. A reading of just a few ohms was obtained. So I removed the degaussing resistor, which didn't rattle when I shook it. This cleared the short-circuit and the set worked when it was switched on. A new 180M type resistor completed the repair.

Samsung CI6837AN (Z68 Chassis)

I hadn't seen this symptom before, but the cure was simple. The raster had five evenly-spaced diagonal flyback lines across the lower half of the picture. I decided to replace the TDA8350Q field/EW correction output chip IC301 before worrying about capacitors and voltage readings. Fortunately this cured the fault.

Olivetti CDU1448

The line output transistor (Q406) in this monitor was short-circuit, no doubt because of the dry-joints at every pin of the line output transformer. It had obviously been worked on before, as the transistor's heatsink had been modified. A hole had been drilled to suit a BU2508AF transistor and a mica kit. Not having the manual, I didn't know what the original transistor type was. So I fitted a new BU2508AF. It ran cool enough, and the monitor worked. So I'll have to wait and see.

To cover myself I told the customer what I'd found. He then told me that the set had been repaired by a local

TV shop two months earlier. A further repair under guarantee had been refused on the grounds that the fault was a different one. I wish I knew the secret of how to avoid under-guarantee jobs! If anything goes wrong with something I've repaired they are back on the phone laying down the law. I've had demands to do a freebie on a set three years after the repair!

Goodmans 2875

This set appeared to be dead. But when the supply to the line output stage was disconnected and a bulb was used as a dummy load the power supply proved to be OK. Closer inspection led to the discovery of a crack around the case of C134 (0.01μF, 1.6kV) in the line output stage. To complete the repair, the short-circuit S2055AF line output transistor also had to be replaced.

Ferguson 36K2 (TX89 Chassis)

A slight tap anywhere would produce field collapse. When I removed the back I was in no way surprised. The PCB is so thin and flimsy that great care is required when sliding it out of the cabinet for inspection. Supported at only the edges, by the cabinet channel mouldings, it was bowed downwards at the middle. Numerous dry-joints were evident over the entire board. A thorough blanket resolder cured the trouble.

Mag DX15F Monitor

The customer complained that the colours were "all up the creek". He continued, with a superior tone of voice, "I know it's not the PC, because I've had it checked by two computer engineers – one even tried to charge me just to check it". I should have been warned, but I just wondered why he had gone to the bother – most people would get the monitor checked first, wouldn't they?

Anyway, after connecting it to my trusty old 286, which I use for basic tests such as this, I found that the symptom was actually no red in the display. When I tapped the top of the cabinet the red immediately returned. I was about to regret this move. "Charming" he pronounced, "call that a repair job?" I now decided that I didn't like this man and tapped the cabinet again, but a perfect, rock-steady picture remained. I knew that it wouldn't last, but it would be no good telling him.

So I breathed in deeply, looked him straight in the eye and, summoning up my most authoritative manner, declared "you've got two choices, sir: put a cross on the cabinet so you know where to tap it, or pay me thirty quid and leave here with a repaired monitor". He returned my gaze and I could sense that at this stage he didn't like me either. "What you got to do to it then?" he asked.

A voice in my head told me "tell him estimates are fif-

teen pounds". But, ignoring this, I said "resolder the tube base board". I knew immediately that I'd made the most basic mistake of all. "Right" he said, "I'll get some quotes and let you know." With that he picked up his monitor and departed, no doubt pleased with himself for having got a quotation, fault diagnosis and repair information free. I hope the other engineers on his list are not as stupid as me.

Toshiba V312 (R2000 Chassis)

The E-E picture would either drift off tune, blank out or appear overloaded, while the sound would either diminish in volume, become distorted or remain unaffected. When a different channel was selected the sound and picture would return to normal. If the original channel was selected again the fault symptom would be displayed. If the machine was switched off and left for an hour or so, then switched on again, the previously faulty channel would probably be OK and a different one would be affected.

Voltage readings and scope checks around the IF section while the fault was present and, for comparison, during normal operation (obtained by changing channel) suggested that it was OK. So it seemed logical to obtain and fit a replacement tuner/modulator block – until I discovered that the trade price with VAT is over £70! The customer might be persuaded to spend that much, but it wouldn't leave anything for my trouble – and what if my diagnosis was wrong? MCES couldn't, on this occasion, help.

I discussed the matter with the customer, who confirmed that a repair approaching £100 was out of the question. We then agreed that I would dismantle the unit and hopefully repair it. If I wasn't successful, a token payment of £20 would be made to go towards the cost of my time etc. I hoped to spot a dry-joint or something obvious.

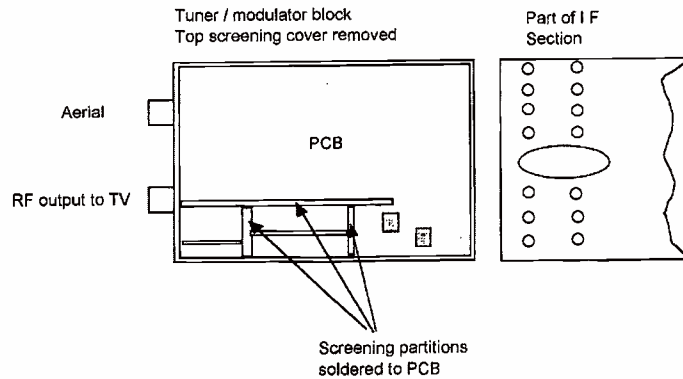
I removed the module's screening cover, swung my powerful illuminated magnifying glass into position, powered up and began my inspection. While checking I discovered that the fault symptom would immediately appear when the screening walls within the module (see Fig. 1) were gently tapped with the handle of a screwdriver. The solder that bonds the screening to the PCB looked a little crusty, so I unplugged the machine and resoldered all the metal-to-PCB connections. After that the picture remained stable during further tapping tests – and I was able to charge a little over £20.

The repair was carried out several months ago and I've heard nothing since. So presumably everything is OK – though it's possible that the customer, knowing the cost of the module, wouldn't bother had the problem returned.

The chassis is used in many Toshiba and Ferguson models, and apparently the drum assembly is supplied only complete, with the lower section, at a cost of some £140. So beware if you make an estimate when there are drum or tuner problems. Incidentally another item that costs far more than it should is the small, plastic capstan pulley in Mitsubishi and JVC machines. It splits and costs about £8 to buy, though I doubt whether it costs more than 10p to produce.

Ferguson 3V42

This machine arrived in the workshop for a routine job – renewal of the broken carriage assembly. It was quickly completed. The monitor was then connected, a tape was inserted and play was selected. My heart sank when I watched the displayed picture, which was nothing short of a mess. There were two very wide horizontal



dark bands that resembled hum bars: in between the bars there was a colourless, spotty picture without a straight vertical line anywhere. The picture was so ragged I had to look at the tape's label to find out what I was supposed to be watching.

"Don't panic" I told myself, "go for the power supply." As the E-E display was normal, a scope check on the playback switched 6V rail, at test point TP2 on the regulator board, seemed to be a good idea. I found a 2V squarewave riding on 4V DC. The likely culprit was the reservoir capacitor C23 (2,200 μ F, 16V), which measured open-circuit. When it had been replaced I had normal playback. Naturally as far as the customer was concerned everything was OK before the carriage broke!

Grundig CUC4400 Chassis

The fault description was interesting. "There was a twangy sound, then a rattle. The set went off then came back on, with a normal picture but no sound." When I'd removed the back cover I realised that this was quite a good description. A large spring sat alongside the TDA7245 audio output chip. Its job is to hold the tube's Aquadag earthing wire tight against the body of the tube. Fortunately, although suspended away from the tube, the bare wire hadn't fallen on to the PCB below.

I refitted the spring to the cabinet moulding at the top of the tube and hooked the wire on to its end, securing it tightly with pliers to ensure that we didn't get a repeat performance.

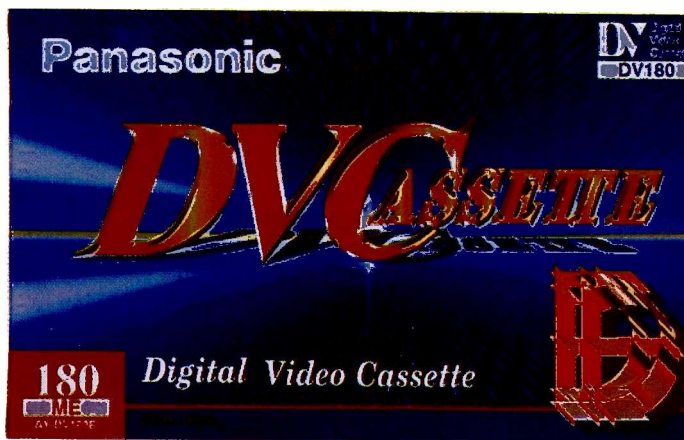
I suspected audio IC failure, but there were no voltages at any of its pins. So a supply rail problem was more likely. As I didn't have the circuit diagram, I reached for my copy of *Television IC Data Files*. This told me that pin 3 is the basic supply point. Armed with this information, I turned the board upside down and followed the print from pin 3. This brought me to R376 (8.2 Ω), which had a dark burn ring around its body. It's in series with rectifier diode D671, which is connected to pin 8 of the line output transformer. Once R376 had been replaced the sound chip had its 16V supply and everything was back to normal.

Sharp C3720H (14A Chassis)

At switch on the red standby light appeared, turned green briefly then returned to red again. The set produced no other sign of life. Checks showed that there was 122V at the collector of the line output transistor Q602 but no line drive – obviously, because the set was in the standby mode. A fault in the field timebase would produce standby operation, so this seemed a good place to start. Sure enough the 3.9 Ω fusible resistor R521 in the output stage's 24V supply was open-circuit. There was no short-circuit from the cathode of the rectifier diode D502 to chassis, so a replacement resistor was fitted. This cured the fault.

Fig. 1: Screening partitions within the tuner/modulator module in the Toshiba Model V312 (R2000 chassis).

Earlier this year Panasonic and Technics held a series of technical seminars in Italy. They covered a number of video and audio developments, including DVD, digital video and TV technology. **George Cole** was there to report



Panasonic and Technics Latest Technology

Panasonic's seminars were held at Stessa in Northern Italy, the first covering developments in TV technology. Panasonic has 27 TV factories worldwide, two in Europe (South Wales and the Czech Republic). Quintrix picture tubes are made in Germany. Each year Panasonic sells around ten million TV sets worldwide, with Europe accounting for 15 per cent. Panasonic has five per cent of the European market, and hopes to increase this to ten per cent by the year 2000.

Tube Technology

Panasonic has introduced several improvements to its Quintrix tubes, including the use of Super Pigment Technology. This involves adding middle gold pigment to the green phosphor. According to Panasonic this enhances the green colour reproduction. Use of a slightly tinted front glass reduces the ambient light reflection,

enabling higher brightness and contrast levels to be achieved. The contrast level improvement is, in comparison with previous tubes, 15 per cent.

A new configuration results in an oval electronic lens whose calibre is 1.7 times larger than that of a conventional lens system. This gives better edge focusing and sharper centre focusing. A new scan-velocity modulation coil varies the horizontal deflection field, again to improve the picture sharpness. The new coil has been integrated with the deflection yoke (see Fig. 1), giving more precise control of the horizontal deflection field.

With a wider and flatter screen the electron beams suffer much distortion as they pass through the deflection fields. This effect can be reduced by making the vertical diameter of the electron beams smaller. A quadruple lens system and a new, rectangular control grid are used for this purpose. The reduced spot size gives a 20 per cent increase in sharpness compared with previous tube technology.

The comma-free yoke has special comma correctors to compensate for the barrel-shaped magnetic field. As a result the RGB spots are more precise.

Finally a new shadowmask has greater curvature, deflecting much of the electron beam energy.

Q-Link

Panasonic has developed Q-link, which is a communication protocol between a TV set and a VCR using a scart connection. It enables data to be downloaded from the TV set to the VCR. Its key features include a WYSIWYR (What You See Is What You Record) feature. When the VCR handset's record button is pressed the VCR changes to the channel being watched and record-

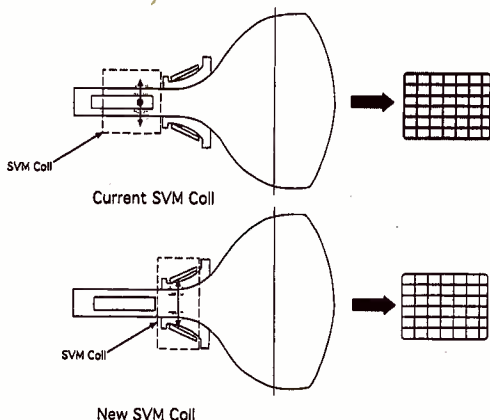


Fig. 1: In the latest Quintrix tubes the scan-velocity modulation coil is integrated with the deflection yoke.

ing begins.

TV Auto Power On makes the TV set switch on from standby when the VCR begins to play. VCR Auto Standby switches the VCR to standby when the TV set is switched to standby – fortunately this feature doesn't work when the VCR is playing, recording or in the timer record mode!

These features sound similar to those offered by the NexTView standard and Sony's new Smart Engine technology. I asked Panasonic whether these systems are compatible. Sadly they aren't – I'll return to the subject of standards when we come to VCR Tape Library systems.

Widescreen Digital Plus

Panasonic's New Wide Digital Plus system offers a number of features. These include extended picture noise reduction, which uses both temporal and spatial processing to produce a 3-D noise system that's claimed to be better than frame-based only noise-reduction systems. The 3-D system is said to be very effective when the picture information contains a large amount of movement. The system also improves 100Hz reproduction, which can suffer from colour smearing – known as the "dirty window effect".

One of the first models to feature much of this new technology is the TX-W32D5DP, a 32in. 16:9 aspect ratio set with 100Hz signal processing and Dolby Pro-Logic sound. It's fitted with the new Euro-5L chassis, which has a lower component count than the Euro-3H.

Digital TV and other Future Developments

Panasonic is involved in digital broadcasting, and Nigel Thomas from Panasonic's Welsh factory demonstrated a prototype terrestrial digital TV receiver (it was not to the same specification as BDB's digital decoder). The receiver has two PC card slots (previously known as PCMCIA) that could be used for common interface modules.

Asked about the use of a 'side-car' for the reception of satellite digital TV programming, Nigel Thomas said that although it was feasible the side car would be at least a quarter of the size of a set-top box, would probably require its own power supply and would thus be expensive.

Panasonic also showed a 42in. plasma flat-screen TV set, a large projection screen set, a prototype TV set with a built-in DVD drive and a 28in. widescreen TV set that incorporates internet capability. According to Panasonic it is too early to launch the latter, while the other sets are currently expensive to manufacture.

Panasonic was asked why none of its new sets offered progressive scan (as opposed to interlaced) technology or Dolby Digital surround sound. There were strong hints that these features would appear in next year's TV range.

Digital Video Technology

If you thought that the limits camcorder compactness had been reached you were wrong. Panasonic unveiled the NV-DS77, said to be the world's smallest digital camcorder. It weighs just 590g without battery and tape, 50g less than its predecessor the NV-DS5. The NV-DS77 has an overall volume of just 620 cubic centimetres, despite incorporating a 3.8in. LCD monitor.

Size reduction has been made possible by high-density packing – the space between many of the 1,700 components is just 0.3mm – and a new eight-layer PCB, also a new super-compact mechanism that's just 59mm in

length (compared with the NV-DS5's 80mm). The upper part of the drum has been cut to reduce its height. The cassette almost touches the drum when inserted.

The NV-DS77 includes variable-speed search, edit effects such as digital wipe and mix (which can be added after the recording), and a 10x optical zoom. An optional PC kit enables images to be downloaded to a computer for manipulation and editing. The NV-DS77 will be launched this autumn – no price details are available so far.

Panasonic is also to launch its first digital VCR, Model NV-DV10000. Its features include a wireless editing controller, LP recording (up to three hours with a 120-minute cassette) and a built-in TV tuner.

The DVC format has been given a boost by the development of longer-running cassettes. There are two new DVC tapes, a 180-minute full-size cassette for DVC recorders and a two-hour mini DV tape for camcorders.

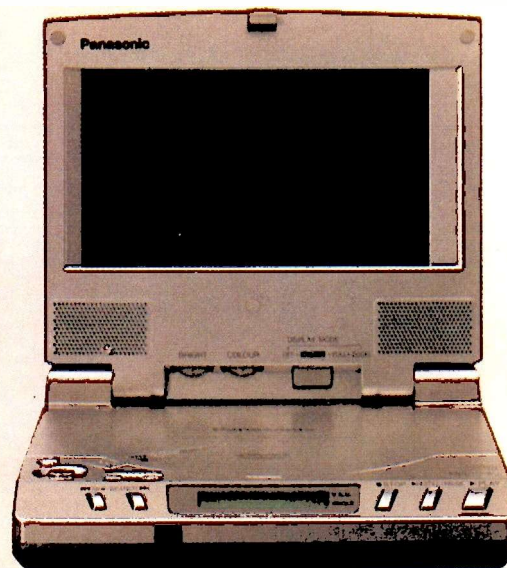
The DVC format relies on metal-evaporated (ME) tape, which is tricky and expensive to make. The new, thinner tape is 5.5 microns thick. It uses a new type of base, a poly-ethylene-naphthalate (PEN) film that's just 4.8 microns thick.

ME tape is produced in a vacuum chamber. The base film is held on a large spool that feeds a second, collection spool. Its magnetic layer consists of column-shaped cobalt crystals. The cobalt is placed in a crucible and heated to 2,000°C by a laser beam. As a result the cobalt vapourises and is deposited on the base tape that runs past it. The film then moves around a cooling drum to protect it from excessive heat. The 0.2 microns thick cobalt layer is covered by a protective diamond-like carbon layer and a fluorine-type lubricant. Panasonic calls this process Tribology Technology.

VHS Developments

The world may be moving towards digital technology but there's still a lot of life in the VHS format. Panasonic's new Model NV-HD680 incorporates some interesting technology. First, it can record teletext data on the tape during the vertical blanking interval. Furthermore subtitle captions can be switched on or off at will – with older teletext-recording VCRs subtitles are 'burnt' into the picture.

The NV-HD680 has a Tape Library system to help the user find programmes on tape. It can store programme data for up to 200 cassettes (an average of three entries



The Panasonic DVD-L10 portable DVD player which has a 5.8in. LCD screen, virtual surround sound and built-in Dolby Digital/MPEG-2 decoders.



The Panasonic DVD-A350 is equipped with a 5.1-channel surround sound decoder for both Dolby Digital and MPEG-2 sound.

per tape). The system assigns a unique ID number to each tape, and automatically stores the data in a SRAM chip within the machine, including programme title, name of broadcaster or channel number, recording time and date, whether any subtitles are recorded and on which tape the programme can be found. The data is collected from the teletext service. Some programme titles are not broadcast, but the user can add a title (of up to 22 characters) using an on-screen menu and the remote control handset.

The user can call up his tape contents on the TV set's screen and scroll through the information pages to find the required programme and tape. When a tape has been inserted, the VCR can be instructed to find the programme from the on-screen menu. The VHS Index Search System (VISS) is used to go to the programme.

The VCR also downloads all the Tape Library data on to the last-used tape, so that if the SRAM chip is damaged the data can still be recovered.

The Tape Library system is very impressive, but there are several competing formats. Sony for example has SmartFile, which stores programme data on a super-thin memory chip that fits inside the cassette label. Hitachi's tape library system is almost identical to Panasonic's, but the two are not compatible. This means that when a user switches VCR brands or exchanges tapes with friends or relatives the benefits of the tape library system are lost.

Prior to the arrival of the VISS format in 1987 there were several incompatible tape index systems. With the introduction of the VISS standard any VISS-encoded tape can be used with any VISS-equipped VCR.

It would be nice if JVC, which handles VHS licensing,

could bring some order into the chaotic tape library market.

DVD Video

Panasonic launched its first DVD Video player in Japan in November 1996, its first US player in the following spring and its first European player last February. At the end of April this year there were 1,435 DVD Video titles in the USA (76 per cent of them films) and 901 titles in Japan (298 films, 187 Karaoke and other titles such as music). Matsushita, Panasonic's parent company, is one of the largest DVD disc manufacturers in the world. It has two plants. The one in Japan produces 600,000 discs a month while the one in California increased its production rate to 2m a month this summer. At the time of writing Matsushita is the only company capable of producing dual-layer DVD discs - which is why they are so scarce.

There are at present four Panasonic DVD players on the market, two table-top models (DVD-A350 and DVD-A150) and two portables (DVD-L10 and DVD-P10). They can all play audio CDs, Video CDs and offer NTSC playback with PAL TV sets. The DVD-A350 incorporates a Dolby Digital/MPEG-2 audio decoder. The DVD-L10 weighs just 910g and has a built-in 5.8in. TFT active-matrix LCD screen in 16:9 format

The DVD-P10 uses a second-generation LSI chip set and a new optical pickup. These are crammed into a 160mm square chassis. There is no LCD screen: it has composite video and S video outputs for connection to a TV set. Panasonic says that thanks to developments in LSI chip technology we can expect even smaller DVD portables.

Fig. 2 shows in block diagram form the first-generation LSI DVD chip arrangement, Fig. 3 the second-generation one. Panasonic is developing a third-generation "super one-chip" arrangement that should be available in 2000: everything except for the pickup preamplifier and driver, the audio DAC and the front panel processor and display/key system will be in one "super chip".

An interesting point is that the regional coding system, which prevents discs intended for one DVD region being used in another one, is not imbedded in the chip set. It will be in the form of software and firmware.

Technics - DVD Audio

The DVD family of discs includes audio, video and

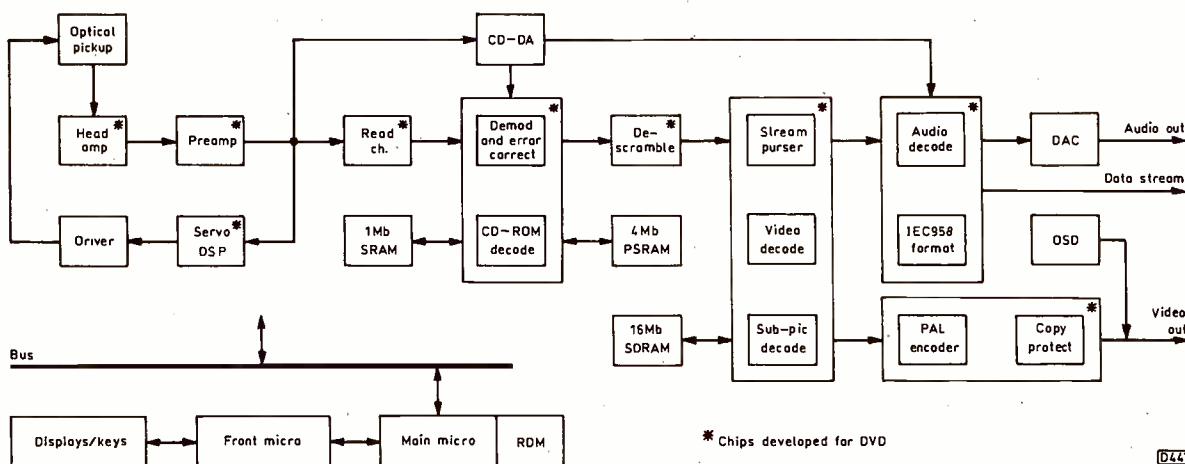
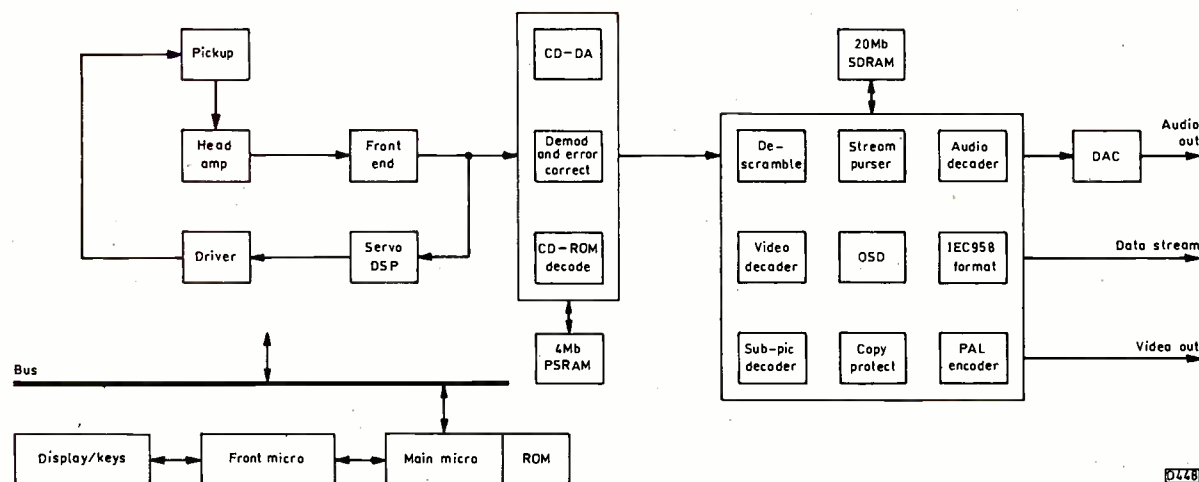


Fig. 2: First-generation DVD player chip arrangement.



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recordable ones. The full specification consists of five books, A for read-only discs, B for video discs, C for audio discs, D for write-once discs and E for rewritable discs. Each book is in three parts, physical, file system and application. The file system used is UDF, which stands for Universal Disc Format. This is a common-file format for all applications, including audio and video. Thus the same file format can be used for different types of DVDs, making it easier to record discs and achieve compatibility. In comparison the CD format uses different file formats for each type of disc – for example CD-ROM uses the ISO 9660 standard. Technics, whose seminars were held in Genoa, devoted much time to the DVD Audio format.

Why do we need another audio format? The CD audio format launched in late 1982 samples an analogue input at a rate of 44.1kHz, producing 16-bit samples. It's far superior to an analogue LP in terms of frequency response, dynamic range, signal-to-noise ratio, harmonic distortion and other factors. But the CD specification was limited by the digital technology then available. It's now possible to have an audio format with a much improved specification.

This is not the only reason however. Although the CD format has been one of the most successful consumer products ever (around 600m CD players and over 10bn discs have been sold), sales are flattening out and the margins on mass-market CD hardware are thin. So enter super CD, which will provide better sound and additional features.

In the mid-Nineties several music industry organisations formed the International Standards Committee (ISC) which drew up a "wish list" of features that should be provided by any new audio format. They included sound quality, multi-channel sound, copyright protection, disc size and packaging. The ISC wanted compatibility with existing CD players and discs, in other words the new discs should also be playable by today's CD decks. This latter feature has proved to be problematical however, and the DVD Audio standard makes it optional rather than mandatory. Incidentally the music industry is not interested in a Regional Coding system that prevents discs being bought and used anywhere.

The DVD Audio Standard

The DVD Forum set up Working Group 4 (WG4) to develop a DVD Audio standard. Current DVD Video players use Dolby Digital and/or MPEG-2 5.1 audio and

linear PCM audio (usually 96kHz/20-bit or 96kHz/24-bit). The latter is part of the DVD Video standard, not the DVD Audio standard, which is much broader. WG4 includes 39 companies from the consumer electronics and computer industries – Matsushita, Hitachi, Sony, Philips, Intel and IBM are all members. It has held thirty meetings, and version 1.0 of the DVD Audio standard should, according to Technics, be completed by the end of September.

The basic DVD Audio specification provides a range of sampling rates, from 44.1 to 192kHz, with 16- to 24-bit samples, the 'standard' specification being 96kHz/24 bits. The audio can be mono, stereo or six-channel. DVD Audio discs are of the same size and thickness as CD discs (12cm in diameter, 1.2mm thick), and only one side is used. An optional dual-layer format, which could be used for a CD audio layer or additional playing time, is available. Multimedia material, such as still pictures, video and text, can be added, with display on a TV set or PC monitor.

DVD Audio discs will play on new DVD Audio decks and a new generation of so-called Universal Players that will play DVD Video and DVD Audio discs. If a DVD Audio disc contains a video clip, this could be played on a DVD Video machine.

The first DVD Audio players and discs are expected to be released in Japan next spring, but there's a fly in the ointment. Sony and Philips have developed another "Super CD" called Super Audio CD (SACD). It offers similar features to DVD Audio but is not compatible (though the audio coding method adopted by SACD could become an optional part of the DVD Audio specification). SADC is due for release in Japan early next year. One can only hope that the two parties will collaborate to produce a single standard.

Solid-state Audio

Looking farther ahead Technics showed us a solid-state audio player that can record up to ten minutes of MPEG audio on a 10Mbyte SRAM card. But from a practical point of view Technics says that a capacity of 100Mbytes is required. Even with the falling price of memory chips, Technics doesn't expect its microchip player to reach the market until well into the next century.

Acknowledgement

My thanks to the various Matsushita groups for their help with this feature.

Fig. 3: Second-generation DVD player chip arrangement.



Robert Blair describes fault-finding procedures and repair techniques for microwave ovens, the aim being cost-effective servicing

Microwave Servicing: *Hints and Tips*

Several articles on microwave oven servicing have appeared in *Television* recently. So it's likely that many readers will be thinking about adding microwave ovens to the range of products they service. The purpose of this article is to help you get started. It's based on my own repair experience over several years. The main theme is time- and money-saving tips that will help you make the work cost-effective.

Health Warning!

Before you carry out any work on the internal circuitry of a microwave oven, ensure that the unit is disconnected from the mains supply and that the high-voltage capacitor has been discharged. With respect to capacitor discharging, the procedure recommended by Panasonic is as follows: wait for thirty seconds after switching the oven off, then use an insulated jumper lead to short the diode lead connector to earth. Hitachi advises that you wait for two minutes before attempting to discharge the capacitor.

A microwave oven's outer covers can be difficult to remove. To prevent injury from the sharp metal edges, always wear a pair of stout industrial gloves. They will also provide protection against the grease that can accumulate in a heavily-used oven.

Fuse Blowing

A blown internal fuse is one of the most common faults encountered. The fuse may be rated at anything from 5A to 13A. Causes of failure are many and varied, but it is usually a fairly straightforward task, with a little logical diagnosis, to decide where the cause of the trouble lies. Don't replace the fuse without making some checks – it

will invariably blow again immediately. There is always a cause for the failure, though it may not be immediately apparent.

The first item to check is the oven lamp. If this blows, it frequently takes the internal fuse with it, in which case the customer will usually say that there was a loud crack before the oven went dead. Unfortunately this fault can sometimes result in damage to components on the digital control panel.

Once you have ascertained that all is well in this department, take a look at the high-voltage rectifier. It's best to check this with one end disconnected. If you use a digital meter with a range of 2M Ω or less, the diode will normally appear to be open-circuit. Using the high range of an analogue meter you will get a diode reading. If it reads the same both ways, replace it.

Some ovens have two diodes, one of which is a back-to-back protection device that's connected in parallel with the high-voltage capacitor. Check this diode as well – you will frequently find that it's short-circuit.

Next move to the high-voltage capacitor. Disconnect all leads from the two sets of terminals. When a test meter's leads are connected to the capacitor's terminals you should see a momentary kick, after which the meter should read infinity. There should be no reading between the terminals and the outer casing, except possibly where an internal diode is used – you occasionally come across a capacitor with an integral diode: if either the capacitor or the diode is faulty, the whole thing has to be replaced.

If the above checks have failed to reveal anything amiss, take a look at the magnetron. A meter connected across its terminals should produce a reading of approx-

imately 0.4Ω. There should be no reading between the terminals and the magnetron's casing. If there is, fit a replacement. In a few models the high-voltage transformer may have to be removed to enable this to be done. Do not neglect to replace all the surrounding bits and pieces, however insignificant they may appear to be.

If all is well with the magnetron, move on to the high-voltage transformer. When this item is faulty you will often find that the windings have a burnt appearance and there's a pungent smell. Again replace it if faulty.

The door and monitor interlock switches can become faulty, the result being a blown fuse. It is recommended that they are both replaced should either of them fail. When you check these switches, remove the spade connectors from the terminals to avoid misleading results.

Repeated Fuse Blowing

More than one component can fail. The result will be repeated fuse blowing, which can be costly. To avoid this, you can use the simple but extremely useful arrangement shown in Fig. 1. It will indicate the presence of a short-circuit switch or other device without the risk of destroying your replacement fuse. In the interests of neatness and safety, use a small case to house the circuit, with a window for viewing the bulb.

Connect the unit to the mains supply then plug the oven into its 13A mains socket. Switch on. If there's no short-circuit present the bulb will glow dully. It will glow at full power if there's a short-circuit. Whatever the result, the new fuse will remain intact. With an oven that has a mechanical timer, select the 'cook' mode. If all is well the bulb will glow with moderate brightness. If there's a fault in the high-voltage section the bulb will glow fully. Unfortunately it is usually not possible to carry out this last test with a digital touch-pad oven.

Random Fuse Blowing

One of the most irritating problems is random destruction of the internal fuse. In my experience the two major causes of this are faulty door switches and, particularly with Sharp ovens, a damaged waveguide cover. The cover will usually be discoloured and show signs of having been burnt. The magnetron probe may also be damaged. Replacement is the only remedy.

Instead of buying individual waveguide covers you may find it more cost-effective to purchase roof-lining material in sheets. New covers can be cut out quite easily using a pair of good scissors, with the old cover as a template.

When fitting a new waveguide cover it's frequently easier to turn the oven upside-down or on to its end. This way you have the help of gravity when replacing the screws. Before fitting the cover, ensure that the waveguide port is free of debris.

Heating Problems

It can sometimes be difficult to determine just where the fault lies when the complaint is that the oven works in every respect except that it doesn't heat up. This is where a Voltstick, available from B&Q stores for about £10, can be handy. It will glow when placed within two-three inches of the magnetron's leads. This proves that the high-voltage section of the oven works. If this section is OK but the oven doesn't heat, the cause is usually poor contacts at the terminals of the magnetron or the high-voltage capacitor. Discharge the capacitor before attempting to clean any of these contacts.

Use a fibre pen or fine file, and tighten the connectors if necessary. Check that there's no corrosion, causing

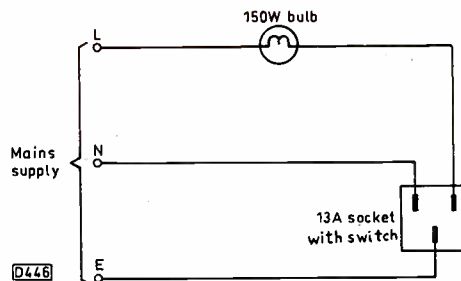


Fig. 1: Simple oven-fuse protector arrangement. Build it in a case with a window to view the bulb.

poor contact, in the connection between the wire and the spade terminal. If the oven still fails to heat, suspect the magnetron or a leaky high-voltage diode or capacitor, particularly if loud buzzing accompanies the fault.

Some manufacturers fit an in-line fuse between the capacitor and the magnetron. Failure of this fuse generally means that the magnetron is faulty.

If the Voltstick fails to glow in the vicinity of the magnetron, start looking for a problem in the AC supply to the transformer, including relays and thermal cutouts, or possibly the transformer itself.

Partial Cooking

Occasionally the complaint with an oven is that it cooks the food only in parts. This can be extremely hazardous from the food poisoning point of view of course. The cause of the problem is failure of the turntable or the distribution fan to rotate. The fan is normally located in the roof of the cavity, behind the waveguide cover. In a few models it's under the cavity floor. It may be belt driven or activated by air pressure from the cooling fan.

If the oven uses a turntable, check for wear on the drive shaft that sits on top of the motor spindle. If this is OK, the motor may have seized. With a fan, the drive belt may have snapped or be slipping. A fan can also foul the waveguide cover, preventing rotation.

Faulty Grill

The grill element can fail in an oven that has this facility. Before you go ahead with the repair it's advisable to contact the customer: replacement elements can be quite expensive.

Control Panel Repairs

As there are few stock faults with digitally-operated control panels, repairs down to component level can be very time consuming. In such cases it may be more expedient to use the services of a company, such as QER (address below), that specialises in trade panel repairs.

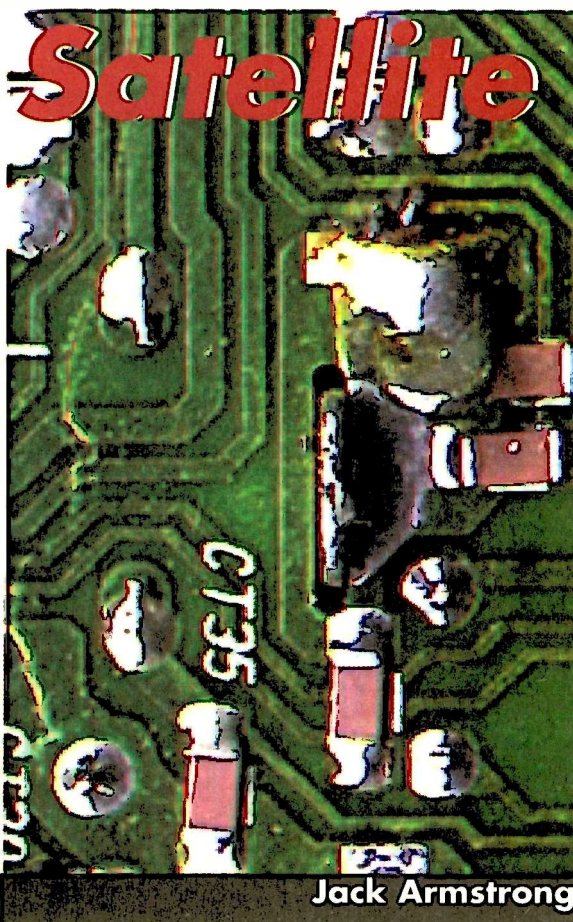
In Conclusion

Most microwave oven repairs are fairly straightforward and, with the exception of some control panel faults, can be carried out in a cost-effective manner. As ovens are being sold at ever-lower prices however, it is advisable to charge a non-returnable 'investigation fee' (deductible from the cost of the repair when completed) in order to cover lost time should the customer decide that the repair is not worthwhile.

Useful Addresses

AWI Ltd., 29 Manners View, Dodnor Industrial Estate, Newport, Isle of Wight PO30 5AF. Telephone 01983 520 121. A good source of spares.

QER, Quality House, Reedlands Road, Clay Flatts Industrial Estate, Workington CA14 3YF. Telephone 0190 067 913. Panel repairs.



WORKSHOP

between the power supply and the main PCB: the connector is not very well designed, and oxidation occurs. The most common problem is a high-resistance chassis connection. You can usually carry out an effective repair by soldering in a wire to bypass the chassis connection then cleaning the connector – I use WD40, but any proprietary switch cleaner will do. The problem can also prevent response to remote-control commands, which is a disaster since there are no front panel controls!

This model has been around for several years. The electrolytics tire. So, as a precaution, I installed the parts in Relkit 3 (for details check with SatCure on 01270 753 311). In addition I replaced R9 (470Ω) – it was hidden by glue that had turned black. My experience has been that this type of petroleum-based glue becomes both conductive and corrosive. R9 is just in front of the decoder video connector.

lift up the decoder board. Underneath you'll see a brown disc capacitor that's labelled either CP527 or C527 or it may be soldered across a diode labelled DP505. Simply cut it out. Then reassemble and you'll get pictures.

Pace Apollo 120

There was what looked like a decoder fault. But it wasn't, because German channels were also affected. The symptoms are difficult to describe. First, the picture lines appeared to be spaced too far apart, or every other line was missing. Secondly there was cogging at the edges of the picture, which would roll or jump depending on the contrast setting. And finally the decoder wouldn't decode. After some time I traced the cause to Q97. It's a BC846B buffer transistor that comes before the clamp circuit in the signal path. I've no idea why it failed.

Pace MSS1000

I had two MSS1000 receivers to repair last week. They had both been in an oven at a moderate heat for a couple of years! Not surprisingly, they had both ceased to work. The electrolytics were so black that I couldn't even read the markings on them. I had to replace the lot – fortunately I keep Relkit 10 (phone 01270 753 311 for details) in stock.

The first MSS1000 had come from Mrs Fu at the Chinese Chippy. When I'd replaced the capacitors and the power supply was working properly it still wouldn't work. It worked perfectly when I plugged in a new front panel assembly. So I replaced the microcontroller chip on the original front panel and reinstalled it. The receiver now worked but the front display didn't light up. I scraped off the chip fat, replaced the vacuum fluorescent tube, capacitor C2 and the transistors on the display board but it still wouldn't light up. Eventually I gave up and quoted a silly price for a new display assembly. She decided that she could manage without it.

The second MSS1000 was the D2-MAC version (MSS1061). I got it running but D2-MAC decoding was very intermittent. It seemed

Amstrad SRD510

This one came by post, very carefully packed – I was pleased that someone had taken note of my suggestions about packaging. All too often I receive parcels that rattle and have to be returned to sender unopened.

The fault report was brief but adequate. "One or two hours after a cold start a squealing noise comes from the left-hand side, the red and green LEDs flash together, the picture changes to a blank screen, then everything goes off. The receiver sometimes comes back on by itself."

I recognised these symptoms. The cause is a poor connection

SRD400 Sillies

Like many other receivers, the Amstrad SRD400 is prone to microcontroller lock-out. Unplug the receiver from the mains supply, plug it back in and the chip will reset itself. Everything will then work. If the complaint is "stuck in standby", the receiver could be in the parental lock mode, caused by kids' fingers or a mains surge. Press h/v, h/v, audio and it will be OK. When you get four horizontal lines on the LED display, the receiver is waiting for the lock code. If you don't have this, plug the receiver into the mains supply and leave it for two days without touching any buttons. When it has been unplugged then plugged back in again, it begins a count-down that lasts for 48 hours. Provided no buttons have been pressed, it comes out of standby – this is actually explained in the User Instructions, but we know what happens to them, don't we!

If you supply an SRD400 with a new LNB and it doesn't work, though it does with an old blue cap type, what's up? With fifty per cent of SRD400s a small modification is required to make them work with a new LNB. Remove the cover and

Satellite Scene

If you're interested in digital satellite systems you might find it useful to take a look at a new web site:

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

It's run by Mike Hancox, who has been very helpful in the past when I've had installation problems. Mike also offers an e-mail helpline for installation, as I do for repair problems. You can contact him at:

satscene@ontv.co.uk

sensible to replace all the electrolytic capacitors on the D2-MAC board – note that one of them is non-polarised. When I refitted the board I found that it wouldn't work at all! Thinking that I must have shorted something out, I put the receiver to one side until I was in the mood. Three days later I looked at it and saw that I'd plugged the D2-MAC board in slightly too far to the left. Thus each of the connector pins was displaced and in the wrong hole! Fortunately this hadn't caused any damage: the receiver worked perfectly once the board had been correctly installed.

This week two more MSS1000 series receivers arrived. An MSS1001 had been treated to a drink of coffee. This had washed over the power supply without, luckily, touching anything else. I flushed the board with soapy water, followed by Isopropanol and a blast from the hairdryer. It worked perfectly once the contents of Relkit 10 had been fitted.

The other one was an MSS501IP which, the customer said, kept displaying the message "Motor Error" and lines on the picture. These are both typical capacitor failure symptoms. So I simply fitted the complete Relkit, which did the trick.

Thorens TSR205

A large number of Polish immigrants stayed in the UK after the Second World War. The ones I know are all really nice people, and Edward is no exception. So, when he told me that the receiver he'd just brought back from Germany didn't work, I had no hesitation about agreeing to look at it – despite having no service information.

Inside, this 205-channel Thorens receiver is pure Samsung. It's very nicely put together, with a mains transformer and no surface-mounted components. The problem with Edward's box was that he had shorted across the LNB connection, with the result that no LNB voltage came from the tuner.

Fortunately the LNB supply circuit was recognisable, as it's very much like that in the old Amstrad SRD400 – but with a 22kHz tone-inserter board added. There's a protection device, in the form of a posistor, but this item was intact. Instead, the 7812 12V regulator U601 had died. There was 30V at its input, 1.1V at the centre reference pin but nothing at its output. Unfortunately my test probe slipped and shorted 30V to the centre pin, after which this pin also read 0V!

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems via e-mail. You can reach him via the Internet at:

jack@netcentral.co.uk

One model per message – state make/model and fault symptoms. If you have no e-mail facilities you can write to him c/o Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps.

I traced the damage I'd caused to a 2SA733 pnp transistor, Q303, on the 22kHz tone board. When a BC557B transistor had been fitted in this position, and a plastic 7812 regulator rescued from a scrap SRD400 chassis had been installed, the repair was almost complete. To improve the protection, I replaced the posistor with a 1Ω fusible resistor which would simply go open-circuit in the event of a short – much easier to replace than a regulator!

Edward was delighted. "Now I can watch de Polsat channel again" he declared, "Czesc!"

Correction:

The e-mail address given for Satellite Scene last month contained an error – "onto" should have read "ontv". See box on facing page.

Test Case 429

We know what Workshop Sage doesn't like: mid-mount VCRs and badged models made by others. So what does he like? Sony VCRs certainly: they are predictable and well-made, and there is good service back-up. Once you get to know their habits and failings, it's not hard to make a profit from servicing them. So why was Sage, a top video technician, getting so exasperated by this SLV353 on his bench? Let's see.

Shortly after a cassette was inserted, it would pop out again, accompanied by a some clicking and whirring from the tape-loading mechanism. But this occurred only when the tape had been fully rewound. If the tape was at any other point, the machine worked perfectly – in the record, play, cue, review and fast-transport modes. Except that if the tape was rewound from one of these modes, or from the stop mode, the machine would auto-stop when the start sensor (right-hand side of the cradle) told it to do so and after this it was seldom possible to select any function. If play was selected for example the two green play arrows on the front panel would light but there would be no action from the cam (threading) motor: it didn't get a go command from the syscon chip, and after a second or two the machine would give up the attempt. The same would happen when fast forward was requested.

The problem was obviously to do with the operation of the start sensor. But Sage could find nothing wrong with it. At tape start pulses of light from the cassette LED fell on the sensor, and a good, strong pulse train appeared at pin 56 (T-sense) of the CXP80116 microcontroller chip. But pin 57 (S-sense) remained at zero volts unless and until the tape was ejected – or rewound

fully to its end. The machine's T sensor is the tape-start one at the right, the S sensor being the tape-end one at the left. All this seemed to be normal enough, but why wouldn't the microcontroller play ball? If Sage slipped a piece of card in front of the start sensor the machine worked well enough.

Sage checked the supplies to the microcontroller and the sensor-pulse amplifier chips IC503 and IC505 carefully. They were correct at 5V and free of hash. He also checked the supply and the pulse feed to the cassette LED (the 'lighthouse') and found that they were OK. But the microcontroller chip wouldn't do its stuff. After much careful thought, taking into account the fact that the play instruction brought light from the front-panel symbols but no tape start, Sage condemned the microcontroller chip and blew £26 odd on a replacement. On its arrival Sage fitted the 80-pin flat-pack chip carefully then tested the machine. The fault was still present, with exactly the same symptoms. Exasperated, Sage put the machine to one side.

When he returned to it some time later, in a better and more constructive mood, Sage went through all the checks again. With the results exactly the same, he came to the same conclusion as before – that the CXP80116 chip was faulty. But it was a new one – and the fault was a very unusual one. Certainly the cause of the problem was centred on the operation of the start sensor at the right of the cassette.

At this point an idea occurred to Sage, one that might have occurred earlier had he studied the operation of a working deck of the same type, and from this he came to a correct diagnosis. What was it? For the solution, turn to page 826.

Servicing the

Panasonic NVJ40/42/45/47/F55

Brian Storm describes the innovations that were introduced with this range of VCRs, and their subsequent fault history

These machines all use the final version of the G mechanism. Their main feature is improved mechanism response time in comparison with previous models. The play and record mode response times were improved by using a new full-loading system. When a cassette is inserted, the video tape is quickly loaded and wrapped around the drum, awaiting the play command. Previously the loading arms stayed at the stop position until a key was pressed. For rewind and fast forward the tape is unloaded to the stop position: both functions also have faster spooling times.

Another update is the head cleaning mechanism which is fitted to the right of the drum. It's activated by the drum's exit guide and gives the heads a brief clean every time a cassette is inserted – and every time the mechanism returns from the rewind or fast forward position.

Remote Control

The combined remote control/bar scanners were redesigned, with more features added. The VCR control panels have brightly-coloured buttons that are colour co-ordinated with the relevant buttons on the remote control units.

NTSC Playback

Another feature that most of these models have is NTSC tape playback facilities. Although this was available with previous models such as the NVL28 and NVJ35, it had never been made a major feature before.

The system works by altering the NTSC chrominance and burst signals to provide compatibility with the PAL system. The 60Hz field, 525-line format remains the same: this means that the TV set must be able to switch its line and field rate automatically between the two standards. Of the models covered in this article, only the NVJ40 does not have an NTSC playback facility.

NTSC Dub

In addition the NVJ45, NVJ47 and NVF55, also the older NVF77 editing deck, have an NTSC dub facility. This can cause some problems for the unwary. It enables NTSC tapes to be copied by allowing the record servo circuitry to lock to the NTSC 60Hz field rate.

The problem is that most users discover this feature only when they try to record a normal PAL broadcast with the machine switched to NTSC dub (probably activated by an over-zealous duster!). The result is an unstable monochrome recording and a panic-stricken phone call for service. Obviously most people are not too happy when asked to pay a service engineer to flick a small switch over to the correct position.

Servicing

A new service feature, designed to help the hard-pressed engineer, is a built-in error code memory. If the machine has an intermittent fault you can press eject, rewind and fast forward together (eject and shuttle forward with a jog/shuttle machine). The VCR will then display any fault code that's been stored. You can activate this feature permanently by linking together test points TPSEV and TPGND (ground).

The last two digits of the timer display show the fault code. If the machine has been unplugged from the mains supply since the fault occurred the data will unfortunately be lost. This service aid can be very useful when dealing with intermittent faults.

Table 1: Luminance/chrominance processor module variations.

<i>Model</i>	<i>Board</i>	<i>Module</i>
NVJ42	VEP03928H	VEFH14D
NVJ42	VEP03928X	VEFH14G
NVJ47	VEP03928M	VEFH14D
NVJ47	VEP03928AB	VEFH14G
NVF55	VEP03857T	VEFH14D
NVF55	VEP03928AF	VEFH14G
NVF77	VEP03928B	VEFH14D
NVF77	VEP03928R	VEFH14G

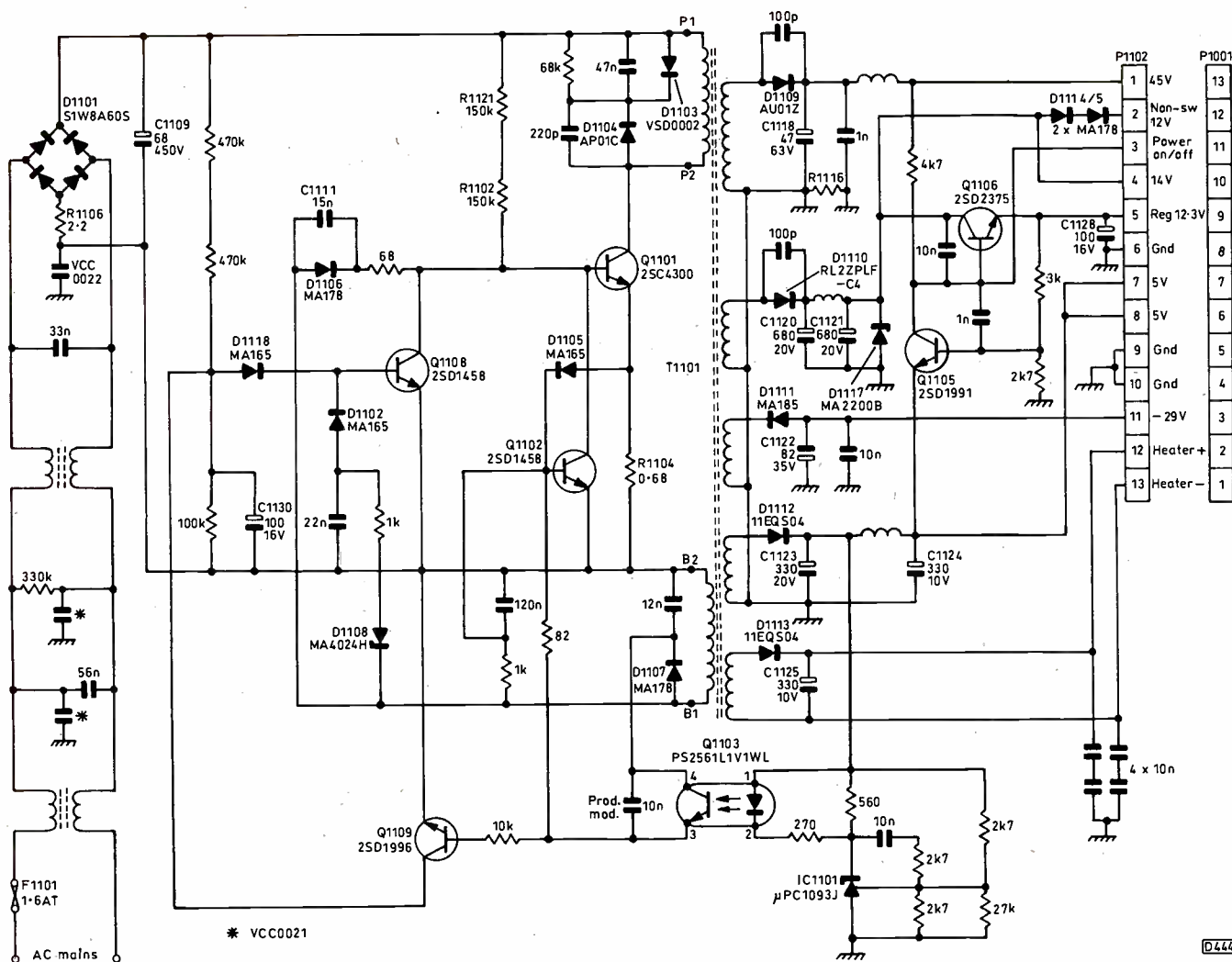


Fig. 1: Circuit diagram of the power supply used in Models NVJ42 and NVJ47. There are considerable differences in the other models.

The fault codes are as follows:

- E0** No fault condition.
- E1** Drum motor stopped.
- E2** Reel rotation stopped.
- E4** Mechanism jammed while unloading.
- E5** Mechanism jammed while moving between fast forward and rewind.
- E9** No serial data communication between the front panel microcontroller chip IC7501 and the system control/servo microcontroller IC6001.

Another service feature is the addition of plug-in connectors between the main PCB and all the sub-panels. The RF amplifier/tuner units have a plug added at the side for mating with the adjacent RF converter. The connecting looms were all changed to push-in card connectors. This makes it easier to disconnect and reconnect sub-panels for test purposes.

The disadvantage of these machines from the servicing point of view is the increased use of surface-mounted components, including the system control/servo chip IC6001. As this particular IC is not wholly reliable, a lot of service departments had to consider an investment in modern desoldering equipment or risk damaging main boards.

Mechanism Faults

The G mechanism was by this stage at its most reliable, though there were some problems with the metal sector gear that drives the drum loading guides. These could ride up and slip off the top of the nylon gears. The result is disastrous gear teeth stripping as the mechanism struggles to unload.

The cause of intermittent mechanism faults, especially from cold, is usually dry-joints at the mechanism solenoid's lead-out wires.

Intermittent stopping (E2 fault code) usually means that the output from one or both of the reel-rotation sensors is low, sometimes because of dust and fluff build-up under the spool. The part number for the optosensors is ON2170

Intermittent powering off when a cassette is inserted often means that there's too much play around the cas-

sette housing mode switch. The best way of dealing with this is to replace the cassette housing right side, which comes as a complete unit. The part number is VX4480.

The Power Supply

The redesigned power supply (see Fig. 1) gives less trouble than the previous types, though you can get problems with Model NVF55 when the earthing track goes open-circuit at a soldered joint to the screening can and anode of Q1103. The result is that the output voltages rise drastically. The power supply then cuts out, going dead.

The NVJ42 and NVJ47 can suffer from high-pitched whistling should the mains voltage be slightly higher than normal. This is easy to cure: add an 0.01µF capacitor across pins 3 and 4 of Q1103.

C1127 (330µF) in the earlier power supply can be the cause of patterning on playback when it goes low in value, or no playback with a distorted E-E picture when it goes open-circuit.

Video Problems

The new luminance and chrominance sub-boards use a ceramic module on stilts to carry out most of the processing. Unfortunately the electrolytic capacitors on the module can leak and corrode adjacent components. This causes numerous symptoms that are cured by replacement of the module. The symptoms include no or poor playback colour; no or poor playback luminance; no E-E luminance; no record colour; no record luminance; and any intermittent version of these faults.

The module part number is VEFH14D or VEFH14G, depending on the luminance/chrominance sub-board

type. Although the boards are interchangeable, the modules aren't! The variations are listed in Table 1.

For dark bars on the E-E picture check C318. For sound-on-vision on the E-E picture check C313. These 22µF electrolytics go open-circuit.

Faults List

Fairly common faults, especially with the NVF55, are:

Capstan motor speed excessive: L2001 open-circuit, so no 12V supply to the stator.

No VU display and a blank raster: IC7001 faulty.

Failure to lock on station with cable channels: Add a 1µF capacitor across C7680

Failure to lock on station when search tuning: D7601 (MA151K) faulty.

Low E-E gain: Tuner unit and RF amplifier faulty. Part no. ENV87837H3Y.

Low feedthrough gain: Tuner unit and RF amplifier faulty. Part no. ENV87837H3Y.

Common faults with Models NVJ40/42/45/47 are:

No E-E sound: IC7651 (AN5451N) faulty.

Rolling E-E picture: C315 (22µF, non-polarised electrolytic) open-circuit.

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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: Cowl and graticule with filter for the Telequipment S51A or S51B scope. Phone P. Guarini on 01709 371 188.

Wanted: Teletext panels for the Philips Models 28CE5594 and 21PT522A/05. Must be in good working order. Service TV, 18 Benfleet Road, Hadleigh, Essex. 01702 558 444.

Wanted: Urgently require red tube for Pye studio video projector (circa 1981) or information on a possible source. Richard Gifford, 4 Gypsy Lane, Needham Market, Suffolk IP6 8DY. 01449 723 009.

For disposal: Bundle of 405-line TV service sheets and other articles from *Electrical and Radio Trading* from mid-50s. Also Viewmaster construction details. All free to a good home. Require any copies of *Television* from about 1980 to 1992 inclusive. Nicholas Arnold, c/o 17 Fairway, Merrow, Guildford, Surrey GU1 2XQ. 01483 573 491.

Wanted: Circuit diagrams/service manuals for the Contec Model KT8135 and Bush Model 2515T (?Indiana 100). Photocopies OK. B. Ecclestone, 10 Stone Road, Norton Bridge, Stone, Staffs ST15 0NS. 01785 760 315.

Wanted: Circuit diagram for the Beamack tube tester which was made in the Sixties. John Haylett, 160 Hookfield, Harlow. 01279 863 789.

Wanted/for disposal: Require the following copies of *Television*: Apr, Sep, Dec 1989; Feb, Jun, Sep 1990; anything from Dec 1972 to May 1976 and June 1950 to Oct 1957 (these latter *Practical Television*). Have for disposal about 90 copies of *Television* between Nov 1977 and April 1996. Vic Smith, VAST Electronics, Unit 47, James Street, Carlisle, Cumbria CA2 5BB. 01228 625 700 ext. 247 afternoons.

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Wanted: Remote control units for the B&O Beovision Models 3912 and 7702. Also service information for the

Canon PC12 photocopier. James Burch, 9 Groveland Road, Beckenham, Kent BR3 3PU. 0181 402 2488.

Wanted: CRT base for a Grundig 22in. Supersound set fitted with the CUC740 chassis - A56-540X 110° tube. Part no. is 29304-042-02. Derek Castle, 99 Buckingham Road, Brighton, E. Sussex BN1 3RB. 01273 326 194.

For disposal: *Radio and Television Servicing* 1969-1980, twelve books in perfect condition. Offers please. John Pawson, 20 Nerissa Close, Waterlooville, Hants PO7 8LP. 01705 422 292 evenings.

Wanted: DPU2553S IC, also a mode switch for the Hitachi Model VTM630M. B. Marsden, 25 St. George's Road, Newquay, Cornwall TR7 1RE. 01637 876 298.

Wanted: Instruction book for the GoldStar GHV1240I VCR, to buy or copy. E.J. Caines, 13 Bate's Close, Easton, Bristol BS5 0UZ. 0117 939 3403.

Wanted: UHF-VHF tuning module or complete working board for the Finlux Model 3029(v) text. D. Brown, 3 Copse Hill, Filey, N. Yorks. 01723 514 283.

Wanted: Service information and dismantling instructions for the Ferguson FC04 video camera. Does anyone have a non-working camera for sale? E.W. Townsend, 13 Dorrit House, Henry Dickens Court, London W11 4DR. 0171 727 2013.

Wanted/for disposal: Require good A66-540X 26in. tube and focus unit for a Ferguson TX10. Have for disposal a Philips N1702/15 VCR with tapes including some that have series 1 Star Trek. Bob Harrison, Badgers Oak, Redbrook Street, Woodchurch, Ashford, Kent TN26 3QU. 01233 860 453. Or e-mail bobharri@globalnet.co.uk

For disposal: *Radio and Television Servicing* 1970-1980; *Television* Oct 1976-April 1988 (complete set); approximately 200 service sheets and manuals from the 1960s-80s. All at bargain prices. Peter Sinclair, The

Gables, Glebe Road, Newent, Glos GL18 1BS. 01452 503 662 daytime.

Wanted: Circuit diagram for the Olivetti SVGA monitor Model CDU1448G/L001. Also advice on why the 3842 power supply chip is shutting down though the line output stage seems to be OK. Peter Antcliffe, 63 Chester Road, Stevenage, Herts SG1 4JY. 01438 359 414.

Wanted: Mains/standby relay for Goodmans portable TV Model 1405R (5V DC/250V AC/10A, labelled OST-S-105DM). Also a standby transformer to suit the Hinari portable TV Model HIT14R. Tony Woods, 76 Leafiel Avenue, Bradford BD2 3RU. 01274 633 933.

For sale: Audio service manuals for most popular makes. Average price £4 inc. postage. Mike Orr, 21 Venus Street, Congresbury, Bristol BS49 5HA. 01934 838 496.

Wanted: Spares for the JVC HRD750 VCR or a complete machine to break for parts. In particular need a capstan motor and power supply. Graham Seward, 2 Orchard Close, Severn Stoke, Worcester WR8 9JJ. 01905 371 504. Or e-mail grahamsew@lineone.net

Wanted: 7415 op-amp IC, also a circuit diagram/service manual for the Sony TV110UWE. R.E. Bailey, 22 Grebe Close, Waterlooville, Hants PO8 9UT. 01705 783 811.

Wanted: Circuit diagram for the IBM SVGA monitor type 6322-002. Peter Antcliffe, 63 Chester Road, Stevenage, Herts SG1 4JY. 01438 359 414.

For sale: Tektronix 5115 storage oscilloscope with 5A18N dual-trace amplifier and 5B10N timebase modules fitted, Polaroid freeze-frame camera, probes, on Model 3 Tek Lab Chart - £300. Laptop and notebook spares and accessories: PCMCIA, batteries, PSUs, AC adaptors, boards, screens, keyboards - Zenith, Twinhead, Mitac, AST, Ambra, Compaq. For list send 55p stamp. Julian Bohan, 30 Stanley Street, Lincoln LN5 8NG. 01522 871 926 or 0958 771 319 (mobile).

What a Life!

Mainly difficulties with TV sets this month. Donald Bullock on servicing and people problems - and that wordprocessor of his

Computers leave me cold. Son James has knocked himself up a beauty entirely out of units from CPC, but I haven't even mustered up enough interest to try to work it. Everybody tells me to throw away the Amstrad PCW8512 I use for writing. Now it seems that I might have to.

Because the heat in Spain dries out the exposed part of the Amstrad machine's printer ribbon, I keep producing articles full of white patches. I thought I'd found a remedy, but it hasn't worked out. It happened like this.

In Spain we put our refuse into a big communal bin. It's common practice for people to place anything they think might be useful to someone else by the side of it. That's where I found a mint Commodore MPS1270 mono-chrome inkjet printer, in its factory packing, but minus the instruction booklet and computer-to-printer lead. James tried it on his computer and pronounced it perfect. All I needed was a simple lead to connect it to the PCW8512. That was some months ago. I've tried here, there and everywhere, but haven't managed to get one.

Now I find that when I boot up the PCW8512 the little red light on the shift-lock key sometimes comes on and the machine won't respond to the keyboard at all. I have to switch off and boot up again. Dunno why. Do you? I does it with various start-of-the-day discs.

On the Cheap

Mr Whiner brought in his ancient Hitachi VCR the other day.

"Can you get this going for tonight?" he asked. "Only the relatives are visiting. Got to have the video working, haven't I?"

"It's essential" I said.

"Not worth spending much on it

of course" he continued, "it's so old. Say perhaps a fiver."

As I cringed away James took it to the workshop. He found that the heat had congealed the mechanism's grease. A clean up made it work all right. So we charged him a tenner.

"Hope it'll last a good while" said Mr Whiner.

It reminded me of Walt, with whom I worked many years ago. He was an excellent engineer who had been in the trade a long time, and the customers had long since got to him. Now and again, after a particularly bad experience, he would cry out "immediately isn't soon enough, free isn't cheap enough and perfection isn't good enough!"

He eventually threw in the towel and got a job repairing bicycles.

Problem with a Mitsubishi

Steven's problems with a Mitsubishi TV set began when Mr Bullneck pushed through the door and interrupted his conversation with the vicar.

"Can you pull me Mitsubishi outa the car, oney I've a bad back, see."

Steven stepped out and followed him to his car. It was about a hundred yards away, on the other side of the busy road, and it was raining. He staggered back carrying a black box about the size of a tea chest. It was a Mitsubishi CT2146TX (Euro 6 chassis).

Once I'd got Bullneck out I gave Steven a drink of water and before long he was able to stagger to the bench and try the set. It worked all right and continued to do so for the rest of the day. So he phoned Mr Bullneck. "Your set's all right" he said.

"Ill-ent" Bullneck rasped. "He goes dead every three days."

Steven opened the set and found a multitude of dry-joints where conductors joined the print. He spent a long time cleaning and resoldering them. Then he tried the set again. It was dead.

There are two chopper circuits in this chassis. The main one provides the HT supply and three LT supplies, at 24V, 12V and 5V. The other one provides standby operation, with 7.5V and -30V outputs. The 7.5V output feeds a 5V regulator, IC951.

As the HT was present, Steven moved over to the standby supply and found that the 5V line produced a hardly detectable reading. The smoothing capacitor C709 (10µF, 50V) was open-circuit.

Steven fitted a replacement and thought everything would be OK. "Not too tricky after all" he muttered. But when he switched the set on it was still dead. So it was back to the main chopper circuit, where the 12V output was missing because the 1.6A protector Z901 had gone open-circuit. He fitted a replacement and switched on again. There were still no results.

"Must be loss of line drive" Steven commented. He resoldered the connections to the line driver transformer T551 and checked the line driver and output transistors, which were both all right. But there was still no line drive. Scope checks showed that everything was OK on the primary side of the line driver transformer. There were no pulses across the secondary winding however. The windings produced DC continuity readings both in and out of circuit. There was no short across the secondary winding. "I reckon I might as well give this one back and recommend Snoddies or Crubb's Foodstore" he moaned.

"Why not take the driver transformer out and check it with a mag-

nifier?" I asked.

He found that the joints to the PCB were clean, but the pins had a tarnished look. So he removed the transformer again and cleaned the pins with fine emery paper. When they were shiny bright he replaced the transformer. This time the set worked at once and proved to be reliable.

"That transformer read OK despite its tarnished pins" Steven commented, "I don't see why the waveform couldn't get through."

"Perhaps the silver-plated pins had developed a silver oxide coating from solder-flux impurities" I suggested.

"Wish I'd shone the pins up earlier" Steven said.

Turkish Delight

Then Greeneyes came into the shop. She'd been to the market.

"I've a packet of Turkish delight for you" she cooed.

"Good" I said, rubbing my hands. "Bring her in!"

Greeneyes made a silly noise and her expression turned cold. She placed a Bush 2114T portable on the counter. "Belongs to Molly" she snapped. "It's dead. Perhaps it heard one of your silly jokes."

The set boasted its Turkish origin and was dead all right. It clicked at switch on. While Greeneyes watched I went straight to the BU508D line output transistor Q402 and found that it was short-circuit. After replacing it I checked R811, the 1Ω resistor in the 24V supply. As expected it was open-circuit. I replaced this as well, and felt I was doing just fine. Show that girl who's clever. Then I switched the set on.

It emitted a curling whisp of smoke, made the same noise that Greeneyes had made over my Turkish delight joke, and looked at me just as coldly.

I checked the set again. Both the items I'd replaced had failed. So I did what I should have done before – I measured the HT voltage. It was high at 145V instead of 110V, and adjusting the HT preset VR801 made no difference. Time to switch off again.

The chopper power supply is of the standard TDA4601 control-chip type. I found that two electrolytic capacitors associated with the chip had fallen in value. C817 was only 6μF instead of 10μF (16V), while C818 had fallen in value from 1μF (50V) to 0.3μF.

I replaced them, also the two items I'd blown up, wound VR801

down to zero, switched the set on and adjusted VR801 carefully for an HT reading of 110V. Everything worked smoothly. The preset's slider ended up dead central along its track, and the set produced an excellent picture.

Another Mitsubishi

At this point a large TV set with a pair of skimpy trousered legs trotted in. Steven saw that it was a Mitsubishi set and disappeared, with a squeaking sound. Being made of sterner stuff, I dashed out and hoisted it on to the bench. The legs stayed where they were, and I noticed that they were part of a tiny body, with a head and arms. Then an enormously amplified voice filled the shop and half the street.

"No picture at all Mr Bulbous" it said. Steven ran out, looking incredulous. But my attention was concentrated on the little fellow who had brought the set in.

"Just a blank screen" said the amplified voice. "Phone number is on the label there."

Steven ran back into hiding and I cringed. I waved the little chap out and tried the set. It was a modern one, and displayed a blank raster. I wanted to check whether there was any sound, but modern sets make me nasty, 'cos I can't work them. I called Steven out.

"It's only a simple fault" I said, "will you set it all up while I make the tea?"

When I returned he had an excellent picture on the screen. Then he switched the set off and back on again. A blank screen was present, as before.

"Ah" he said brightly. "The trouble will be to do with the X24C04P EEPROM chip IC702. When it fails various problems can be present. Often the one we've got now, or the teletext may be missing, there may be no Nicam sound or, with B series sets only, the rotating base. Or any combination of these faults." He was about to walk out as he spoke, and I noticed that his backside looked like a sackful of cats heading for the river.

"Rotating base?" I asked.

"Yes, permanently or intermittently" he continued. "SEME does a kit that puts matters right, at just £10.33 plus VAT. The part number is RK216G. In addition to the EEPROM chip it includes two 68kΩ resistors and an 0.01μF capacitor. These are not needed in all models. It's worth ordering the kit, because it comes with a technical bulletin



He staggered back carrying a black box about the size of a tea chest.

that lists every model affected and tells you which parts each one needs for the repair. CPC does the chip on its own at £6.68 plus VAT. This set will need just the chip – others need the whole kit and detailed picture geometry adjustments."

I sauntered off. Getting clever, this boy. Not a clever as me, only I just don't bother. And anyway his tea isn't a patch on mine!

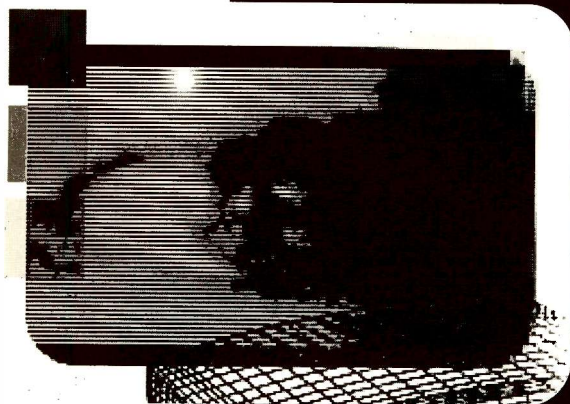
Sky TV

I've noticed that during interviews with overseas reporters in Sky TV's news broadcasts there is a noticeable delay before they seem to be able to hear and respond to the anchor man's questions.

The other day, during a conversation between the newsreader and someone in Ireland, the delays were longer – two or three seconds. The newsreader ended the interview prematurely, blaming a "slow line".

Are the delays the result of bandwidth problems I wondered? Does the transmitted picture have to be sent piecemeal and built up at the other end? At any rate the lip sync remains intact.

TV Fault Finding



Reports from
Philip Blundell, AMIIElec
John Pitt-Francis
Michael Maurice
Chris Watton
Giles Pilbrow
Graham Colebourn
Maurice Kerry
David A. Chaplin and
Glyn Dickinson

Philips D16 Chassis

"Dead set" was the complaint. When it was switched on the only response was that the standby, power on, teletext and RGB lights were flashing. The table at the back of the manual tells us that this means "protection line active". A scope check at the collector of the surface-mounted transistor Tr7657 confirmed this: the voltage was at 0V instead of 5V.

As usual with Philips sets of this era, the protection line monitors the audio, field, EW and line output stages. It shuts the set down if a fault is sensed in any of them. To find out which section is faulty, check voltages as follows:

Audio stage: Collector of Tr7130.

EW circuit: Anode of diode D6502.

Line output stage: Collector of Tr7495.

Field output stage: Emitter of Tr7425

In a correctly working set there should be 0V at all these points. In fact the voltage at the emitter of Tr7425 was pulsing high, indicating that there was a field timebase fault – loss of field drive in fact.

The field drive comes from the digital video board. There's no circuit diagram for this in the manual (the board is available under an

exchange scheme) but the circuit description book does have a circuit, so you can check for simple faults. In this case coil L5251 was open-circuit, removing the supply to the DPU2553 digital processor chip.

This was not the end of the story however: while the set was on test another fault appeared. When the set was first switched on from cold there would be no colour – the colour flickered then, after a few minutes, stayed on. A burst of freezer soon showed that the culprit was crystal X1207 on the digital video board. A new crystal cleared this final fault. **P.B.**

Samsung CI5013T (P58SC Chassis)

This set was dead. The chopper transistor Q801 read short-circuit but this was a red herring: C816 (2.2nF, 1kV), which is in parallel with Q801, had gone short-circuit. The surge limiter resistor R801 (5.6Ω, 7W) had failed as well. C816 is part no. 31417-901-660 (Willow Vale code 79331CA); R801 is part no. 31039-687-569 (WV code 79331RA). **P.B.**

Philips FL1.7AA Chassis

This set's picture would black out intermittently. The slightest pressure at the rear of the large signal panel would instigate the fault. A few seconds spent looking around with the magnifying glass revealed the cause: a dry-joint at jumper 4404, by plug L03. **P.B.**

Grundig CUC7301 Chassis

When this set had been on for a few minutes line drive would be lost. The TDA8362A colour decoder/timebase generator chip IC150 produces the drive waveform, which is fed to the line driver stage via a BC858B buffer transistor (CT169). Scope checks soon

revealed that this surface-mounted transistor was the cause of the trouble.

The set was actually a **Matsui Model 20V1T**. **P.B.**

JVC CS2180EK

Tuning drift was the problem, particularly during the first twenty minutes. IC921 and C925 in the 30V regulator circuit were proved innocent by substitution. I then had an expensive choice: to try replacing either the tuner or the station select module, type SBX-M904A(E). A chat with the very helpful JVC technical help team indicated that the module was the more likely cause. A replacement cured the fault, but the customer was faced with quite a large bill. Has anyone tried component-level fault-finding with this problem? It sounds like a stock fault. **J.P-F.**

Hitachi CPT2250 (Salora Chassis)

There was no picture and a faint smell – the sound was OK. RB589 (0.68Ω safety) was found to be overheating because the TDA2653A field output chip had failed. Replacements restored normal operation. **J.P-F.**

Decca 165 Chassis

There was no tuning, just a snow storm. Was it the tuner? No! This was proved by unsoldering pin 4 of the tuner and feeding it from the slider of a 100kΩ potentiometer connected across the 33V supply. This gave perfect tuning. Since QR07 read OK, the fault seemed to lie in the M491BB1 voltage synthesis chip IR01. A replacement restored the tuning. **J.P-F.**

Akai CT2115

Neither operation of the front control nor the remote control unit would bring this set out of standby,

even to trip. The supplies all seemed to be OK and no dry-joints could be seen. It seemed that the PCA84C640P microcontroller chip could be the cause, so I debated on whether to get one and try it or buy a manual. A replacement chip proved to be a good bet, restoring correct operation. **J.P-F.**

Sony KVMX25TU

The picture would go off after ten minutes. Dry-joints at the line driver transformer T801 were the cause. I also resoldered some chopper transformer joints – they looked next in line to give trouble. **J.P-F.**

Toshiba T284T8B

The customer complained of a dead set with a bad smell of burning. The cause was the Lorlin-type mains switch, which was now a charred mess. Fortunately the customer had fitted a 3A fuse in the plug. It had blown, preventing a possible fire. Also fortunately there was no damage to the mains input PCB or the components adjacent to the switch. **M.M.**

Panasonic Euro 1 Chassis

When this set was switched on the standby light blinked for a fraction of a second then went out. Panic is the usual reaction when this sort of thing occurs, as the cause of the fault is generally in the digital section. Not this time however. Quite by accident I found that if the set was left on for some time the raster would be restored. The fault was in the power supply. Replacing all four electrolytics and the high-value resistors produced normal operation at switch-on. **M.M.**

Toshiba 2927DB

No text was the complaint with this set. When I called Toshiba's very helpful technical department I was told that memory corruption was the probable cause. I was able to clear the fault by going into the manufacturing mode and resetting the option bytes. **M.M.**

Nokia MP37H1

This portable produced no picture or sound, though the graphics were OK. The video signal is routed through the text board, where there was an input but no output. The cause of the fault was a BC858 surface-mounted transistor VR08. There was normal sound and vision once it had been replaced.

The way in which this set is constructed makes it difficult to work on the text board. Its print

side is so close to the tuner that it is impossible to reach it with a probe. I removed the text module then refitted it at an angle of approximately 30°. After completing the repair I removed the board and refitted it correctly. **M.M.**

Philips GR2.2 Chassis

This set tripped when switched on. It remained dead, with no flashing LEDs. I disconnected the line output stage and checked the HT, which was OK at 148V. When the 32V rail was disconnected the set fired up. The culprit was the standby thyristor Thy6670: a replacement restored normal operation. **M.M.**

Philips CP90 Chassis

The width fluttered in and out, but only when it was set correctly. If the width was increased or decreased the picture was steady. The cause of the trouble was eventually traced to C2619 (1.5nF, 2kV), which is one of the tuning capacitors in the line output stage. **C.W.**

Hitachi C2119TZ

If one of these sets is stuck in the standby mode it's worth checking the TA8427K field output chip, which may be short-circuit. It's a common cause of this problem. **C.W.**

Ferguson TX80 Chassis

This set was stuck in standby. The cause was found in the line output stage, where DP12 (BA157) had failed. It's the rectifier for the 8-6V supply and is connected to pin 7 of the transformer. **C.W.**

Hitachi G100 Chassis

This set (Model C2564TN) was tripping. To isolate the power supply for test, disconnect plug PL702 and connect a 60W bulb between the plug's orange lead and chassis. If the bulb lights, the power supply is OK – the HT should be 140V. In this event a fault in the line output stage is likely. I found that D704 (BY228), which is one of the EW modulator diodes, was the cause of the trouble. A nasty dry-joint at L650 had probably led to its failure. **C.W.**

Philips 2A Chassis

There was disturbance to the line and field sync – a jumping picture and line tearing, which varied with the video content. The fault was still present when a signal was fed in at the scart socket, clearing the tuner and IF sections. Our next sus-

pect, the TDA2579/N5 sync chip, was also blameless. It's video input looked good when scoped, but I noticed that the fault was not so bad when the probe was applied. This indicated that I was in the right area. The culprit turned out to be C2550 (1µF), which was open-circuit. **C.W.**

Sony BE2A Chassis

The power supply tripped loudly. No short-circuits could be found, and the tripping stopped when the feed to the line output stage was disconnected. The cause was eventually traced to T604, which had shorted turns. This transformer is connected directly across a line output transformer winding to feed pulses to the power supply for synchronisation. The part no. is 1-424-078-11. **G.P.**

Ferguson TX91 Chassis

The sound was permanently at maximum. I traced the cause to the BC858B transistor TV02 which was leaky. Note that in this chassis the volume control voltage comes from the jungle chip IV01, not the microcontroller chip. **G.P.**

Sanyo ED1 Chassis

There was no picture, just a bright glow at the top of the screen. This indicated a field fault. The cause turned out to be the DPU2553 deflection processor chip IC508 on the digital PCB. Its part no. is 409 211 87 01. **G.P.**

Ferguson T10R (Thomson TX90 Chassis)

If there's no or low sound with inability to produce the tuning menu, the hotel mode needs to be released. To do this proceed as follows:

- (1) Use the remote control unit to put the set into standby.
- (2) Switch off using the mains switch. Wait thirty seconds.
- (3) Switch back on at the mains while simultaneously pressing the remote control unit's standby button.
- (4) A menu will be displayed. The hotel mode can be switched on/off by using the volume +/- keys. Press the TV button to clear the menu. **G.P.**

JVC MXII Chassis

There was intermittent field collapse with one of these sets. The

cause was traced to zener diode D441, type RD3.0ES(B2), which went leaky when warm. It's connected to pin 13 of the TA8859P vertical distortion compensator chip IC461. This provides the field drive at pin 8. **G.P.**

JVC C14ET1EK (Onwa Chassis)

In addition to the usual high HT problem caused by C911 and C909 in the power supply this set had no teletext. The cause was C020 (3.3 μ F, 50V) which was open-circuit. **G.P.**

Matsui 1450

This set wouldn't come out of standby from cold. I found that the 5V supply to the microcontroller chip was low because C611 (470 μ F, 25V) had dried up. For reliability C609 and C607 should also be replaced. **G.P.**

GoldStar CTI2190F

The complaint with one of these sets was intermittent teletext operation. The cause was traced to a dry-joint at the emitter of Q1 on the text PCB. **G.P.**

Sony AEIC Chassis

We've had many Sony sets that have suffered from progressive cramping at the bottom of the screen with associated width reduction. The cause of the fault is the field scan coupling capacitor, which falls in value. We recently had one of these sets with this fault and also no sound. The customer told us that the two faults had appeared on the same day, and cleared slowly as the set warmed up. He felt that there had to be a common cause.

A new scan coupling capacitor (C531, 680 μ F) corrected the field scan problem, but not the sound fault. The cause of this second problem was ripple on the 15.5V line – it activated the turn-on mute circuit. Normal sound was restored when C615 (1,000 μ F, 25V) had been replaced – it's the reservoir capacitor for the 15.5V supply. **G.C.**

JVC AV21F1EK (JX Chassis)

If there's no picture, just a blank screen, check for a cracked solder joint at pin 2 of the line output transformer. **G.C.**

Philips 14TVCR240

This TV-video combination could manage only a rude, blurring noise. The power supply was tripping

because the line output transformer had failed, so no surprises here. Charles Hyde can supply the transformer under stock code P81397.

The front panel buttons also needed repair. **G.C.**

Goodmans Compact 110

These handy 10in. sets have an Onwa-type power supply on a separate board. It generates a single 13V output at about 3A. There's no mains switch – a label on the back of the set advises the viewer to disconnect it from the mains supply when not in use. So the chopper circuit runs continuously, and eventually does its Onwa special thing and blows up. To repair it, you will need Philip Blundell's article (February issue page 236) and an Onwa kit. You may also need a new output reservoir capacitor (CP12). This is a 6,800 μ F, 16V type, but its ripple rating is what really matters, and it shouldn't be over 35mm tall. I fitted a low-ESR, 105°C, 3,300 μ F, 25V capacitor rated at 3.15A (RS 394-850).

In addition to most of the parts in the kit, RP24 (1.8k Ω) and the three small control transistors had to be replaced. RP24 had burnt out. The supply will operate when QP02 (the third small transistor) is short-circuit emitter-to-base, but the regulation is awful – the output is 50 per cent high with normal mains input and loading. I prefer to fit higher-rated transistors in these positions, such as the 100V-rated BC639 (npn) and BC640 (pnp). They are much less likely to fail when the electrolytics wear out and the supply produces an excessive output again. **G.C.**

Toshiba 2500TBT

Cramping at the top of the picture gradually cleared after about an hour. The cause was C317 (2.2 μ F) which was low in value when cold. It's situated at the back of a heatsink near a 3,300 μ F capacitor, in the field circuit area. **M.K.**

Sony KV14M1U

At switch on the EHT could be heard to rustle up then die. The standby LED then started to flash six times on/off, pause then repeat. This is an over-voltage or excess-current indication. The line output transformer proved to be faulty. We have found that this is the usual cause of the trouble. **M.K.**

Panasonic TX29AD2DP

If line pairing develops at two-three inches from the bottom of the

screen when the set is hot, try replacing D508 in the field circuit. It's an MA723TA5 diode and must be this type. We've had this fault more than once. **M.K.**

Hitachi C1414T

This dead teletext portable had a short-circuit line output transistor (Q702) which, I was surprised to find, is not mounted on a heatsink. I thought it was type BU508DF, but a closer look showed that it was type BU2508DF. The only difference appears to be that the BU2508DF is rated at 0.4 μ sec while the BU508DF is rated at 0.7 μ sec. Anyway a new BU2508DF restored the set to life. Although the transistor seemed to run quite warm it battled on, and the owner tells me that the set is still well several months later. **D.A.C.**

Rediffusion Mk 4 Chassis

This teletext set produced a good picture when it was first switched on, but after a few seconds the picture turned to a very bright green raster with flyback lines. As I couldn't find any circuit fault I tried tapping the neck of the tube. There was a click and a flash and the picture returned. I explained to the owner that the tube was faulty and was liable to short again at any time. **D.A.C.**

Hitachi CPT1491 (NP84CZ Chassis)

At switch on this portable produced a whistling noise from its chopper transformer with no sound or picture. The power supply would shut down after a few seconds. When the feed to the line output stage was disconnected the power supply worked all right. As no other faults could be found, I ordered a new line output transformer. When this had been fitted the sound and picture came up, though the tube had seen better days! **D.A.C.**

Ferguson TX90 Chassis

This set did nothing though the HT supply was present and correct. There was a 19V input at pin 1 of the MC7812CT regulator IC105, but very little emerged at pin 3. A new 12V regulator brought the set back to life. **D.A.C.**

GEC C1656H

This 16in. colour portable is fitted with the ITT CVC1100 chassis. At switch on there was only a squawking noise from the chopper transformer. Very often this is because

line output transformer has failed. I checked the line output transistor first and found that it was short-circuit all round. A second-hand BU208D restored normal operation, but why had the previous one failed?

There were no dry-joints in the chopper and line output sections, and all likely resistors, capacitors, diodes etc. checked out OK. I then opened the mains plug and found that the live and neutral terminal screws were very loose. After putting this right I replaced the second-hand line output transistor with a new one and gave the set a long soak test. **D.A.C.**

Ferguson 14M1 (TX86 Chassis)

Repeated failure of the TIPL791 line output transistor is common with these sets. The cause is dry-joints, usually in the power supply, the line driver stage or at the pins of the 12V regulator.

In a couple of cases the set would fail when the back cover was replaced, but no amount of tapping

would reveal the whereabouts of the poor connection when it was removed again. The dry-joint was found to be at R61, which is in the extreme corner of the power supply. The plastic extension between the panel and the back cover presses on it. The easiest way of replacing this item is to fix it to the back cover with hot melt before fitting. **G.D.**

Mitsubishi CT2023B

The set was dead though there was HT at the line output stage. This usually means dry-joints at the line driver transformer. Not this time however. The line oscillator wasn't working because its start-up supply was low. The start-up isolation diode D501 had a slight leak. **G.D.**

Philips 25MN1550 (GR2.2 Mono Chassis)

This set had been elsewhere. It produced a snowy raster with the words "ERR TUNER" on the screen. There were no remote control functions. This points to a fault on the tuner's data lines. I was

about to change the tuner when I realised that this is a mono set that doesn't have data lines!

As the microcontroller chip had been replaced I decided to try a new EEPROM. This made no difference. The previous repairer had replaced the microcontroller chip IC7708 with a Nicam type (suffix 1637) instead of the standard version (suffix 1237). When the correct chip had been fitted the set could be tuned in. **G.D.**

Matsui 1455

This set reverted to standby very occasionally. Whenever the board was touched it came back on again! After a long battle (and a lot of solder) I found that the 2SD1426 line output transistor was intermittent. **G.D.**

Thomson TX90 Chassis

There were no signals though some variation in the snow could be seen when trying to tune. The 33V tuning supply was missing because RH04 (27kΩ) by the line output transformer was open-circuit. **G.D.**

AN 5150	= 299	STR 44115	= 475
AN 5515	= 160	STR 90120	= 400
AN 5521	= 100	STRD 5441	= 400
AN 7174	= 495	STRD 6802	= 375
BA 5406	= 180	STRM 6545	= 775
BA 7766	= 175	STRM 6546	= 795
BU 27515	= 1400	STRM 6549	= 725
CNX 62A	= 080	STRM 6559	= 900
CNX 82A	= 060	STRS 5701	= 1700
CNX 83A	= 080	STRS 5717	= 550
CNY 70	= 350	STRS 5741	= 600
HA 11377	= 250	STRS 5941	= 700
HA 11744	= 650	STRS 6307	= 450
KA 2101	= 100	STRS 6309	= 550
KIA 6299H	= 200	STRS 6525	= 1350
LA 3160	= 120	STRS 6545	= 725
LA 4120	= 270	STRS 6707	= 800
LA 4270	= 300	STRS 6708	= 550
LA 4505	= 220	STRS 6709	= 550
LA 7225	= 250	STRZ 2152	= 1000
LA 7830	= 090	STV 5180D	= 400
LB 1294	= 125	STV 2102B	= 650
LM 1881N	= 375	STV 2110B	= 685
M 293B1	= 1500	STV 2118A	= 1000
M 710B1	= 610	STV 2118B	= 1085
M 523075P	= 900	STV 2145	= 400
MB 8719	= 360	STV 2151A	= 950
MDA 2060	= 350	STV 2160	= 500
MEA 2050	= 250	STV 8224A	= 450
OM 370	= 1515	STV 9379	= 400
SAA 1025	= 250	STV 9379F	= 415
SAA 1250	= 250	TA 7280P	= 190
SAA 1293-3	= 515	TA 7318P	= 490
SAA 1293A-3ITT	= 850	TA 7698AP	= 400
SAA 3004P	= 400	TA 8216	= 300
SAA 7000	= 550	TA 8718N	= 500
SAA 9057	= 475	TDA 1170S	= 135
SAF 1039P	= 699	TDA 2579A	= 210
SMR 4000	= 825	TDA 3502	= 360
STK 441	= 980	TDA 3780	= 500
STK 463	= 850	TDA 4505M	= 1450
STK 4046/v	= 1200	TDA 4944	= 175
STK 4151/2	= 850	TDA 7256	= 400
STK 4162/2	= 790	TDA 8218	= 300
STK 4843	= 2100	TDA 8740	= 600
STK 5481	= 470	TDA 9860	= 500
STK 7233	= 550	TEA 2114	= 250
STK 730-060	= 645	TEA 5114	= 200
STK 730-080	= 600	TEA 6101	= 550
STK 78603	= 850	TEA 8170	= 240
STR 5412	= 280	TFMS 5300	= 170
STR 7001	= 500	TFMS 1380	= 085
STR 16006	= 500	TFMS 5360	= 170

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(A) SMD Transistors Kits - 7 types, 10 of each BC 807-40, BC 817-40, BC 846B, BC 850C, BC 856B, BC 860B, IN 4148. Order Code: KIT08. Price: £7.85.

(B) SMD 0.2W Preset Kits - 13 values, 5 of each 100R, 220R, 470R 1K, 2K2, 4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1M. Order Code: SMDPreset. Price: £32.50.

(C) SMD Electrolytics 105 PEG Kit - 15 values of 5 each 22/47/100 at 6.3V, 10/22/47/470 at 16V, 33/100 at 25V, 1/2.2/4.7/10/22/47 at 50V. Order Code: KIT20. Price: £20/25.

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We welcome letters from our readers and try to publish as many as we can. You can send them typed, handwritten, or on disc. Address them to the Letters Editor, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Cancer

In a recent letter (July) Brian Milne asked about the incidence of cancer in the TV servicing trade. Several factors need to be considered.

The root of the recent scares about a connection between exposure to power-frequency EM fields and cancer was an American study that discovered a sharp increase in the incidence of leukaemia in homes situated under power cables. But further studies found that the true cause was the motor car. In the USA power lines frequently run alongside highways, and the cause of the cancer clusters was subsequently found to be exposure to benzene from car exhaust gas. Benzene is an extremely dangerous carcinogen: so dangerous that there's no safe minimum level of exposure. Its signature cancer is leukaemia. Benzene can enter the body by inhalation and through the skin.

Two factors, an initiator and a promoter, are required to cause cancer in an otherwise healthy organism. Initiators actually start the cancer, by causing genetic damage that leads to abnormal cell multiplication. Typical initiators are carcinogens like benzene, cigarette smoke and ionising radiation. Promoters speed the rate of growth of the cancer. Electromagnetic fields are known growth promoters, and as such can be used to aid bone and tissue healing after an accident or surgery. Unfortunately EM fields can also increase the rate of tumour growth. At present there is no evidence whatsoever that power-

Letters

frequency EM fields can initiate cancer.

There are several cancer risks associated with consumer electronics servicing. Many bench engineers smoke, exposing themselves and their non-smoking colleagues to significant risk. Dioxins, isocyanates and other nasties can be found in the smoke produced by burning plastics, and the colophony resin used in soldering fluxes isn't particularly good for you. British petrol contains high levels of benzene, significant amounts of which remain unburnt, to be pumped out of the exhaust pipe. Even a catalyst-equipped vehicle emits substantial amounts of benzene. Vehicle drivers are at greatest risk from benzene, and the TV trade can involve a lot of driving. Benzene's close relatives xylene and toluene are found in paints and adhesives. Living where he does, Brian Milne may face an additional risk factor: Aberdeen is based on granite, and will thus tend to have a higher level of radon gas in its atmosphere.

While working in close proximity to CRTs may expose a TV serviceman to higher levels of soft X-rays than the average viewer, it has been established that soft X-ray radiation below 30keV presents no significant risk. I have a Geiger counter that can detect X-rays, and have found no discernible increase in radiation above the background level from either my TV set or my computer monitor.

Apart from the environmental risks, cancer is one of the diseases of old age. It appears to be on the increase because we are all living longer. Statistically we all have a one-in-three chance of contracting some sort of cancer, although most cancers are now curable if caught in time.

A group of nutrients known as antioxidants are known to reduce your chances of developing cancer. They include vitamins C and E and beta-carotene. If, probably like most of us, your diet doesn't exactly fall into the 'healthy' class, you can buy antioxidants in capsule form. Vitamin

C is the major player, but the recommended daily allowance of 75mg is just the absolute minimum needed to prevent scurvy. Research has shown that large doses of vitamin C, typically the 1,000mg I take daily, appear to be effective in reducing the incidence of cancer. Smokers in particular need a good intake of vitamin C. I find the Asda and Superdrug own brands best value.

*Pete Roberts,
Runcorn, Cheshire.*

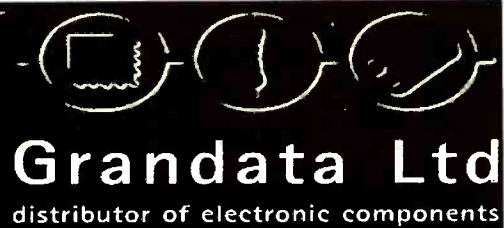
Digital Problem

A couple of weeks ago a customer who had a problem with his Pace PRD800 satellite receiver called. During the course of the day the picture would disappear at random. The sound was still present, though noisy. I replaced transistor Q105 and all the usual power supply electrolytics and the unit behaved perfectly. But when I plugged it in at the customer's house the picture had disappeared! While fiddling with the connections etc. I discovered that the picture reappeared when the UHF input was disconnected. The incoming signals were found to be at about 80dBµV – we're about two miles from the Black Hill transmitter. Signal attenuation only made matters worse.

My spectrum analyser showed that signal levels in about a 30dB range were present. There was nothing obvious at the same frequency and about the same level however. But when the sensitivity of the meter was increased definite noise at about 45dBµV was detected. I checked with the BBC, and was told that digital tests on several channels had been carried out during the past few weeks. The customer said that the picture would always reappear at 5.30 p.m., and never went during the weekend.

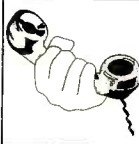
The test transmissions seem to be pretty much full-time now, and I've had about six other customers with the same problems. Our local transmitters are Black Hill (chs. 37-50) and Craighelly (chs. 21-31 + 48). I

continued on page 807



TRANSISTORS/LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price		
BC107	8p	BD434	30p	BU126	65p	BUV48AF	325p	MJ4502	300p	AN35	50p	LINEAR ICs		AN6340	600p	BA335	55p	BA7004	200p
BC108	8p	BD435	31p	BU128	125p	BUV48C	250p	MJ10012	300p	AN203	210p	AN6341	200p	BA338	80p	BA338	80p	BA7007	200p
BC109	8p	BD436	30p	BU133	125p	BUV50	425p	MJ11015	250p	AN210	165p	AN6342	325p	BA340	75p	BA340	75p	BA7021	180p
BC109C	10p	BD437	28p	BU137	150p	BUV61	1000p	MJ10116	300p	AN211	150p	AN6345	400p	BA336	175p	BA336	175p	BA7025L	350p
BC140	20p	BD438	36p	BU180	100p	BUV70	200p	MJ10332	800p	AN214Q	170p	AN6346	350p	BA401	60p	BA401	60p	BA7107	475p
BC142	20p	BD439	40p	BU184	100p	BUV93	375p	MJ15003	250p	AN217P	285p	AN6350	610p	BA402	50p	BA402	50p	BA7212S	200p
BC143	20p	BD440	40p	BU204	65p	BUV93	375p	MJ15003	250p	AN227	285p	AN6352	450p	BA511	145p	BA511	145p	BA7252S	150p
BC147	8p	BD441	40p	BU205	70p	BUW11A	200p	MJ15004	300p	AN227P	285p	AN6355	500p	BA516	150p	BA516	150p	BA7515L	150p
BC149	8p	BD533	50p	BU206	100p	BUW11AF	225p	MJ15015	250p	AN259	150p	AN6360	320p	BA521	100p	BA521	100p	BA7755	250p
BC159	8p	BD534	38p	BU207	150p	BUW12A	150p	MJ15022	400p	AN262	140p	AN6362	400p	BA524	240p	BA524	240p	BA7767AS	155p
BC166	30p	BD535	25p	BU208	70p	BUW12F	250p	MJ15023	400p	AN271	230p	AN6363	375p	BA526	180p	BA526	180p	BA8501	300p
BC171	10p	BD536	38p	BU208A	75p	BUW13A	200p	MJ15024	700p	AN277	190p	AN6367NK	400p	BA532	120p	BA532	120p	CA3140E	38p
BC172	10p	BD537	40p	BU208AT	200p	BUW13AF	200p	MJ15028	700p	AN277P	190p	AN6371	400p	BA532	120p	BA532	120p	CXN62A	50p
BC177	14p	BD538	40p	BU208B	200p	BUW48	550p	MJE340	25p	AN278	180p	AN6375	450p	BA536	150p	BA536	150p	CXN93A	80p
BC178	14p	BD643	50p	BU208D	130p	BUW49	550p	MJE350	80p	AN298	150p	AN6380	275p	BA537	95p	BA537	95p	CXN93A	80p
BC179	14p	BD645	50p	BU209	90p	BUW81A	150p	MJE2955T	65p	AN302	330p	AN6387	480p	BA538	100p	BA538	100p	CXN93A	80p
BC182	7p	BD647	50p	BU225	120p	BUW84	75p	MJE3055T	65p	AN303	330p	AN6390	450p	BA539	100p	BA539	100p	CXN93A	80p
BC182L	7p	BD649	50p	BU232	120p	BUW88	75p	MJE3055T	65p	AN304	330p	AN6397	450p	BA540	100p	BA540	100p	CXN93A	80p
BC183	7p	BD675	90p	BU236	55p	BUX10	150p	MJE13005	60p	AN316	350p	AN6400	450p	BA541	100p	BA541	100p	CXN93A	80p
BC183L	7p	BD676	40p	BU235	55p	BUX11	200p	MJE13007	100p	AN317	350p	AN6401	450p	BA542	100p	BA542	100p	CXN93A	80p
BC184	7p	BD677	38p	BU236A	60p	BUX12	150p	MJE13009	100p	AN318	350p	AN6402	450p	BA543	100p	BA543	100p	CXN93A	80p
BC184L	7p	BD678	38p	BU236B	60p	BUX13	150p	MJE13010	100p	AN319	350p	AN6403	450p	BA544	100p	BA544	100p	CXN93A	80p
BC212	7p	BD679	40p	BU237	85p	BUX14	150p	MJE13011	100p	AN320	350p	AN6404	450p	BA545	100p	BA545	100p	CXN93A	80p
BC212L	7p	BD680	40p	BU238	85p	BUX15	150p	MJE13012	100p	AN321	350p	AN6405	450p	BA546	100p	BA546	100p	CXN93A	80p
BC213	7p	BD681	45p	BU239	85p	BUX16	150p	MJE13013	100p	AN322	350p	AN6406	450p	BA547	100p	BA547	100p	CXN93A	80p
BC213L	7p	BD682	45p	BU240	85p	BUX17	150p	MJE13014	100p	AN323	350p	AN6407	450p	BA548	100p	BA548	100p	CXN93A	80p
BC214	7p	BD707	50p	BU249	85p	BUX18	150p	MJE13015	100p	AN324	350p	AN6408	450p	BA549	100p	BA549	100p	CXN93A	80p
BC237	7p	BD709	50p	BU241	175p	BUX19	150p	MJE13016	100p	AN325	350p	AN6409	450p	BA550	100p	BA550	100p	CXN93A	80p
BC238	7p	BD711	50p	BU243	175p	BUX20	150p	MJE13017	100p	AN326	350p	AN6410	450p	BA551	100p	BA551	100p	CXN93A	80p
BC239	7p	BD736	50p	BU244	250p	BUX21	150p	MJE13018	100p	AN327	350p	AN6411	450p	BA552	100p	BA552	100p	CXN93A	80p
BC301	20p	BD828	55p	BU262A	70p	BUX22	150p	MJE13019	100p	AN328	350p	AN6412	450p	BA553	100p	BA553	100p	CXN93A	80p
BC302	20p	BD839	55p	BU263	120p	BUX23	150p	MJE13020	100p	AN329	350p	AN6413	450p	BA554	100p	BA554	100p	CXN93A	80p
BC303	20p	BD897	50p	BU264	100p	BUX24	150p	MJE13021	100p	AN330	350p	AN6414	450p	BA555	100p	BA555	100p	CXN93A	80p
BC304	25p	BD899	50p	BU265	225p	BUX25	150p	MJE13022	100p	AN331	350p	AN6415	450p	BA556	100p	BA556	100p	CXN93A	80p
BC327	7p	BD977	50p	BU266	90p	BUX26	150p	MJE13023	100p	AN332	350p	AN6416	450p	BA557	100p	BA557	100p	CXN93A	80p
BC328	7p	BDX33	60p	BU267	90p	BUX27	150p	MJE13024	100p	AN333	350p	AN6417	450p	BA558	100p	BA558	100p	CXN93A	80p
BC337	7p	BDX37	100p	BU268	90p	BUX28	150p	MJE13025	100p	AN334	350p	AN6418	450p	BA559	100p	BA559	100p	CXN93A	80p
BC338	7p	BDX44	100p	BU269	100p	BUX29	150p	MJE13026	100p	AN335	350p	AN6419	450p	BA560	100p	BA560	100p	CXN93A	80p
BC441	28p	BDX47	60p	BU270	70p	BUX30	150p	MJE13027	100p	AN336	350p	AN6420	450p	BA561	100p	BA561	100p	CXN93A	80p
BC446	8p	BDX54C	75p	BU271	60p	BUX31	150p	MJE13028	100p	AN337	350p	AN6421	450p	BA562	100p	BA562	100p	CXN93A	80p
BC471	12p	BDX62C	125p	BU272	60p	BUX32	150p	MJE13029	100p	AN338	350p	AN6422	450p	BA563	100p	BA563	100p	CXN93A	80p
BC516	22p	BDX63C	175p	BU273	60p	BUX33	150p	MJE13030	100p	AN339	350p	AN6423	450p	BA564	100p	BA564	100p	CXN93A	80p
BC537	25p	BDX64C	175p	BU274	60p	BUX34	150p	MJE13031	100p	AN340	350p	AN6424	450p	BA565	100p	BA565	100p	CXN93A	80p
BC546	8p	BDX65	80p	BU275	60p	BUX35	150p	MJE13032	100p	AN341	350p	AN6425	450p	BA566	100p	BA566	100p	CXN93A	80p
BC547	8p	BDX66	80p	BU276	60p	BUX36	150p	MJE13033	100p	AN342	350p	AN6426	450p	BA567	100p	BA567	100p	CXN93A	80p
BC548	8p	BDX67C	175p	BU277	60p	BUX37	150p	MJE13034	100p	AN343	350p	AN6427	450p	BA568	100p	BA568	100p	CXN93A	80p
BC549	8p	BDX68	80p	BU278	60p	BUX38	150p	MJE13035	100p	AN344	350p	AN6428	450p	BA569	100p	BA569	100p	CXN93A	80p
BC550	8p	BDX77	175p	BU279	60p	BUX39	150p	MJE13036	100p	AN345	350p	AN6429	450p	BA570	100p	BA570	100p	CXN93A	80p
BC556	8p	BDX87C	175p	BU280	60p	BUX40	150p	MJE13037	100p	AN346	350p	AN6430	450p	BA571	100p	BA571	100p	CXN93A	80p
BC557	8p	BDX88C	150p	BU281	60p	BUX41	150p	MJE13038	100p	AN347	350p	AN6431	450p	BA572	100p	BA572	100p	CXN93A	80p
BC558	8p	BDW24	50p	BU282	60p	BUX42	150p	MJE13039	100p	AN348	350p	AN6432	450p	BA573	100p	BA573	100p	CXN93A	80p
BC559	8p	BDW93	50p	BU283	60p	BUX43	150p	MJE13040	100p	AN349	350p	AN6433	450p	BA574	100p	BA574	100p	CXN93A	80p
BC560	8p	BDW94	50p	BU284	60p	BUX44	150p	MJE13041	100p	AN350	350p	AN6434	450p	BA575	100p	BA575	100p	CXN93A	80p
BC637	20p	BDY29	225p	BU285	60p	BUX45	150p	MJE13042	100p	AN351	350p	AN6435	450p	BA576	100p	BA576	100p	CXN93A	80p
BC639	20p	BDY56	225p	BU286	60p	BUX46	150p	MJE13043	100p	AN352	350p	AN6436	450p	BA577	100p	BA577	100p	CXN93A	80p
BC640	20p	BDY58	225p	BU287	60p	BUX47	150p	MJE13044	100p	AN353	350p	AN6437	450p	BA578	100p	BA578	100p	CXN93A	80p
BCY33	20p	BDY90	125p	BU288	60p	BUX48	150p	MJE13045	100p	AN354	350p	AN6438	450p	BA579	100p	BA579	100p	CXN93A	80p
BCY34	20p	BDY92	100p	BU289	60p	BUX49	150p	MJE13046	100p	AN355	350p	AN6439	450p	BA580	100p	BA580	100p	CXN93A	80p
BCY70	16p	BF137	35p	BU290	60p	BUX50	150p	MJE13047	100p	AN356	350p	AN6440	450p	BA581	100p	BA581	100p	CXN93A	80p
BCY71	16p	BF167	30p	BU291	60p	BUX51	150p	MJE13048	100p	AN357	350p	AN6441	450p	BA582	100p	BA582	100p	CXN93A	80p
BCY72	16p	BF181	16p	BU292	60p	BUX52	150p	MJE13049	100p	AN358	350p	AN6442	450p	BA583	100p	BA583	100p	CXN93A	80p
BD115	16p	BF185	16p	BU293	60p	BUX53	150p	MJE13050	100p	AN359	350p	AN6443	450p	BA584	100p	BA584	100p	CXN93A	80p
BD124P	10p	BF195	7p	BU294	60p	BUX54	150p	MJE13051	100p	AN360	350p	AN6444	450p	BA585	100p	BA585	100p	CXN93A	80p
BD131	25p	BF199	8p	BU295	60p	BUX55	150p	MJE13052	100p	AN361	350p	AN6445	450p	BA586	100p	BA586	100p	CXN93A	80p
BD132	25p	BF200	16p	BU296	60p	BUX56	150p	MJE13053	100p	AN362	350p	AN6446	450p	BA587	100p	BA587	100p	CXN93A	80p
BD133	25p	BF225	30p	BU297	60p	BUX57	150p	M											



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LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price		
HA13001	650p	LA2800	350p	LA7096	200p	LF353	48p	MC3302	50p	SAB3029	525p	STK3102 II	530p	STK5478	380p	STR16006	500p	TA7281	200p
HA13002	200p	LA3120	200p	LA7113	125p	LF355	60p	MC3401	45p	SAB3035	275p	STK3105	2500p	STK5479	300p	STR17006	500p	TA7282	160p
HA13006	400p	LA3150	200p	LA7126	275p	LF357	70p	MC3423P	100p	SAB3036	725p	STK3122 II	725p	STK5481	470p	STR20005	450p	TA7283	200p
HA13007	300p	LA3160	120p	LA7129	1300p	LF398	300p	MC3488AP	250p	SAB3037	250p	STK3152 II	900p	STK5482	285p	STR20015	450p	TA7284	200p
HA13108	250p	LA3181	40p	LA7210	60p	LH2426S	600p	MC34063AP	300p	SAB3042	825p	STK3156	500p	STK5483	440p	STR20015	450p	TA7285	200p
HA13117	175p	LA3216	65p	LA7212	150p	LM301	25p	MN1220T	800p	SAB3044	130p	STK4017	400p	STK5486	450p	STR30110	330p	TA7286	400p
HA13118	140p	LA3226	60p	LA7214	125p	LM311	35p	MN1226	450p	SAB3029	225p	STK4019	480p	STK5487	525p	STR30115	275p	TA7287	220p
HA13119	140p	LA3246	75p	LA7220	150p	LM319	15p	MN1276	1300p	SAB3210	250p	STK4021	250p	STK5488	480p	STR30120	400p	TA7288	200p
HA13127	350p	LA3300	140p	LA7222	110p	LM324	20p	MN1280	70p	SAB8048	225p	STK4022	530p	STK5490	480p	STR30123	450p	TA7289	325p
HA13128	400p	LA3301	110p	LA7224	110p	LM335Z	120p	MN3004	600p	SAB8051AP	700p	STK4025	530p	STK5492	450p	STR30125	550p	TA7290	450p
HA13130	450p	LA3361	100p	LA7225	250p	LM339	35p	MN3005	2000p	SAD2005	450p	STK4026	450p	STK5495	450p	STR30125	550p	TA7291	250p
HA13135	500p	LA3365	70p	LA7292	275p	LM348	45p	MN3011	110p	SAD2005	700p	STK4028	450p	STK5498	450p	STR40090	350p	TA7300P	75p
HA13139	600p	LA3370	70p	LA7294	150p	LM358	45p	MN3102	150p	SAD2007	400p	STK4032 II	1050p	STK5500	450p	STR40115	600p	TA7301	70p
HA13150A	1150p	LA3373	70p	LA7295	200p	LM381	150p	MN3102	150p	SAD2008	400p	STK4034 X	925p	STK5502	450p	STR41090	330p	TA7307	100p
HA13151	875p	LA3375	300p	LA7297	120p	LM382	130p	MN3207	375p	SAD2009	400p	STK4036	470p	STK5503	450p	STR43111	950p	TA7310	100p
HA13403	400p	LA3376	80p	LA7305A	75p	LM386	60p	MN3208	950p	SAD2112	450p	STK4038	680p	STK5504	450p	STR44115	475p	TA7312	120p
HA13406W	400p	LA3380	300p	LA7308	300p	LM387	100p	MN3208	950p	SAD2121	225p	STK4040 II	850p	STK5505	450p	STR44115	475p	TA7312	100p
HA13408	350p	LA3390	250p	LA7311	200p	LM387	100p	MN3208	950p	SAD2122	225p	STK4042 II	850p	STK5506	450p	STR44115	475p	TA7312	100p
HA13412	400p	LA3400	250p	LA7323	120p	LM389N	105p	MN3302	350p	SAD2200	200p	STK4044	900p	STK5507	450p	STR44115	475p	TA7312	100p
HA13426	500p	LA3411	90p	LA7323	120p	LM393	50p	MN3302	350p	SAD2201	200p	STK4044	900p	STK5508	450p	STR44115	475p	TA7312	100p
HA13432	400p	LA3410	150p	LA7330	350p	LM710	15p	MTA001M	600p	SAD2202	200p	STK4046	950p	STK5509	450p	STR44115	475p	TA7312	100p
HA13441	450p	LA3430	135p	LA7331	250p	LM710	15p	NE555	450p	SAD2203	200p	STK4046	950p	STK5510	450p	STR44115	475p	TA7312	100p
HA17524	250p	LA3600	100p	LA7332	225p	LM723	40p	NE567	115p	SAD2204	200p	STK4046	950p	STK5511	450p	STR44115	475p	TA7312	100p
KA2102	100p	LA3605	100p	LA7340	300p	LM741DIL	18p	NE567	115p	SAD2205	200p	STK4048	950p	STK5512	450p	STR44115	475p	TA7312	100p
KA2130	150p	LA3607	125p	LA7346	150p	LM741MET	45p	NE571	290p	SAD2206	200p	STK4048	950p	STK5513	450p	STR44115	475p	TA7312	100p
KA2130	150p	LA3607	125p	LA7346	150p	LM741MET	45p	NE571	290p	SAD2207	200p	STK4048	950p	STK5514	450p	STR44115	475p	TA7312	100p
KA2206	150p	LA4031	120p	LA7350	200p	LM10135N	650p	NE594	85p	SAD2208	200p	STK4050 II	1600p	STK5515	450p	STR44115	475p	TA7312	100p
KA2209	125p	LA4032	140p	LA7350	200p	LM1040N	650p	SGS444	500p	SAD2209	200p	STK4050 II	1600p	STK5516	450p	STR44115	475p	TA7312	100p
KA2210	230p	LA4051	160p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2210	200p	STK4050 II	1600p	STK5517	450p	STR44115	475p	TA7312	100p
KA2212	65p	LA4100	85p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2211	200p	STK4050 II	1600p	STK5518	450p	STR44115	475p	TA7312	100p
KA2213	130p	LA4101	85p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2212	200p	STK4050 II	1600p	STK5519	450p	STR44115	475p	TA7312	100p
KA2214	100p	LA4102	120p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2213	200p	STK4050 II	1600p	STK5520	450p	STR44115	475p	TA7312	100p
KA2224	50p	LA4120	100p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2214	200p	STK4050 II	1600p	STK5521	450p	STR44115	475p	TA7312	100p
KA2244	75p	LA4120	270p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2215	200p	STK4050 II	1600p	STK5522	450p	STR44115	475p	TA7312	100p
KA2261	100p	LA4138	105p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2216	200p	STK4050 II	1600p	STK5523	450p	STR44115	475p	TA7312	100p
KA2263	100p	LA4140	60p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2217	200p	STK4050 II	1600p	STK5524	450p	STR44115	475p	TA7312	100p
KA2264	100p	LA4142	65p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2218	200p	STK4050 II	1600p	STK5525	450p	STR44115	475p	TA7312	100p
KA2284	75p	LA4145	65p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2219	200p	STK4050 II	1600p	STK5526	450p	STR44115	475p	TA7312	100p
KA2303	100p	LA4160	100p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2220	200p	STK4050 II	1600p	STK5527	450p	STR44115	475p	TA7312	100p
KA2401	100p	LA4162	110p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2221	200p	STK4050 II	1600p	STK5528	450p	STR44115	475p	TA7312	100p
KA2412	225p	LA4178	100p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2222	200p	STK4050 II	1600p	STK5529	450p	STR44115	475p	TA7312	100p
KA2912	125p	LA4180	150p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2223	200p	STK4050 II	1600p	STK5530	450p	STR44115	475p	TA7312	100p
KA2913A	175p	LA4182	180p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2224	200p	STK4050 II	1600p	STK5531	450p	STR44115	475p	TA7312	100p
KA2914A	200p	LA4190	300p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2225	200p	STK4050 II	1600p	STK5532	450p	STR44115	475p	TA7312	100p
KA2247	100p	LA4192	140p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2226	200p	STK4050 II	1600p	STK5533	450p	STR44115	475p	TA7312	100p
KIA6213S	400p	LA4200	130p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2227	200p	STK4050 II	1600p	STK5534	450p	STR44115	475p	TA7312	100p
KIA6210AH	400p	LA4201	120p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2228	200p	STK4050 II	1600p	STK5535	450p	STR44115	475p	TA7312	100p
KIA6281H	250p	LA4260	120p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2229	200p	STK4050 II	1600p	STK5536	450p	STR44115	475p	TA7312	100p
KIA6283H	150p	LA4261	300p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2230	200p	STK4050 II	1600p	STK5537	450p	STR44115	475p	TA7312	100p
KIA6299K	210p	LA4265	125p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2231	200p	STK4050 II	1600p	STK5538	450p	STR44115	475p	TA7312	100p
KIA7227CP	200p	LA4270	300p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2232	200p	STK4050 II	1600p	STK5539	450p	STR44115	475p	TA7312	100p
KIAT3151	45p	LA4282	350p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2233	200p	STK4050 II	1600p	STK5540	450p	STR44115	475p	TA7312	100p
LI45V	300p	LA4420	140p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2234	200p	STK4050 II	1600p	STK5541	450p	STR44115	475p	TA7312	100p
LI65V	200p	LA4422	130p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2235	200p	STK4050 II	1600p	STK5542	450p	STR44115	475p	TA7312	100p
L200	250p	LM4425A	200p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2236	200p	STK4050 II	1600p	STK5543	450p	STR44115	475p	TA7312	100p
L272	200p	LA4430	130p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2237	200p	STK4050 II	1600p	STK5544	450p	STR44115	475p	TA7312	100p
L272M	110p	LA4440	200p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2238	200p	STK4050 II	1600p	STK5545	450p	STR44115	475p	TA7312	100p
L290B	200p	LA4445	200p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2239	200p	STK4050 II	1600p	STK5546	450p	STR44115	475p	TA7312	100p
L2918	200p	LA4446	200p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2240	200p	STK4050 II	1600p	STK5547	450p	STR44115	475p	TA7312	100p
L292B	225p	LA4461	120p	LA7355	175p	LM1203	225p	SGS445	500p	SAD2241	200p	STK4050 II	1600p	STK5548	450p	STR44115	475p	TA7312	100p
L293C	325p	LA4466	225p	LA7355	175p	LM1203	225p	SGS445	50										

JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SC1675	90p	2SC2261	70p	2SC2719	25p	2SC3263	28p	2SC3798	220p	2SD257	195p	2SD880	40p	2SD1327	150p	2SD1763A	60p
2SC1678	80p	2SC2267	90p	2SC2721	120p	2SC3264	390p	2SC3807	120p	2SD287	250p	2SD882	25p	2SD1328	60p	2SD1764	70p
2SC1683	100p	2SC2270	60p	2SC2724	15p	2SC3269	50p	2SC3808	70p	2SD291	250p	2SD889	35p	2SD1330	60p	2SD1765	70p
2SC1684	30p	2SC2271	25p	2SC2738	200p	2SC3270	50p	2SC3811	60p	2SD313	25p	2SD892A	75p	2SD1347	70p	2SD1769	110p
2SC1685	30p	2SC2274	15p	2SC2749	350p	2SC3271	75p	2SC3831	250p	2SD315	25p	2SD894	35p	2SD1348	65p	2SD1773	100p
2SC1729	900p	2SC2275	50p	2SC2750	300p	2SC3277	280p	2SC3832	135p	2SD325	30p	2SD895	100p	2SD1350	150p	2SD1776	70p
2SC1730	10p	2SC2278	70p	2SC2751	270p	2SC3279	200p	2SC3833	250p	2SD330	65p	2SD896	200p	2SD1376	60p	2SD1783	70p
2SC1735	70p	2SC2283	70p	2SC2752	75p	2SC3280	200p	2SC3851	100p	2SD348	300p	2SD898B	225p	2SD1378	60p	2SD1785	160p
2SC1740	10p	2SC2290	1800p	2SC2767	300p	2SC3281	200p	2SC3852	80p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p
2SC1741	35p	2SC2291	40p	2SC2769	400p	2SC3284	600p	2SC3853	220p	2SD357	40p	2SD905	450p	2SD1380	100p	2SD1792	120p
2SC1755	90p	2SC2298	35p	2SC2773	700p	2SC3293	85p	2SC3855	220p	2SD367	40p	2SD916	130p	2SD1382	60p	2SD1796	75p
2SC1756	35p	2SC2307	300p	2SC2774	500p	2SC3298	50p	2SC3857	500p	2SD369	50p	2SD917	300p	2SD1384	50p	2SD1806	75p
2SC1758	30p	2SC2308	10p	2SC2785	40p	2SC3299	120p	2SC3858	550p	2SD381	100p	2SD921	320p	2SD1390	350p	2SD1812	45p
2SC1760	70p	2SC2312	300p	2SC2786	20p	2SC3300	400p	2SC3866	275p	2SD382	100p	2SD923	360p	2SD1391	250p	2SD1815	50p
2SC1775	10p	2SC2314	70p	2SC2787	10p	2SC3303	100p	2SC3868	100p	2SD371	240p	2SD946	120p	2SD1392	85p	2SD1825	60p
2SC1781	20p	2SC2316	150p	2SC2791	500p	2SC3306	130p	2SC3870	200p	2SD380	650p	2SD947	100p	2SD1395	80p	2SD1827	120p
2SC1789	100p	2SC2320	10p	2SC2792	220p	2SC3307	600p	2SC388A	25p	2SD381	50p	2SD950	300p	2SD1396	120p	2SD1843	70p
2SC1809	40p	2SC2324	120p	2SC2793	700p	2SC3309	150p	2SC3883	210p	2SD382	75p	2SD951	200p	2SD1397	100p	2SD1846	350p
2SC1810	250p	2SC2328A	50p	2SC2808	40p	2SC3310	125p	2SC3884A	200p	2SD386	70p	2SD957A	520p	2SD1398	120p	2SD1847	275p
2SC1815	10p	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	60p	2SD1399	300p	2SD1849	280p
2SC1819	70p	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	60p	2SD965	35p	2SD1400	280p	2SD1850	325p
2SC1826	60p	2SC2329	480p	2SC2814	40p	2SC3326	50p	2SC3886A	275p	2SD400	14p	2SD970	170p	2SD1402	120p	2SD1853	40p
2SC1827	60p	2SC2330	300p	2SC2824	75p	2SC3327	60p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1856	40p
2SC1829	500p	2SC2331	50p	2SC2825	900p	2SC3328	50p	2SC3892A	250p	2SD402	120p	2SD973	60p	2SD1405	80p	2SD1857	75p
2SC1833	27p	2SC2333	200p	2SC2826	200p	2SC3330	20p	2SC3893	225p	2SD414	45p	2SD973A	70p	2SD1406	60p	2SD1858	40p
2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	325p	2SD415	55p	2SD982	90p	2SD1407	60p	2SD1863	35p
2SC1841	12p	2SC2335	55p	2SC2832	300p	2SC3333	120p	2SC3896	400p	2SD424	350p	2SD985	120p	2SD1408	125p	2SD1864	85p
2SC1844	50p	2SC2336A	125p	2SC2834	280p	2SC3345	100p	2SC3897	400p	2SD426	150p	2SD986	120p	2SD1409	170p	2SD1877	175p
2SC1845	15p	2SC2344	150p	2SC2837	250p	2SC3346	130p	2SC3907	250p	2SD427	350p	2SD998	70p	2SD1411	85p	2SD1878	160p
2SC1846	35p	2SC2347	35p	2SC2839	40p	2SC3352	200p	2SC3927	250p	2SD438	35p	2SD1010	40p	2SD1412	75p	2SD1879	275p
2SC1847	45p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	15p	2SD1012	40p	2SD1413	60p	2SD1880	360p
2SC1855	85p	2SC2360	120p	2SC2873	60p	2SC3355	50p	2SC3943	75p	2SD468	15p	2SD1020	40p	2SD1415	190p	2SD1881	350p
2SC1856	25p	2SC2361	150p	2SC2877	120p	2SC3356	120p	2SC3944	80p	2SD471	20p	2SD1021	120p	2SD1417	75p	2SD1884	300p
2SC1865	700p	2SC2362	50p	2SC2878	20p	2SC3358	50p	2SC3950	120p	2SD476	100p	2SD1022	250p	2SD1425	260p	2SD1886	300p
2SC1870	700p	2SC2365	280p	2SC2879	3200p	2SC3376	300p	2SC3953	50p	2SD525	50p	2SD1024	850p	2SD1426	135p	2SD1887	225p
2SC1871	425p	2SC2369	100p	2SC2882	60p	2SC3377	50p	2SC3955	60p	2SD526	70p	2SD1027	850p	2SD1427	160p	2SD1889	300p
2SC1875	20p	2SC2371	25p	2SC2883	60p	2SC3378	120p	2SC3964	100p	2SD545	18p	2SD1030	75p	2SD1428	180p	2SD1895	225p
2SC1881	70p	2SC2373	210p	2SC2889	200p	2SC3379	1200p	2SC3972	210p	2SD549	120p	2SD1031	70p	2SD1430	280p	2SD1910	175p
2SC1890	15p	2SC2383	50p	2SC2899	50p	2SC3381	130p	2SC3973	250p	2SD551	300p	2SD1036	600p	2SD1431	200p	2SD1911	300p
2SC1895	50p	2SC2389	45p	2SC2910	60p	2SC3383	80p	2SC3975	210p	2SD554	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p
2SC1904	125p	2SC2407	110p	2SC2910	25p	2SC3383	80p	2SC3987	160p	2SD555	500p	2SD1047	180p	2SD1433	300p	2SD1929	50p
2SC1906	15p	2SC2408	120p	2SC2911	80p	2SC3387	50p	2SC3996	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p
2SC1907	20p	2SC2412K	50p	2SC2912	120p	2SC3397	20p	2SC3997	1250p	2SD558	200p	2SD1055	60p	2SD1439	165p	2SD1933	45p
2SC1909	250p	2SC2440	200p	2SC2921	650p	2SC3400	35p	2SC3998	800p	2SD560	50p	2SD1060	130p	2SD1441	220p	2SD1939	60p
2SC1913	90p	2SC2458	10p	2SC2922	480p	2SC3401	50p	2SC4006	100p	2SD571	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p
2SC1914	30p	2SC2459	50p	2SC2923	75p	2SC3402	40p	2SC4020	100p	2SD575	530p	2SD1063	200p	2SD1445	200p	2SD1944	50p
2SC1921	15p	2SC2466	55p	2SC2928	550p	2SC3405	130p	2SC4023	325p	2SD592	25p	2SD1064	250p	2SD1446	300p	2SD1945	80p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	400p	2SC4029	35p	2SD596	25p	2SD1065	160p	2SD1448	60p	2SD1958	210p
2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p
2SC1929	180p	2SC2470	65p	2SC2937	250p	2SC3417	90p	2SC4046	40p	2SD601	40p	2SD1073	350p	2SD1452	275p	2SD1984	60p
2SC1940	110p	2SC2481	120p	2SC2939	400p	2SC3419	120p	2SC4056	20p	2SD602	60p	2SD1088	150p	2SD1453	140p	2SD1991	50p
2SC1941	27p	2SC2482	20p	2SC2944	300p	2SC3420	80p	2SC4059	40p	2SD612	50p	2SD1094	375p	2SD1455	250p	2SD1994	200p
2SC1942	350p	2SC2483	120p	2SC2958	50p	2SC3421	45p	2SC4064	140p	2SD613	70p	2SD1110	225p	2SD1457	165p	2SD1996	45p
2SC1944	350p	2SC2484	185p	2SC2962	800p	2SC3422	75p	2SC4106	150p	2SD617	300p	2SD1111	20p	2SD1458	75p	2SD2006	75p
2SC1945	350p	2SC2485	400p	2SC2979	180p	2SC3423	60p	2SC4107	175p	2SD633	70p	2SD1113	225p	2SD1459	60p	2SD2006	250p
2SC1946	1500p	2SC2491	200p	2SC2987	250p	2SC3425	65p	2SC4123	200p	2SD636	10p	2SD1128	200p	2SD1468	40p	2SD2011	50p
2SC1947	450p	2SC2498	50p	2SC2988	150p	2SC3446	150p	2SC4124	200p	2SD637	15p	2SD1133	65p	2SD1487	225p	2SD2012	60p
2SC1953	45p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1494	150p	2SD2018	65p
2SC1957	70p	2SC2502	140p	2SC2999	50p	2SC3456	200p	2SC4137	40p	2SD639	20p	2SD1138	40p	2SD1496	300p	2SD2023	80p
2SC1958	10p	2SC2503	600p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	350p	2SD1140	40p	2SD1497	230p	2SD2061	100p
2SC1962	175p	2SC2512	20p	2SC3019	320p	2SC3459	180p	2SC4157	400p	2SD655	18p	2SD1142	350p	2SD1497-02	350p	2SD2066	150p
2SC1967	1300p	2SC2517	120p	2SC3020	1450p	2SC3460	130p	2SC4159	100p	2SD661	60p	2SD1145	25p	2SD1505	90p	2SD2125	180p
2SC1969	160p	2SC2519	60p	2SC3022	1850p	2SC3461	275p	2SC4161	125p	2SD666	25p	2SD1148	175p	2SD1506	50p	2SD2136	85p
2SC1970	100p	2SC2527	300p	2SC3025	500p	2SC3466	60p	2SC4169	60p	2SD667	20p	2SD1153	30p	2SD1508	60p	2SD2144	35p
2SC1971	40p	2SC2534	150p	2SC3026	450p	2SC3468	70p	2SC4199	40p	2SD669	35p	2SD1159	65p	2SD1509	100p	2SD2151	175p
2SC1972	600p	2SC2535	300p	2SC3030	300p	2SC3481	300p	2SC4204	60p	2SD673	350p	2SD1160	150p	2SD1511	75p	2SD2255	175p
2SC1973	15p	2SC2538	100p	2SC3037	125p	2SC3482	275p	2SC4231	250p	2SD676	250p	2SD1163A	220p	2SD1519	250p	2SD2331	250p
2SC1975	120p	2SC2540	1900p	2SC3038	125p	2SC3486	275p	2SC4235	300p	2SD717	180p	2SD1					

VCR BELT KITS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI VP7100, VS9300, VS9500, VS9700, VS9800 120p		TX3650, VCR3000, VCR3002, VCR9500 75p		406, 407, 4092, 410, GV4111, 412, 414, 415, 416, 417, 4192, 4200, 420, 430, 434, 435, GV437, 440, 450, 4592, 460, 464, 470, 500, 501, 5050, 5095, GV5105, 511, 530, 5395, 540, 560, 5695, MV4005, 4105, SE4100, 4104, 4120, 5102, 5104, 5105, TVR37001 70p		N.E.C. N850, N831, N832, N833 100p		V1710, 730, 750, 970, VX710, 712, 720, 730, 970, 971, 972 100p	
VS1, VS2, VS3, VS5, VS12, VS15, VP88 70p		FISHER VBS7000 245p		HINARI VXL2 80p		PVC2300, PVC2400 100p		VX9880 110p	
VS10 65p		VBS9000 120p		VXL7, VXL8, VXL9, VXL10, VXL11, VXL19, VXL90, VCR34, VTV100, 75p		DX1000, 1600, 1800, 2000, 3000, N9012, 9013, 9014, 9016, N9033, 9034, 9053, 9054, 9055, 9056, 9066, 9096, 9110, 9120, N9510, 9520, 9530, 9610 80p		SANYO VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50 65p	
VX59, VS105, 112, 115, 116, 120, 125, 126, 155, 165, 205, 220, VS24, 240, 244, 245, 247, 248, 250, 512, 515, 516 200p		FVHP520, FVHP530, FVHP420 60p		HITACHI VXL2 80p		NATIONAL PANASONIC NV300, NV330PX, NV332, NV333 NV340, NV366 100p		VTC5300, VTC5350, VTC5400, VTC5500 80p	
VX22, VS23, VS25, VS35, VS37, VS38, VS53, VS55, VS66 200p		FVHP830, 840 60p		VXL7, VXL8, VXL9, VXL10, VXL11, VXL19, VXL90, VCR34, VTV100, 75p		NV777, NV788 100p		VTC9100, VTC9300 140p	
VX55, VS66 200p		FVHP905, 906, 907, 908, 910, 911, 915, 916, 918 75p		VXL4, VXL35, VTV300 100p		NV2000, NV2010, NV3000 75p		VTC1100, 1300, 1500, VHR1100, 1110, 1150, 1200, 1300, 80p	
VX54, VS66, VS8, VS9 120p		VBS3300, VBS7500, VBS7600, VBS9000 100p		VXL5, VXL6 100p		NV7000, NV7200, NV7800 75p		VHR1500, 2370, MVR220 80p	
VX57, VS89 105p		VBS3500 75p		VXL7, VXL20 90p		NV8600, NV8610, NV862 145p		VHR2100, VHR2300, VHR2500, VHR2700 100p	
ALBA VCR4000 130p		FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20 110p		HITACHI VT11, 14, 16, 17, 19, 33, 330, 34, 35, 350, 38, 39, 88, 165, 5030 75p		NV230, 250, 280, 430, 431, 433, 450, 460, 465, 470, 650, 730, NV770, 810, 870, 890, 970, AG 85p		VHR3100, 3110, 3150, 3300, 3310, 3400, 3500, 3700, 3800, VHR0500, 700, TLS1000, TLS1001 65p	
VCR5000, VCR6000 105p		FVHD230, 250, 270, 370, FVHP1100, 1200, 1250, 130, 132, FVHP1340, 1400, 1410, 1440, 1500, 2000, 200, 210, 250, 3, 300, 310, 320, 2000, 410, 420, 430, 440, 445, 470, 475, FVSD2905 85p		V7500, VT5500, VT18 120p		NV830, NV850 80p		VHR1200, 130, 14, 141, 143, 14, 150, 151, 153, 154, 15, 16, 171, VHR194, 220, 23, 235, 240, 244, 250, 251, 274, 297, 310, 330, VHR335, 390, 4100, 4105, 4150, 4200, 430, 4300, 4350, 474, VHR4770, 5080, 5100, 5200, 5300, 5350, 5700, 6850, 7100, VHR7200 7250, 7260, 7300, 7400, 7500, 7520, 7530, 7530, VHR7540, 7700, 7747, 78212, 8000, 8100, 8200, 8250, 8500, VHR8000, 8801, VHRD4000, 410, 4500, 4600, VHR4610, 4710, 4890, 6700 60p	
VCR1000, 2000, 6000, 6100, 6200, 8600, 8602, 8603, 8604 80p		VBS2905 75p		V7800, VT8000, VT8030, VT8040, VT8300, VT8500, 8700 60p		NV600, NV688, AG6010, AG6015 85p		VMD66, VMD68P 80p	
VCR7000, VCR8000, VCR8000, VCR8800 110p		G.E.C. V4005 150p		V7900, VT9000 75p		NV670, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130, 400, NVH70 50p		VTR1000 70p	
VCR9000, 8704, 8714, 8800, 8804, 9000, 9005, 9244, 9340 100p		V4007 80p		VT52, VT57, VT61, VT62, VT63, 64, 65, 85, 85, 640 95p		NVM1, NVM3, NVM5 70p		VTR1000 70p	
DB9800, DB9804, TVR4 100p		GOLDSTAR GHV1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245, GHV1246, 1247, 1248, 1250, 1266, 51, 8000, 8200, 8210, 8215, VCPA100, VCPA130 80p		VT3000 120p		PHILIPS VR6460, VR6920 170p		VTC6010 75p	
TX3650, UF20, 22 24, VCR3000, 3002, 4000, 9500 75p		V4004 100p		VT100, 110, 111, 113, 115, 118, 120, 125, 128, 130, 135, 138 100p		VR6540 100p		VTC8000 110p	
VS1004 105p		V4007 80p		VT145, 150, 168, i70, 175, 220, 225, 250, 255, 258, 260, VTR30 60p		VR6442, VR6542 100p		VTC8300 115p	
BLAUPUNKT RTV100 200p		GOLDSTAR GHV1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245, GHV1246, 1247, 1248, 1250, 1266, 51, 8000, 8200, 8210, 8215, VCPA100, VCPA130 80p		VMS50 VMS60 90p		VR2025, VR2580 100p		VTC8800 110p	
RTV200, RTV222, RTV224 90p		GHV1290, 1291, 1295, 1296, VCP4000, 4200, 4300, 4301, VCP4305, 4306, 4310, 4311, 4315, 4320, 4321, 4325, 4326 120p		HR3300, HR3330, HR3360, HR3660, HR4100 130p		DV186, 190, 286, 291, 292, 468, 471, 562, 571, 761, VR201, 202, 203, 211, 215, 212, 213, 223, 311, 312, 313, 3210, 3219, 322, 32, 323, 535, VR20V1, 20DV2, 20RW7, 21DV1, 21DV2, 21D, V3, 25B01, 25B02, 11, 12, 302, 303, 305, 31DV1, 31DV2, 31D, V3, 35B11, 35B12, 35B13, 725B8, VR30DV2, 35B02, 35B03, 635B7, 715B4, 715B5, 715B8, VR865B2, 915B2, 925B3, 925B4, 925B5, 925B6, 925B7, 6290VR291, VR6293, 6362, 6367, VR6390, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, VR6676, 6710, 6760, 6761, 6762, 6870, 6970, 6975, VR685B4, 865B1, 925B3 75p		VTC9000, 381, 384, 385, 386, 388, 390, 393, 838, 9100, 9300, 9500, VCR3100 110p	
RTV322, RTV248 100p		VHS11, VHSAH3 100p		HR7200, HR7300 50p		VR445B92, VR445B92, VR4443, 6843, 6843, VR6943 100p		VTC9300, VCR700, VCR750, VCR7800, VCR800 115p	
RTV306, 307, 309, 310, 311, 312, 328, 414, 434, 444, 707 135p		VHSVH4, VHSWH1, VHSXH1 50p		HR7350, HR7600, HR7610, HR7650, HR7855 50p		VR4589, VR4589B20, VR445B922, VR4443, 6843, 6843, VR6943 100p		VTC9500, 571, 573, 581, 582, 583, 584, 585, VCR313, VCR361 110p	
RTV211, RTV214 135p		VHSYH2 50p		HRD110, 111, 120, 121, 220, 225, BP500 60p		VR6390, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, VR6676, 6710, 6760, 6761, 6762, 6870, 6970, 6975, VR685B4, 865B1, 925B3 75p		VTC9800, 405, 408, 550, 605, 614, 681, 682, 682, 684, 685, 693 70p	
RTV324, RTV32565p		VHSB11, VHSCH 1 50p		HRD170, 171, 180, 210, 211, 217, 230, 300, 320, 321, 330, 337, HRD350, 370, 400, 430, 440, 441, 500, 530, 700, 750, 950, HR5000, 5500, 8000, 9000, BR5060, BR5600, 605, 920, 925 45p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC1008, 405, 408, 550, 605, 614, 681, 682, 682, 684, 685, 693 70p	
RTV315, RTV316, RTV319, RTV320, RTV317 50p		VHSAN3 110p		HRD227, 520, 521, 522, 527, 600, 610, 620, 637, 641, 650, 830, HRD840, HRDX20, 22, HRJ200, 205, 300, 305, SR330, HR510 125p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC1103, 105, 106, 113, 11613, 211, 234, 244, 254, 30, 33, 35, VCA326, 37, 40, 43, 454, 48, 50, 505, 51, 52, 53, 55, 56, 57, 58, VCA600, 605, 615, 67, 68, 1031, VCB320, VCBS97, VCD805, VCD806, 810, 815, VCH80, 502, 502, 5011, VCS5100 65p	
RTV301, RTV333, RTV338, RTV404, RTV424 85p		VHSDS2 125p		HRJ215, 315, 316, 318, 400, 405, 407, 410, 411, 415, 416, 507, HRJ610, 615, 715, 97, HR54700, 5800, SR3200, SRS368E 60p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC1212, 310, 410, 610, VCT1314, VCT3152, VCC10 80p	
FERGUSON 3292, 3V00, 3V01, 3V16, 3V22, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922 120p		VHSA3Y3 125p		HRJ600 40p		VKR6850, VKR6855 70p		VTC1310, 410, 610, VCT1314, VCT3152, VCC10 80p	
3V23, 8923, 8924, 8929 50p		VHSA3Y2 100p		LOGIK VR955 180p		VKR6860, VKR6810, VKR6820 70p		VTC1310, 410, 610, VCT1314, VCT3152, VCC10 80p	
3V29, 3V30, 8930, 8931, 8933, 8940 65p		VHSEY1, VHSEY2 70p		MATSU MX600, 730, 735, 750, 755, 765, 850, 6000, VS985 75p		SE4104, VR231, 2310, 2319, 231, 232, 2329, 237, 23, 241, 2410, 2419, 242, 243, 245, 2469, 247, 2479, 251, 252, 256, 257, 258, 33, 19, 332, 3329, 333, 337, 339, 3419, 342, 343, 3469, 347, 3479, 35, 1, 352, 357, 358, 422, 4229, 432, 437, 442, 4229, 432, 437, 442, 44, 5, 4469, 447, 4479, 451, 452, 457, 458, 459, 512, 522, 529, 6379, 642, 647, 722, 7229, 723, 7379, 747, 8399, 845, 9489 70p		VTC1400, 103, 105, 106, 113, 11613, 211, 234, 244, 254, 30, 33, 35, VCA326, 37, 40, 43, 454, 48, 50, 505, 51, 52, 53, 55, 56, 57, 58, VCA600, 605, 615, 67, 68, 1031, VCB320, VCBS97, VCD805, VCD806, 810, 815, VCH80, 502, 502, 5011, VCS5100 65p	
8945, 8947, 8948 45p		VHSC11 100p		HRD640, 950, 960, 980, 590, 640, 660, 670, 720, 730, 740, 770, HRD820, 860, 870, 880, 910, 960, 980, HRDX20, 25, HRJ210, HRJ215, 315, 316, 318, 400, 405, 407, 410, 411, 415, 416, 507, HRJ610, 615, 715, 97, HR54700, 5800, SR3200, SRS368E 60p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC1500, 125, 213, 225, 262, SLVX1, 20, 3 75p	
8945, 8947, 8948 45p		VHSC11 100p		MITSUBISHI HS200 200p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC1600, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p		VHSC11 100p		HS300, 301, 302, 307, 310, 337, 338, 347, 349, 40, 41, 412, 421, 480, HS810, 20, 30, HSE10, 20, 30, 70 80p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC1700, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p		VHSC11 100p		HS303, HS304, HS306, HS307, HS330, HS400, HS710 110p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC1800, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p		VHSC11 100p		HS710, HS710, HS410 110p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC1900, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p		VHSC11 100p		HSM1000, 16, HSM23, 25, 33, 34, 35, 37, 54, 55, 57, 58, 59, 68 65p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC2000, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p		VHSC11 100p		SAISON VR2000, VHL3 90p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC2100, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p		VHSC11 100p		SAMSUNG SV716, 717, V1616, V-621, V1626, VX616, VX617, VX619, VX626, VX627, VX629, 714 75p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC2200, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p		VHSC11 100p		SAMSUNG SV716, 717, V1616, V-621, V1626, VX616, VX617, VX619, VX626, VX627, VX629, 714 75p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC2300, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p		VHSC11 100p		SAMSUNG SV716, 717, V1616, V-621, V1626, VX616, VX617, VX619, VX626, VX627, VX629, 714 75p		VR3260, 6349, 6448, 6449, 6548, 6648, 495B260, 6448B95, 495B6 110p		VTC2400, 109, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659, 690, 711, 880 120p	
8945, 8947, 8948 45p									

VIDEO SERVICE KITS

<p>AMSTRAD VCR700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, VIDEO LAMP Order Code: SK41 £5.50</p> <p>FERGUSON & JVC 3V42/43 HRD435/HRD725 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK37 £16.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, SUPPLY CLUTCH, TAKE UP CLUTCH Order Code: SK38 £9.00</p> <p>3V58/59/64/65 HRD170/180/210/230/300/320/370/400/430/530/700/750 HRSS000 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND Order Code: SK44 £7.00</p> <p>3V29/3V30 HR7200/7300/7350 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK05 £5.00</p> <p>3V35/36, 38/39/49 HRD110/111/120/225 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK04 £5.00</p> <p>3V31/3V42 HR7600/7610/7650/7655 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33 £11.00</p> <p><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE, T/U CLUTCH Order Code: SK34 £5.00</p> <p>3V35/36/38/39/49 HRD110/111/120/121/225 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER, REEL IDLER, TENSION BAND Order Code: SK35 £10.00</p> <p><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE Order Code: SK36 £5.50</p> <p>3V29/3V30 HRD7200/7300/7350 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK31 £10.00</p> <p><i>Economy Kit Contents</i> BELT SET, T/U REEL IDLER TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE, T/U CLUTCH Order Code: SK32 £5.00</p> <p>3V44/45/48/53/54/55/57 HRP50/HRD140/150/158/160 HRD250/257/565/566/755 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39 £15.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER Order Code: SK40 £9.50</p> <p>FISHER FVHP905/906/907/908/910/911/916/918 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57 £13.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK58 £5.00</p> <p>FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK68 £11.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK69 £3.00</p>	<p>HITACHI VT11/VT33 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK08 £5.00</p> <p>VT11/VT33 <i>Contents</i> BELT SET, T/UP REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, FF/REW IDLER, CLUTCH PLATE, TENSION BAND Order Code: SK45 £13.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, FF/REW IDLER TYRE, T/UP REEL TABLE TYRE, SUPPLY REEL TABLE TYRE Order Code: SK46 £3.75</p> <p>VTS2/61/62/63/64/65/85/86/640 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK49 £14.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, FF/REW IDLER Order Code: SK50 £3.00</p> <p>VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/48/450/498/510/520/25/26/530/35/36/540/545/46/48/570/75/576/580/85/88 <i>Contents</i> TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE, TENSION BAND Order Code: SK52 £9.75</p> <p>VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VT130 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK51 £14.00</p> <p>PANASONIC NV2000/NV2010/NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK03 £5.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK02 £5.00</p> <p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE Order Code: SK01 £5.00</p> <p>NV2000/NV2010 <i>Contents</i> BELT SET, PINCH ROLLER, FF IDLER, PLAY IDLER, TENSION BAND, VIDEO LAMP Order Code: SK13 £6.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, PULLEY TYRE Order Code: SK14 £6.00</p> <p>NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK11 £9.50</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, CLUTCH TYRE Order Code: SK12 £3.25</p> <p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK15 £7.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, PLAY IDLER Order Code: SK16 £2.25</p> <p>NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (P/X/C)/AG1810 (P/K) <i>Contents</i> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK27 £6.00</p> <p><i>Economy Kit Contents</i> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TYRE Order Code: SK28 £3.00</p> <p>NV332 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29 £12.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30 £5.10</p> <p>NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23 £6.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK24 £3.25</p>	<p>NV600/NV688 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND Order Code: SK25 £12.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK26 £6.00</p> <p>NV730/NV770 <i>Contents</i> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK19 £5.50</p> <p><i>Economy Kit Contents</i> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER TYRE Order Code: SK20 £3.00</p> <p>NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK21 £5.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK22 £2.75</p> <p>NV777/NV788 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK17 £6.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK18 £4.00</p> <p>SHARP VC381 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND, VIDEO LAMP Order Code: SK47 £8.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL IDLER TYRE Order Code: SK48 £3.25</p> <p>VC500/VC571/VC581/VC582/VC583/VC584/VC5F3 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND Order Code: SK60 £9.50</p> <p><i>Economy Kit Contents</i> REEL IDLER Order Code: SK61 £5.00</p> <p>VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VC100/VC102/VC104/VC104/VC202 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64 £13.50</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK65 £3.75</p> <p>VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62 £13.50</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63 £5.00</p>
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FOR MORE DETAILS OF OVER 500 TYPES OF SERVICE KITS . . . PLEASE RING US!

SERVICE KIT & UPGRADE FOR ONWA TV CHASSIS

FAILURE OF ZD401 (ZD401 ON THE 20/21 CHASSIS) IS NOT UNCOMMON.

THIS KIT HAS BEEN ASSEMBLED AS A REPAIR KIT FOR COMPONENT FAILURES AND AS AN UPGRADE FOR THE POWER SUPPLY.

THE KIT CONSISTS OF ALL THE REQUIRED COMPONENTS AND COMES COMPLETE WITH FULL INSTRUCTIONS AND CIRCUIT DIAGRAM.

THE KIT IS DESIGNED TO FIT THE FOLLOWING MAKES AND MODELS.

- * ALBA / BUSH
- * AKAI
- * GOODMANS
- * HINARI
- * JVC
- * MATSUI

ORDER CODE : ONWAKIT PRICE: 1200p

* SOME MANUFACTURERS HAVE ALREADY TAKEN STEPS TO UPGRADE THE POWER SUPPLY

REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	V535, V553, V555, V556, V575	CH18	3200p	FV31R	HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H	CH20	2200p	VCA103, 103GV, 106, 106GVM, 254GVM		CH23	2500p
GRANADA	VHSDP1, VHSYJ2	CH05	1100p	FV57H	HRD540, 580, 630, 860, 910, 960, HRD970, HRDX20	CH27	2400p	VC5211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610		CH24	2500p
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400, 73401, GSE1295P, GSE1891P, 206010, 206015, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p	VR3005, VR3905	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p	VR2970		CH02	2800p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p		VR2970		CH02	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2800p	NV730	N830EG, N831EG, N831EG, N832, N833EG	CH01	2800p	THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2800p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD 140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755	CH02	2800p	N855	6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH02	2800p		V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540	CH01	2800p
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2800p	CASSETTE LIFE ASSEMBLY (69120366)	DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH05	1100p	TOSHIBA	V55, V57	CH01	2800p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2800p	VR6443, VR6448, 49S86	VCA100, VCH851, VCH852	CH22	2900p		V65, V66	CH02	2800p

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AMSTRAD MOD KIT

☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆

FITS :

VCR 4500, 4600, 4700, 5200, TVR 1,2,3

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PRICE : £2.25 + VAT each

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MODE SWITCH

NV2000, 2010, 7000, 7200, 7800 (VS50048)	
NV230, 260, 430, 810, 870, 2300, 4300 (VSS0110)	£3.50
NV830 (VSS0091)	£2.25
NV300, 333, 340, 366, 688, 777, 778 (VSS0060)	£2.10
NVG21, 25, NVH65, NVD80 (VSS0175A)	£3.75
	£2.00

AUDIO CONTROL HEADS

AMSTRAD ORIGINAL NO: 150751
 Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000
 Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER, TOWADA, UNIVERSUM
 ORDER CODE: AH01 PRICE: 1350p

AMSTRAD ORIGINAL NO: 153134
 Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244
 Also fits: ANTECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLD-HAND, GRANADA, HINARI, MARQUANT, OMEGE, PROFEX, SCHNEIDER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA, UNIVERSUM
 ORDER CODE: AH02 PRICE: 1450p

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NV67 etc	875p
VBR0050	NV300, NV340 etc	875p
VBR0061	NV777 etc	875p
VBR0103A	NV250, NV450 etc	625p
VBR0125		625p

VIDEO TOOLS

VIDEO CLEANING STICKS

Price 17p each 15p each pack of 10pcs
 13p each pack of 25pcs
Order Code: SP14

VIDEO MAINTENANCE TOOLS

Set of 8 Allen keys packed in a plastic wallet
Order code: TOOL 9, Price 125p
 Specifically designed for video maintenance

UNIVERSAL HEAD EXTRACTOR

Hand tool designed for extracting hard to remove heads without damage to either the head or the mounting assembly. Adjustable so as to suit various heads.
Order code: TOOL 8, Price 600p

VCR ALIGNMENT KIT

CONTAINS: SET OF 7 HEAD & TAPE PATH ALIGNERS

- RCA TYPE AUDIO & CONTROL HEAD POSITIONING TOOL
- RCA ADJUSTMENT TOOL FOR TAPE GUIDE POSTS
- RCA TYPE BACK TENSION TOOL
- TENSION ADJUSTMENT TOOL FOR VARIOUS USES
- VCR ADJUSTMENT TOOL

SET OF 8 ALLEN KEYS

0.77mm	0.90mm
1.27mm	1.50mm
1.60mm	2.00mm
2.40mm	3.00mm

3 REVERSIBLE SCREWDRIVERS
SPRING HOOK

CIRCLIP PLIERS
MICRO SCREWDRIVER

VCR HEAD EXTRACTOR
Order code: TOOL 10, Price 2900p

TRANSPARENT REPAIR/ADJUSTMENT CASSETTE

This transparent videocassette replaces a normal videotape during measurements, adjustments and inspection. The mechanical parts come into sight and become accessible.

Order code: TOOL 23, Price 500p

BACK UP BATTERIES

PHILIPS

Part Nos: 138 - 101138, 138 - 10313 1.2v 90mAH
 Order Code: BB01
 Part Nos: 138 - 10229, 2.4v 100mAH
 Order Code: BB02

Price: 70p

Price: 135p

FERGUSON

Part No: 00E6 - 067 - 001 1.2V 100mAH
 Order Code: BB03
 Part Nos: 00E6 - 606 - 8001 2.4V 100mAH
 Order Code: BB04

Price: 90p

Price: 150p

SATELLITES

MAKE & MODEL	CODE	PRICE
PACE PRD800, PRD900	SATPSU1	600p
PACE SS9000, 9200, 9010, 9210, 9220	SATPSU2	550p
AMSTRAD SRD510, SRD520	SATPSU3	600p
AMSTRAD SRD500	SATPSU4	600p
AMSTRAD SRX340, SRX345, SRX350	SATPSU5	600p
PACE D100/150	SATPSU6	650p
CHURCHILL D2MAC	SATPSU7	650p
PACE MSS100	SATPSU8	1100p

MAKE & MODEL	CODE	PRICE
PACE MSS200/300 APPOLL	SATPSU9	900p
PACE MSS500/1000	SATPSU10	1230p
FERGUSON SRD4	SATPSU11	650p
ECHOSTAR SR5500	SATPSU12	1600p
ECHOSTAR 6500/7700/8700	SATPSU13	2750p
AMSTRAD SRD600	SATPSU14	2600p
MIMTEC (Surenson)	SATPSU15	700p
AMSTRAD SRD700, SR950, SRX100, 301, 501, 502, 1002, 2001, SRD2000 SAT250	SATPSU16	650p

SATELLITE TUNERS

PACE PRD800/MSS200 2Ghz (221-2077062)
 ORDER CODE: TUNER01 PRICE: 1400p + VAT

PACE PRD900/MSS1000 2Ghz (221-21770112)
 ORDER CODE: TUNER02 PRICE: 1400p + VAT

SWITCH MODE TRANSFORMERS

PACE 9000
 ORDER CODE: PACE9000 PRICE: 800p

PRD800/PRD900
 ORDER CODE: PRD800 PRICE: 550p

SATMETER

The Satmeter is a professional portable satellite strength meter designed for the installation and maintenance of satellite TV systems. The Satmeter can be used as stand alone with powering the LNB as well as in loop.

Through operation with satellite RX powering the LNB.

* Acoustical signal: On signal strength *LED indicator: Vert/Hori

* Frequency Range: 900 to 2050 Mhz *Input impedance: 70 Ohm

* Power amplifier: 18db *Detection Range: -60 to -10 DBM

* Max. input signal: -10 DBM

ORDER CODE: TOOL22

PRICE: 8500p

REPLACEMENT TV SWITCHES

GRUNDIG

PART No: 29703, 29102
 USED ON:
 C7500, C8500, C8502, C8712 ... ETC
 Order Code: SW1 Price: 100p

PHILIPS

USED ON:
 K30, K35, K40, KT3, KT4
 Order Code: SW13 Price: 95p

SONY

USED ON:
 KV1612, KB1612, KV1614, KV2052, V2056
 KV2062, KV2067, KV2212 ... ETC
 Order Code: SW5 Price: 130p

USED ON:
 KV1400, KV1440, KV2040, KV2060
 (POWER SWITCH 26mm)
 Order Code: SW12 Price: 110p

SONY

USED ON:
 KV2020
 (POWER SWITCH 21mm +Remote)
 Order Code: SW6 Price: 130p

SONY 2 PIN FUNCTION SWITCH

Order Code: SW9 Price: 35p

FUSES

CURRENT RATING	TIME LAG (20mm)		QUICK BLOW (20mm)	
	ORDER CODE	PRICE	ORDER CODE	PRICE
100mA	FUSE36	75p	FUSE37	60p
160mA	FUSE01	75p	FUSE17	60p
250mA	FUSE02	75p	FUSE18	60p
315mA	FUSE03	75p	FUSE19	60p
400mA	FUSE04	75p	FUSE20	60p
500mA	FUSE05	75p	FUSE21	60p
630mA	FUSE06	75p	FUSE22	60p
800mA	FUSE07	60p	FUSE23	60p
1A	FUSE08	60p	FUSE24	60p
1.25A	FUSE09	60p	FUSE25	60p
1.6A	FUSE10	60p	FUSE26	60p
2A	FUSE11	50p	FUSE27	60p
2.5A	FUSE12	50p	FUSE28	60p
3.15A	FUSE13	55p	FUSE29	50p
4A	FUSE14	55p	FUSE30	50p
5A	FUSE15	60p	FUSE31	50p
6.3A	FUSE16	60p	FUSE32	50p

CERAMIC PLUG TOP

CURRENT RATING	ORDER CODE	PRICE
3A	FUSE33	100p
5A	FUSE34	100p
13A	FUSE35	100p

20mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
6.3A	FUSE38	100p
8A	FUSE39	100p
10A	FUSE40	100p
3.15A	FUSE41	85p
4A	FUSE42	85p
5A	FUSE43	85p

32 mm CERAMIC SLOW BLOW

CURRENT RATING	ORDER CODE	PRICE
8A	FUSE44	185p
10A	FUSE45	185p
15A	FUSE46	185p
20A	FUSE47	210p

38mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	825p

NB. All fuses are made in the UK and fully meet BS4265 & BS1362 safety standards and should not be compared with cheap imported types

**** ALL THE ABOVE PRICES ARE FOR PACKS OF 10 FUSES ****

VOLTAGE TESTER

A terminal screwdriver incorporating continuity & voltage with Euroslot.

ORDER CODE: TOOL11

PRICE: 220p

SPRING HOOK

Spring Hook, to unlock springs in audio tape recorders & VCRs

ORDER CODE: TOOL20

PRICE: 265p

FAULT FINDING / COMPARISON BOOKS

Satellite Fault Finding Guide Issue 1.
Listing about 1,000 faults for over a range of 24 different brands.

Order Code: BOOK05.

Price £8.50 - No VAT.

TELEVISION Edition 6

Lists more than 8,450 faults with 460 pages covering 58 different brands

Price: 1600p only - no VAT. Order Code: BOOK02

SEMICONDUCTOR COMPARISONS 1997/8

Listing more than 31,600 Semiconductors with suitable alternative complete with descriptions and base information.

Price: £15.50 - No VAT. Order Code: BOOK04

Video Recorders Edition 5 1997

Over 300 pages packed with more than 5500 faults for different brands

Price £15.00 - No VAT. Order Code: BOOK01

Satellite Repair Manual Edition 4

A comprehensive guide to receiver reviewing, featuring stock faults and installation tips.

Price £15.00 Only No VAT Postage 100p
Order Code: BOOK03

SEMICONDUCTOR COMPARISONS 1997

The new 1997 Jaeger Semiconductor with 952 pages packed with information on over 80,000 semiconductors in much greater detail plus marketing data on SMD devices and a separate generic table of all type designations.

Price: £40.00 only - No VAT (+ £5 Postage).
Order Code: BOOK06

SERVICE AIDS

DESCRIPTION	VOLUME	CODE	PRICE
VIDE HEAD CLEANER	75ML	SP01	145p
SWITCH CLEANER	176ML	SP02	155p
SILICONE GREASE	200ML	SP03	180p
FREEZE IT	170ML	SP04	295p
FREEZE IT	400ML	SP16	580p
FOAM CLEANER	400ML	SP05	180p
ANTI-STATIC	200ML	SP06	180p
AEROKLEANE	200ML	SP07	200p
AERD DUSTER	200ML	SP08	340p
AERD DUSTER	400ML	SP17	580p
PLASTIC SEAL	200ML	SP09	250p
GLASS CLEANER	250ML	SP10	170p
CDLKLKLENE	250ML	SP13	235p
EXCEL POLISH 80	250ML	SP18	180p
ADHESIVE 120	400ML	SP19	225p
LABEL REMOVER 130	200ML	SP20	260p
REFURB 140	400ML	SP21	260p
TUBE SILICON GREASE	50 GRAMMES	SP11	225p
TUBE SILICON SEALANT WHITE	75ML	SP22	250p
TUBE SILICON SEALANT CLEAR	75ML	SP23	250p
TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	150p
DRIVE CLEANER	200ML	SP24	150p
SCREEN CLEANER	200ML	SP25	145p
COMPUTER CARE KIT	-	SP26	2100p

All the above items are manufactured by Servisol
If you purchase more than one Servisol Product, postage & package will be charged as follows:

300p for 2-5 cans 500p for more than 5 cans

SOLDERING ACCESSORIES

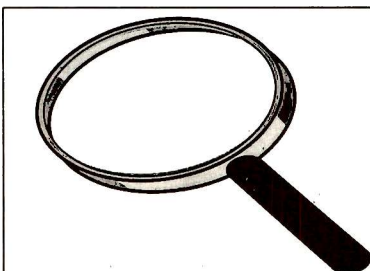
DESCRIPTION	CODE	PRICE
ANTEX SOLDERING IRONS		
25 WATT 240 VAC (XS25W 240V)	S101	900p
15 WATT 240 VAC (XS15W 240V)	S102	900p
25 WATT SPARE ELEMENT	S103	450p
15 WATT SPARE ELEMENT	S104	450p
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SPARE SPONGE	S109	55p
SOLDER		
18 SWG 500 GRAMMES	S110	500p
20 SWG 500 GRAMMES	S111	650p
22 SWG 500 GRAMMES	S112	700p
DESOLDERING AIDS		
SDLDR MOP STANDARD GAUGE 1.2MM X 1.5M	S107	100p
SOLDER MOP 1.2MM X 10M	S113	420p
DESOLDERING PUMP	S105	320p
SPARE NOZZLE	S106	60p

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Part No.	Code	Price	HITACHI	LOT44	1050p	4515 01 19	LOT169	1500p	TLF 14520 F	LOT40	1500p	094-01020/0.7	LOTS9	1400p	1-439-303-31	LOT94	1300p
AKAI			2424593	LOT79	1600p	4515 01 24	LOT137	1600p	TLF 14521 F	LOT39	1850p	094-01021/0.6	LOTS9	1400p	1-439-303-32	LOT94	1300p
45150344	LOT56	1650p	2432101	LOT79	1600p	4515 01 01	LOT136	1600p	TLF 14567 F	LOT39	1850p	094-01027/0.0	LOT186	1825p	1-439-311-00	LOT95	1550p
101-214017-03	LOT278	1300p	2432461	LOT169	1500p	4515 03 06	LOT169	1500p	TLF 14568 F	LOT40	1500p	094-01038/0.7	LOT245	1900p	1-439-311-11	LOT95	1550p
101-220005-03A	LOT72	1600p	2432611	LOT80	1800p	4515 03 02	LOT180	1550p	TLF 14584 F	LOT41	2000p	094-01052/0.8	LOT186	1825p	1-439-311-13	LOT95	1550p
D 050/37	LOT27	1450p	2432651	LOT80	1800p	4515 03 04	LOT169	1500p	TLF 14586 F	LOT42	1800p	094-01057/1.1	LOT285	1450p	1-439-311-32	LOT95	1550p
D 053/37	LOT207	1550p	2432761	LOT169	1500p	4515 03 05	LOT180	1550p	TLF 15606 F	LOT256	2000p	610.018.6620	LOT189	1650p	1-439-331-22	LOT96	1550p
D 056/37	LOT56	1650p	2432981	LOT37	1200p	4515 03 06	LOT168	1550p	TLF 70012 F	LOT78	1500p	610.018.6637	LOT215	1800p	1-439-331-41	LOT98	1550p
D 059/37	LOT200	1400p	2432981	LOT37	1200p	4515 03 08	LOT22	1250p	TLF 70012A	LOT78	1500p		LOT215	1800p	1-439-332-11	LOT99	1600p
D 069/37	LOT56	1650p	2432982	LOT37	1200p	4515 03 09	LOT178	1500p	TLF 70018	LOT78	1500p		LOT215	1800p	1-439-332-11	LOT99	1600p
FCM 2015 AL	LOT78	1500p	2433011	LOT171	1650p	4515 03 10	LOT168	1550p	TLF 70018 F	LOT274	1550p		LOT202	1800p	1-439-332-21	LOT99	1600p
FERGUSON			2433012	LOT171	1650p	4515 03 13	LOT30	1250p	TLF 70181	LOT274	1550p		LOT202	1800p	1-439-332-41	LOT100	1500p
00 D-3-508-001	LOT38	1250p	2433014	LOT171	1650p	4515 03 14	LOT172	1400p	TLF 70182	LOT278	1300p		LOT211	1850p	1-439-332-41	LOT101	1450p
00 D-3-508-002	LOT38	1250p	2433212	LOT168	1500p	4515 03 15	LOT22	1250p	TLF 70182A	LOT272	1600p		LOT211	1850p	1-439-333-00	LOT100	1500p
00 D-3-508-003	LOT276	1400p	2433291	LOT172	1350p	4515 03 18	LOT192	1550p	TLF 70162A	LOT272	1600p		LOT211	1850p	1-439-333-11	LOT100	1500p
00 D-3-515-001 PL1	LOT276	1400p	2433301	LOT246	1600p	4515 03 19	LOT30	1250p	TLF 70162B	LOT272	1600p		LOT211	1850p	1-439-333-11	LOT100	1500p
00 D-4-208-001	LOT79	1600p	2433441	LOT198	1900p	4515 03 20	LOT190	1650p	TLF 70162C	LOT272	1600p		LOT211	1850p	1-439-333-11	LOT100	1500p
00 D-4-208-002	LOT79	1600p	2433442	LOT191	1600p	4515 03 22	LOT196	1550p	TLF 7001 B	LOT274	1550p		LOT211	1850p	1-439-333-12	LOT100	1500p
00 D-4-235-002	LOT240	1250p	2433451	LOT81	1350p	4515 03 24	LOT22	1250p	PHILIPS				LOT211	1850p	1-439-363-11	LOT268	1400p
00 D-4-235-002 HTI	LOT81	1350p	2433452	LOT82	1250p	4515 03 25	LOT198	1550p	4822 140 10142	LOT142	1800p		LOT308	1350p	1-439-363-21	LOT268	1400p
00 D-4-235-00201G	LOT81	1350p	2433453	LOT82	1250p	4515 03 26	LOT198	1550p	4822 140 10145	LOT134	1450p		LOT308	1350p	1-439-387-11	LOT311	1450p
00 D-4-260-004 HTI	LOT38	1250p	2433455	LOT234	1600p	4515 03 28	LOT27	1450p	4822 140 10146	LOT112	1700p		LOT307	1450p	1-439-387-21	LOT311	1450p
00 H-0-701-2400	LOT182	1450p	2433521	LOT85	1600p	4515 03 29	LOT193	1500p	4822 140 10151	LOT102	1700p		LOT310	1500p	1-439-416-11	LOT255	1600p
06 D-3-083-001	LOT82	1250p	2433581	LOT22	1250p	4515 03 30	LOT179	1550p	4822 140 10161	LOT103	1250p		LOT310	1500p	1-439-416-12	LOT255	1600p
06 D-3-083-002	LOT82	1250p	2433721	LOT83	1400p	4515 03 31	LOT207	1550p	4822 140 10171	LOT104	1500p		LOT310	1500p	1-439-416-21	LOT255	1600p
06 D-3-084-001	LOT23	1400p	2433751	LOT01	1300p	4515 03 34	LOT56	1650p	4822 140 10176	LOT114	1150p		LOT310	1500p	1-439-416-23	LOT255	1600p
06 D-3-087-001	LOT23	1400p	2433752	LOT01	1300p	4515 03 35	LOT193	1550p	4822 140 10198	LOT105	1500p		LOT310	1500p	1-439-416-41	LOT255	1600p
06 D-3-088-001	LOT84	1450p	2433757	LOT250	1350p	4515 03 38	LOT27	1450p	4822 140 10201	LOT116	1600p		LOT310	1500p	1-439-416-51	LOT271	1550p
06 D-3-093-001	LOT204	1600p	2433891	LOT23	1400p	4515 03 40	LOT200	1450p	4822 140 10206	LOT104	1500p		LOT310	1500p	154125A	LOT275	1500p
06 D-3-095-001	LOT87	1000p	2433892	LOT84	1450p	4515 03 41	LOT56	1650p	4822 140 10216	LOT118	1550p		LOT229	1700p	TOSHIBA	LOT131	1450p
06 D-3-095-002	LOT87	1000p	2433893	LOT23	1400p	4515 03 43	LOT56	1650p	4822 140 10236	LOT111	1500p		LOT229	1700p	37010	LOT131	1450p
06 D-3-095-002	LOT87	1000p	2433952	LOT33	1000p	4515 03 44	LOT56	1650p	4822 140 10246	LOT105	1500p		LOT229	1700p	37011	LOT131	1450p
06 D-333-512-001	LOT204	1600p	2434002	LOT200	1400p	4515 03 46	LOT201	1650p	4822 140 10247	LOT107	1450p		LOT229	1700p	37012	LOT131	1450p
FETX 100 90 DEG	LOT04	1500p	2434141	LOT33	1000p	4515 03 50	LOT27	1450p	4822 140 10254	LOT117	1550p		LOT229	1700p	37013	LOT131	1450p
FETX 90 WHITE	LOT06	1650p	2434141	LOT33	1000p	4515 03 51	LOT27	1450p	4822 140 10263	LOT210	1350p		LOT229	1700p	37014	LOT131	1450p
FETX 100 100 DEG	LOT34	1500p	2434274	LOT44	1050p	4515 03 75	LOT56	1650p	4822 140 10271	LOT208	1650p		LOT229	1700p	37015	LOT131	1450p
GRUNDIG			2434274	LOT44	1050p	4516 16 01	LOT22	1250p	4822 140 10274	LOT123	1450p		LOT229	1700p	37016	LOT131	1450p
29201.008.01	LOT153	1750p	2434453	LOT86	1600p		LOTS1	1550p	4822 140 10282	LOT122	1300p		LOT229	1700p	37017	LOT131	1450p
29201.014.01	LOT140	1500p	2434455	LOT234	1600p	731003	LOT49	1450p	4822 140 10283	LOT104	1500p		LOT229	1700p	37018	LOT131	1450p
29201.015.01	LOT149	1400p	2434593	LOT44	1050p	276-16399	LOT50	1450p	4822 140 10294	LOT125	2150p		LOT229	1700p	37019	LOT131	1450p
29201.017.01	LOT80	1250p	2435062	LOT296	1400p	334 B 07803	LOT50	1450p	4822 140 10306	LOT110	1200p		LOT229	1700p	1810951	LOT55	1400p
29201.018.01	LOT163	1300p	2435121	LOT87	1000p	334 B 078030	LOT50	1450p	4822 140 10325	LOT122	1500p		LOT229	1700p	2433751	LOT250	1350p
29201.018.02	LOT61	1700p	2435131	LOT251	1450p	334 B 08104	LOT74	1600p	4822 140 10326	LOT122	1500p		LOT229	1700p	2433752	LOT281	1300p
29201.019.01	LOT62	1250p	2435141	LOT282	1300p	334 B 08108	LOT295	1600p	4822 140 10328	LOT124	1450p		LOT229	1700p	2433753	LOT281	1300p
29201.019.02	LOT62	1250p	2435301	LOT88	1450p	334 P 18506	LOT51	1550p	4822 140 10349	LOT106	1250p		LOT229	1700p	2433754	LOT281	1300p
29201.022.01	LOT63	1700p	2435671	LOT89	1600p	334 P 18507	LOT75	1500p	4822 140 10353	LOT284	1450p		LOT229	1700p	2433755	LOT281	1300p
29201.022.02	LOT166	1600p	2436201	LOT109	1200p	5908-05008A-AA	LOT70	1500p	4822 140 10356	LOT284	1400p		LOT229	1700p	2433756	LOT281	1300p
29201.022.03	LOT165	1350p	2436202	LOT109	1200p	D 108/37	LOT49	1500p	4822 140 10367	LOT284	1400p		LOT229	1700p	2433757	LOT281	1300p
29201.022.04	LOT165	1350p	2432101-2	LOT79	1600p	DCF1577	LOT273	1700p	4822 140 10368	LOT286	1400p		LOT229	1700p	2433758	LOT281	1300p
29201.022.04A	LOT165	1350p	2433451H	LOT81	1350p	DCF2077A	LOT272	1300p	4822 140 10381	LOT109	1200p		LOT229	1700p	2433759	LOT281	1300p
29201.024.01	LOT65	1500p	2433453H	LOT62	1250p	KFS 60226B	LOT279	1550p	4822 140 10384	LOT128	1300p		LOT229	1700p	2433760	LOT281	1300p
29201.024.04	LOT164	1400p	2433891H	LOT23	1400p	MSH1-FB008	LOT78	1500p	4822 140 10395	LOT127	1550p		LOT229	1700p	2433761	LOT281	1300p
HINAMI			2433892G	LOT84	1450p				4822 140 10406	LOT116	1600p		LOT229	1700p	2433762	LOT281	1300p
154 139 K	LOT24	1500p							4822 140 10421	LOT109	1200p		LOT229	1700p	2433763	LOT281	1300p
51 13614 1	LOT24	1500p							4822 140 10708	LOT103	1250p		LOT229	1700p	2433764	LOT281	1300p
51 14184 1	LOT24	1500p											LOT229	1700p	2433765	LOT281	1300p
CF 44 A	LOT24	1500p											LOT229	1700p	2433766	LOT281	1300p
HM51-1411834-1	LOT24	1500p											LOT229	1700p	2433767	LOT281	1300p


**NIKKAI BABY 10
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continued from page 794

feel that we'll be getting a lot more calls.

The BBC didn't believe that its transmissions would cause any problems of this nature. There seems to be no obligation, as Ch. 5 had, to sort out viewers' problems. Has anyone else had this difficulty?

Niel Jorgensen, Easter Satellites, Eastersat@zetnet.co.uk

The Internet

In his article on the internet in the August issue Peter Marlow failed to mention newsgroups. Basically these are enormous bulletin boards, covering everything you might ever want to know/talk about/exchange information on – also, it has to be said, some you wouldn't! Most are in text format, though some are for binaries.

Readers may in particular like to be aware of a newsgroup sci.electronics.repair. Although the input to it is largely North American, there is an increasing number of UK contributions. The scope of this newsgroup is very wide, but TV sets, VCRs and computer monitors form the staple diet, and many technicians/repairmen share their information/experience here. I have repaired several monitors quickly after posting a question, the information often coming back within hours. As with all newsgroups, you have to tolerate a certain amount of nonsense, but this is a minor irritation.

Anyone who posts to this newsgroup will sooner or later be aware of the ESR and low-ohms meter kit available by mail order from Dick Smith Co. in Australia. Orders can be faxed. This high-quality kit costs about £24 including postage and arrives in about ten days. I have one and it's quite simply fantastic value. Incidentally the chap who designed the meter, Bob Parker, often posts to this forum himself. Anyone wanting more information can get it by aiming their browser at either <http://www.flippers.com/esrktmtr.htm> or <http://www.nlc.net.au/~bobp/> or go to <http://www.dejanews.com> and do a search for "esr meter".

Chris Laudan, Horsford, Norwich.

Mains Plug Screws

My thanks to Martin Pickering and Ray Porter for their replies (July issue) to my earlier letter on loose neutral mains plug screws.

In my early days we had a bedroom light switch that dangled from

the ceiling just above the headboard. The thing would start to buzz when I turned out the light. Tightening its terminals cured this.

It would be interesting to see what would happen if the screw threads were in the opposite direction. Would using a tighter thread and a finer pitch improve retention?

In many applications the earth terminal is not used: I've come across plugs in which the earth screw has fallen out and been left to rattle about inside the plug.

Although the live wire is held by a screw, it isn't buffered against mechanical shock by the spring clips. This suggests that vibration may have a part to play.

David Smith, Leigh, Lancs.

Drive Belts

Our thanks to several readers who provided detailed calculations for working out the diameter of a drive belt (Letters, June). The correct figure for the example given by David Martin in June is 59.36mm, which is not greatly different from the figure (58.6mm) produced by his simplified calculation.

With regard to the reduction factor to provide the necessary grip and prevent slipping on the pulleys, R.C. Oaksford points out that the harder the flexing properties the smaller the reduction factor, which approaches zero with say leather or similar non-stretch materials.

P.J. Ratchiffe says that the stiffness of a new rubber belt being deformed around the pulleys should be adequate to provide slip-free drive for light-duty applications: to avoid damage to the drive bearings, no additional tensioning is required. He goes on to say that the drive belt dimensions have to be fairly precise in the absence of a third pulley adjustment to take up the slack. For heavy duty examples (e.g. a car alternator/fan belt) it's necessary to calculate the maximum loading torque before slippage occurs for a given tensioning force. Refer to standard texts (A-level physics). In practice if the drive belt slips it produces a characteristic squeal. The tensioning criterion should be set out in the owner's manual.

Ray Porter mentions that the "belt shortness" required depends on its stiffness, which in turn depends on the rubber, its width and its thickness. The torque required to transmit from a drive pulley depends on the application: for example loading motors have to deliver more torque than a tape-counter mechanism, so the

amount of pre-load will differ and the "shortness" will be different given the same belt cross-section. Ray suspects that a practical rule of thumb could be applied, and wonders whether a survey of say three examples of each of the common applications might produce the information sought. Do any other readers have such data?

John Hopkins wonders why it should be necessary to work out the diameter, since suppliers can provide belts for almost anything for about £1.

Many thanks to all those who contributed information on this subject.

Editor.

How to stay in business

Here's a comment or two from a TV dealer – with the emphasis on *dealer*.

(1) I agree with the abolition of all manufacturers' recommended prices. We know that they are a con, so that the impression of a bargain can be given by cutting £50-£100 off an inflated price.

(2) There's a lot of moaning in the telly business at the moment about £99 portables, videos etc. The trade will not collapse as a result of this. Deal a bit harder. Get a better price on what you buy. You will be surprised by what can be saved.

(3) The freeby merchants. This is one field in which I've failed. In the post recently I had bills for the rates, electricity, the phone, spares, £800 for a recent car repair – nowhere did the word free appear in any of them.

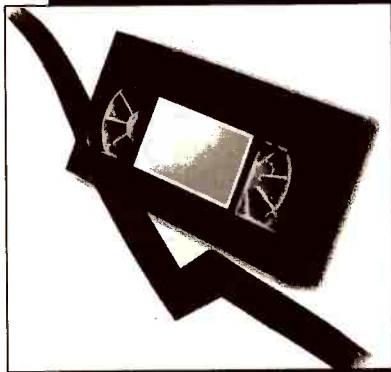
What's this all about I hear you say?

Well, in recent TV ads (not mine) I've noticed free call out to any area, free estimates, no VAT and discounts for OAPs. Think about this. A fifteen mile trip to pick up say a 29in. Sony set, then back to the workshop, then bench time (say two hours) while checking the set and preparing an estimate. Estimate refused. Take TV set back to customer. No charge. How do you envisage paying the above bills when engaged in this type of farce?

I would never have been able to get into the TV game if the established TV dealers in my area had been on their toes. I knew nothing about electronics – could hardly change a fuse. At the time I worked in a scrap yard. But I knew how to sell. Not bragging either. If I can still manage it at 71 years, anyone can.

Life will certainly be interesting in the near future.

Rex Webb, Proprietor, KTV Warehouse Sales/Service Centre, Camborne, Cornwall.



Reports from
Nick Beer
Terry Lamoon
Michael Dranfield
Philip Blundell, AMIE
Chris Watton
Ronnie Boag and
Christopher D. Nunn

JVC HRJ225

Drive for the front loading mechanism was not present because the lever (part no. PQ4635A-2) behind the reels was not being counter-sprung into position: the lever's lug, to which the counter spring is attached, had broken off. A new lever cured the fault. But, looking at the size of the lug and considering the tension on the spring, I feel that it's likely to break again. **N.B.**

Philips VR6547

This machine did nothing. The dealer who sent it to me had discovered that the ICP for the 5V supply was open-circuit. A replacement made no difference, but at least it didn't fail. When the power supply was run without load the outputs seemed to be OK, though the voltages across the 12V, 6V and -30V rails were slightly low. On load, every output fell to about half the correct level.

The biasing of the optocoupler PC1 was excessive because the 2SC1740S error detector transistor Q31 was leaky. **N.B.**

Panasonic NVL28B

This machine was dead. No, it was not C9 this time! Tests on the secondary side of the power supply revealed that the 20V over-voltage protection zener diode D1113 was short-circuit. It had clearly been replaced before, apparently quite recently. When I removed it and ran the power supply without load I dis-

VCR Clinic

covered why – the 20V line was at 35V. All the other voltages on the secondary side of the circuit were proportionately high. The cause of the trouble was C1114 (47 μ F, 16V) in the feedback network on the primary side of the circuit. **N.B.**

Matsui VP9601

Intermittent tape chewing was the complaint. So I took the top off the machine and put it on test. It worked happily all day. What to do? I decided to make it work harder by putting it into rewind then stopping it half way through. As the brakes didn't act immediately, the tape looped. The cure was a new mode switch – it's a common cause of problems with this model. **T.L.**

Philips Turbo Deck

If the problem with a machine fitted with this deck is failure to load or intermittent failure to do so, check whether the loading motor's pulley shaft is damaged or split. If it is, order the kit from Philips – part no. 4822 310 10657. **T.L.**

Sony SLVE7

Tape damage is a common problem with these machines. Always check that the load arm moves freely. If it doesn't, take it off, clean it thoroughly, lubricate the contact points and replace it in the correct position. The machine should then be OK. **T.L.**

Matsui VP9405

The complaints were that this machine didn't always eject, loaded badly or the tape jammed. I went straight for the mode switch, but it had already been changed. Time to put the machine through its paces. Loading was very slow, but manual load with no cassette was perfectly free. When I inserted another cassette for loading I put the slightest

pressure on the loading belt, which stopped. It started again when gently pushed. The loading motor was faulty and was unable to take much resistance. A replacement cured the problems. **T.L.**

Toshiba V254

Looping on rewind was the problem, because the capstan didn't stop quickly enough. I spoke to the Toshiba boffins about this. They suggested adding a 100 μ F, 6.3V capacitor across the Cap +5V supply, positive lead to the cathode of DT107 and the negative lead to jumper wire JT035. It worked. **T.L.**

Sanyo VHR390

This machine played all right but shut off in rewind. Fast forward was OK. I was suspicious of the reel sensor which, when I checked it, was full of dirt and hair. This was removed and the area was thoroughly cleaned. The machine then worked perfectly. **T.L.**

Matsui VX1100

This relatively new machine was dead. The cause was simply that R534 (470k Ω) in the primary side of the power supply had gone open-circuit. **M.Dr.**

Akai VSF410

This machine had gone off after a power surge during an electrical storm. The clock lit up and, when the power button was pressed, the machine powered up. But it immediately powered down again. The 13V zener diode D13 had gone short-circuit, leaving Tr1 without base bias. **M.Dr.**

Tatung TVR912

There were several symptoms with this Sharp clone. Play stopped after about one second; the counter read six minutes when an E180 tape had

been fully rewound; and if the ACE head was unplugged during a rewind the tape counter continued to count. Very strange! The cause of these symptoms was about 0.8V of ripple at pin 22 of the microcontroller chip.

A check in the power supply showed that there was about 4V peak-to-peak of 50Hz ripple on the UR 6.5V line. The 0.27Ω safety resistor R904 in the feed to the bridge rectifier was open-circuit, hence the 50Hz ripple. A replacement failed at switch on: D907 (1N4003) in the bridge was short-circuit. Replacing these two items restored normal operation. M.Dr.

Grundig VS520/540

We've had a number of these machines with a dead power supply: once the mains feed has been disconnected the power supply won't restart. If the mains fuse is intact, replacing C407 (220μF, 25V), C420 (100μF, 25V) and C443 (100μF, 10V) usually solves the problem. P.B.

Philips VR258/05

If there's no front keyboard or remote control operation (the machine will accept a tape but won't eject or play it), check whether the Wickman fuse F1403 (315mA) is open-circuit. P.B.

Ferguson FV62 (R2000 Cat 1 Chassis)

This machine was dead with a blown mains fuse and a short-circuit chopper transistor (TP08). After fitting a Thomson repair kit I found that the power supply worked but the output voltage was high – check for 14.2V across test points BP04 and BP05, with a 220V AC mains input. The correct voltage was obtained when CP10 (10μF) had been replaced.

One component that's not included in the kit is the ZPD3.9V zener diode DP15 – it's not shown on the circuit diagram, but is connected in parallel with RP33 (1.5Ω). It can go short-circuit when TP08 fails. The result is low output voltages. P.B.

Baird 8945

The customer said that this two-speed machine kept jumping to LP. After testing it for several days we returned it as the fault hadn't put in an appearance. It came back a few days later with a post-it note that pointed to the LP LED and the comment that this would light when the fault occurred.

We plugged it in and left it. After a while we heard a faint relay ticking sound every thirty seconds or so. Sure enough the LP LED was coming on. This was in the E-E mode, with no tape inserted. A check at the active pin of the switch produced a DC reading that wavered between 2.5-5.5V. The reading should be 0V for LP and 8.5V for SP. Dismantling and cleaning out the switch cured the fault.

This Model was also sold as the **Ferguson 3V42** and the **JVC HRD455EK**. C.W.

Saisho VR2500/Matsui VX990

There was a warble on the sound and poor playback chroma lock. The cause was traced to C08 in the power supply. It's near the STK5332 multi-voltage regulator chip. C.W.

Ferguson FV22L

There's a modification to deal with various timer faults such as ignoring the stop time or stopping prematurely in the OTR mode: fit an 0.047μF capacitor between pins 3 and 8 of connector CN603, on the print side of the PCB. A kit is available, part no. 01P1-500-001 – or Willow Vale 20122MT. C.W.

GoldStar RQ5041

The customer complained that this machine sometimes failed to start. The buttons worked and the display symbols lit, but the machine didn't respond. On test we found that the drum didn't rotate because its supply was missing. There was a 12V output at the power supply, but it didn't reach the motor because L202 (100μH) was open-circuit. C.W.

Daewoo V435

The symptoms were cutting out in play and record, and noisy in play, fast forward and record. The solution was to replace the reel gear total assembly, part no. 97SB382410. R.B.

Samsung P130R

IC702 (KA8301) had blown in half because the outputs from the power supply were twice what they should be! The culprit was C104 (33μF, 35V), whose value had decreased by about a half. Obvious enough, but don't leave the power supply connected for any length of time while testing or C017 will be sent into orbit (yes, it happened!). It's rated at 25V and, under the fault

condition, receives some 50V.

As there are only a few electrolytics in the power supply I replaced them all. The machine then worked very well. C.D.N.

Amstrad DD8900

This monster's lower deck had a fault: intermittent eject. I decided to remove the bottom plate rather than the top deck. After about a million attempts to get the deck to refuse to eject, the fault suddenly appeared. The cassette housing drive spindle was being overdriven, and thus jamming, because the down switch was dirty. C.D.N.

Toshiba V703B

This VCR's display had become dim. The machine then died completely. Heating the power supply brought it back to life, and with the aid of a can of freezer I found that C813 (47μF, 16V) in the power control circuit was the cause of the trouble. C.D.N.

Sanyo VHR3100

When a cassette was inserted the carriage would move backwards and forwards then the machine would switch off. If a tape was loaded manually, fast forward and rewind were OK but in the play mode the capstan motor ran very fast while the drum motor sometimes wouldn't rotate at all. The cure was to replace IC4001 (LC7412-8017). Shop around, because the price tends to vary quite a lot. C.D.N.

Aiwa HVG75K

The playback sound disappeared when this machine had been working for one to two hours. It came back when IC701 (BA7767AS) was frozen, but a replacement failed to cure the fault. After more heating and freezing I found that C732 (0.1μF) was the culprit. It sits just under IC701. C.D.N.

Ferguson 3V32/JVC HR7655EK

This machine sometimes failed to unload and eject, though the stop light flashed – as if it was waiting for the mechanism to unwind.

The loading belt and timing were OK. When I disconnected the motor I found that 12V was present in the unload mode. The voltage dropped to 3-6V when the loading motor was reconnected. But a new loading motor made no difference! Q5 was OK but D19 produced a high reading. Thankfully a replacement cured the fault. C.D.N.

The S-VHS ET Specification

The latest VHS system development is S-VHS ET. Peter Brough describes the evolution of the system and the characteristics of the new version

During the twenty or so years since the basic VHS VCR format was first introduced, a number of other versions have appeared. These include VHS HQ, VHS Hi-Fi, S-VHS, W-VHS and D-VHS. A new system, S-VHS ET (for Expanded Technology), has just been released in Japan. It's main feature is that it enables S-VHS recordings to be made using standard VHS tape, the main penalty being a lower signal-to-noise ratio than with S-VHS tape.

Background

Earlier versions of the VHS system have been covered by articles in previous issues of *Television*. Here's a brief background to S-VHS.

S-VHS was launched in 1987. Prior to that a number of small improvements had been made to VHS picture quality, most notably with VHS HQ which arrived in 1985. This used several techniques to improve the picture, including an increase in the white-clip level from 160 to 180 per cent and filtering to reduce noise. Subsequent improvements in video tape technology and VCR circuitry increased the VHS horizontal resolution from about 240 lines to some 260.

JVC, which licenses VHS, had always been keen to ensure that any VHS development was compatible with older VHS machines. Thus Hi-Fi and HQ tapes can be played by machines that don't have these features. But

in 1987 JVC launched Super VHS (S-VHS), which uses a variety of techniques to greatly improve picture quality. The FM bandwidth was extended from about 3MHz to around 5MHz, increasing the horizontal resolution to about 400 lines. The white-clip level is 210 per cent (dark clip 70 per cent). There is no overlap between the luminance (Y) and colour (C) sidebands and, by using separate Y/C outputs instead of RF or composite video, cross-colour and other artefacts are avoided.

S-VHS picture quality is a great improvement on VHS, but a price has to be paid for it. High-coercivity video tape, composed of super-fine ferric oxide particles, has to be used (at least this was the case before the arrival of ET technology). The tape typically costs about three times that of standard VHS tape. And S-VHS equipment is only partly compatible with VHS: S-VHS equipment can play and record in the VHS mode, but the vast majority of VHS machines cannot play S-VHS recordings (see below).

S-VHS ET

JVC is keen to stress that S-VHS ET is not a new format. It's more a new technology that extends the S-VHS system. Unfortunately JVC has not released full technical details of how ET works. What we do know is that the combination of a high-performance video head and an improved preamplifier enables the system to record a 160 per cent wider signal bandwidth on VHS tape – JVC recommends the use of high-grade VHS tape for ET recordings.

Table 1 summarises the basic NTSC specification for S-VHS ET. Apart from a slightly lower white-clip level, the S-VHS ET and S-VHS specifications are almost identical. JVC adds that the ET technology also involves a new signal-emphasis system.

S-VHS ET Compatibility

S-VHS ET recordings can be played back using an S-VHS machine, with 400-line horizontal resolution, or a standard VHS deck that's equipped with S-VHS Quasi-Playback (SQPB). With the latter option the horizontal resolution is 280 lines. The SQPB system enables a VHS recorder to play S-VHS tapes, though with VHS quality. It was originally intended for owners of S-VHS camcorders, so that recordings could be played back by an existing VHS machine.

Table 1: Basic S-VHS ET Specification (NTSC).

Peak white FM	7MHz
Sync tip FM	5.4MHz
Deviation	1.6MHz
White clip	About 190%
Dark clip	About 70%

Colour-under phase-shift recording is used for the chrominance signal.

Audio is standard VHS linear and FM.

With the exception of the white-clip level this specification also applies to the S-VHS format.

What ET does is to enable VHS tape to be used to make both VHS and S-VHS recordings. It would be interesting to compare an S-VHS recording with an ET one using an S-VHS machine.

Future Plans

Asked why S-VHS ET had been developed, JVC pointed out that the advent of digital broadcasting will produce a demand for higher-resolution recordings. There is little doubt that JVC is keen to increase the market for S-VHS, hence the intention to launch S-VHS models in the UK later this year at under £350. JVC is also considering the use of ET technology in camcorders. It expects other manufacturers to introduce S-VHS ET equipment.

JVC introduced two S-VHS ET models in Japan in early June, the HR-S100 and the HR-V100. The latter has a built-in satellite receiver. Prices work out at the equivalent of about £221 and £265 respectively. Production of the HR-V100 is to start at a rate of 10,000 a month: production of the HR-S100 will be at half this rate initially.

S-VHS ET is to be launched in the USA later this year. A European launch will follow next year.

Incidentally JVC says that the cassette ID hole system designed to be used by an S-VHS machine to check whether a standard or an S-VHS tape is loaded fell into disuse soon after the launch of S-VHS! All machines use the signal waveform to determine the type of recording, ignoring the presence or absence of an ID hole.

Acknowledgement

My thanks to Mr Masayuki Murakami of the Victor Company of Japan for his help with this article.

Book Review

The Professional "Screwdriver Experts" Guide - Satellite Receiver Repairs and Modifications, by Martin Pickering. Over 350 pages. Available from SatCure, PO Box 12, Sandbach, Cheshire CW11 1XA by mail order at £19.95 plus £2.50 post and packing, also from most suppliers of satellite accessories.

This is the fifth edition of the *Satellite Repair Manual*, which has become a virtual bible for satellite receiver servicing. I just wonder whether, if one had to start from scratch, it would be possible put together such a vast store of technical data and know-how. But Martin has been at it since the start of satellite TV, and has gradually built up this fantastic storehouse of knowledge. The fifth edition has once again been significantly extended, so even if you have an earlier one it's as well to buy and benefit from this latest version.

The great advantage of the book is its essentially practical nature. It tells you exactly what to look for and do, and how to go about it. There is a very helpful faults index at the end, listing the more common faults with the more common receivers, but it's only a sampling of the fault information contained in the book. If you don't find what you need to know via this index, simply go to the relevant section for the receiver concerned. A model cross-reference and page index at the beginning is a further help.

You'll want to know a bit about digital satellite TV of course, so a good, readily comprehensible section of over twenty pages has been added on this subject. Other general sections inform us about LNBS, sparklies, interference and so on. But the heart of the book is its detailed information on particular models.

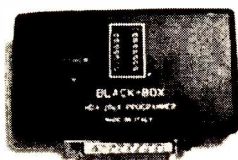
I would say that it's an essential reference source for anyone involved in satellite receiver servicing - until the sixth edition comes along, as it inevitably will! It's very good value too.

J.A.R.

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Servicing the JVC C14/C21ET1

These models use a version of the Onwa chassis and as a result are more troublesome than those fitted with a standard JVC chassis. Cliff Martin provides a fault guide based on service experience with many hundreds of the sets

These JVC sets were fitted with the well-known Onwa chassis that has appeared in several brand ranges, for example Goodmans and Bush. The component reference numbers in the following article relate mainly to the 21in. version. The two sets are very similar in design, but the circuit reference numbers vary between the two models. There are also differences in the chassis layout.

Power Supply

It's by now well known that the power supply in these chassis can cause big problems, because when faulty the HT output can rise from 112/115V to over 200V. You can always tell when this has happened, because the 12V regulator zener diode ZD401 will be short-circuit and its feed resistor R419 will be burnt out. In severe cases the top of the HT reservoir capacitor will have split open.

An upgrade kit, part number TPCA0068B (14in. model) or TPCA0068C (21in. model), is available from JVC and can be used to repair the power supply. But it doesn't contain zener diodes ZD901 (8.2V) and ZD902 (9.1V). It's essential to replace them, as they almost certainly contributed to the fault. If the set has one of those cheap, open-type skeleton presets for HT adjustment, replace it with a better-quality one – intermittent wiper

contact causes a dramatic rise in the HT voltage.

To improve reliability, the upgrade kit components should be fitted to any set that comes in for service.

The kit also modifies the overvoltage protection circuit to ensure that the set goes into the safety mode should the fault occur again. This is achieved by switching off the 5V supply to the microcontroller chip. As a result the HT relay drops out.

If the set seems to be dead, i.e. the standby LED is not alight, don't assume that the power supply is not working. It may be that R404/R918 (0.68Ω) is open-circuit. This removes the LT supplies and can be confusing because, in the 14in. model, the HT reservoir capacitor is connected to the output from the relay. So there are no outputs from the power supply.

If there are no pulses at the collector of the chopper transistor Q904, check whether its base drive coupling capacitor is open-circuit. It may read OK when checked with a capacitance meter, but won't work in circuit.

If Q904 is short-circuit it will have taken out R902 as well and maybe R914. Ensure that these items are replaced with original parts, as they are safety components. C909 and C911 should be replaced if this has happened – these two capacitors are included in the power supply kit.

If the HT rectifier diode is leaky or short-circuit, the relay will drop in then straight back out again. The diode supplied with the upgrade kit is an improved version. Remember to check that its series safety resistor hasn't suffered.

Although it's best to use the upgrade kit, if the set is required in a hurry replacing both zener diodes with standard types and the two 47μF capacitors with 105°C types should be OK and ensure reasonable reliability.

The modification to the cutout is as follows: in Model C21ET1 short out R677 and remove R678; in Model C14ET1 short out R663 and change the value of R401 from 10kΩ to 47kΩ (see Fig.1).

A 5V supply is fed to pin 10 of the colour decoder/timebase generator chip IC301, regulated by ZD301. This zener diode is suspect in the event of faults such as high brightness.

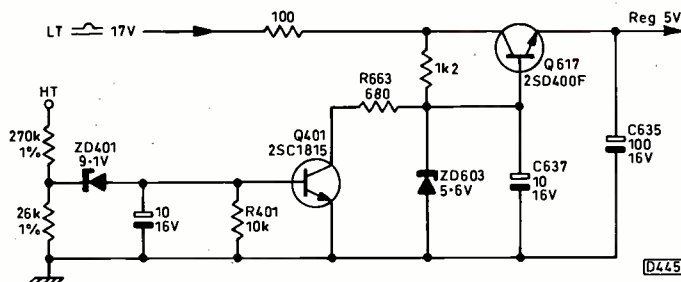


Fig. 1: The overvoltage protection circuit used Model C14ET1. For more reliable operation short out R663 and change the value of R401 to 47kΩ.

It saves a lot of time and money if supply voltages are carefully checked before you start replacing ICs etc.

Line Timebase

The line output stage is quite reliable. It provides the 24V and 12V supplies. Sometimes the 0-68 Ω surge limiter resistors here go high in value. The voltage on the 12V line will fall, causing strange faults, notably field cramp at the bottom of the screen.

Failure of the line oscillator to start usually means that R317 (21in. model) or R323 (14in. model) has gone open-circuit, removing the start-up supply to IC301.

Sync Faults

Sync faults are rare, but poor field sync can be caused by C308 going almost open-circuit. It couples the video signal to the base of Q302. This fault doesn't affect the contrast or the picture in any other way. For no sync with 14in. sets, check whether R340 is open-circuit.

The IF Strip

In most chassis the IF strip is probably the most reliable section. Not so in this one! Any capacitor is likely to fail, especially if it's of the ceramic type. These capacitors always go leaky: 2-3k Ω is a common reading. They can cause the following faults:

No sound: Check C110.

No sound with a slight whistle: Check C106.

Severe sync crushing with a soot-and-whitewash picture: Check C113.

No AFC action: Check C119 (21in. model) or C129 (14in. model).

If there's no picture, check whether the test points in the IF section are pushed over so that they touch the metal coil screening cans. This fault may clear if the set is tapped.

CF101 can go open-circuit. This will add a 6MHz carrier to the video. The result is patterning and no colour.

Control System

The control system is fairly reliable. The microcontroller chip doesn't fail very often, though it frequently gets accused of having done so.

The most common fault is intermittent reverting to standby. This is caused by leakage in the tack switches. If the set shuts down when switch AV is pressed I've found that it's best to replace all the switches.

Another problem is failure of the set to stop when search tuning. It's caused by a fault in the ident circuit, around transistors Q614/615. Any component in this area is suspect. The capacitors and 1N4148 diodes D609 and D610 are favourites. Failure of this circuit also mutes the sound.

In Conclusion

In conclusion, I wish other engineers the best of luck with these (and other!) sets. Although the chassis used in these models is troublesome, it doesn't reflect on the quality of JVC's own current and past TV chassis. These are so reliable that it would be difficult to prepare a fault-finding article on them such as this one.

The basic Onwa power supply circuit was shown on page 237 of the February issue, but the component reference numbers vary greatly from model to model and mostly don't match with these JVC sets.

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**Reports from
David C. Woodnott
and
Eugene Trundle**

Sony CCDF150E

The complaint was that previously recorded tapes played back all right but new recordings wouldn't play back correctly. The cause was traced to failure of C206 and C216 on board CV9. Replacement of these two surface-mounted capacitors and a service restored the unit to good health. **D.C.W.**

Sony CCDTR305E

This small handycam didn't produce any E-E pictures – playback was OK. An internal inspection revealed that L852 had become detached from its normal position. As a result there was no HT supply to the camera section. Refitting L852 restored normal operation – the customer denied any knowledge of possible impact! **D.C.W.**

Canon UC2000E

The note that came with this camcorder said that it wouldn't accept a tape but would close the housing if a tape wasn't fitted. When we checked it we heard the capstan motor rotating at high speed. Further checks proved that the FG sensor was faulty. A new motor restored the unit to normal working order.

This model is very similar to a **Samsung** one that uses the same or a very similar mechanism! **D.C.W.**

Sony CCDTR810E

The complaint was "no operation" but in fact the unit was dead – there was no power-up. The cause was

Camcorner

easy to spot: PS1502, a surface-mounted protector, was open-circuit. Despite various checks and a long soak test no reason for its failure could be established. **D.C.W.**

Sony CCDTR75E

This camcorder's mechanism wouldn't accept a tape but closed satisfactorily without one. A common cause of this is failure of the drum to rotate, possibly because of a ribbon-cable connection problem. But the drum could be seen to start, at which point the mechanism ejected the tape.

A check on the cassette brake-release mechanism showed that it was working correctly. When the take-up and supply reel spools were rotated manually however the supply reel was almost completely jammed. Further examination revealed the cause: the spindle was bent.

All was well once the spindle had been straightened and the reel had been refitted. No other damage had been sustained. It's an uncommon fault with this mechanism. You more often get it with the **Canon UC** mechanism (Models UC10 etc.). Someone must have been a bit heavy-handed I suppose. **D.C.W.**

Chinnon VC1500 etc

This and similar **Orion** models now often damage the tape when used in the play revue mode. The usual cause is a worn capstan drive belt. If a Chinnon replacement isn't available, a JVC type for a similar mechanism will work all right – Willow Vale part no. 20406NA. **D.C.W.**

Canon E600E

The report with this camcorder listed a couple of seemingly unrelated symptoms. First there was intermittent zoom operation with the W/T buttons. Then the fade button worked only occasionally, with the fade sometimes staying on after the button was released. This model

has a direct-acting fade: hold the button in to fade, release it to restore the picture.

They are not common faults with this model. In fact during initial tests it was difficult to get the unit to misbehave for long enough to be able to carry out any meaningful checks. As the various connectors on the camera head are sometimes damaged by side-case impact I decided to check them. They looked to be OK, but I resoldered them as a precaution. All to no avail: although the unit worked for long periods with its case removed, as soon as the case was refitted the faults reappeared – intermittently of course!

Further internal inspection revealed that the short ribbon cable (EF20) between the camera head and the main VTR PCBs was slightly fractured. A replacement cured the problems. Doubtless refitting the case had moved the cable sufficiently to cause the fracture to become intermittent. **D.C.W.**

Sharp VLE30H

Intermittent operation was the complaint with this early Viewcam. It would shut down, sometimes after being moved or the camera section being tilted. An internal inspection revealed that one of the two ribbon cables which connect the camera unit to the main recorder section was fractured. It's best to replace them as a pair – they are identical. The cables allow independent movement of the two sections of the unit, and are generally reliable. A replacement cable pair (Tilt FPC) restored the unit to good health. **D.C.W.**

JVC AA-V35

This dual-battery charger appeared to be quite dead, with no LEDs alight and no output voltages. It did draw current from the mains supply however. We found that the double-wound toroidal choke L23 was short-circuit between windings. **E.T.**

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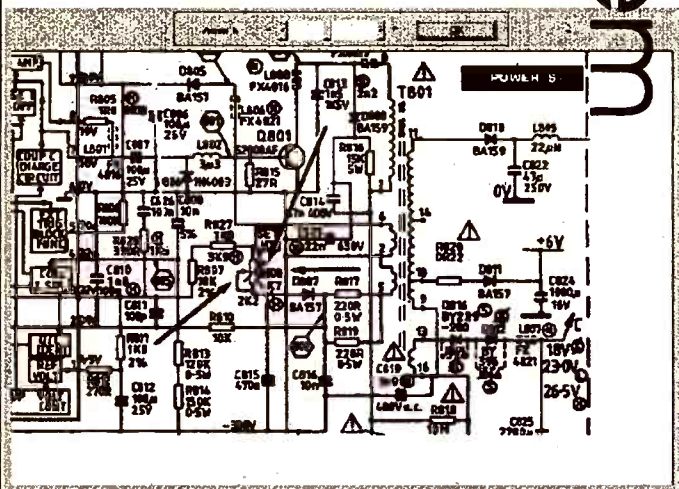
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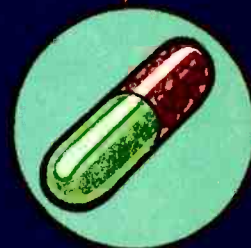
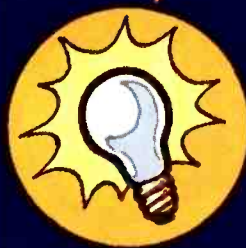
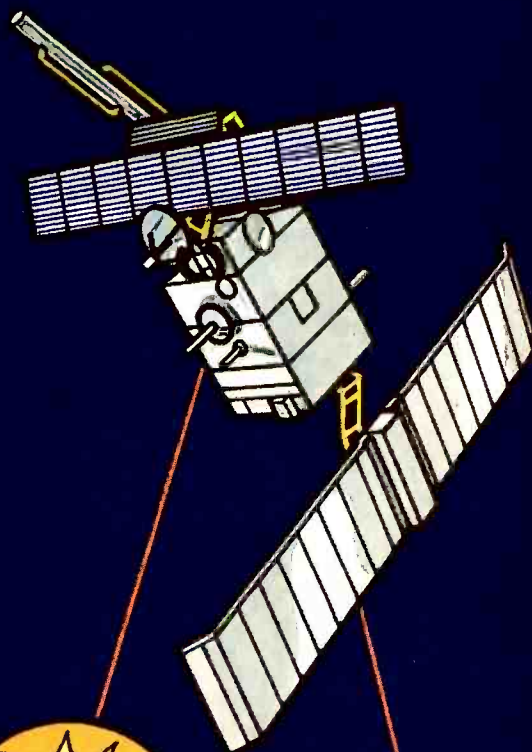


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RETRA president Brian McPherson addressing the conference.

The second RETRA Service Conference presented an opportunity to consider the problems of servicing in the digital age. Eugene Trundle reports on the proceedings

Service '98

Following last year's very successful first service conference, dealer association RETRA held a second one in late June. It was again very well organised and attended, with much of interest for dealers, service managers and technicians.

The proceedings were opened by RETRA president Brian McPherson. He emphasised in particular the need to provide the public with an excellent service – this point was driven home by an hilarious Wallace and Gromit 'industrial-training' film – and the desirability of having mandatory codes of practice in servicing, backed up by a compulsory licensing and registration system similar to the gas industry's CORGI one. He felt that the most likely solution to the problem of providing future technical training for technicians would be by means of 'distance-learning' courses – we'll return to this later.

MPEG and Multiplexing

Granada's training manager Peter Herd was the first guest speaker. He began by pointing out that digital TV became possible only with the advent of low-cost digital signal processors and memory banks and the development of sophisticated data-compression techniques. He then explained the MPEG-2 compression system, which is based on removing the redundant information in ordinary pictures, describing how each frame is broken down into macroblocks for DCT (discrete cosine transform) processing and quantisation. This was followed by details of run-length coding, 'packetisation' and streaming (PES), packet identifiers (PIDs) and mul-

tiplexing for transmission, all supported by clear diagrams presented on a large viewing screen.

Aerials for DTV-T

In the next presentation Tim Jenks, technical executive of the CAI (Confederation of Aerial Industries), explained why good a aerial installation would be required for reception of the new digital terrestrial TV transmissions and exploded some of the myths of signal distribution via cables. He stressed the importance of using good-quality feeder cable and accessories and of avoiding impedance mismatches.

Using the local Sutton Coldfield transmitter as an example, he explained how aerial response and spurious responses (side lobes) affect the reception of Channel 5 (analogue) and the new digital multiplexes, and why wideband aerials will become more common in the future. Well-known on the Continent, and likely to be used more widely in the UK, are group K (UHF channels 21-48) and group E (channels 35-68) aerials.

Dishes for Digital TV

Bill Collins, Technical Services manager of Astra, examined some aspects of dish installation for satellite DTV reception. The alternatives are a dual-feed (analogue and digital) system or a dedicated digital system with a smaller dish. While an existing analogue-type signal-strength/peaking meter might, at a pinch, do for DTV work – you also need a 22kHz tone generator – a new purpose-designed meter is much better. The ideal type has a bit error-rate (BER) readout.

The FEC (forward error correction) applied to the signals is greater for the UK than for other European countries. Nevertheless correct polarisation setting for minimum cross-polar interference between digital carriers, an LNB with low phase-noise, and the avoidance of signal reflections in feeder cables are all vitally important.

Surface-mounted Chip Tips

Steve and Darren Beeching of Grove Farm Publications gave a demonstration of how to deal with surface-mounted LSI chips: they removed and refitted one there and then, watched by the audience via two close-up TV cameras and a large screen. Several types of equipment were used – Leister, Pace and Chemtronics Chemask. The latter is a peel-off, heat-dissipating compound.

Several techniques and many different tools and accessories are available for surface-mount work. No single system is suitable for all applications. When removing S-M devices, the main dangers are print damage and the dispersal of small, adjacent components.

The next step with S-M technology will be ball-gate arrays, in which a matrix of surface connectors covers the underside of an IC.

A 'technical information module' on soldering and desoldering is available from Grove Farm Publications. For more details phone 01636 626 895.

Quality vs Quantity

The DTV group of broadcasters was represented by Jim Slater, whose talk covered many aspects of terrestrial digital TV. He began by comparing transmitter powers and signal-to-noise ratios for analogue and digital TV, leading on to a description of the various DTV multiplexes, their operators and contents. We also learnt that BDB is to get a new and better name – not then known, but see Teletopics.

Attention was next turned to the trade-off in DTV broadcasting between bit rate and image quality. Multiplex operators will want to broadcast as many programmes as possible simultaneously, within the constraints of acceptable quality. It's likely, in Jim Slater's view, that within five years it will be possible to transmit twice as many programmes within a given bit rate, using techniques such as Statmux – statistical multiplexing. This would, for example, enable sixteen programmes to occupy a 32Mbits/sec data stream, each with a variable bit rate to suit its picture content from moment to moment, but averaging 2Mbits/sec across the board. Thanks to the flexibility of the MPEG-2 system, the receiver could handle this without the need for any hardware changes!

The ITC has demanded a minimum standard for DTV-T sound transmission: in its 256kbit form it can carry Dolby Pro-Logic Surround sound, which is considered adequate for home cinema purposes. None of the broadcasters in the DTV group have plans for five-channel sound, nor is this in the specification for first-generation set-top boxes. Five-channel sound is expensive to produce, has limited take-up and would be justified only for a dedicated movie channel.

There were more details of the widescreen Test Card M, which was shown in prototype form on page 541 of our June issue. It will have a moving clock, a rotating colour cube, and Carol will write on the blackboard – to check for dropped frames. A sound/vision synchronisation check will also be provided. Even so, what's seen on the screen will be just the "tip of the iceberg": there will also be comprehensive digital test sequences, basically MPEG-2 transport streams stored on CD-ROM, to 'stress' different aspects of the overall system to the

limit. Test card transmission may become rare as precious air time is sold off – as happened with terrestrial analogue TV in the Seventies!

Euras

Antje Brandt of Euras International explained the workings of the Euras fault database, which now serves 20,000 customers Europe-wide. She described the "caring and sharing" philosophy of Euras, particularly of those individuals and companies who contribute to it. The system currently has some 500,000 fault tips: we will be reviewing it in a forthcoming issue.

From a reply to Chris Avis we learnt that tips are gratefully received but not paid for, though there are prize draws and the like!

NVQs for Technicians

Bob Douglas, a member of the EESLB (Electrical and Electronics Servicing Lead Body), explained the current situation with National Vocational Qualifications (NVQs) in our industry. He pointed out that they demonstrate actual competence in a way that the traditional qualifications and standards can't. Expressing his disappointment at the bad press that NVQs have had in the past, he explained the concept, purpose and structure of the NVQ system. Full information on the subject is available from the EESLB c/o EEB, Savoy Hill House, Savoy Hill, London WC2R 0BS (0171 836 3357).

City and Guilds courses and qualifications will continue to be available as long as they are required, and new technology courses along the lines of C&G 2240 are being developed. Their use depends on funding however, and the constraints described last year haven't gone away!

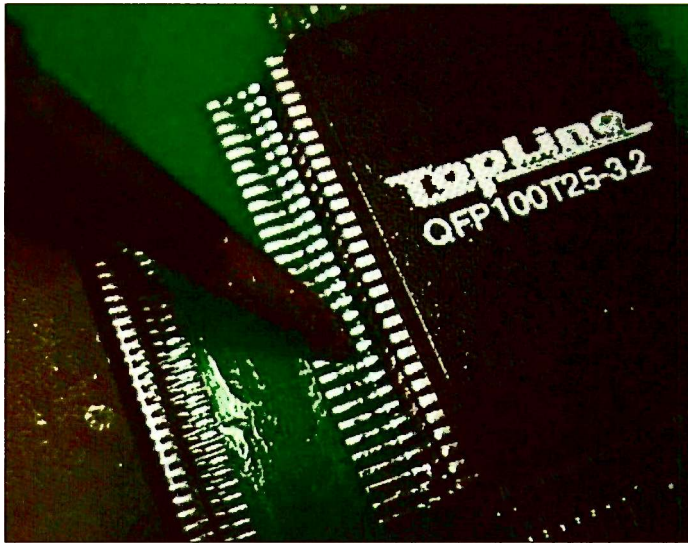
Distance Learning

Terry Tudor is the Project Manager for Bolton College Consultancy Services. In addition to conventional C&G and BTEC courses, the College is to offer a new form of 'distance learning'. It's called the ADAPT project, and will be focused on the new NVQs for brown- and white-goods servicing. Many varied methods of communication will be used: papers, videotapes, CD-ROMs, the internet, ISDN and videoconferencing.

Several partners have teamed up to help make ADAPT a success – primarily Bolton College, the CAI, Circuit Tech, the EESLB, IBM, LJ Technical Systems, RETRA and Satvision plc. Each has been involved in different

Multi-pin surface-mounted chips like this are making the engineer's life more difficult.





Use of a fine-tip soldering iron with a surface mounted chip during the Beeching demonstration.

aspects of the learning process and its delivery to students.

The ADAPT project will be able to serve 130 candidates, with thirty assessor/mentors, starting next January. It will cover NVQ Level II: Level III coverage is scheduled to start a year later. Recruitment for the initial Level II project begins this autumn – 24 computer workstations are on free loan offer to selected dealers to support Assessor and NVQ training. For more details phone 01204 388 122 or fax 01204 528 032.

Philips Service

The only equipment manufacturer present this year was Philips Consumer Electronics, whose SE England Technical Support Manager Bob Green reviewed the company's current technology in consumer TV/video gear. He mentioned the ever-falling prices and customers' ever-increasing expectations.

Philips CE's response to the servicing challenge into the next millennium comes in three main forms, the first of which is CSM – Customer Service Mode. When called up by the user's remote-control handset, this provides up to 22 lines of on-screen information on software settings, error modes etc., typically for relaying to a service technician over the phone.

Complementary to CSM is Compar – Computer Aided Repair – in which an ordinary (e.g. 486) PC forms the central element of a fault-diagnosis system. It's Windows-based and has diagnostic software on a floppy disc. The software can be easily updated via the internet (Philips operates a closed intranet site for dealers and service agents) or a CD-ROM. A single interface box is used for communication with a DST (Dealer Service Tool) remote-control handset, or IR signals provided by suitably-equipped TV sets and VCRs, or via a hardwire hook-up with forthcoming products. The link from the interface box to the PC is in RS232 form. Compar automates the process of fault-finding, and could be developed to provide remote fault-finding via a modem. Given compatibility, it would work with other makes of equipment.

The third factor in the service plan is Searchman, an electronic service manual system, again based on a simple, inexpensive PC and easily updated. We saw a screen demonstration of this. It was very impressive: the circuits, equivalent to many square feet of diagram that can be zoomed in, are taken directly from the design software and are thus crystal clear.

Compar and Searchman are due to be released this

month (September), which is exiting news. Bob Green's parting shot was, not surprisingly, a call for every workshop – every bench even – to get kitted up with a PC.

Q and A Session

The final questions and answers session was very interesting. Brian McPherson was of the opinion that registered, licenced repairers would have to form a 'closed shop' to be effective. Jim Slater suggested that five-channel surround sound has appeal to only a tiny minority of people. Bob Green said that Compar specifications have been made available to other manufacturers, and that the system would be accessible to those without Philips Service accounts. Bill Collins mentioned that the Astra 19.2°E slot is too full to be able to provide DTV, and that BSkyB is involved in litigation with ITV over the latter's wish not to "go satellite".

Trade Stands

Some of the cost of the conference was met by a group of exhibitors who had trade stands alongside the meeting hall. *Alban Electronics* displayed a wide range of test equipment; *CHS* concentrated this year on its computerised communications systems *CHES* and *CHAOS*; *Euras* demonstrated its fault database; *Konig* displayed spares, accessories and test equipment as both a manufacturer and supplier; *SEME* concentrated on soldering equipment and rework stations. *Willow Vale* was there as a well-known distributor of spares, tools and service equipment.

Full Marks

In conclusion I found it a good conference of great interest to anyone who lives in the rapidly-changing world of consumer electronics servicing.

BACK ISSUES

We have available a limited stock of the following back issues of *Television*:

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1996	January to September inclusive, November and December
1997	January to December inclusive
1998	January, February, March, April, June and August

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DX and Satellite Reception

DX and satellite TV reception and news from abroad. Further thoughts on the use of phaser systems for interference reduction, with a test of the MFJ system. Roger Bunney reports

Good news at last: June was an excellent month for Sporadic E reception. There were high-level signals on most days, and some exotic ones for those willing to search. Syria ch. E3 was seen on several occasions, also an unidentified Arabic ch. E3 station likely to be in Jordan. The favoured direction of propagation seems to have been from the south/south east – there have, so far, been no reports of reception from Finland or Iceland. The composite SpE log for the month is as follows:

3/6/98: TVE (Spain) chs. E2, 3, 4; RTP (Portugal) ch. E3; RAI (Italy) chs. IA, B; Video (Italy) ch. E2 (47-86MHz); TVR (Romania) ch. R3; NRK (Norway) E2; Syria E2; unidentified Arabic E3 signal; ARD (Germany) E3; HRT (Croatia) E4; RTS (Serbia) E3.
4/6/98: TVE E2, 3, 4; RAI IB; Video E2.

5/6/98: TVE E2, 3, 4; RAI IA, B; RTP E3; C+ (France) L2.
7/6/98: RAI IA, B; Video E2; TVE E2; Syria E2.
9/6/98: RTLKL (RTL Klub, Hungary) R2; Arabic E3; YT-1 (Ukraine) R1.
10/6/98: RTS E3.
11/6/98: TVE E2, 3, 4; RTP E3,
12/6/98: RAI IA; Video E2; RTS E3; unidentified Italian IA signal – with M logo at bottom RH side.
14/6/98: RTP E2, 3.
15/6/98: RAI IA; RTP E2; TVE E2; RTS E4; NRK E2, 3.
16/6/98: RAI IB; TVE E2, 3, 4; HRT E3; Video E2; RTP E2, 3.
17/6/98: RTP E3; TVE E2.
18/6/98: RAI IA, B; RTS E4; HRT E3; TVE E2, 3, 4; RTP E3.
21/6/98: TVE E4; RAI IA, B; SVT (Sweden) E2, 3, 4; NRK E2, 3; ARD E3; LTV (Lithuania) R1.
22/6/98: RAI IA.
23/6/98: TVE E3, 4; RAI IA, B; Video E2; ARD E2; LTV R2; ORT (Russia) R1, 2; LTV R2; ETV (Estonia) R2; MTV (Hungary) R1.
26/6/98: RTLKL R2; RAI IA, B; RTS E3; TVR R1; Syria E2; RTP E3; TVE E2, 3, 4; Video E2.
27/6/98: SVT E2, 3; LTV R2.
28/6/98: Video E2.
30/6/98: NRK E4.

It may help with the identification of Arabic ch. E2 signals to bear in mind that the Syrian network doesn't use VITS (data signals in the field blanking interval) while Dubai does.

Garry Smith (Derby) mentions a ch. E3 signal with an 'elipse' type logo. He thinks it may be from a Turkish TV6 station. Also a "stripy

1" signal seen in chs. R1 and R2, thought to be from the Ukraine. Can anyone provide any information on this possibility?

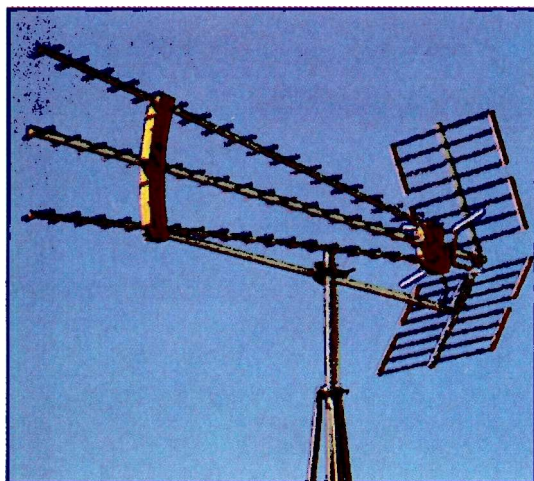
Satellite Sightings

There was a mass of World Cup feeds from France from the second week of June onwards. ITV made extensive use of Intelsat at 31.5°W, with ITV-MCR WC98 at 10.968GHz vertical and a couple of 'floating' uplinks, from hotel venus etc. The main ITV-MCR feed was often carried by the 11.026GHz vertical transponder as well. The BBC mainly used the French Telecom satellites at 5°W and 3°E. Live two-way interviews were often carried by the 11.607 and 11.643GHz transponders at 5°W, the latter with "BBC PARIS ST" on the test pattern. Many of these analogue feeds were duplicated in digital form.

For me the most significant event was my first reception from the new Nilesat craft at 7°W. Libyan TV video was present on the 7th at 11.867 and 11.905GHz (no audio, just subcarriers at 6.6, 7.2 and 7.8MHz). Reception was difficult with mega-volt signals from Telecom 2A at 8°W. My thanks to Alan Davidson (Scotland) who alerted me to signals from this satellite.

The first concert in the Rolling Stones' Bridges to Babylon European tour, on June 13th, created interest. Much of the pre-concert rehearsal, rigging etc. from the Zeppelin Field, Nuremburg, Germany was seen live via Intelsat K (21.5°W) at 11.531GHz horizon-

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tal from 1830 onwards. The extensive tour build-up included a poorly-linked, part-prerecorded half-hour plus item, with live inserts from the first concert, via Eutelsat II F2 (10°E) at 11.633GHz horizontal. The list of tour dates included the UK venues that were cancelled and moved to Helsinki for tax reasons. It provided a fascinating view of the world of pop business.

VOA-TV had problems on the evening of the 26th. Its Worldnet feeds via Eutelsat at 10°E (11.153GHz horizontal) for Serbia (2100) and Bosnia (2130) were of appalling quality. When the intermittent vision carrier was present it provided overloaded, burnt-out pictures – with no audio.

On the 29th the regular UKI-149 GMTV SNG feed via Intelsat K for the breakfast-time show revealed the presenter, in wellies, standing in a sea of thick mud with swamped tents. The venue was Glastonbury, washed out for the second year running.

Sports enthusiast Dean Rogers (London SE2) was obviously delighted with the mass of football feeds. He found other items of interest however. An unusual one for TV was live mountain biking via Eutelsat II F4 (7°E) for Eurosport (still with SIS). The Le Mans 24-hour race was seen via Intelsat K, with live coverage up to midnight. Odd to see cars racing in darkness! The action in the pits, with quick tyre changes and servicing, was dramatic.

I recently mentioned horse racing via Sirius (5°E) as being digital but clear. John Womersley (Bradford, Yorkshire) points out that two days after the magazine appeared conditional access was imposed. The Sainsburys feed for its stores via Eutelsat II F3 (16°E) is no good either: the MPEG offering on the Open Broadcast Network is now conditional access at 11.128GHz horizontal. More digital excitement, via Telecom 2C at 3°E: the Globocast, Brazil World Cup reverse programme feed to Europe carried all the commercials, programmes, soaps etc. To help our digital zappers, PID (picture identification) entry is required for APTV-1 – 12.549GHz hor/5632/(3/4)/(v512/a650/f8190).

John Locker (Wirral) comments on the mass of BBC and ITV feeds via Intelsat at 31.5°W and the Telecom satellites. Interesting that the Eurosport feed was also seen in C band at 18°W. The STS91 MIR docking mission ran into communi-

cations problems, so no Ku-band downlinks were seen: the 16.83GHz downlink at 16°W was very weak and was cross-strapped to C band at 18°W for transmission to NASA. John spotted the newly-launched THOR-3 when it came over the horizon to 36°W for tests. Signals were seen at 11.8 and 11.727GHz vertical. By now the satellite should have taken up residence at 1°W.

Terrestrial News

Ireland: The TV3 commercial channel has announced an opening date: September 21st. Initially the programmes will consist of mainly imported material – until the Canadian-backed operation can build up its own production.

Italy: The ABS company is to replace the transmitters at Udine, Monte Penice, Monte Cammarata and Punta Badde Urbara. This will involve a move to UHF. Numerous RAI VHF-FM transmitters are also to be replaced.

UK: The Radiocommunications Agency has confirmed that the 380-400MHz band has been allocated to the emergency service and public safety radio. It's been a NATO allocation. Police, fire and ambulance services will probably move to this band. Public utilities and road services, e.g. the AA, will not have access to it.

Eastern Europe: There is to be TV expansion in Romania, with the government seeking bids for 21 terrestrial broadcast licences. Bulgaria is preparing legislation that will lead to the first nationwide commercial TV network being opened.

Malaysia: The government has put a stop to further terrestrial TV stations being opened. Its nationwide network Radio Televisyen Malaysia has been refused permission to open a third terrestrial network.

Sweden: The commercial network TV4, the national broadcaster SVT, Canal Plus, TV3 and Kunskaps TV are the successful applicants for terrestrial digital TV franchises.

Kunskaps TV will share time with the business news channel TV8. TV4 and SVT will both have regional programming channels allocated to their services.

Norway: There are to be no more NRK or TV2 analogue transmitters. The present analogue system will continue until terrestrial digital TV is in operation. Bands I and III will then be closed for TV, with digital transmission at UHF (including NRK-1).

Denmark: For Danish local TV,



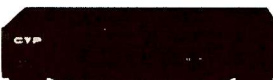
check the following channels during tropospheric lifts: E23V Naestved*, Esbjerg and Kolding*; E23H Kobenhavn and Arhus*; E28V Vejle*; E35H Aberna; E40V Holeby; E43H Svendborg; E49H Odense; E51V Alborg*; E57V Herning*; E60H Kobenhavn* and Slagelse*; E60V Fredericia*. Asterisked transmitters relay TV Danmark either all or part time. **Internet DX:** Those linked to the internet can access a couple of

Football time: a States-bound feed via Intelsat K at 21.5°W.

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UK uplink company SISLink in action via 21.5°W.

website radio receivers and tune them for either local or DX reception. They are as follows. An ICOM IR-R7000 in Bethesda, Maryland, USA at

<http://www.nihac.imfo.nih.gov/lis-tener.html>

and a Drake R8 in North Carolina, USA at

<http://www.chilton.com/scripts/radio/R8-receiver>

Is this the first website DXing?

Satellite News

This might be bad news for sat-zappers. Sony has developed a data speed-up package, type DSM-T1, that doubles the data rate at an SNG uplink site. A matching DSM-R1 demodulator is required for reception. The system provides a degree of security and reduces transponder rental time.

AsiaSat-3R is still on course for launch at 105.5°E, but the launch of the proposed AsiaSat-4 at 122°E has been put back to 2000. Canal Plus is to arrive in Asia in the autumn of 1999: it will run the Taiwanese digital DTH TV service Carnival Star, with about fifty TV channels plus radio and various multimedia services. Mediaguard encryption is to be used, and fifteen manufacturers have been licensed to make decoder boxes. DirectTV Japan has signed up 110,000 subscribers in six months for its digital service which promises 130 channels by September. But rival SkyPerfectTV has signed up 672,000 subscribers with an offer of 107 channels to increase to 170 by the middle of the year. The Indonesian Indovision service is suffering from a high subscriber churn rate: 1,000 new subscribers

sign up each month but 400 terminate. The target of 750,000 subscribers is unlikely to be reached in the foreseeable future – the highest total reached to date is 37,000. Indovision's B-MAC services have ended with a move to digital transmission.

World Television News, London, has been bought by Associated Press TV (APTV) for nearly £40m. There's talk that this might involve redundancies.

Intelsat 704 has fed HDTV signals to NHK Tokyo while 801 has fed HDTV to Brazil, the first ever HDTV programming seen in Latin America.

Signal Phasers

The subject of signal phasing units has come up several times in this column over the past year. There is continuing interest since Band I is still active for DX-TV, though local but legal interference is an increasing problem. Analogue TV is likely to be around in Band I for at least another ten years, so any means of interference reduction is worth trying.

The main problems arise from computer radiation and the high-level noise around 49MHz. The former is usually wideband, so notch filtering doesn't help much. It can help with the 49MHz problem however.

Todd Emslie's simple yet effective wideband nulling system was described in the July issue. It can be used across the VHF spectrum, the only additional electronics required being an attenuator and a couple of wideband preamplifiers. A simple preamplifier can be made from a BFY90 transistor and a few other components, at a total cost that should be less than £2. A more expensive alternative is the C.M. Howes ultra-wideband scanner preamplifier kit, which costs £15.95. It's based on a small MSA0685 microwave device with appropriately designed PCB. The claimed gain is 15dB from 4-1,300MHz with a noise figure of under 3dB at HF/low VHF rising to 3-2dB at 1,300MHz. There is usable gain outside this bandwidth.

This could be an interesting preamplifier for general use in the TV bands. I'm building a couple of samples and will report back on their performance. The exceptionally wide bandwidth and quoted gain could result in overloading and non-linearity problems, and in particular breakthrough of the outputs from nearby HF transmitters/taxi

base stations/police UHF repeaters etc. So I feel that it would be wise to add bandpass coupling. The preamplifier is intended for mast-head mounting with a scanner aerial, and a power interface board (for coaxial cable powering) with a switchable 10dB attenuator is part of the kit. It's available from C.M. Howes Communications, Eydon, Daventry, Northants NN11 3PT (tel. 01327 260 178).

The MFJ Noise Cancelling Signal Enhancer Model 1026 is currently available from short-wave specialists/dealers. It's a phasing system with a built-in whip interference pickup aerial/preamplifier. Model 1025, to special order, uses on an external input from an interference pickup aerial – it incorporates an interference preamplifier. The input from the DX aerial is combined with the adjusted anti-phase interference input to reduce, or possibly cancel, the interference. It's priced at the £125 plus level. There are lots of knobs and switches and a red LED – it looks good!

The system can also be used to provide gain (in the absence of interference) with the inputs from two aeriels. A directional aerial system can be created using a couple of vertical dipoles. The circuitry differs from designs previously shown in these pages, though it appears to be a fairly basic affair. There's a push-button locking switch for use below or above 7-12MHz. The unit can, with additional controls for this purpose, be used in an amateur transmitting station.

I obtained a Model 1025, powered it at 12V from an external 13A block PSU, and switched on. A discone aerial was used for the interference input and a two-element wideband Band I aerial for the DX input. I tuned to chs. E2/R1, which are continuously jammed by signals from the 300 plus homes on my estate, but the results were disappointing. The phaser refused to provide anything more than a few dBs of interference reduction, despite prolonged adjustment of the phase switches and the on-board preamplifier gain controls.

Before I start to alter the circuitry I'm going to check with MFJ in Starkville, USA, on the phaser's performance at low VHF, and see whether there might be any modifications for use in this part of the spectrum. I'll report back. In the meantime I suggest that the Todd Emslie approach be considered: it's cheap, cheerful – and it works!

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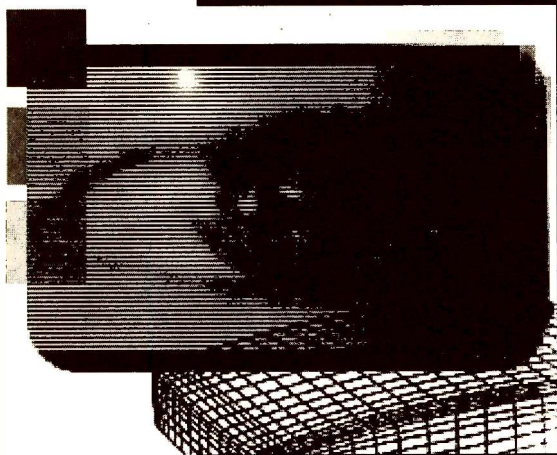
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Reports from

Ian Field

Gerry Mumford

C.J. Guy and

Chris Hawkins

Viglen CA1426LT

The power supply was running and the heaters were glowing. When the PC was fired up and connected a vertical line flashed on the screen, accompanied by a scrunch sound. This had me worried: I thought that the LOPT was arcing internally. I decided to dismantle the monitor and look for other causes however.

With these monitors the base section of the case has to be separated from the CRT/escutcheon assembly before the PCB can be removed. I use masking tape on the monitor's front surround and reinforce the middle, top and bottom with DIY tape (fabric tape with PVC top layer). Put the monitor face down and check that the anode cap is discharged. I find that a charge can build up while you are working on the unit. A quick squirt of water-based cleaning spray to bridge the anode cavity to the Aquadag will prevent this. But make sure that the anode is discharged first: most cleaners contain alcohol and will burst into flames if a spark occurs. Hook the anode lead on to the line output stage heatsink. The cleaning spray leakage trick ensures that I don't forget to clean the grime from around the anode connection!

Lift the CRT base away, disconnecting the earthing braids as you do so. This leaves only the scan plug and degaussing lead. With a logical approach, these monitors are not as difficult to strip down as they look.

Once the many screws (some

Monitors

partly hidden) had been removed I was able to see that the solder had been applied very sparingly. The connection at one end of L301 had arced away. Cleaning and resoldering this completed the repair. **I.F.**

Hyundai HCM421E

This monitor came in because of an intermittent frame fault. It took a considerable time to appear. Much time was wasted on the soldering, which was quite good overall apart from solder whiskers.

The user height control (V size preset) at the rear of the case felt loose, but no amount of wiggling it would produce the fault until the monitor had fully warmed up. As I didn't have a replacement in stock I decided to strip, clean and retension the old one. It looked as if the wiper's slip-ring metalisation had worn, so as well as retensioning the spring contact I offset it. A quick rub with a graphite pencil completed the renovation. When the control had been reassembled the problem had been completely cured. **I.F.**

Daewoo CMC1427S

There was a bright raster with fly-back lines. The chassis looked difficult to get at, so I decided to pick on the CRT base assembly which is awkward to get at! It's fixed to the tube's neck with hot-melt glue, and there's a knack to removing the shield, most of which is the heatsink for the video output chip and remains attached to the CRT panel. Lever out the tab and unsolder that end. Ease the PCB out of the shielding box while keeping the solder melted at the other end. It's obvious when you study it carefully, but looks a right puzzle to begin with.

Once in I found that the 80V HT supply was low at only about 13V. So back to the main board which, despite appearances, is easy to get at. Unclip the plastic 'floor' from the front assembly to gain access to two screws, one in the LOPT cage and one enclosed by the field out-

put heatsink. The PCB then unclips, slides back and lifts out.

The 80V supply comes from the chopper circuit via the 2SC2073 emitter-follower Q111, whose base is driven by Q112 (2SA910) via R112 (10 Ω). The base of Q111 is decoupled by C113 (100 μ F, 100V), whose charging current is too much for the very tiny 10 Ω resistor which goes open-circuit. Q111 is then cut off. **I.F.**

CTX 1451LR

This monitor was dead. The line output transformer had failed, taking with it the BU2520DF line output transistor. The customer refused the estimate, so the monitor was returned unrepaid. But some observations may help others.

The diodes at each end of the row along the secondary side of the chopper transformer were both cooking. The BYV96E HT rectifier had almost certainly been damaged by the line output stage shorts. Although it doesn't look like one, the data book says it's a 3A rectifier. No cause could be found for the distress suffered by the BYD33G (1.3A) LT rectifier. I suspect that it partially fails, the result being line drive pulses with a slow edge followed by failure of the LOPT.

If you service one of these monitors it would be a good idea to replace these two diodes before trouble with the LOPT develops. Most of the CTX monitors of later manufacture I've seen use 3A rectifiers for every rail. UF540X series rectifiers are a good choice, the UF5404 as a replacement for the BYD33G and the UF5408 as a replacement for the BYV96E. The Tr specification for UF540X series rectifiers is in the range 50-75 μ sec. **I.F.**

Compaq 444

The complaints were "intermittently dead or faulty line lock". The monitor was very touchy, and occasionally blew the line output transistor. PCB deflusing was the

answer. Almost invisible cracks tend to develop around the nylon support pillars. Don't miss the earth pins on the LOPT focus block when going over the soldering. Dry-joints here can do odd things! **I.F.**

EM144CE

This monitor was dead. On inspection I found that a large crack had spread in three directions from the focus unit's earth pin. When this had been repaired I checked the soldering around all the other heavy components – some displayed signs of mechanical stress.

While resoldering around the chopper transformer I noticed that the connections to the 115V rectifier D109 were heat fatigued: when I resoldered it one pad lifted on the tip of the iron. If this had happened to the rectifier that supplies the regulation optocoupler the power supply would probably have blown up. So I checked the condition of the PCB around all the chopper power supply rectifiers very carefully. Once all this had been attended to the monitor worked well. **I.F.**

CTX 1569S

If one of these monitors switches on and the LED lights for about a second, followed by switch-off, suspect dry-joints at Q106 on the secondary side of the power supply circuit. It's surprising how common this fault is! **G.M.**

Dell D1428HS

When faulty these monitors are usually totally dead. They can play a particularly nasty trick however, as they use a soft-start on/off switch that's connected to a surface-mount OEM microcontroller panel. If a video signal is connected when you are probing around this panel, the 5V supply appears to be present but a bit low. So you think the monitor is stuck in standby (a microcontroller error) and that this is the reason why the main supply rails are down.

In fact the measured voltage is a "ghost" derived from the sync signals: all the supplies are down. The cause of the problem is always R5 (0.33Ω, 0.5W) being open-circuit. It's in the primary side of the power supply.

In this model the supply lines remain up even in standby. **G.M.**

Compaq 476

There was a white screen with fly-back lines – an image was present

but was very faint. The cause of the fault was in the supply to the brightness network. Rectifier diode D803 (1N4937) had gone short-circuit. As a result its feed resistor R806 (0.22Ω, 0.5W) was open-circuit. **G.M.**

Dell D1528LS

There was EW bowing and excessive width that couldn't be controlled. A pair of transistors in the line output stage, Q438 (2SC2236) and Q439 (2SA966), had gone short-circuit while R478 (1Ω, 0.5W) had burnt up. Replacing these items cured the problem, but the transistors ran very hot.

Further investigation revealed that their feed coil L403 (611204130/1) was short-circuit. When a cold DC check is carried out on this component a reading of 1.8Ω should be obtained. We replaced the coil with one rescued from a scrap chassis. The transistors then ran cool again. **G.M.**

CTX CVP5468NI

This monitor appeared to be dead, but the supplies were all present. The line output stage wasn't in operation however, because of a huge dry-joint at the HT feed diode D412. **G.M.**

HM Technology CK1420

This monitor was dead with the fuse intact. A quick check revealed that there was no supply at the UC3842 chopper control chip. Start-up resistor R531 (560kΩ, 0.5W) had gone open-circuit.

When this resistor had been replaced the monitor was still dead, with only a few volts at the chip (which incorporates under-voltage lock-out). It transpired that zener diode ZD501 (36V, 500mW) was very leaky. **G.M.**

Sony KX27PS1

This heavy beast didn't want to start. When it did, a loud and raucous whistling sound came from the power supply, which is enclosed in a thick aluminium case. It was difficult to open this because of the hardened heatsink compound in all the joints. Once I managed to get inside I found that the power supply was full of dry-joints. A good clean and resolder cured the problem. For good measure I replaced the small electrolytics inside the case. **C.J.G.**

Tatung TM3401

This monitor produced a dull display. The cause was R475 (100kΩ)

in the beam-limiter circuit. Shades of the TX90 chassis! **C.J.G.**

Commodore 1084SP1

This monitor whistled while its owner waited but didn't cure itself. Diode D6517 (BY228) was short-circuit.

It's worth looking at the solder joints under the SUB D 9-pin connector before you return one of these monitors to its owner. **C.H.**

Aldix Soundvision 15

The power supply was pulsing and the HT voltage was at a third of its normal level. So there appeared to be a fault in the line output stage. The line output transistor and transformer checked OK, but when I traced back to the damper diode network (DP30, DP31) I found that DP31 was dead short. An RGP30 diode fitted as a replacement restored normal operation.

This monitor uses a DBL2054D chip in the field output stage. A TDA1675 is a suitable replacement. **C.H.**

AOC 45

The owner said he had seen smoke followed by lots of noise, after which there was nothing but a bad smell. When I ventured inside the monitor I couldn't see any burnt components. So I switched on, which produced a squealing noise from the power supply.

Diode D904, which is connected directly to the transformer, turned out to be short-circuit. When removed it appeared to have fried. No markings remained, so a BY399 was fitted as a replacement. The monitor then worked all right, though the smell lingered on. **C.H.**

Compaq Presario 313

If the left and/or right channel fails to produce sound, check IC5 and IC6 (both type TDA7058) by replacement. The Philips data book says that the chip is protected against short-circuits, but the customer proved, with his 30W hi-fi speakers, that this was not so! A case of multimedia madness. **C.H.**

KT KTM1428

This repair was a long, drawn-out business. The width was correct, but the height stretched to infinity. To cut a long story short, to obtain a normal display I had to replace all the very small 0.125W resistors in the field output circuit – R318 (1MΩ), R319 (150kΩ), R320 (320kΩ) and R323 (180kΩ). I used 0.5W replacements. **C.H.**

Answer to Test Case 429 - see page 783 -

Rather as with the last two test case items, the cause of Sage's woes was an incomplete knowledge of exactly how the system is designed and is supposed to work! Some VCRs sit happily, with a fully-rewound tape and with light falling on the start sensor via the tape's transparent leader, ready to respond to any forward deck command - but not a backward one. Others, like this Sony model, have a little program in the system-control software: it moves forwards any fully-rewound tape to the point where the clear leader section is wound into the cassette shell and the start sensor is thus blinded by the opaque tape. If the control system in such a machine is thwarted in this respect, it objects: continued activation of either of the tape-end sensors results in shut down and/or ejection of the cassette.

Sage now knew why the control system was behaving as it did, but not why the short forward-wind movement failed to take place. Close observation of the capstan motor then revealed that it tried but failed to wind the tape forwards at the crucial moment after cassette insertion or the end of a rewind. In fact the capstan motor itself was faulty, despite the fact that the machine worked correctly in all the other modes!

Sage cleaned and lubricated the capstan motor and replaced its electrolytic capacitor C001. After this all was well. Phew!

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Servicing the Panasonic Euro 1 Chassis

This was one of the first TV chassis that uses digital signal processing to be introduced in the UK. While most faults are conventional power supply/deflection ones, the digital section sometimes calls for a different approach to fault-finding: as an aid, Panasonic has introduced the LUCI PC interface. John Coombes on what this involves and general fault-finding.

FireWire Developments

The basic FireWire digital data interconnection system was described in our July issue. Since then further developments have been announced. Geoff Lewis, B.A., M.Sc., provides an update.

Reviews

Martin Pickering on a new consumer electronics product, the internet set-top box. Stock up and make a fortune! Plus Eugene Trundle on a video alignment test tape from SEME at under £30.

A PC-based Portable Servicing Database

Michael Maurice decided that it was time to update his servicing administration. As most of his work is undertaken in the field, a portable PC system and printer were required. The results, using the equipment and software selected, are impressive.

Satellite Polariser Test Modules

Last August we published a motorised dish tester designed by Pete Haylor. He has since designed simple magnetic and mechanical polariser modules that can be added to the original unit either singly or together.

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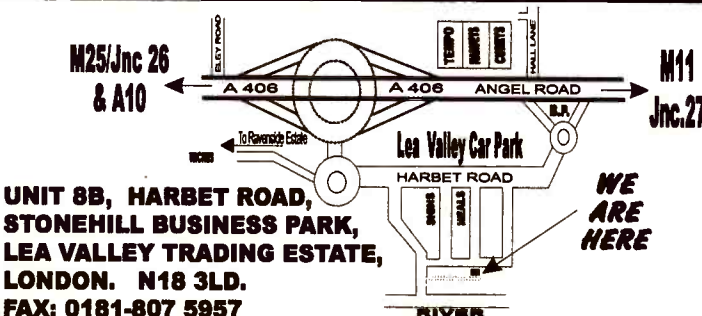
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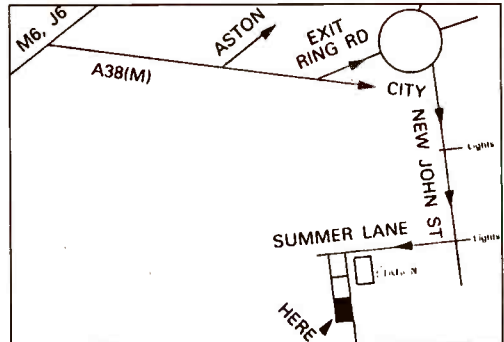
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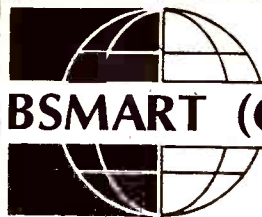
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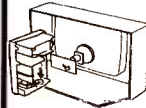
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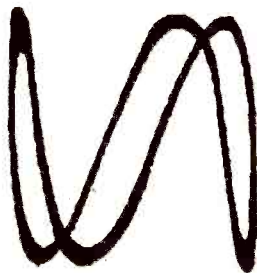
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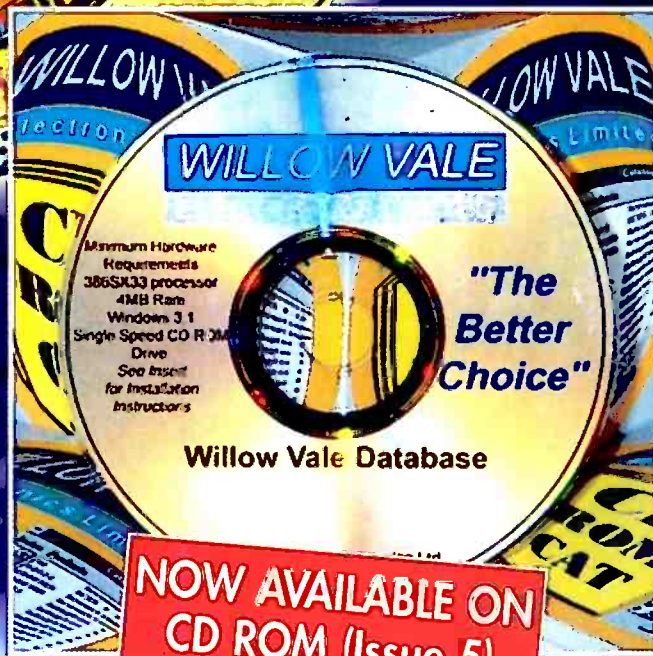
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